1986 ANNUAL REPORT FROM THE WATER BUDGET MANAGERS

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1986

ANNUAL REPORT

FROM

THE WATER BUDGET MANAGERS

This report is to fulfill the annual Fish Passage Center reporting requirements to the Northwest Power Planning Council under its Columbia River Basin Fish and Wildlife Program, and the annual reporting requirements to the Bonneville Power Administration under Its funding contracts which supported this work.

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1986 WATER BUDGET MANAGERS ANNUAL REPORT

I. INTRODUCTION

1986 was the fourth year of operation of the Fish Passage Center (formerly Water Budget Center) under the guidance and supervision of the fishery agencies and tribal Water Budget Managers, and the third year of formal water budget Implementation. The first year, 1983, was considered a trial year because the water budget had not yet been incorporated as a firm constraint into the regional coordinated plan of operation for power production.

In addition to management of the Water Budget, the Water Budget Managers and FPC staff developed and directed the Smolt Monitoring and Water Budget Evaluation Programs of Section 304(d) of the Fish and-wildlife Program. The fishery agencies and tribes also authorized the Water Budget Managers to coordinate agency and tribal system operational requests throughout the year, including spill management for fish passage. Thus the Water Budget Managers, with their supporting staff at the Fish Passage Center, work to Implement policies and priorities of the state and federal fishery agencies and Indian tribes in carrying out applicable measures of the Fish and Wildlife Program.

This report summarizes Water Budget Manager activities in implementing program measures, including 1986 flow conditions, water budget usage and spill management, and the in-season management portion of the 1986 Smolt Monitoring Program including data management.

II. 1986 RUNOFF

The Northwest Power Planning Council's Fish and Wildlife program requires this report to include:

(A) The actual flows achieved for that calendar year;

(B) A record of the estimated number of smolts which passed Lower Granite and Priest Rapids dams, and the period of time over which the migration occurred; and

(C) A description of the flow shaping used for that calendar year to achieve improved smolt survival.

Each of these activities is dependent upon the manner in which the natural runoff from the previous winter's snowpack occurs, and the amount and distribution of precipitation during the runoff period. The following is a discussion of the 1986 runoff and a brief discussion of the resultant stream flows. A more thorough discussion of stream flows appears in Section III of this report.

A. RUNOFF VOLUMES

The 20-year period of 1961 through 1980 is used by the Columbia Basin Water Management Group as the basis for determining the average January through July (Jan-Jul) seasonal runoff. Other comparisons commonly in use are with the shorter terms of 1963-1977 or 1970-1985, and the longer term 50 years of 1929-1978. Listed below are the averages in million acre-feet (MAP) for Jan-July runoff above The Dalles for each of these different periods of record, compared with the actual observed 1986 runoff, adjusted for upstream storage and diversions.

Average Jan-Jul Runoff Above The Dalles, MAF

1961-1980 (20 years)	1963-1977 (15 years)	1970-1985 (16 years)	1929-1978 (SO years)	1986 Actual
107.0	109.6	109.93	102.7	108.3

The data show that 1986 system runoff was a little above the official 20-year average, and about 5% greater than the SO-year average. The 1986 runoff year therefore can be characterized as slightly above average.

It is important to note that the above data for actual 1986 Jan - Jul runoff at The Dalles is after-the-fact information which was unknown at the time that the start-of-season Coordinated Plan of Operation for Water Budget implementation was being developed. This factor and its significance is discussed more fully later in this report.

B. RUNOFF FORECASTS

The Water Management Group designates the April 1 forecast each year as the "official" Jan-Jul runoff forecast for the year. Forecasts, such as the April 1, assume that normal precipitation will occur throughout the duration of the forecast period.

Table 1 compares the month-by-month forecasted Jan - Jul runoff with the 1961-80 average runoff at selected locations. The March runoff forecast, which provided a basis for uch of the annual Coordinated Plan of Operation (CPO) for implementing the Water Budget, indicated that runoff would be about seven percent below normal at Grand Coulee, four percent below normal at The Dalles, and three percent above normal at Lower Granite.

These runoff values, both magnitude and departure from normal, significantly influence the degree of system operational flexibility that project operators are willing to commit to in developing the anuual CPO. But, as discussed more fully later, it is the magnitude and departure of the runoff forecasts from runoff that actually occurs that has the greatest influence on the degree of in-season system operational flexibility utilized to meet the needs of migrating juvenile fish.

TABLE 1

1986 FORECASTED VS. AVERAGE (1961-80) JANUARY-JULY RUNOFF

JAN-JUL RUNOFF	GRAND COULEE		LOWER GRANITE		THE DALLES	
	Kaf	% of Ave.	Kaf	% of Ave.	Kaf	% of Ave.
1961-80 Ave.	64,840		30,090		106,900	
MONTHLY FCST:						
January	58,700	91	26,800	89	96,800	91
February	58,600	90	24,600	82	93,300	87
March*	60,400	93	30,980	103	103,000	96
April	60,900	94	33,400	111	106,080	99
May	62,400	96	34,800	116	108,000	101
June	61,500	95	36,100	120	108,000	101

*The March runoff forecast is highlighted because this is the latest available to work with In developing the start-of-season Coordinated Plan of Operation for Water Budget implementation.

Figures 1 and 2 compare forecasted and observed runoff at The Dalles and Lower Granite, respectively. Also shown for each forecast period is the percentage that the forecasted runoff varied from the observed runoff. Note that the forecasts are for the remaining runoff from the forecast month through April, whereas all of the forecasts presented in Table 1 are for the Jan - Jul period updated each month. It is the forecasts for residual runoff presented in Figures 1 and 2 that have the greatest influence on actual system operational flexibility.

Figure 1 shows that the January 1 forecast of Jan - Jul runoff at The Dalles was about 11% below what actually occurred, and that the February forecast was 15% low. Subsequent forecasts of the residual runoff made in March and April also were on the low side but relatively close to the observed runoff. The May forecast of residual runoff was very accurate, whereas the June forecast overestimated the remaining Jan - Jul runoff at The Dalles by about 8%.

Runoff forecasts for the Snake River at Lower Granite (Figure 2) started out much lower than observed runoff-26% low in January and 34% low in February. Forecasts remained below observed but the difference decreased with each subsequent forecast period to about zero with the last (June) forecast of residual runoff.

Forecast errors in the January-March period result primarily from the actual precipitation deviating from the assumed normal precipitation. The National Weather Service (NWS) reports that later in the season (April on), forecasts are expected to have greater accuracy because the snow accumulation season is generally over, and maximum water content of the snowpacks are known. Also, spring and summer precipitation usually has less impact on runoff volume than does winter precipitation, but this was not the case in 1986.

Table 2 lists observed 1986 monthly precipitation for selected areas and indicates the percentage of the 1961-80 monthly average for the same locations. Because the runoff forecasts assume normal precipitation, most of the difference between 1986 forecasted and observed runoff can be attributed to precipitation that was well above normal throughout the Columbia Basin in February, and again to a lesser extent in April and May (Table 2).

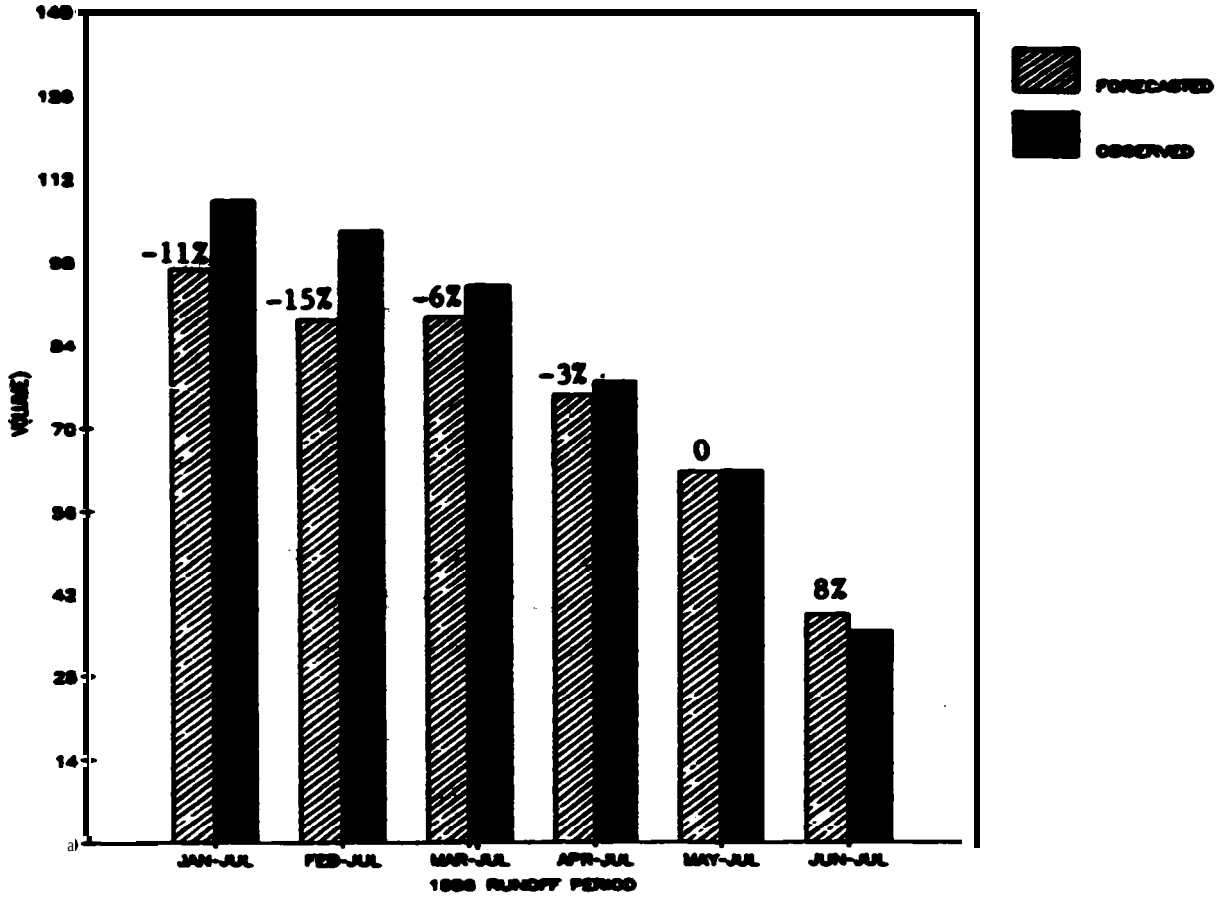


FIGURE 1 THE DALLES FORECASTED VS. OBSERVED RUNOFF

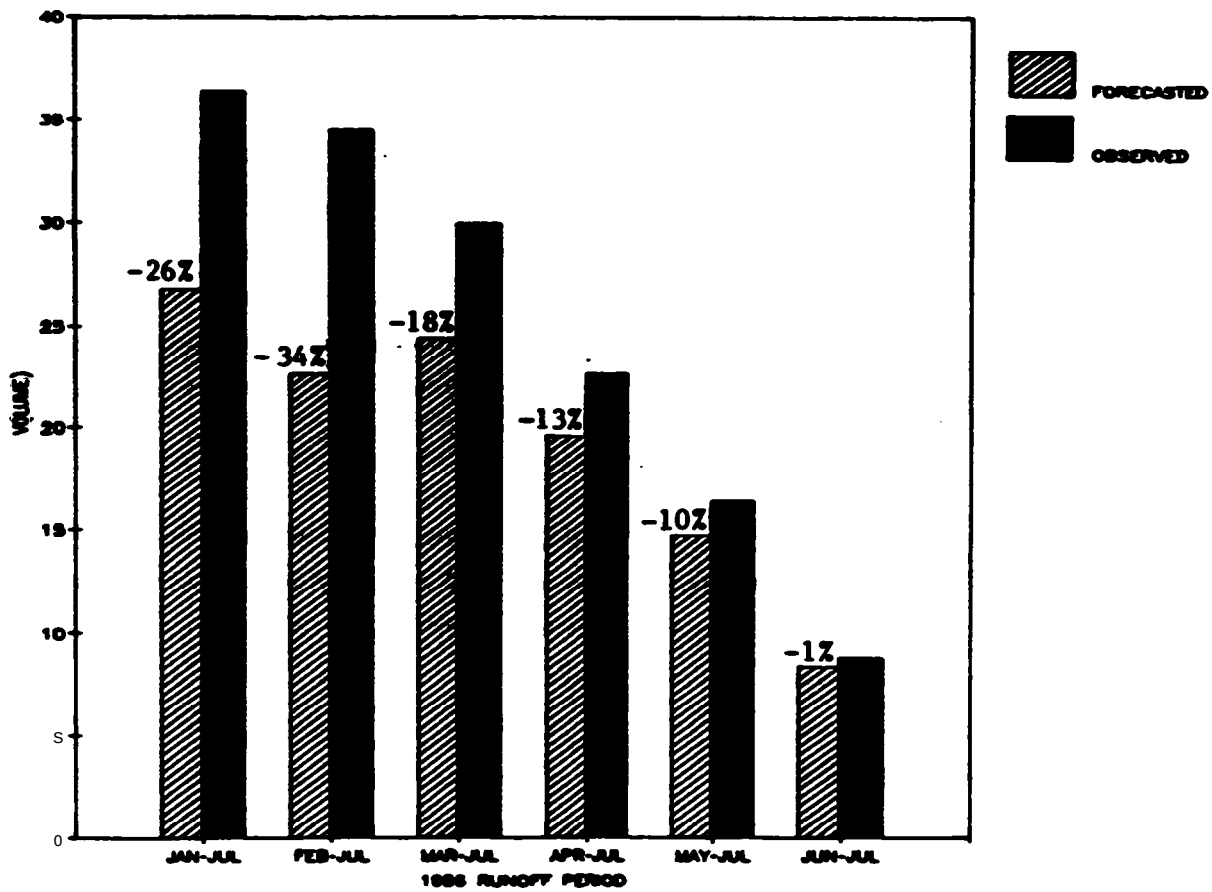


FIGURE 2 LOWER GRANITE FORECASTED VS. OBSERVED RUNOFF

TABLE 2

1986 OBSERVED VS. AVERAGE (1961-80) MONTHLY PRECIPITATION

MONTH	COL. ABOVE COULEE		COL. ABOVE TDA		UPPER SNAKE		SNARE ABOVE IHR	
	inches observed	% of ave.	inches observed	% of ave.	Inches observed	% of ave.	inches observed	% of ave.
January	2.88	83	2.80	84	2.06	78	2.01	75
February	3.19	138	3.97	185	4.30	234	4.25	246
March	1.67	88	1.76	92	1.63	98	1.74	99
April	1.70	108	1.70	105	3.23	190	1.91	116
May	2.14	105	1.83	105	2.10	99	1.75	102
June	2.37	105	1.42	77	0.81	34	0.97	53

By comparison, 1985 runoff forecasts were consistently higher than actual runoff* because actual precipitation was below normal for most of the Jan - Jul period. The significance of this is the affect on the ability to project and guarantee system operations that can provide Water Budget flows while meeting other project functions. Forecasts for more runoff than actually occurs result in less water than anticipated, and more conflicts in meeting flow demands for competing purposes. This was the situation in 1985, as discussed in detail in the 1985 Water Budget Measures Annual Report, wherein desired flow levels to protect a prolonged outmigration in the mid-Columbia were not provided beyond the period agreed to in the CPO, and flows in the Snake River were allowed to drop below the 85 kcfs minimum for smolt migration on 22 days during the Water Budget period.

In contrast, with the 1986 runoff forecasts being consistently lower than actual runoff, more water than anticipated was available with which to meet competing demands. This resulted in more system operational flexibility and generally favorable flows for migrating juvenile fish, as discussed more fully below under "Implementation of the 1986 CPO".

* See Figure 1, page 5 of the 1985 Water Budget Managers Annual Report. Note that the percentage that actual runoff departed from forecasted is shown in the 1985 report. Since the intent was to illustrate the forecast error, it probably would have been clearer to show the percentage that forecasted runoff departed from actual, as is done in the 1986 report.

III. 1986 WATER BUDGET IMPLEMENTATION

A. DEVELOPMENT OF TEE 1986 COORDINATED PLAN OF OPERATION (CPO)

1. Background

Annual development of the Water Budget CPO is through a Water Budget Implementation Work Group chaired by the Corps of Engineers (COE) with participation by the Water Budget Managers, Bonneville Power Administration (BPA), Northwest Power Planning Council (NPPC), Public Utility Districts (PUDs), and Idaho Pover Company (IPC). The Fish and Wildlife Program specifies that these coordination meetings shall start in Jauuary vhen the official January runoff forecast is available, and shall culminate with an official CPO transmitted to the NPPC by the COE in March.

Five such coordination meetings were held to develop the 1986 CPO-the first in January, and the last on March 21-followed by several telephone consultations through March 31 to attempt to reach agreement on working. The resulting 1986 Water Budget CPO vas transmitted to the NPPC by the COB on April 3.

2. Mid-Columbia (Priest Rapids) CPO

Two opposing positions regarding the mid-Columbia Water Budget implementation arose at the early Work Group coordination meetings.

The Water Budget managers proposed a modification of the fixed schedule approach used in 1985. This specified the level of Water Budget requests over a 45-day period, with the starting date selected by the Water Budget managers. The modification vould provide the flexibility to extend beyond the 45-day period specified in the 1985 CPO If necessary to protect the riddle 80% of the spring jwenile fish migration. The Water Budget managers believed this to be reasonable and equitable because the official runoff forecast at hand indicated that adequate vater vould be available to permit such flexibility without undue impact on power marketing or other operational considerations.

On the other hand, BPA would not support a repeat of the 1985 CPO, especially with the proposed modification, because of the potential that more than the 3.45 MAF volume of water specified in the Fish and Wildlife Program could be allocated to assist fish passage. The BPA position stated by its representatives on the Work Group vas that it would not support any approach that provided more

than 3.45 MAF of water because it viewed the Fish and Wildlife Program as establishing the maximum Water Budget allocation, regardless of flow year.

This led to a BPA proposal that would limit the mid-Columbia Water Budget volume to 3.45 MAF to be used in weekly average blocks. One departure from past years in the BPA proposal, which all parties agreed was a major improvement, vas the offer to provide projections of average power flows for each week, and to guarantee to provide that average weekly flow if augmentation by the Water Budget was not requested. However, the BPA proposal reserved to it the right to shape flows in a manner of its choosing during weeks when Water Budget flows were not requested. This was not accepted by the Water Budget managers because it brought back the potential problem of severe weekday/weekend flow swings. In addition, the proposal could limit the flexibility in Water Budget use needed to try to cover 80% of the juvenile fish migration if flow augmentation was required for more that four weeks out of the eight-week Water Budget period. This is because weekly accounting with a fixed base of 76 kcfs uses the Water Budget in four weeks or less at flow requests of 134 kcfs or greater.

At subsequent Work Group coordination meetings, several other options vere presented and evaluated-three by the Water Budget managers, and one by the COE. The main thrusts of the Water Budget managers options were:

1. adherance to the Fish and Wildlife Program Water Budget volumes, but retaining the flexibility to use the Water Budget on a daily basis; or
2. a modification of the BPA proposal so that veekend flows vould not be less than a specified amount throughout the two month Water Budget period, whether or not a water budget request was in place; or
3. a fixed flow schedule similar to the 1985 CPO, but which would remain in effect until 90% of the spring migration had taken place.

The COE option vas a compromise version of the BPA and Water Budget managers proposals. It provided for a minimum weekend flow of 85 kcfs during non-Water Budget weeks having a weekly average greater than 110 kcfs. Although lower than the 80% of the five-day weekly average flow level during weekends proposed by the Water Budget managers, this level was considered high enough to prevent a repeat of the extreme weekday/weekend swings that took place during the 1984 Water Budget period.

Deliberations by the Work Group of the pros and cons of each option resulted in endorsement of the COE proposal by all parties except BPA, which held to its position that It would not support any Implementation procedure that could be construed as providing more than 3.45 MAF of water for fish. Further, since the Work Group vas endorsing a departure from the BPA proposal, BPA withdrew its offer to provide projected weekly average flows as a basis for determining if Water Budget flow augmentation would be needed.

The end result was that, lacking any evidence that power or any other project functions would be significantly impacted, the COE proposal was submitted to the NPPC. In the final version, the COE assumed the role of providing the advance weekly average flow projections for Priest Rapids, and of guaranteeing flows at that level during non-Water Budget weeks, including the specified weekend minimums. A copy of the 1986 Water Budget CPO is Included as Appendix A.

It is considered by many parties to be feasible and equitable to provide more water for fish during the better runoff years than the minimum specified for a critical year in the Fish and Wildlife Program. The COE letter transmitting the CPO to the NPPC (Appendix A) states that: "The runoff this year is expected to be better than critical. Therefore, a CPO was developed that may provide more water than specified in the Water Budget. In particular, the CPO provides an average weekend flow of at least 85,000 cfs to transport juvenile fish in the mid-Columbia when the average weekly flows are expected to be greater than 110,000 cfs even though the Water Budget Managers are not requesting Water Budget."

Also, in recognition that BPA did not support this position, the transmittal letter states that: ".. the plan does not fully reflect agreement of the parties.."

3. Snake River (Lower Granite) CPO

A trial approach to Snake River Water Budget implementation has been in effect since 1984, This approach specifies the volume of water from Dworshak Reservoir shapeable by the Water Budget managers on a sliding scale--the largest amount during below average runoff years, decreasing to zero in above average runoff years (See Appendix A). It is assumed that uncontrolled runoff and power flows will provide the needed flows in above average runoff years. The

maximum shapeable volume available from Dworshak under this approach is 400,000 acre-feet, which is one-third of the Snake River Water Budget volume specified in the NPPC Program.

A similar sliding scale arrangement for participation by Brownlee Reservoir has been proposed by IPC. Formalizing of any offer by IPC is subject to execution of an acceptable storage agreement between BPA and IPC to compensate IPC for participation in the Water Budget. The necessary agreement presently is in the negotiation stage, and has been for four years, so Brownlee is not yet committed to Water Budget participation. According to BPA, both parties have recently stated that they want an agreement in place by January 1, 1987.

Snake River runoff forecasts for both 1984 and 1985 were for levels that resulted in zero shapeable volume from Dworshak, making 1986 the first year that the trial agreement was put to a test. The sliding scale formula resulted in 400,000 acre-feet from Dworshak shapeable by the Water Budget managers, if necessary, during the 1986 Water Budget period.

In order to maximize the effectiveness of the use of the amount of shapeable water available, several departures from the Fish and Wildlife Program implementation and accounting stipulations were worked out informally on a trial basis between the Water Budget managers and COE, as follows:

1. If the accounting base specified in the Fish and Wildlife Program was followed-50 kcfs in April, 65 kcfs in May, and 60 kcfs in June-the available water would cover a maximum of only 10 days, depending upon the month and magnitude of the Water Budget request. It was agreed, therefore, that Water Budget accounting would take place at Duorshak with the use rate being simply the additional outflow requested from Duorshak above what already was being provided toward the power base (3300 cfs was used as the Dworshak power base in the calculation to reach 400 kaf of Water Budget). This would greatly enhance the ability to provide at least minimum flows for fish at Lower Granite throughout the Water Budget period.

2. Accounting on an average weekly basis greatly reduces flexibility and could result in some use of the limited amount of Water Budget on days not needed. It was agreed that requests could be made for daily releases from Dworshak to maintain average flows of 85 kcfs at Lower Granite.

3. Rapid fluctuations in streamflows at Lower Granite due to the large amount of uncontrolled runoff, coupled with the uncertainty of streamflow forecasts several days out, make it difficult to request flw augmentation three days in advance with assurance that such augmentation actually will be needed. It was agreed, therefore, to reduce the three-day advance notice requirement when necessary to 48-hour or 24-hour notice. Flow augmentation requests would be based upon short-term streamflow forecasts provided daily for the Snake River by the NOAA River Forecast Center.

These **informal** agreements illustrate willingness on the part of the parties involved to vork out vays to use the allocated vater in the best manner possible for its intended purpose-which is to enhance smolt survival by providing timely passage through reservoirs.

B. IMPLEMENTATION OF THE 1986 CPO

1. Hid-Columbia (Priest Rapids)

Table 1 is a log of Priest Rapids flows in kcfs kept by the Fish Passage Center. The table shows the following:

1. BCC Projected Wkly Ave.
   the flow projections for each Monday through Sunday weekly period provided to the Water Budget managers by the RCC; e.g. 140.

2. WB Mgrs Requested Wkly Ave.
   the Water Budget managers responses regarding requested level of average flows for each Monday through Sunday weekly period using the Water Budget; e.g. 140.

3. Actual Flow
   the average flow at Priest Rapids for each day during the Water Budget period; e.g. 148.

4. Weekday Ave. [Wk Av]
   the average flow for the five weekdays, Monday through Friday; e.g. 162.
   the average weekly flow, **Monday through** Sunday; e.g. [148].

5. Weekend Ave. (% of **Wkdy)**
   the average flow over the weekend; e.g. 113.
   the ratio in percent of the average weekend flows compared to the average weekday flws; e.g. (88%).

6. WB USE, Wk, Total
   the amount of Water Budget used each **week** in MAF (Wk).
   the total of Water Budget usage in MAF by the end of each week (Total).

7. ACCOUNTING
   the box in the upper right corner of Table 1 showing the rate of Water Budget usage in **MAF/Wk** at different flw request levels.

TABLE 3

1986 PRIEST RAPIDS WATER BUDGET FLOWS (Q),kcfs

DATE	RCC Projected Wkly Ave.	WB Mgrs Requested Wkly Ave.	Actual Flow	Weekday Ave. [Wk Av]	Weekend Ave. (% of Wkdy)	WB USE MAF Wk	WB USE MAF Total
Apr			148			ACCOUNTING	
15 T			167			kcfs	MAF/Wk
16 W	>130	no request	196	162		140	0.89
17 T			163			130	0.75
18 F			138			120	0.61
19 S			112	[148]	113	110	0.47
20 S			113		(70%)		
21 M			125				
22 T			175				
23 W	>140	no request	160	162			
24 T			176				
25 F			175				
26 S			151	[157]	143		
27 S			134		(88%)	0	0
28 M			146				
29 T			171				
30 W	>140	no request	170	160			
May							
1 T			156				
2 F			158				
3 S			134	[150]	123		
4 S			112		(77%)	0	0
5 M			128				
6 T			144				
7 W	>115	140	152	139			
8 T			138				
9 F			135				
10 S			142	[138]	136		
11 S			130		(98%)	0.89	0.89
12 M			135				
13 T			142				
14 W	>110	140	147	142			
15 T			145				
16 F			140				
17 S			132	[139]	133		
18 S			133		(93%)	0.89	1.78
19 M			144				
20 T			141				
21 W	>105	130	149	138			
22 T			134				
23 F			121				
24 S			121	[130]			
25 S			102	-----	113	0.75	2.53
26 M	Memorial Day		114		(82%)		
27 T			132				
28 W	>115	120	147	131			
29 T			135				
30 F			129				
31 S			143	[138]			
June					154		
1 S			164		(117%)	0.61	3.14
2 M			162				
3 T			166				
4 W	>120	no request	176	169			
5 T			165				
6 F			177				
7 S			173	[167]	163		
8 S			152		(96%)	0	3.14
9 M			153				
10 T			151				
11 W	>140	no request	146	150			
12 T			148				
13 F			no data				
14 S			138	[145]	137		
15 S			136		(91%)	0	3.14

Figure 3 is a graphic comparison of the weekly average projected, requested, and actual flow data presented in Table 1. As noted both in Table 1 and Figure 3, projected weekly average flows from April 21 through Hay 4 provided by the COE (RCC) were for greater than 140 kcfs. Actual veeekly averages occurring during that period vere 150 kcfs or greater due to reservoir drawdown required to provide flood control space. Weekend minimums agreed to in the CEO vere exceeded in all cases.

May started out as a cool weather month and, lacking a pwer demand that would require more water to be released from storage, the average veekly flow projections provided by the RCC for the first two weeks in May were based on holding the flood control pool elevation at Grand Coulee by simply passing inflow. This prompted the Water Budget managers to make the Water Budget requests indicated in Table 1 and illustrated in Figure 3. Note that the flow scale in Figure 3 starts at 100 kcfs, rather than zero, which tends to exaggerate the differences between actual, requested, and projected flows. The slight difference between actual and requested flow averages from May 5 - 18 is within flow measurement accuracy and it should be considered that the requested flow was met.

A decision was made by the project operators to control the Water Budget flows with Grand Coulee. This vas to prevent larger releases from reservoirs higher in the system that would result in more power generation, and thus require more spill at downstream reservoirs to avoid overgeneration. The result, depicted in Figure 4, was that providing the first two veekly Water Budget requests lwered the Grand Coulee pool elevation below what vould have been maintained without Water Budget augmentation. This operation did not adversely impact other project functions. This, combined with a lack of increased runoff due to belw normal temperatures and high elevation precipitation in the form of snow, kept the weekly average flow projections provided by the RCC belw the 130 kcfs May minimum for fish recommended by the fishery agencies and tribes.

In actuality, the first Water Budget requests, covering Hay 5 - 18, vere for 140 kcfs. At this point, about 34% of the chinook yearlings and 13% of the steelhead juvenile migrants had reached McNary Dam, 36% of the mid-Columbia chinook yearlings and 3.5% of the steelhead had passed Rock Island Dam, and 70% of the Snake River chinook yearlings and 21% of the steelhead had passed Lower

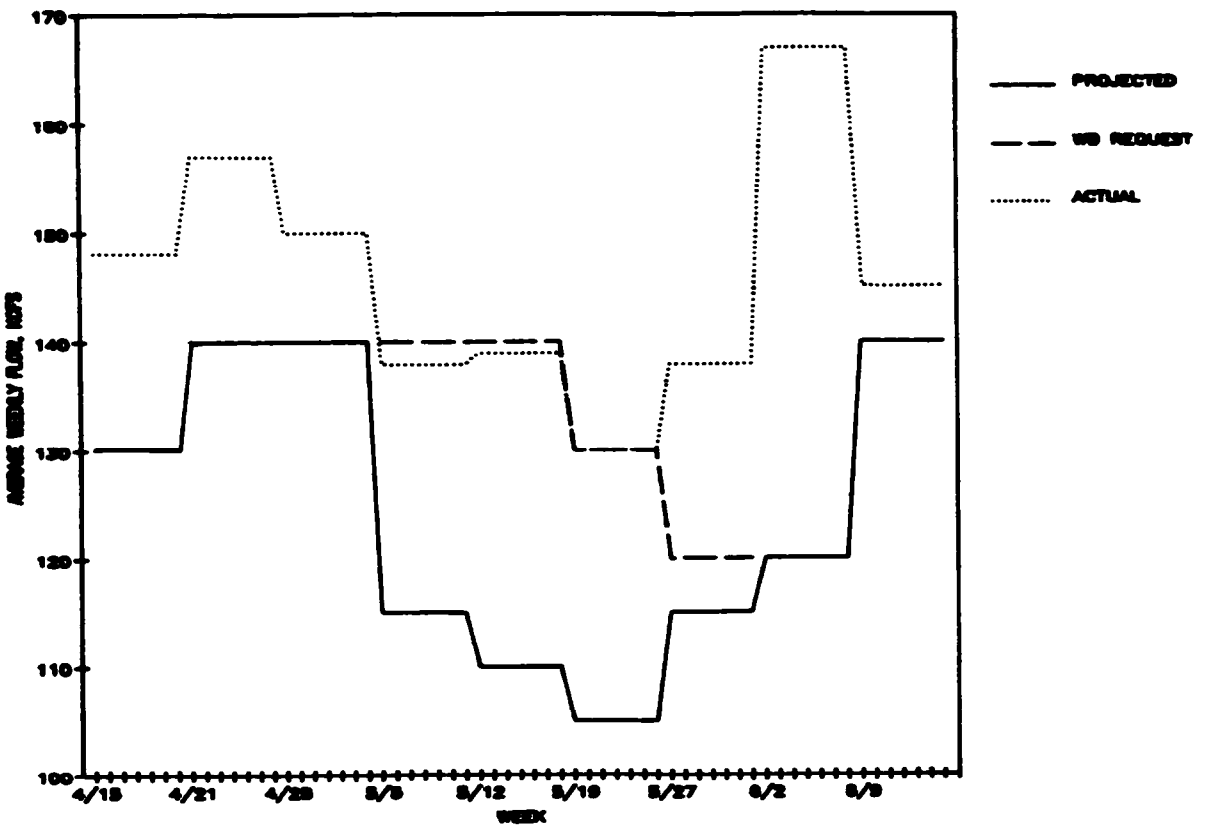


FIGURE 3 1986 PRIEST RAPIDS FLOWS

Granite Dam. Because these juvenile migrants had been experiencing flows at or above 140 kcfs, the Water Budget managers initial requests for Priest Rapids were for the maximum allowed by the NPPC Program (140 kcfs) to keep flws at this level. The rationale was the intention to keep the smolts moving through the reservoirs at as rapid a rate as possible within the capabilities of the Water Budget. hooking ahead, the intent vas to decrease flows gradually, if necessary, avoiding any sudden drop that the migrants might react to as vell as the follow level itself.

Projected operation of Goulee without the Water Budget for the third veek in May (see Figure 4) vas to start reservoir refill. The actual operation, including providing Water Budget flovs, closely paralleled the projected operation vithout Water Budget flovs because actual runoff during that week was greater than anticipated from the streamflow forecast simulation.

However, based on the forecast for decreasing runoff combined with the projected refill of Goulee reservoir to offset the earlier dravdovn made to provide the Water Budget, It vas apparent that continued use of the Water Budget was necessary. At this point in the migration, about 83% of the mid-Columbia chinook yearlings and 42% of the steelhead juveniles had passed Rock Island Dam, 89% of the Snake giver chinook yearlings and 62% of the steelhead had passed Lover Granite Dam, and 74% of the yearling chinook and 53% of the steelhead had reached McNary Dam.

Since the Water Budget would have been exhausted before the end of May If continued at the maximum level, the Water Budget managers chose from the many options considered the aforementioned alternative that vould prevent sharp flw decreases which might slow or stop the migration through reservoirs. This decision vas influenced by long-range forecasts for increased flows in early June. The affect of this decision is that the Water Budget volume of 3.45 MAF would have been used by June 4 if Increased runoff had not occurred.

During the fourth week in May, actual reservoir refill, even while providing Water Budget flows, was at a much faster rate than projected without the Water Budget (Figure 4) because of a sudden jump in temperatures to 25°F above normal, causing greatly increased snowmelt and resulting runoff.

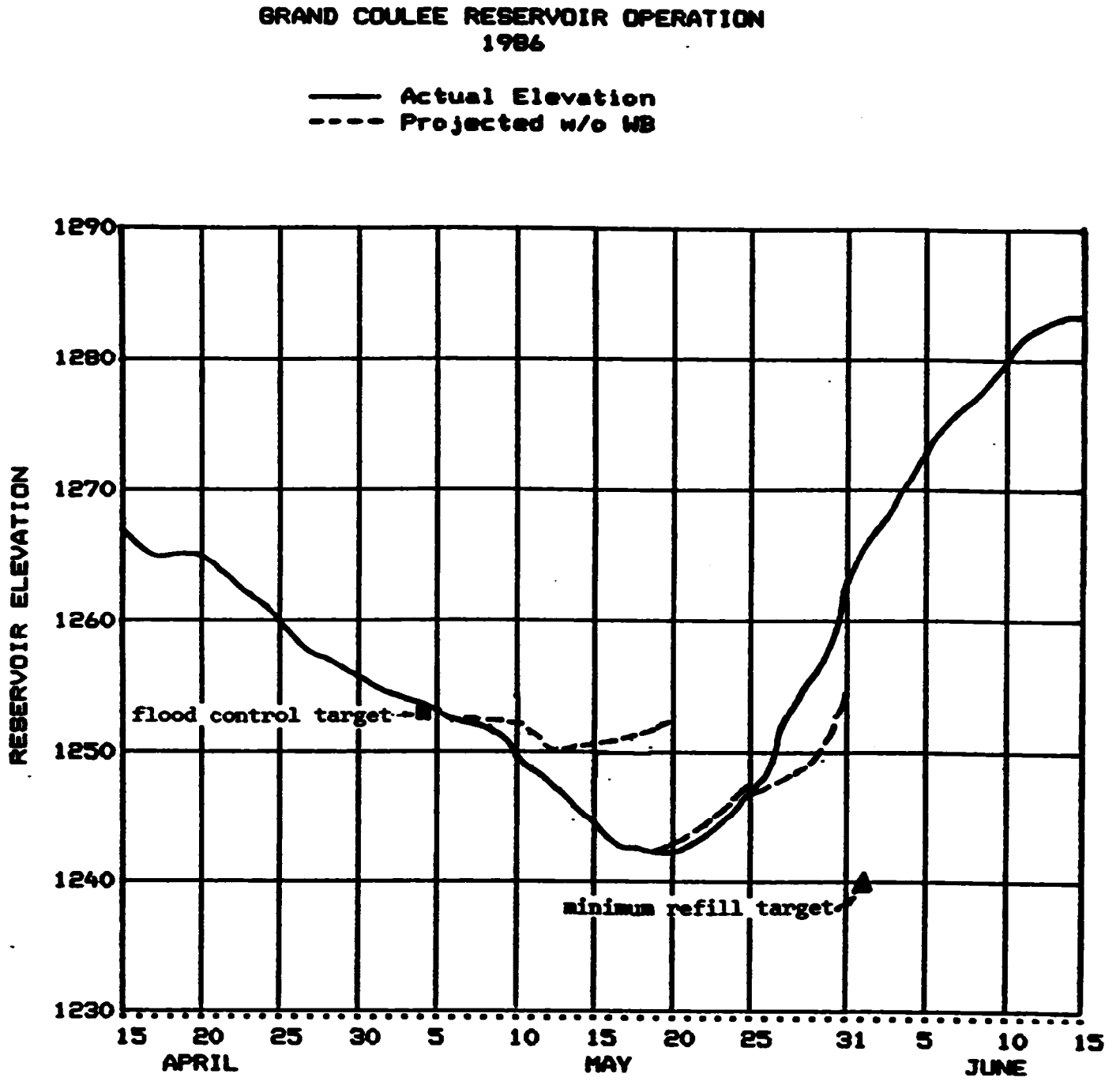

GRAND COULEE RESERVOIR OPERATION
1986
Actual Elevation
Projected w/o WB
RESERVOIR ELEVATION
1290
1280
1270
1260
1250
1240
1230
flood control target
minimum refill target
15
20
25
30
5
10
15
20
25
31
5
10
15
APRIL
MAY
JUNE

FIGURE 4

These differences point out the potential problems in making flow augmentation decisions up to twelve days in advance based upon streamflow forecast simulations that, beyond four days out, only indicate probable streamflows with an assumed sequence of weather events.

To reiterate, flow augmentation strategy used by the Water Budget managers was to initially maintain near optimum flows, and then to use the Water Budget as needed to insure any necessary decreases in flaw levels would take place gradually through the Water Budget period. This approach was used in order to maintain the best possible travel times down through the lower Columbia that the Water Budget volume would allow.

The late May warring trend of 20-25°F above normal and accompanying increased streamflows occurred just as the Water Budget allocation was about used up, and extended through the remainder of the Water Budget period.

In summary, mid-Columbia flows for fish were good throughout the 1986 Water Budget period. It should be noted, however, that with runoff slightly above average it took nearly the entire Water Budget to maintain flows for just four weeks. If additional low flow periods had occurred at either end of the migration-late April or early June-the Water Budget could not have been stretched to cover these periods in or&r to protect 80% of the migration. On the other hand, in a year with enough additional spring rainfall, it is possible that fewer Water Budget requests would be needed.

The potential for such rainfall/runoff variability points out the need to retain the flexibility in system operations needed to respond to actual conditions as they occur. Such flexlbillty is needed to get the full benefit intended in using the Water Budget-to shape flows to the movement and needs of the fish.

This need to maintain the maximum system operational flexibility possible is the basis for Water Budget managers concern over the Fish and Wildlife Program amendment, promulgated by the NPPC, which proposes to adopt the 1986 CPO method for mid-Columbia Water Budget implementation as the permanent method for both the mid-Columbia and Snake Rivers. The following addresses that concern relative to the mid-Columbia; concern relative to the Snake is addressed in the next section.

The nature of the concern can be further illustrated by examining what conditions potentially could have existed in the mid-Columbia in 1985 given the runoff that year, both forecasted and actual, but applying the 1986 CPU method of Water Budget implementation. Two of the many possible scenarios are presented.

Because one can only speculate as to what average weekly streamflow projections would have been provided to the Water Budget managers by the RCC in 1985 using the 1986 CPO approach, the first scenario assumes that Water Budget requests would have taken place in accordance with the schedule set forth in the 1985 CPO, until the Water Budget was exhausted. A valid argument might be that it would not have been necessary to request Water Budget flow augmentation as early as was actually the case (April 15) because flood control and power operations would have maintained desired flow levels for juvenile fish migration without Water Budget requests. The project operators insist, however, that the Water Budget was in effect for 45 days beginning April 15, regardless of whether or not those flows would have existed without being requested.

Under the above stated assumption, therefore, Water Budget requests would have been for 120 kcfs from April 15 through April 28, 130 kcfs from April 29 through May 5, and 140 lccfs from May 6 until exhausted. The 3.45 MAF of specified Water Budget volume would have been fully used on May 18 under this scenario; 33 days from the start, and 28 days before the end of the Water Budget period (June 15). Actual flows during much of the period during which Water Budget requests were in effect , or would have been in effect under this scenario (April 15 - May 18). were substantially higher than requested due to power marketing. This resulted in major drawdown of Coulee Reservoir which was considered acceptable by the project operators in light of forecasts for sufficient runoff later in the season to meet refill requirements. Under this scenario, the fact that the forecasts were faulty and the anticipated runoff did not occur would have resulted in flows after May 18 much less than needed for migrating juvenile fish in order to meet refill obligations.

A second and probably more likely scenario is that Water Budget flow augmentation to 120 kcfs would have been requested for the third week in April, and that the actual flows from April 23 through about May 10 would have existed for power marketing purposes without Water Budget requests. At this point, It was becoming

evident that there were sizeable runoff forecast errors that would cause reservoir refill problems. Under this scenario, 2.84 MAF of Water Budget would remain after May 10 which would extend to June 3 at an average use rate of 135 kcfs (which is about the average of the use rate for the same length of time under the first scenario).

Although this could have provided good flows for fish for a longer period than the first scenario. refill requirements would cause a large drop in flows after the Water Budget had been provided because of the large drawdown of Coulee Reservoir and the uch less than anticipated residual runoff. Coulee Reservoir was drawn down to elevation 1215.6 on May 15 in the 1985 season. To meet the refill targets of elevation 1240 by May 31 and elevation 1285 by June 30 would require reservoir releases to be less than reservoir inflow during that 1½ month period by an amount sufficient to provide 4.43 MAF of water to fill that nearly 70 feet of storage space. The resulting flows in the mid-Columbia would have needed to be considerably less than desirable for migrating smolts, if reservoir refill once again was given priority over fish needs. This would have occurred while large numbers of juvenile migrants were still in the system.

It is hoped that this discussion of the potential problems had the 1986 CPO method been applied to 1985 conditions Illustrates the undesirability of locking Water Budget implementation into a procedure that requires a specific set of conditions to work well. The Water Budget managers believe that, at the very least, the Fish and Wildlife Program should include language similar to that which appears in each CPO, so that any procedure identified Includes flexibility for In-season modification to properly deal with real-time conditions as they occur.

2. Snake River (Lower Granite)

The Water Budget was not called upon for Lower Granite flow augmentation during 1986 because flows were above the 85 kcfs minimum for nearly the entire two-month Water Budget period (see Figure 5). One short-term streamflow forecast for the Snake River prepared by the River Forecast Center indicated a forthcoming drop in flow at Lower Granite, perhaps below 85 kcfs, in early May. The Water Budget managers decided to wait to see if this would be a short-term drop in flow, or an extended low-flow period that would justify using the

limited amount of water available. It turned out to be of short duration, dropping to 81 kcfs for one day and back up to 90 kcfs the following day. Consequently, no Water Budget usage was requested in order to conserve that water for subsequent use should an extended low-flow period occur.

Figure 5 also shows the juvenile steelhead and yearling chinook index counts at Lower Granite during the 1986 water budget period. This gives some indication of whether or not there is an Increase and decrease of smolt counts with flow increases and decreases.

As noted above, a later need for the Water Budget did not arise and Snake River flows also can be characterized as generally favorable for juvenile fish migration throughout the 1986 Water Budget period. These favorable events do not, however, negate the advantage of having flexibility in managing the Water Budget should different runoff conditions occur.

As mentioned earlier, the Water Budget managers also are very concerned about application to the Snake River of the 1986 mid-Columbia CPO method as proposed in the Fish and Wildlife Program Amendments being considered by the NPPC.

To begin with, it is inconceivable that the project operators would be willing to project and guarantee streamflows at Lower Granite lacking sufficient storage control to meet such guarantees when the projections are in error, as they are bound to be. The following “for example” involves likely occurrences, rather than a worse case. For illustrative purposes, it will be assumed that a BPA/IPC storage agreement is in place so that Brownlee Reservoir also is participating in providing the Water Budget.

To set the stage, the following facts should be kept in mind. First, the active storage in Dworshak and Brownlee Reservoirs combined can control only about 10% of the average Jan - Jul runoff at bower Granite, and only about 20% of that active storage would be shapeable as Water Budget flow augmentation, assuming continuation of the COE position regarding Dworshak, and Brownlee participation as proposed by IPC. Second, Dworshak hydraulic capacity is 10 kcfs so that larger releases would require spill which, while possible, is resisted by the project operators. Third, the Water Budget implementation method

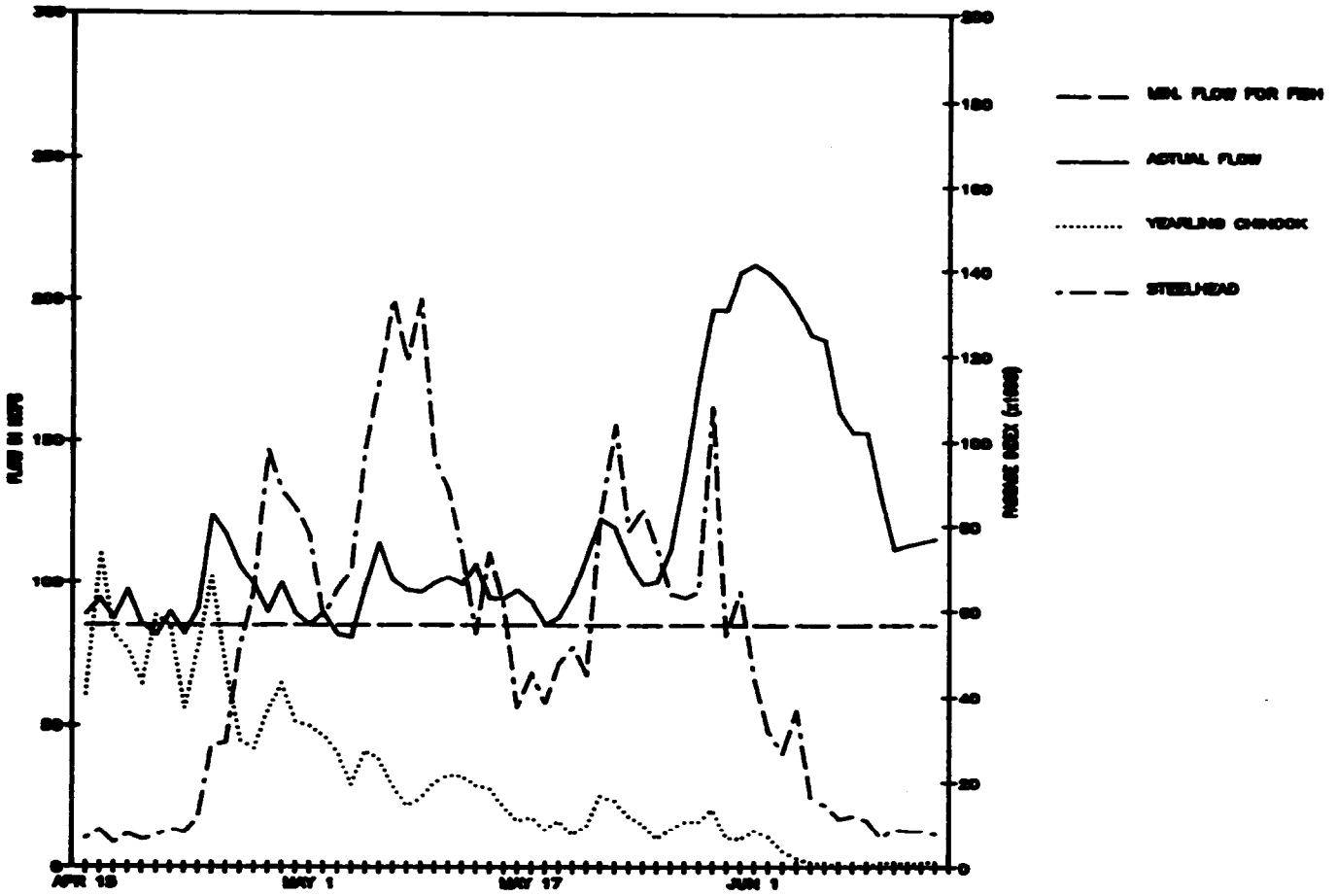


FIGURE 5 LOWER GRANITE DAM, 1986

proposed as a Program amendment calls for the RCC to provide average weekly streamflow projections covering a period extending 12 days ahead. And fourth, the proposed Water Budget accounting is on a weekly average basis.

For example, suppose that the RCC average streamflow projection for a week early in the Water Budget period was for a level that turned out to be about 15 kcfs greater than what would actually occur without augmentation from storage, and was high enough that augmentation using the Water Budget was not requested. This is a distinct possibility because streamflow estimates that far in advance require an educated guess as to the most likely sequence of weather events. As discussed earlier, streamflows at Lower Granite fluctuate rapidly due to large amounts of uncontrolled runoff greatly Influenced by sudden changes in weather. If the weather suddenly turned cooler than anticipated, and the expected precipitation was in the form of snow rather than rain-a common occurrence-the combined effect could easily reduce the runoff to cause flows at Lower Granite to be 15 kcfs less than projected.

Raving guaranteed the projection, Lower Granite flows would need to be augmented by 15 kcfs from storage, which would require about 208,000 acre-feet of stored water for the week. Even though not charged to the Water Budget, it would represent more than one-third of the total Snake River storage commitment.

In order to fill the hole in the reservoirs caused by that week's operation, the bower Granite streamflow projections for some future weeks would likely be reduced to provide for reservoir refill which, if the projections were low enough, would prompt Water Budget flow augmentation requests. If a Water Budget request occurred in April, the proposed weekly accounting method would use the shapeable Water Budget at a rate of 485,000 acre-feet per week, which is 81% of the maximum Snake River storage commitment; if in May, the use rate would be 277,000 acre-feet per week, which is 46% of the maximum storage commitment.

Whether or not advanced average weekly streamflow projections and guarantees are a Snake River requirement, weekly Water Budget accounting against the specified power base flows as proposed in the Fish and Wildlife Program Amendments would severely restrict the flexibility and utility of the Water Budget. Even including Brownlee participation as identified by IPC, 15 days is

the maximum period that the maximum Snake River Water Budget storage commitment would cover under the proposed weekly accounting procedure, depending upon the month and magnitude of the request and regardless of how small the actual increase in storage releases that would be required to meet the request.

As concluded in the rid-Columbia discussion, at the very least, Fish and Wildlife Program language should provide flexibility for in-season modification to properly deal with real-time conditions as they occur, regardless of the Water Budget implementation procedure Identified. Furthermore, the Water Budget managers believe that the informal, trial approach for the Snake River agreed to by the RCC and Water Budget managers for 1986 was the best arrangement for Snake River streamflow forecasting and Water Budget implementing and accounting devised to-date. Because this informal agreement did not get a real test in 1986 due to the amount of uncontrolled runoff, the Water Budget managers believe that it is worthy of further testing. In addition, a similar streamflow forecasting and Water Budget implementing and accounting procedure would be applicable to Brownlee Reservoir participation.

IV. 1986 SPILL IMPLEMENTATION

A. SPILL REQUESTS

Numerous spill requests were made by the Water Budget managers throughout the juvenile migration. Table 4 lists these requests by date and purposes together with the RCC responses.

The purposes include: (1) minimum spill levels at specified projects in accordance with the Detailed Fishery Operating Plan (DFOP) of the fishery agencies and tribes; (2) distribution of surplus spill by projects and amounts correlated with fish movement and needs; (3) spill distribution for dissolved gas control; and (4) special spill operations at specified projects for research purposes.

As occurred in 1985, all parties could not agree upon a spill plan. The 1986 result, therefore, was the COE 1986 Juvenile Fish Passage Plan, the fishery agencies and tribal DFOP, and the NPPC program, all of which differed in some aspects concerning the level of fish protection and resulting spill to be provided at various locations. BPA also presented a fourth position in two letters to the Water Budget managers: (1) on April 18, which stated in part that "the Water Budget managers shall only make spill requests which are within, and pertain directly to, the guidelines established by the COB Juvenile Fish Passage Plan"; and (2) on April 25, with a suggestion that the Water Budget managers make "spill for fish passage requests in conformance with that level of spill which has been set aside to provide the minimum level of protection..."

In recognition that the Water Budget managers are obligated to support the fishery agencies and tribes spill criteria contained in the DPOP and submitted to the NPPC. that the RCC is obligated to support the COE 1986 Juvenile Fish Passage Plan, and that the NPPC Program does not specify a maximum level of protection, the Water Budget managers Included the following statement in applicable spill requests from them to the RCC: "We recognize that the spill amounts in this recommendation exceed levels assumed necessary to attain the 90% objective established by the Northwest Power Planning Council. The agencies and tribes regard the NPPC objective as the lower rather than the upper limit

TABLE 4

1986 SPILL MANAGEMENT

WB MGR. REQUEST Date	REQUESTPURPOSE Min.Fish Passage	Surplus Spill	Diss.Gas Control	RCC RESPONSE Yes	No	Modified
2/21	X			X		
2/26	(Special research operation)			X		
3/14		**X**		**X**		
4/1	**X**	**X**		**X**		
4/10		X				X
4/14	X					X
4/23	**X**				**X**	
4/25		X		X		
4/29		X		X		
5/28		X		X		
6/2			**X**	**X**		
6/10	**X**	**X**				**X**
6/13	X					X
6/19	X	X				X
6/23	(Special research operation)			X		

to the interim juvenile fish protection that should be provided. When there is a surplus of Federal firm power, or when Federal non-firm exists, we are requesting that the Corps and BPA make every effort to provide spill in excess of the NPPC minimum."

B. RESPONSES TO REQUESTS

For illustrative purposes, flow and spill at Federal projects from March 20 to June 30 are plotted on Figures 6 - 9 for LWG, LGS, LMN, and IHR on the Snake River, and Figures 10 and 11 for MCN and JDA on the lower Columbia. Note that at the Snake River collector dams (Lwg and LGS) spill takes place only when flows exceed project hydraulic capacity. A more complete discussion of flows and spill and the relation to fish passage, including plots for other projects, will appear in the annual Smolt Monitoring Program Report.

Referring to Table 4, the majority of requests were carried out as requested (indicated with a check under "yes" in the “RCC Response" column). These requests were made during the highest runoff periods which, coupled with a relatively low Southwest power market and favorable reservoir refill conditions, resulted in considerable surplus spill. This made It possible to satisfy the requests within the COE 1986 Juvenile Fish Passage Plan.

Several requests were modified by the RCC to provide less spill than requested, either because spill was requested at collector projects, or because the requested amount was greater than called for in the COE plan and the COE and BPA did not consider that enough surplus spill was available.

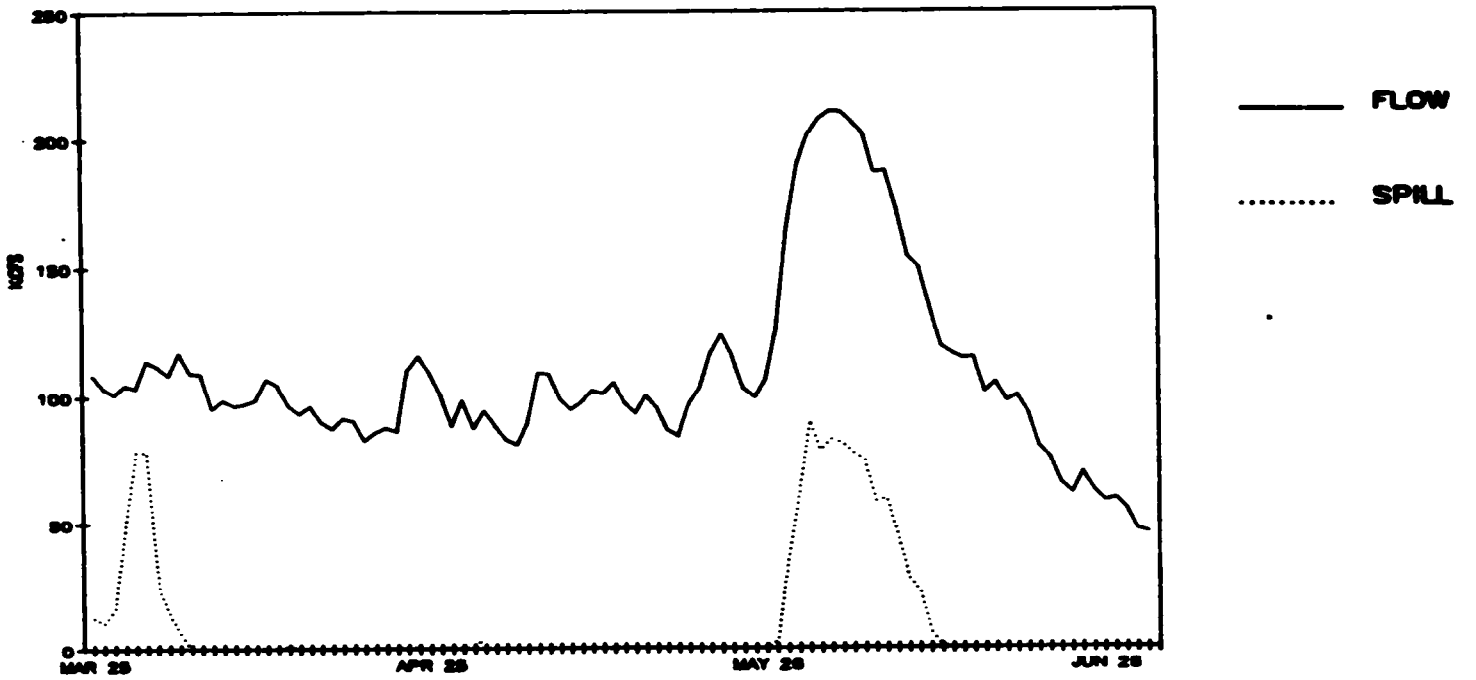


FIGURE 6 1986 FLOW AND SPILL AT LOWER GRANITE

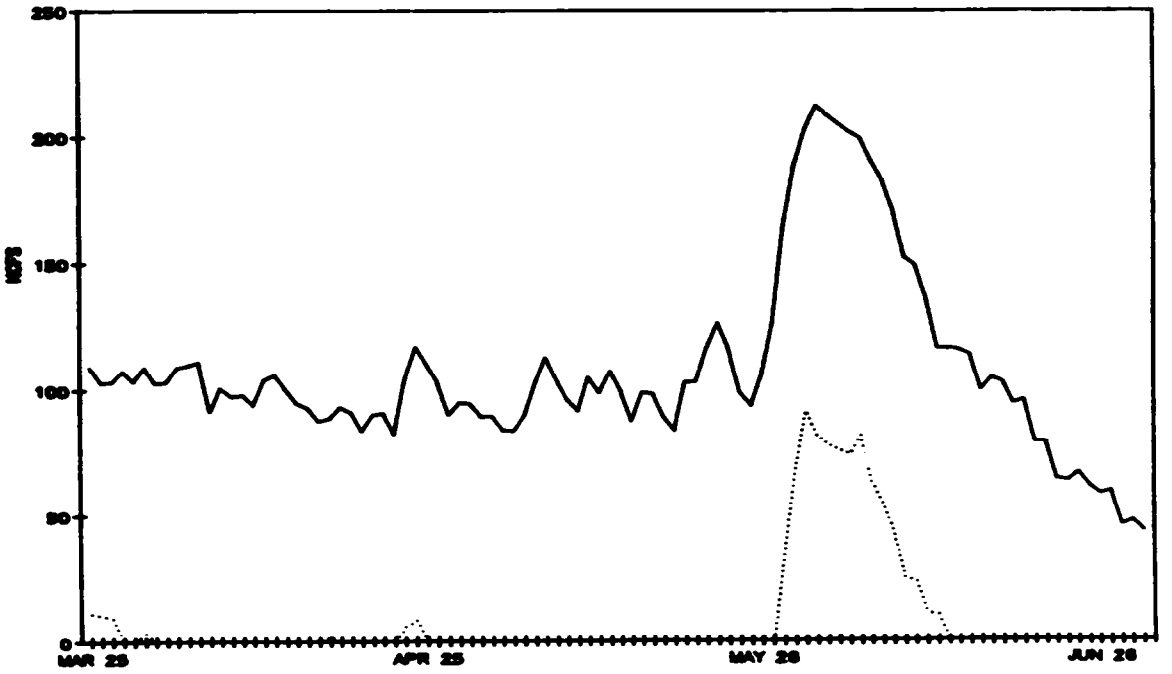


FIGURE 7 1986 FLOW AND SPILL AT LITTLE GOOSE

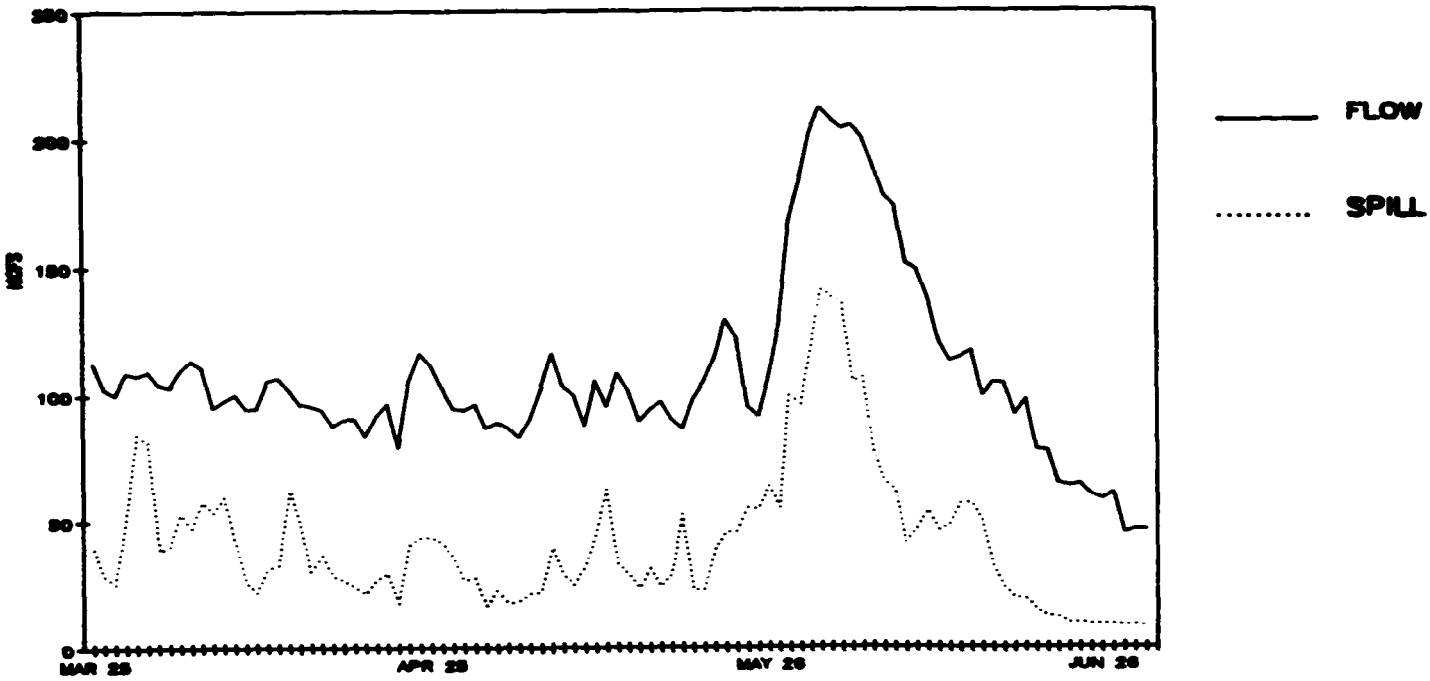


FIGURE 8 1986 FLOW AND SPILL AT LOWER MONUMENTAL

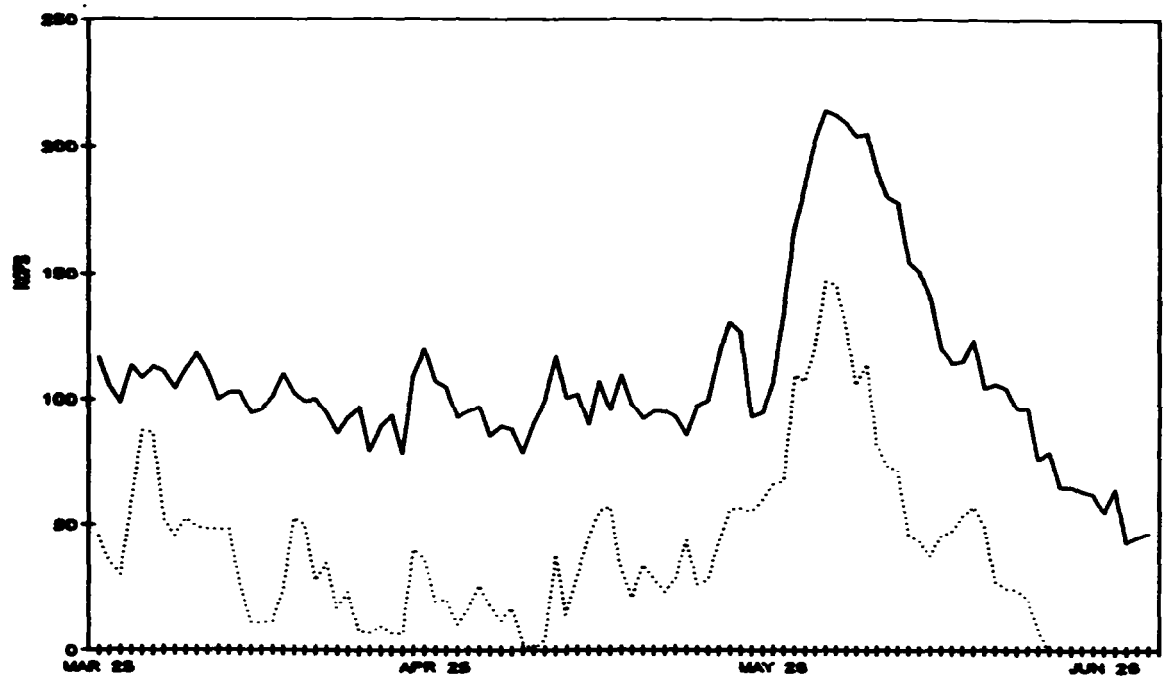


FIGURE 9 1986 FLOW AND SPILL AT ICE HARBOR

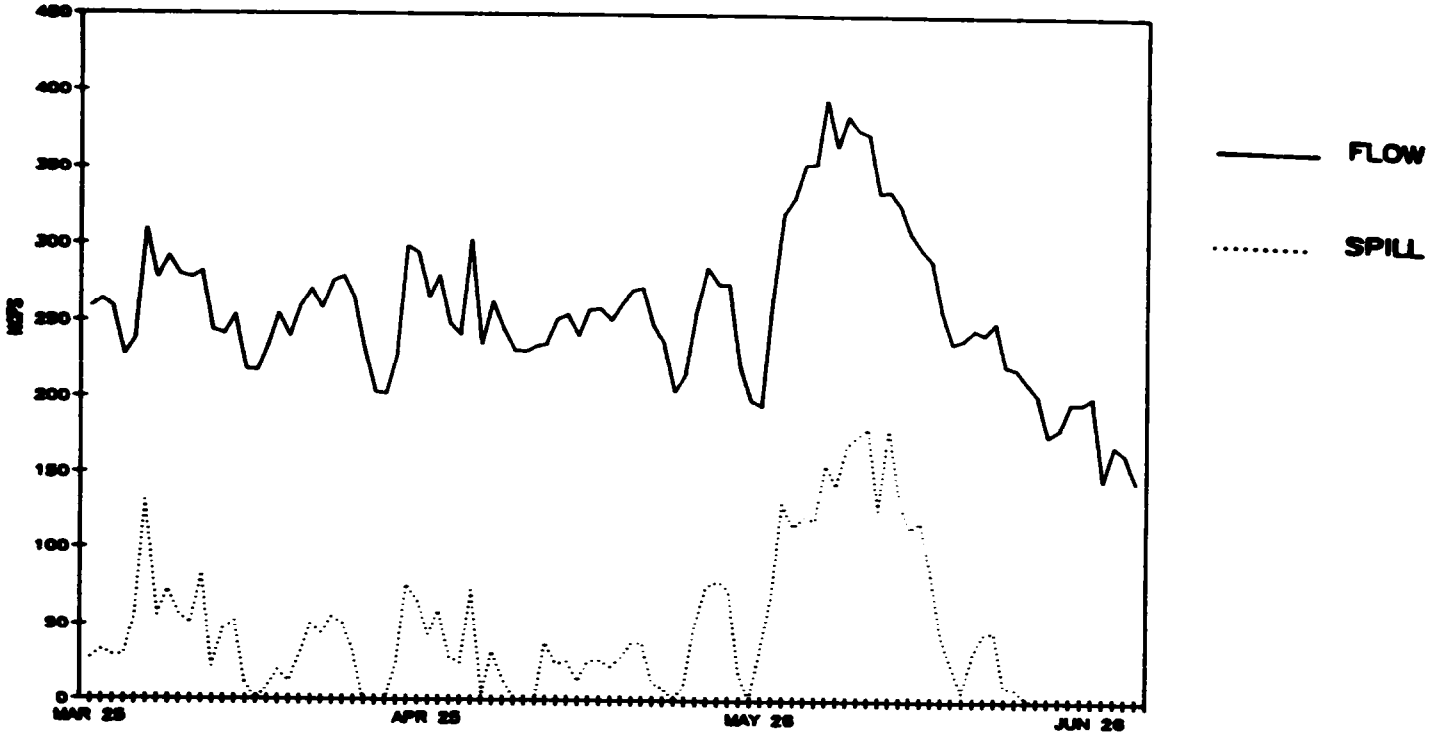


FIGURE 10 1986 FLOW AND SPILL AT MCNARY

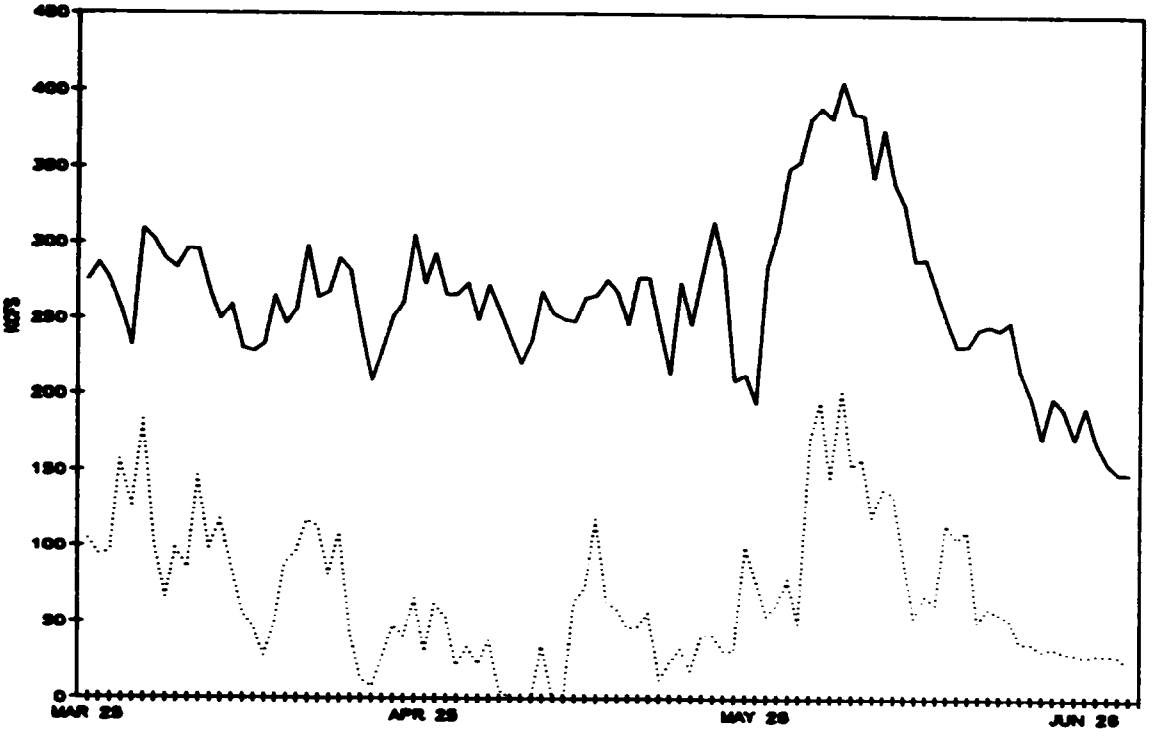


FIGURE 11 1986 FLOW AND SPILL AT JOHN DAY DAM

To Illustrate the spill request and response process, the following four pages provide copies of:

1. The Water Budget managers April 14, 1986 request for "Spill for Fish Passage"', including the rationale for the request;

2. The RCC response to the April 14 request, stating the reasons for and nature of modifications to the request by the COE;

3. A letter to the Water Budget managers from BPA stating the BPA position to such requests, quoted from above under "Spill Requests"; and

4. The Water Budget managers April 23 request for spill at The Dalles, discussed in the following paragraph, and the rationale for the request.

One request was denied. This was for spill for fish passage at The Dalles, with the RCC contending that the required passage index level had not yet been reached. Since the COE sonar monitoring at The Dalles was not operational until later, the RCC position was based upon previous year's smolt monitoring data, whereas the Water Budget managers calculations and spill request were based upon 1986 air lift counts at John Day and passage at McNary Dam. These 1986 data Indicated to the Water Budget managers that the spill request was both appropriate and consistent with the NPPC Program which calls for protection of 80% of the juvenile migration. A memorandum from the Water Budget managers to the RCC which elaborates on the data and analysis used as the basis for this request appears in Appendix C.

Another unresolved issue is the criteria for summer spill levels. The COE followed Its 1986 Juvenile Fish Passage Plan and reduced the summer spill at John Day Dam according to FGE test results over the objections of the fishery agencies and tribes. Given the reduced levels, the Water Budget managers requested that spill be concentrated during fewer hours to provide a higher Instantaneous rate of spill. A memorandum from the FPC to the RCC documenting the fishery agencies and tribes position also appears in Appendix C.

4/15/86

FISH PASSAGE CENTER

825 N.E. 20TH AVENUE • SUITE 336 • PORTLAND, OR 97232-2295
PHONE (503) 230-4099

SYSTEM OPERATIONAL REQUEST

TO: Jim Cayanus, Reservoir Control Center

FROM: Water Budget Managers:

Malcolm H. Karr, Columbia Basin Tribes

Michele DeHart (Acting), Fish & Wildlife Agencies

REQUEST
#86-9

DATE:
April 14, 1986

SUBJECT:
Spill for Fish Passage

SPECIFICATIONS:

This request is for spill for fish passage and should be implemented before the spill distribution list for surplus spill.

According to the spill criteria submitted to the COE and the Northwest Power Planning Council by the agencies and tribes, spill for fish passage will commence at Lower Monumental two days after the Little Goose aggregate collection count exceeds 15,000.

Passage indicies at Lower Granite and the Lewiston trap indicate that the migration is early this year, and that typical dates of passage are not applicable.

The Little Goose daily collection count was 15,902 on April 13, 1986. This would commence spill for fish passage at Lower Monumental on April 15 and on April 18 at Ice Harbor.

We are requesting the following spill for fish passage operations at Lower Monumental and Ice Harbor Dams. We recognize that the spill amounts in this recommendation exceed levels assumed necessary to attain the 90% objective established by the Northwest Power Planning Council. The agencies and tribes regard the NPPC objective as the lower, rather than the upper limit to the interim juvenile fish protection that should be provided. When there is a surplus of Federal firm power, or when Federal non-firm exists, we are requesting that the Corps and BPA make every effort to provide spill in excess of the NPPC minimum.

Lower Monumental	starting April 15	spill 31% Daily Average Flow	6 PM - 6 AM
Ice Harbor	starting April 18	spill 41% Daily Average Flow	6 PM - 6 AM

275.86/SOR

SOR Response

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208-2870

REPLY TO
ATTENTION OF:

NPDEN-WM

April 18, 1986

TO: Water Budget Managers:

Malcom M. Karr, Columbia Basin Tribes
Michele DeHart (Acting), Fish & Wildlife Agencies

FROM: Reservoir Control Center

James W. Cayanus
Fishery Operations Coordinator

SUBJECT: Spill For Fish Passage
REFERENCE: FPC Request #86-9 dated April 14, 1986 (copy attached)

1. Prior to your request referred to above, Lower Monumental was already instructed to spill a minimum of 50 percent of project discharge from 1800 to 0600 hours every day, starting April 15, 1986. The spill during those hours should average out about 50 percent of the daily average flows, well above the 31 percent spill level you requested.

2. Your request for spilling 41 percent of the daily average flows at Ice Harbor from 1800 to 0600 hours is in conflict with the Corps 1986 Juvenile Fish Passage Plan and cannot be implemented as stated. As you know, the Plan does not require spilling at Ice Harbor to achieve the 90 percent passage objective.

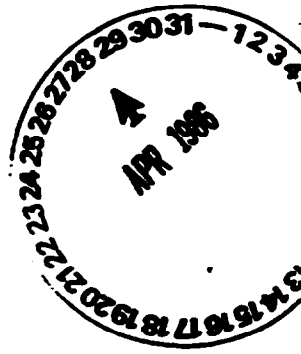
However, we do understand that the 90 percent objective is a minimum target and, for that reason, we do spill at Ice Harbor whenever we can. Therefore, while we cannot go along with your request of 41 percent spill, we will upgrade, as a result of your request, Ice Harbor to the Number Two position on the spill priority list and instruct the project to spill, whenever possible, up to 50 percent instantaneous flows during the hours indicated. This will ensure that, when surplus spill is available, Ice Harbor spill will approach the 41 percent level you need between 1800 and 0600 hours.

Currently, spill at Ice Harbor during those hours is about 29 percent of daily average flows. Because higher flows are expected within a week or two in the Lower Snake River, the chances for our diverting surplus spill to Ice Harbor and substantially increasing our night-time spill there look reasonably high.

SORT 86 -

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208 - 3621

APR 25 1986



In reply refer to: PJI

Mr. Mal Karr and Ms. Michelle DeHart
Water Budget Managers
Fish Passage Center
825 NE. 20th Avenue, Suite 336
Portland, Oregon 97232-2295

Dear Mr. Karr and Ms. DeHart:

We are receiving copies of your system operational requests and have some comments on your recent requests to the Corps', which may be helpful.

In 86-9, you have requested spill in excess of that required to meet the 90 percent survival minimum target. It is understandable that you want protection above minimum however, any spill above minimum must come from surplus or overgeneration spill. In 86-8, where you specify overgeneration spill distribution, it is not consistent with your request for "Spill For Fish Passage." I suggest that you make your spill for fish passage requests in conformance with that level of spill which has been set aside to provide the minimum level of protection and then increase those levels through the "Distribution of Surplus Spill" list.

In 86-8, "Distribution of Surplus Spill", your third priority calls for no limit at Lower Monumental. We have been working with Tom Berggren, of your office, to establish an operation. This operation will maintain generation using Unit 3 at Lower Monumental such that consistent sampling through gatewell dipping can be maintained. We suggest you make a note on this request which clarifies your request to allow continuous operation of Unit 3.

Sincerely,

for John W. Ferguson
Fisheries Biologist

cc:
J. Cayanus, Corps-RCC
J. Ruff, NPPC

4/23/86
1330

FISH PASSAGE CENTER

825 N.E. 20TH AVENUE • SUITE 336 • PORTLAND, OR 97232-2295
PHONE (503) 230-4099

SYSTEM OPERATIONAL REQUEST

TO: Jim Cayanus, Reservoir Control Center

FROM: Water Budget Managers:

Malcolm H. Karr, Columbia Basin Tribes

Michele DeHart (Acting), Fish & Wildlife Agencies

REQUEST #86-11

DATE: April 23, 1986

SUBJECT: The Dalles Dam: Spill for Fish Passage

SPECIFICATIONS:

We are requesting the following spill for fish passage at The Dalles Dam according to the fishery agencies and tribes spill criteria, submitted to the COE and NPPC.

By comparing daily and cumulative passage indicies for 1985 and 1986 for McNary Dam, we estimate that the 10% point of passage of yearling salmon occurred at McNary on April 12 or 13. According to the agencies and tribes spill criteria, the 10% point of passage occurs five days later, and triggers spill, at The Dalles. The COE criteria calls for 7,500 fish in the daily gatewell sample at John Day to trigger spill at The Dalles. The 7,500 trigger has been exceeded at John Day gatewell samples since April 12.

This request for spill for fish passage at The Dalles has been delayed by the agencies and tribes to facilitate research being conducted at the project from April 11 through April 21.

It is recognized that the spill amounts in this request exceed levels generated by computer modeling assumed necessary to attain the minimum 90% dam survival objective established by the Northwest Power Planning Council. The fishery agencies and tribes consider the 90% objective as a lower rather than an upper limit to the interim juvenile fish protection that should be provided. When there is a surplus of Federal firm power, or when Federal non-firm power exists, we would expect the Corps to make every effort to provide spill in excess of this minimum.

The Dalles: Spill 41% of the Daily Average Flow 6:00 pm - 6:00 am

The sluiceway should operate according to optimum criteria agreed upon by the agencies and tribes.

310.86/SOR

V. IN-SEASON FLOW AND SPILL MANAGEMENT RATIONALE

The preceding sections discussed the nature and some of the results of flow and spill system operational requests from the Water Budget managers to the COE RCC. This section describes utilization of applicable portions of the smolt monitoring program, including data management, to explain how and why those requests were determined.

A. DATA FOR IN-SEASON MANAGEMENT

The primary purpose of the Fish Passage Data Information System is to provide centralized collection, analysis, and storage of data used in implementing the Water Budget Measures Program. Both in-season management and post-season analyses of the outmigration is conducted by the FPC on the basis of this information. In-season management requires quick access to real-time data by the Water Budget managers. These data are obtained through the Smolt Monitoring Program and from outside sources such as the Corps of Engineers (COE), fish and wildlife agencies, public utility districts (PUDs), and the tribes.

Smolt migration information for 1986 was collected for spring, summer, and fall chinook and steelhead in the Snake and mid-Columbia reaches. These data were gathered at several monitoring sites (Table 5) throughout the basin, and communicated to the Fish Passage Center via computer terminals. Additional in-season data obtained from the CROHMS data system included adult counts, flow, spill, water temperature, dissolved gas saturation, other project operational data, Ice Harbor and John Day hydroacoustic monitoring, and Little Goose collection counts. Information is accessed daily to assist in managing:

a. the Water Budget,
b. spill for upstream and downstream migration,
c. spill distribution for nitrogen abatement, and
d. project facilities for upstream migrating adults.

Hatchery data maintained and used by the FPC include:

1. Agency and hatchery managing the release
2. Fish species and race
3. Release site, river, and major river system
4. Release dates
5. Numbers of fish released
6. Size of fish, indicated as number per pound
7. Brood year and probable year of migration
8. Comments (eg., number of clipped fish)
9. For releases of freeze branded fish: Brand symbol, location, and rotation

TABLE 5

FISH PASSAGE CENTER SMOLT MONITORING SITES

1986

Site	Method	Data Gathered
Hid-Columbia		
Rock Island	**Bypass Trap**	Brands, Species
Priest Rapids	Gatewell Dip	Brands, Species
Snaka River		
Snake River Trap	Dipper Trap	Brands, Species
Clearwater Trap	Scoop Trap	Brands, Species
Lower Granite	Bypass/Collection	Brands, Species
Lower Monumental	Hydroacoustics Gatewell Dip	Brands, Species Migration Index
Lower Columbia		
McNary Dam	Bypass/Collection	Brands, Species
John Day Dar	Airlift Pump	Brands, Species
The Dalles Dam	Hydroacoustics	Migration Index
Bonneville Dar	Bypass trap Gatewell Dip	Brands, Species

During the migration season, the Fish Passage Center staff contacts hatchery release coordinators or hatchery managers on a weekly basis to keep track of and coordinate actual fish releases with the Water Budget.

B. FORMULATION OF SYSTEM OPERATIONS BEQUESTS (SOR)

The underlying rationale, stated earlier, is to provide the best flow and spill conditions possible throughout the system to maximize survival of at least the middle 80% of the spring juvenile fish outmigration. This dictated how the Water Budget managers chose to use the Water Budget, and the magnitude and timing of spill requests.

Applying this objective requires the ability, among other things, to estimate when the 10% and 90% points of migration occur. These estimates vere accomplished in 1986 by preparing daily plots of cumulative juvenile passage indices at selected locations and comparing these with the same plots for the entire 1985 spring migration season and with migration timing data for previous years. Since the actual migration points could be calculated for 1985, comparison vith the 1986 curves as they progressed gave a basis for estimating vhen and where the 1986 migration points of concern occurred.

These data, combined with other factors that influence smolt migration and survival such as existing and projected flows, provided the basis for deciding vhen and to what extent to request flov augmentation using the Water Budget. The magnitudes and locations of spill requested likewise were based upon these monitoring data plus consideration of dieeolved gee saturation and water temperature data, consistent with spill criteria of the fishery agencies and tribes for each project.

VI. PASSAGE INDICES AND MIGRATION TIMING

Although the NPPC Fish and Wildlife Program calls for estimates of the size of the smolt outmigration at Lover Granite and Priest Rapids dams, no technique for making reliable estimates has been found. The past estimates at Lower Granite, McNary and John Day dams using collection efficiency relationehipe contain large error terms, and due to facility modifications would need to be re-evaluated. Because of the lack of precision in any estimate obtained and the absence of collection efficiency relationships for Priest Rapids Dam, an amendment has been submitted to the Northwest Power Planning Council to change the Program to accept relative magnitude estimates, i.e., passage indices, rather than absolute magnitude estimates. Only passage indices are reported herein.

A. PASSAGE INDICES

An index of total passage by species for several projects is presented to permit year-to-year comparison of the magnitude of the outmigration. These indices are the annual sum of the daily passage indices (daily collection divided by the proportion of river flow through the powerhouse). The annual passage indices are not estimates of total passage, and they are not comparable between projects and between species within a year. We believe they are useful for comparing the size of the outmigration between years within a species.

Total 1986 passage indices are listed in Table 6 for Lower Granite, Rock Island, and McNary dams. These index the outmigration by species for each major river reach. Comparisons are made vith 1985 passage indices. All years with data will be used in the annual Smolt Monitoring Program report. Data for McNary Dam ends on August 31 in 1986, whereas for 1985 It extends through the end of the sampling season on September 26. It is anticipated that 1986 collection and passage index values listed will increase by less than 0.1% for yearling chinook, steelhead, coho, and sockeye, and by less than 1% for sub-yearling chinook by the end of the sampling season.

A detailed diecuesion of the significance of these data, together with the results of travel time and survival analyses using 1986 data, will appear in the annual Smolt Monitoring Program report scheduled for publication in February 1987.

TABLE 6: Total Passage Indices at Columbia River Projects in 1986 (preliminary) and a comparison with 1985 Indices.

Project	1986 Collection	1986 Index	1985 Collection	1985 Index
Lover Granite				
Yearling Chinook	1,620,361	1,645,170	1,742,244	1,768,547
Sub-Yrlg. Chinook	53,576	55,098	44,008	44,008
Steelhead	3,094,104	3,274,159	2,689,579	2,803,144
Sockeye	7,199	7,624	6,467	6,519
Rock Island				
Yearling Chinook	20,479	26,116	32,399	38,891
Sub-Yrlg. Chinook	44.799	72,981	21,082	24,374
Steelhead	31,108	38,893	30,129	34,254
Coho	48,916	59,305	12,037	13,654
Sockeye	31,286	42,811	31,202	36,804
McNary*				
Yearling Chinook	2,487,264	2,917,067	2,952,613	3,116,140
Sub-Yrlg Chinook	6,049,724	6,615,443	6,524,570	6,531,412
Steelhead	715,378	874,764	840,037	881,698
Coho	80,422	111,175	71,752	72,107
Sockeye	796,855	1,043,376	1,029,832	1,075,970

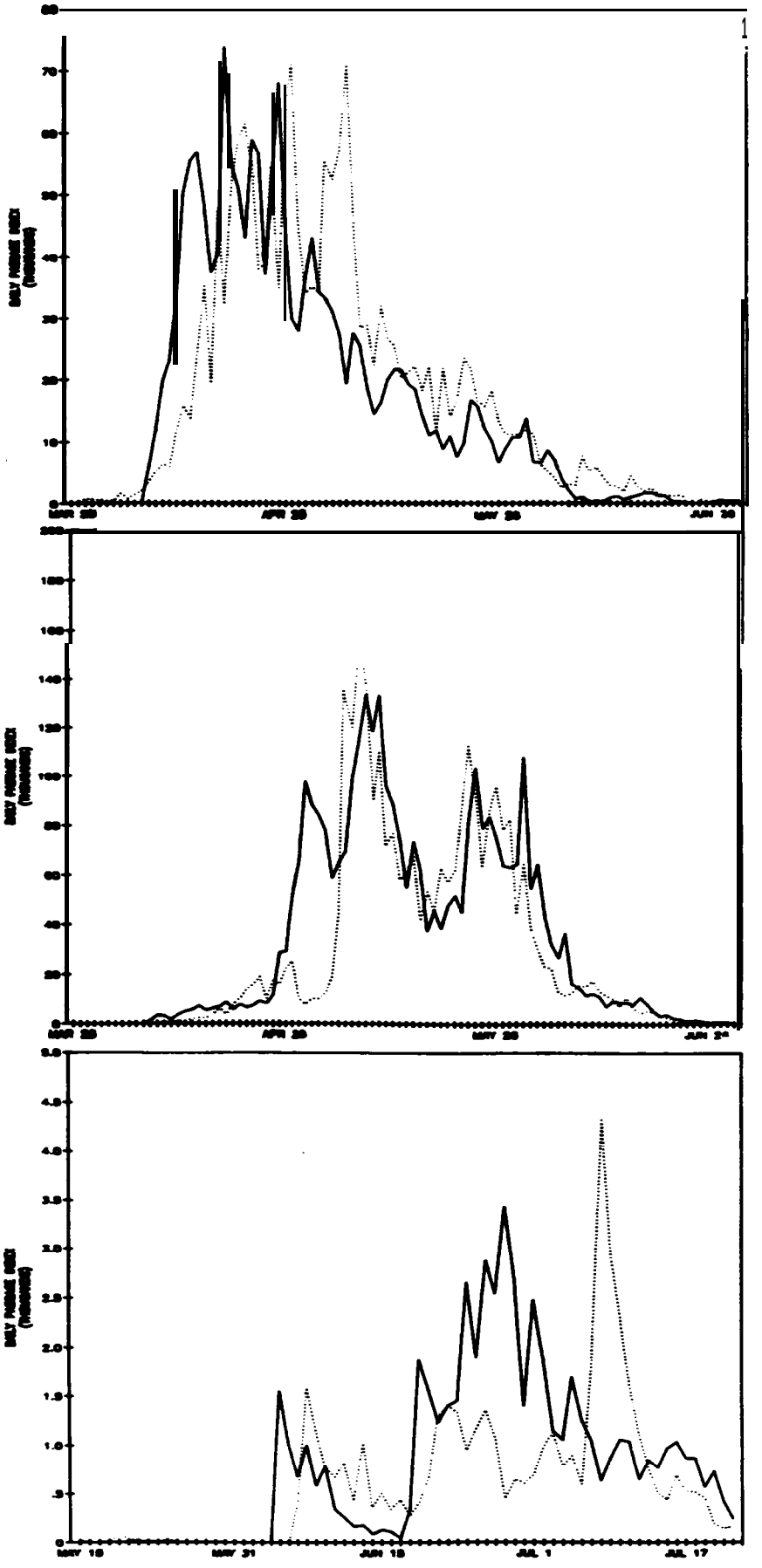
* McNary collections through August 31, 1986 and September 26, 1985.

B. MIGRATION TIMING

The first indication of fish movement out of the upper Snake is provided by the traps located on the Clearwater and Snake Rivers near Lewiston, Idaho, and operated by the Idaho Department of Fish and Game. Further details on the operation of these traps in 1986 will be provided in an annual report from the Idaho Department of Fish and Game. Both of these traps provide qualitative information on smolt movement, and the information is largely used for in-season management of downstream projects. In 1986, the Clearwater and Snake River traps operated continuously from March 22 to May 27, and March 15 to May 29, respectively, when they were removed due to high water conditions. The trap on the Snake River was operated again beginning June 17 for a 10 day period. Peak collections on the Clearwater River occurred within days of the release of Dworshak Hatchery spring chinook and steelhead. Major peaks for yearling chinook occurred on April 3. 14, and 24. Steelhead passage peaked on April 26 and May 22.

1. Lower Granite

Sampling at Lover Granite extended from April 5 through July 24. The daily migration is illustrated in Figure 12. Passage dates and duration are shown in Table 7. Yearling chinook and sub-yearling chinook passage peaked earlier in 1986 than 1985 by about two weeks; however, the date of median passage was only 5 to 7 days earlier in 1986. The steelhead peak occurred one day early and the date of median passage vas 4 days earlier. In both years the steelhead migration exhibited a bimodal distribution with high passage indices early and late in May and a significant dip daring mid-May.



Yearling Chinook

Steelhead

Subyearling Chinook

LEGEND

1986

1985

FIGURE **12** LOWER GRANITE Migration Timing

TABLE 7

Juvenile Passage Dates at Lower Granite Dam, 1985 and 1986

	Peak	10%	50%	90%	80% Passage Duration
			1985		
Chinook Yearling	5/4	4/15	4/30	5/24	39 days
Chinook Sub-Year.	7/9	6/11	7/4	7/14	33 days
Steelhead	5/6	5/3	5/15	5/31	28 days
			1986		
Chinook Yearling	4/16	4/10	4/23	5/21	41 days
Chinook Sub-Year.	6/29	6/10	6/29	7/16	36 days
Steelhead	5/7	4/27	5/11	5/31	34 days

2. Rock Island

Sampling of the second powerhouse bypass system at Rock Island began on April 1 and continued through August 31. The daily migration is illustrated in Figure 13. Passage dates and duration are shown in Table 8.

The chinook yearling migration at Rock Island was later in 1986 than 1985 because hatchery releases were delayed until the FERC ordered spill would be available to aid in project passage in the mid-Columbia. Even though the 1986 releases were later, the median and 90th percentile dates of passage were very similar for both years. The sub-yearling migration was earlier in 1986 because the high flows and spill levels during the first two weeks of June moved many Wells summer chinook quickly from the Methow giver and past the upper projects. The steelhead passage vas very similar between 1985 and 1986, whereas the coho passage occurred about one week earlier in 1986.

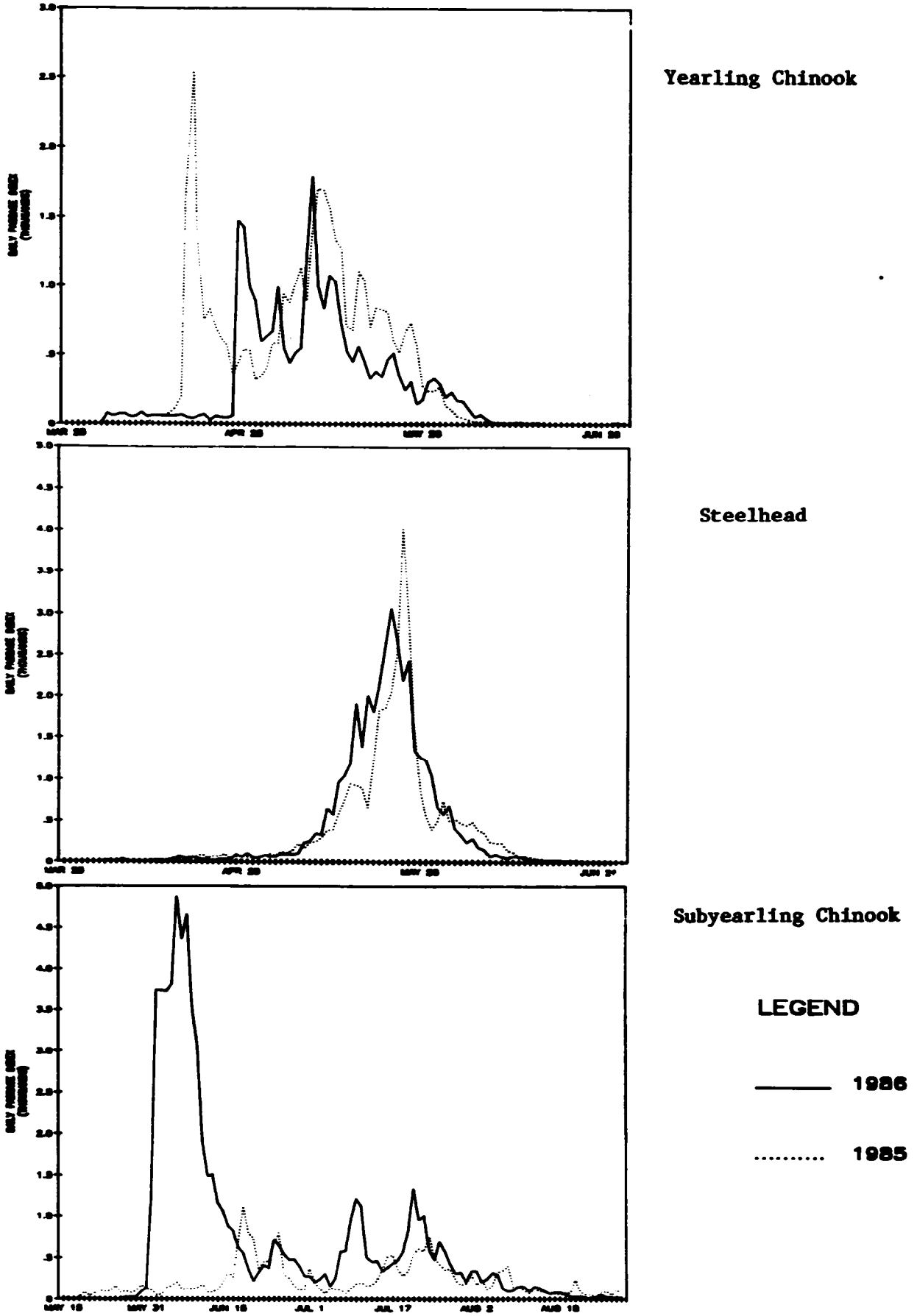


FIGURE 13 ROCK ISLAND Migration Timing

TABLE 8

Juvenile Passage Dates at Rock Island Dam, 1985 and 1986

	Peak	10%	50%	90%	80% Passage Duration
			1985		
Chinook Yearling	4/16	4/16	5/07	5/22	36 days
Chinook Sub-Year.	6/19	6/09	7/10	8/08	60 days
Steelhead	5/23	5/11	5/22	6/02	22 days
Coho	6/04	5/23	5/28	6/05	13 days
			1986		
Chinook Yearling	5/7	4/24	5/6	5/23	29 days
Chinook Sub-Year.	6/6	6/3	6/10	7/24	51 days
Steelhead	5/21	5/11	5/20	5/29	18 days
Coho	5/21	5/16	5/21	5/28	12 days

3. McNary Dam

Sampling at McNary Dam in 1986 began on March 26 and was scheduled to continue through October 30. In 1985, the COE continued limited gatewell dipping after September 26 through the end of the sampling season. The daily migration is Illustrated in Figure 14. Passage dates and duration are shown in Table 9.

The timing of the chinook yearling migration past McNary Dam in 1985 and 1986 was similar. Also, the 10, SO, and 90 percentiles of the passage distribution were only 1 day apart for both years. The shape of the yearling chinook migration curve at McNary remained markedly bimodal, with the first peak occurring on April 7 for both years, and the second and largest peak occurring on May 13 for 1985, and on May 11 for 1986. The first peak is dominated by yearling fall chinook from Ringold and Lyons Ferry hatcheries; the second peak by spring chinook from the mid-Columbia and Snake givers.

The most dramatic change in the outmigration at McNary occurred for sub-yearling chinook. Relative to 1985, the migration vas greatly protracted. The 1986 outmigration period began about 10 days earlier due to the high flows during

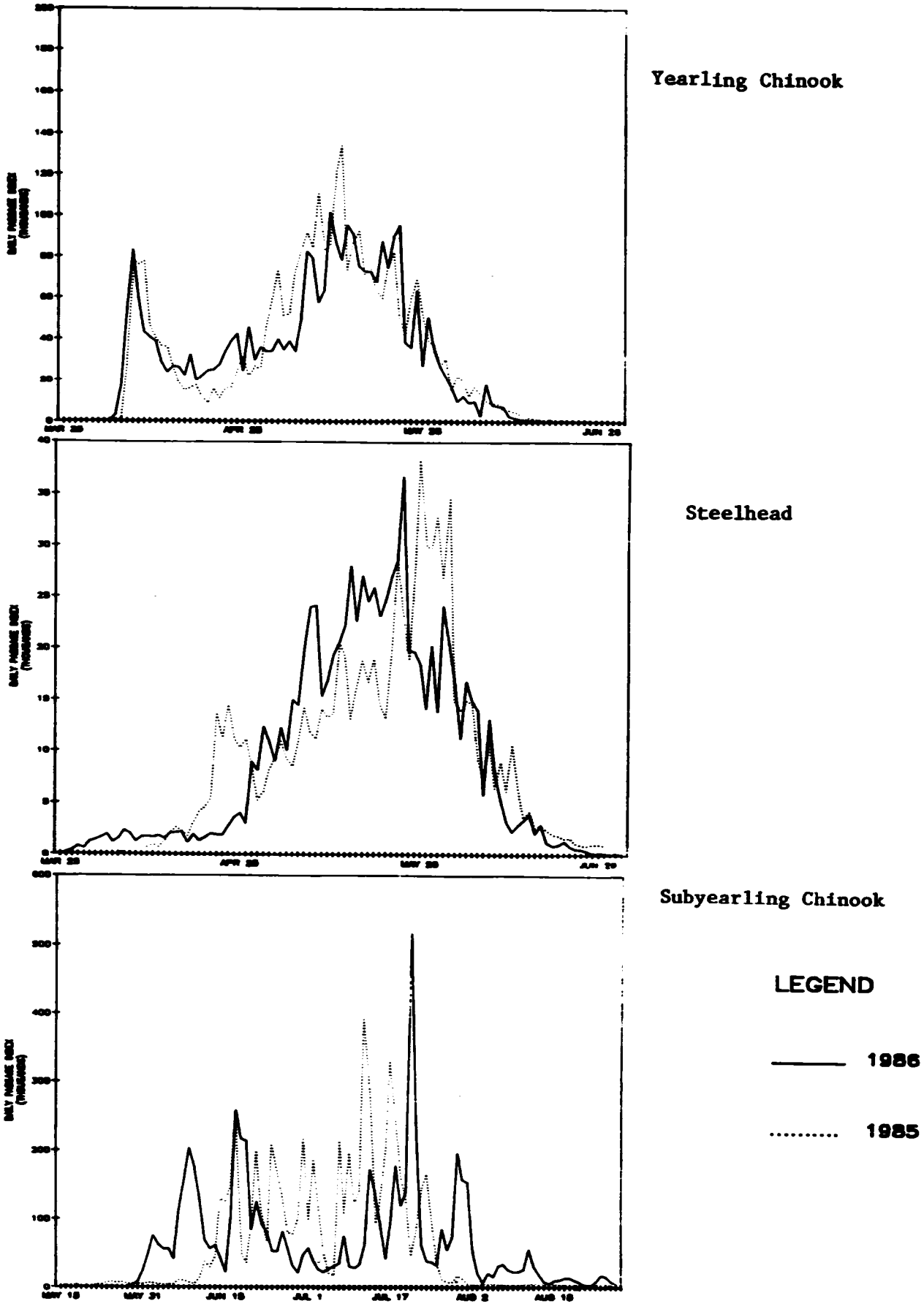


FIGURE 14 McNARY Migration Timing

TABLE 9

Juvenile Passage Dates at McNary Dam, 1985 and 1986

	Peak	10%	50%	90%	80% Passage Duration
			1985		
Chinook Yearling	5/13	4/11	5/11	5/27	46 days
Chinook Sub-Year	7/13	6/17	7/09	7/24	37 days
Steelhead	5/26	4/25	5/22	6/06	42 days
Coho	6/11	6/03	6/11	6/13	10 days
Sockeye	5/26	4/30	5/20	6/08	39 days
			1986		
Chinook Yearling	5/11	4/10	5/10	5/26	46 days
Chinook Sub-Year	7/22	6/8	7/10	8/1	54 days
Steelhead	5/23	4/29	5/18	6/3	35 days
Coho	5/23	5/20	5/28	6/8	19 days
Sockeye	5/23	5/1	5/23	6/6	36 days

late May and early June, which moved hatchery released sub-yearlings more quickly through the Mid-Columbia and lover Snake River. The 1986 migration curve is bimodal, with much lover passage occurring during the June 29 to July 12 period than occurred in 1985. The 1986 steelhead migration past McNary was contracted by one week relative to the 1985 migration, with the bulk of the migration occurring several days earlier in 1986.

VII. ADULT FISB PASSAGE

Monitoring adult fish passage, including fishway inspections, is a PPC activity outside of the Water Budget Measures Program that is not funded by BPA. However. it is supervised by the Water Budget managers and taken into account in passage and flow requests, and because the overall goal of the fishery agencies and tribes is to increase upriver runs of salmon and steelhead, they have assigned this activity to the FPC with funding support provided by the fishery agencies.

The following brief summary of adult fish passage is provided therefore to give some indication of the combined results of the many actions underway to Increase upriver runs, from control of ocean harvest to a multitude of in-river management actions for both juveniles and adults.

Most major construction or routine maintenance work in or around the adult fish passage facilities is conducted during the winter, a time when relatively few fish are passing through the Columbia River system. Thus, unless a special condition existed, fish ladder and attraction water were operated at full criteria when Inspected. On most occasions, the facilities were either in or near criteria. A detailed report of project inspections made in 1985 and 1986 will be published by the FPC at a later date.

From preliminary 1986 counts, it appears that total adult salmonids passing Bonneville Dam will exceed l,OOO,OOO for the second straight year. Adult returns at Bonneville, Ice Harbor, and Priest Rapids are shown in Table 10. The numbers of adult salmonids passing Bonneville Dam continued to increase for most species. Sockeye salmon was the only species which shoved a large reduction in numbers returning to the Columbia River. Sockeye counts appear to fluctuate dramatically since the previous tvo seasons totals vere about 100,000 greater than this year's return. Returns of steelhead and upriver bright fall chinook were again at record levels. Coho and spring chinook salmon counts also increased in 1986. Spring chinook jacks vere fever than in 1985, which might indicate a reduction in 1987 adult returns. Tule fall chinook numbers were reduced to the point that trapping of this stock was initiated at Bonneville Dam for transportation to Spring Creek NFH to augment the returu to the hatchery. Summer chinook return rates were again depressed.

TABLE 10

A comparison of Columbia River adult fish counts at Bonneville, McNary, Ice Harbor, and Priest Rapids Dams for calendar years 1986, 1985, and the 10 year average (1976-1985)

Summer Steelhead 1/	1986 2/	1985	10-year average
Bonneville	362,900	342,400	177,200
McNary	154,400	178,800	83,600
Ice Harbor	97,300	118,800	56,900
Priest Rapids	20,722	33,600	14,900
Spring Chinook			
Bonneville	123,200	91,000	83,500
McNary	76s 100	63,300	40s 100
Ice Harbor	39,100	33,500	22,300
Priest Rapids	22,100	24,700	14,700
Summer Chinook			
Bonneville	31,100	29,900	33,500
McNary	25,500	22,100	23,500
Ice Harbor	7,700	5,300	6,200
Priest Rapids	16,100	17,300	16,800
Fall Chinook (Adult Count)			
Bonneville	219,000	189,000	153,200
McNary	98,900	93,300	41,000
Ice Harbor	2,600	2,000	1,400
Priest Rapids	13,900	11,100	6,500
Coho (Adult Count)			
Bonneville	98,828	38,500	26,000
McNary	632	2,800	2,400
Ice Harbor	0	8	184
Priest Rapids	18	150	358
Sockeye			
Bonneville	57,900	166,900	80,000
McNary	45,800	98,200	45,400
Ice Harbor	16	24	217
Priest Rapids	42,200	118,500	65,600

1/ Steelhead counts from June 1 - October 31
2/ 1986 counts thru September 30 and are preliminary data.
3/ Numbers from 1985 and previous years taken from Columbia River Fish Counts, OWFW, Howard Jensen, January 1986.

Note: All totals greater than 500 are rounded to nearest 100 fish.

VIII. CONCLUSIONS AND RECOMMENDATIONS

A. RUNOFF AND STREAMFLOW FORECASTING

1. Forecasting errors inherent in present forecasting methods, depending upon the magnitude and direction of departure from actual values, will continue to present difficulties in properly utilizing system flexibility to consistently prwide desirable flows for fish passage.

2. The technology exists vith which to upgrade forecasting methods but funds and/or staff are lacking with which to purchase, Install, and maintain the additional field monitoring stations of various types required, and to process the Information.

3. Upgraded forecasting methods that can produce a demonstrated improvement in accuracy should prompt more flexibility in flood control and other operational rule curves that are developed from such forecasts.

Recommendation

All parties affected should jointly undertake a concerted effort to improve runoff and streamflow forecasting methods, with first priority given to the Snake River Basin because of its lack of storage capability vith which to compensate for forecast errors in providing flows for fish.

B. FLOW MANAGEMENT

1. Although the 1986 mid-Columbia CPO for Water Budget implementation and accounting worked vell, it is unlikely that similar favorable circumstances will occur in the same manner or same order in future years.

2. The variability from year-to-year in rainfall/runoff conditions and in flood control and power requirements presents a need to retain the flexibility in system operations needed to respond to actual conditions as they occur in order to be able to provide suitable migration flows for juvenile fish, especially to insure that at least 80% of the spring migration is protected.

3. Sudden and often unpredictable changes in Snake River flows at Lover Granite because of the large amount of uncontrolled runoff makes the Water Budget implementation method proposed as a Fish and Wildlife Program amendment unsuitable for application in the Snake Biver.

4. The informal, trial agreement for 1986 Water Budget Implementation and accounting for Duorshak Reservoir augmentation of flows at Lower Granite, although not fully tested, represents the best arrangement devised to-date, and a similar arrangement would apply to Brownlee Reservoir participation.

5. Lack of a BPA/IPC agreement for Brownlee Reservoir participation in providing Water Budget flows presently limits the volume of shapeable water in the Snake River to the amount of Duorshak Reservoir participation agreed to by the COE.

Recommendations

a. Flexibility in implementing the mid-Columbia Water Budget should be provided preferably by using a sliding scale power base for accounting, with a higher base for higher runoff years. This method would make weekly streamflow projections and Water Budget accounting acceptable.

b. Flexibility in Implementing the Snake River Water Budget should be provided by allowing further testing of the informal, trial agreement, including accounting, adopted in 1986 for Duorshak Reservoir participation.

c. The needed BPA/IPC storage agreement to permit Brownlee Reservoir participation in providing Water Budget flows should be expedited, including Water Budget and accounting arrangements similar to those in 1986 for Duorshak Reservoir participation.

d. Whatever approach or approaches are adopted as a Fish and Wildlife Program amendment, the language should provide the flexibility needed to make in-season modifications to properly deal with real-time conditions as they occur.

c. SPILL MANAGEMENT

1. Lack of a juvenile fish passage (spill) plan endorsed by all parties automatically places the fishery agencies and tribes, acting through their Water Budget managers, at odds with project operators in making spill requests.

2. Secondary energy sales and reservoir refill continue to receive priority by the project operators over fish migration needs at projects as identified by the fishery agencies and tribes.

RECOMMENDATIONS

a. Continue to search for a fish passage plan that is acceptable to all parties. This effort would be enhanced if all parties would approach the problem from the basis of providing the best possible conditions for fish without causing impacts on other project functions that would be unacceptable to the region, as opposed to identifying the minimum conditions that will satisfy criteria that are not acceptable to all parties.

b. Acceptance by project operators of Fish and Wildlife Program recommended priorities for water use, which place fishery needs ahead of secondary pover marketing and reservoir refill, would alleviate much of the controversy.

APPENDIX A

1986 COORDINATED PLAN OF OPERATION

FOR

WATER BUDGET IMPLEMENTATION

4. Data Exchange.

a. The Water Budget Managers shall be represented at the daily RCC briefings. The managers will prepare a fishery report for this briefing and deliver it every Thursday throughout the period.

b. The COE and BPA shall make available to the Water Budget Managers forecasts generated for system planning purposes.

5. Priest Rapids Flow Augmentation for Fish. Studies, using the 1986 volume shaped to the 50 years (1929-1978), indicate flows equal to or greater than 134 kcfs should be possible in May and June, while still complying with current power and nonpower constraints.

Priest Rapids flow augmentation and implementation described below is agreed to on an interim basis for 1986 only.

a. Priest Rapids' Water Budget will be implemented using weekly average flows and is based upon advance projections of weekly average flows provided by the Corps in consultation with USBR and BPA. This flow projection may be composed of both power and nonpower components. The flow component for power needs will be provided to the RCC by BPA. Water Budget requests would occur within the time period and flow and volume limits identified in the Program.

b. During the period of April 15 through June 15, the Corps will identify the projected Monday through Sunday weekly average flow by 3:00 p.m. on Wednesday of the preceding week.

c. Water Budget Managers will relay their decision as to whether or not to augment weekly average flow for the next week to the Corps' RCC by 12:00 noon on Thursday of the preceding week.

d. If the Water Budget Managers decide to augment the projected weekly average flow the Water Budget usage will be measured as the difference between the Water Budget Managers' weekly average flow requests and the power base flow of 76 kcfs and will not exceed 3.45 MAF for the season.

e. When a Water Budget request is in effect, the weekend and holiday average flows will not be lower than 80 percent of the average of the five preceding weekdays.

f. If the Water Budget Managers decide not to augment flows with the Water Budget during a given week, the weekly average flow provided for that week will not be less than the projected weekly average flow identified by the Corps on the preceding Wednesday. If the projected weekly average flow is greater than 110 kcfs, the weekend and holiday average flows will not be less than 85 kcfs.

g. The RCC and Water Budget Managers will jointly monitor the runoff and juvenile migration and may, by mutual agreement in consultation with other affected parties, modify the operation at Priest Rapids.

6. 1986 Lower Granite Water Budget. Requests from the Water Budget Managers for flow at Lower Granite (LWG) will be met first from uncontrolled runoff, then from Dworshak (DWR) and Brownlee (BRN) storage under the following conditions:

a. Idaho Power Company (IPC) may use BRN storage up to the end of May to meet Water Budget requests if such releases are agreeable to IPC.

b. Water shapeable for Water Budget in DWR that can be used to meet an average weekly flow of 85 kcfs at LWG will be based on enclosure 3. Additional water may be available from DWR to provide extended flows up to 140 kcfs at LWG if DWR refill is not jeopardized. Enclosure 3 is based on studies of water budget implementation procedures made by the Corps and coordinated with the Water Budget Managers and others during the past years. Under current conditions it is estimated that the flow at LWG will average over 100 kcfs during the 15 April to 15 June period.

c. The RCC and Water Budget Managers will jointly monitor the runoff and juvenile migration and may, by mutual agreement in consultation with affected parties, modify the operation at LWG.

7. While it is recognized there is no Water Budget requirement at Lower Columbia projects, a 1986 objective for weekend flows will be not to average less than 80% of the average flow for the previous five weekdays during the period April 20 through June 9. Memorial Day weekend will be treated as in 5e., above.

8. The Water Budget request may not be implemented if it conflicts with other nonpower constraints. The severity of the conflict will be analyzed by the Corps and appropriate action taken, with documentation of the basis for decision forwarded to the Water Budget Managers.

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION, CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208-2870

REPLY TO
ATTENTION OF:

April 3, 1986

Water Management Branch

Mr. Robert Saxvik, Chairman
Northwest Power Planning Council
Suite 1100, 850 SW Broadway
Portland, Oregon 97205

Dear Mr. Saxvik:

I am writing to advise you of our Coordinated Plan of Operation (CPO) for Water Budget implementation for juvenile fish during the period April 15 through June 15 as requested in Section 304(c)(2) of your Fish and Wildlife Program. The CPO is the combination of several proposals and is attached as enclosure 1.

The runoff this year is expected to be better than critical. Therefore, a CPO was developed that may provide more water than specified in the Water Budget. In particular the CPO provides an average weekend flow of at least 85,000 cfs to transport juvenile fish in the mid-Columbia when the average weekly flows are expected to be greater than 110,000 cfs even though the Water Budget Managers are not requesting Water Budget.

Since the plan does not fully reflect agreement of the parties, providing weekend flows in future years is subject to further study because of potential impacts on both power and fishery resources. Therefore, it appears to us appropriate that the Council continue to support research to define these impacts as soon as possible.

Sincerely,

George R. Robertson
Brigadier General, U.S. Army
Division Engineer

Enclosures

CF:
Water Budget Managers
BPA
USBR-Boise
PNUCC
IPC
NWPP
FERC

NPDEN-WM
March, 1986

COORDINATED PLAN OF OPERATION APRIL 15 THROUGH JUNE 15, 1986

1. Introduction. This Coordinated Plan of Operation (CPO) has been developed by the Army Corps of Engineers in cooperation with Water Budget Managers, fishery agencies and tribes, BPA, USBR, utility companies, and others. It is intended that this plan meet, in so far as possible, the Section 304 measures in the Northwest Power Planning Council's Fish and Wildlife Program relating to the Water Budget for April 15 through June 15, 1986. This CPO relates only to the Water Budget Period and does not include other aspects of operation for fishery. A Fish Passage Plan encompassing other measures to provide for juvenile passage at specific Corps projects is being submitted as a separate document.

2. Runoff Forecasts. Copies of the interagency coordinated March 1 water supply and peak stage forecasts are attached as enclosures 1 and 2 and summarized below for key locations.

Location	Jan-Jul MAF	Jan-Jul %	Apr-Jul MAF	Apr-Jul %	Est Peak Flow in KCFS
Grand Coulee	60.4	93	52.3	93	---
Priest Rapids	66.9	94	58.3	95	195-255
Brownlee	10.9	115	5.8	105	---
Dworshak	3.3	91	2.4	86	---
Lower Granite	30.9	103	21.2	96	150-220
The Dalles	103.0	96	81.1	94	290-380

3. Reservoir Status. The major Columbia River Basin reservoirs have been drawn down for power and flood control purposes but limited storage has been reserved for Water Budget use. Reservoirs are above refill curves (variable energy content curves - VECC). Canadian treaty storage is being operated in accordance with the Detailed Operating Plan, dated October 1985. The following table summarizes the status of the major reservoirs and the rule curves resulting from the forecasts shown in enclosures 1 and 2.

Reservoir	Max/Min Limits MSL	Max Capacity MAF	Elev 2-28-85 (MSL)	VECC 31 Mar MSL	Flood Control Elev MSL	Flood Control Date
Mica	2470/2394	7.0	2402.8	2401.8	2454.9	1 Apr
Arrow	1444/1378	7.1	1405.6	1377.9	1399.9	1 Apr
Duncan	1892/1794	1.4	1813.5	1794.2	1807.7	1 Apr
Libby	2459/2287	5.0	2355.0	2346.4	2354.4	15 Mar
Hungry Horse	3560/3336	3.2	3505.3	3492.2	3505.6	1 May
Albeni Falls	2062/2050	1.2	2054.6	2053.5	2056	1 Apr
Grand Coulee	1290/1208	5.2	1287.5	1220.2	1244.1	1 May
Dworshak	1600/1445	2.0	1559.4	1525.4	1518.5	1 Apr
Brownlee	2077/1976	1.0	2071.4	---	2055.1	1 Apr

WATER SUPPLY FORECASTS
ISSUED BY
NATIONAL WEATHER SERVICE
NORTHWEST RIVER FORECAST CENTER
PORTLAND OREGON

MAR 86 FINAL 1 W A T E R S U P P L Y F O R E C A S T S

OSTREAM AND STATION	PERIOD	FORECAST	% AVERAGE
COLUMBIA RIVER			
MICA RESERVOIR INFLOW, BC	FEB-SEP	14400.0	107 13400.
	APR-SEP	13900.0	107 12980.
ARROW LAKES INFLOW	FEB-SEP	27800.0	103 27000.
	APR-SEP	26600.0	103 25900.
BIRCHBANK, BC	APR-SEP	44300.0	99 44610.
GRAND COULEE, WA	JAN-JUL	60400.0	93 64840.
	APR-SEP	62200.0	93 66840.
ROCK ISLAND DAM BLO, WA	APR-SEP	68800.0	95 72780.
THE DALLES NR, OR	APR-SEP	95000.0	94 101000.
	JAN-JUL	103000.0	96 106900.
KOOTENAI RIVER			
LIBBY RESERVOIR INFLOW, MT	APR-SEP	6520.0	93 7041.
KOOTENAY RIVER			
KOOTENAY LAKE INFLOW, BC	APR-SEP	15700.0	92 17090.
DUNCAN RIVER			
DUNCAN RESERVOIR INFLOW, BC	FEB-SEP	2380.0	101 2354.
	APR-SEP	2300.0	101 2274.
CLARK FORK			
ST. REGIS, MT	APR-SEP	3800.0	86 4411.
PEND OREILLE RIVER			
PEND OREILLE LAKE IN, ID	APR-SEP	12400.0	82 15150.
S.F. FLATHEAD RIVER			
HUNGRY HORSE RES INFLOW, MT	APR-SEP	1980.0	87 2278.
FLATHEAD RIVER			
FLATHEAD LAKE INFLOW, MT	APR-SEP	6290.0	86 7278.
COEUR D'ALENE RIVER			
COEUR D'ALENE LAKE IN, ID	APR-SEP	2000.0	70 2848.
OKANAGAN RIVER			
TONASKET NR, WA	APR-SEP	1560.0	95 1644.
CHELAN RIVER			
LAKE CHELAN INFLOW, WA	APR-SEP	1180.0	98 1202.
YAKIMA RIVER			
PARKER NR, WA	APR-SEP	1940.0	93 2096.
SKAGIT RIVER			
CONCRETE NR, WA	APR-SEP	5720.0	85 6724.
COWLITZ RIVER			
MAYFIELD RES INFLOW, WA	APR-SEP	1670.0	82 2038.
	APR-JUL	1460.0	82 1778.
CASTLE ROCK, WA	APR-SEP	2270.0	85 2673.
SNAKE RIVER			
JACKSON LAKE INFLOW, WY	APR-JUL	949.0	120 788.
PALISADES RES INFLOW, ID	APR-JUL	4070.0	125 3254.
HEISE NR, ID	APR-JUL	4330.0	125 3465.
WEISER, ID	APR-JUL	5450.0	104 5254.
BROWNLEE RES INFLOW	APR-JUL	5840.0	105 5556.
LOWER GRANITE RES IN, WA	JAN-JUL	30900.0	103 30090.
	APR-JUL	21200.0	96 22140.
TETON RIVER			
ST. ANTHONY NR, ID	APR-JUL	435.0	116 375.
HENRYS FORK			
REXBURG NR, ID	APR-JUL	1260.0	110 1148.
BIG LOST RIVER			
MACKAY RESERVOIR INFLOW, ID	APR-JUL	189.0	124 153.
BIG WOOD RIVER			
HAILEY, ID	APR-JUL	319.0	125 255.
MAGIC RESERVOIR INFLOW, ID	APR-JUL	366.0	125 293.

Encl 1

CAREY NR, ID	APR-JUL	121.0	130	93.
DESCHUTES RIVER				
BENHAM FALLS, Or	APR-SEP	700.0	98	715.
OWYHEE RIVER				
OWYHEE RES INFLOW, OR	MAR-JUL	674.0	135	499.
BOISE RIVER				
BOISE NR, ID	APR-JUL	1820.0	125	1454.
MALHEUR RIVER				
DREWSEY NR, OR	MAR-JUL	88.0	97	91.
N.F. MALHEUR RIVER				
BEULAH RESERVOIR INFLOW, OR	MAR-JUL	69.0	97	71.
PAYETTE RIVER				
HORSESHOE BEND NR, ID	APR-JUL	1810.0	109	1668.
WEISER RIVER				
WEISER NR, ID	APR-JUL	339.0	85	399.
POWDER RIVER				
SUMPTER NR, OR	MAR-JUL	71.0	109	65.
SALMON RIVER				
WHITEBIRD, ID	APR-JUL	6520.0	105	6211.
GRANDE RONDE RIVER				
LA GRANDE, OR	MAR-JUL	198.0	100	198.
TROY, OR	MAR-JUL	1520.0	105	1454.
CLEARWATER RIVER				
OROFINO, ID	APR-JUL	4180.0	85	4917.
N.F. CLEARWATER RIVER				
DWORSHAK RES INFLOW, ID	APR-JUL	2410.0	86	2805.
	APR-SEP	2540.0	85	2985.
CLEARWATER RIVER				
SPALDING, ID	APR-JUL	6800.0	85	8000.
	APR-SEP	7220.0	85	8460.
UMATILLA RIVER				
GIBBON NR, OR	APR-JUL	67.0	94	71.
PENDLETON, OR	APR-JUL	143.0	101	141.
S.F. WALLA WALLA RIVER				
MILTON NR, OR	APR-JUL	53.0	98	54.
M.F. JOHN DAY RIVER				
RITTER, OR	APR-JUL	125.0	116	108.
JOHN DAY RIVER				
SERVICE CREEK, OR	APR-SEP	896.0	117	764.
CROOKED RIVER				
PRINEVILLE RES INFLOW, OR	MAR-JUL	180.0	125	144.
OCHOCO CREEK				
OCHOCO RES INFLOW, OR	MAR-JUL	28.0	122	23.
S. SANTIAM RIVER				
WATERLOO, OR	APR-SEP	584.0	101	578.
N. SANTIAM RIVER				
MEHAMA, OR	APR-SEP	848.0	101	838.
WILLAMETTE RIVER				
SALEM, OR	APR-SEP	4700.0	101	4655.
CLACKAMAS RIVER				
ESTACADA, OR	APR-SEP	757.0	100	757.
MCKENZIE RIVER				
VIDA NR, OR	APR-SEP	1150.0	95	1207.

THESE FORECASTS ARE SELECTED FROM THOSE PREPARED BY: NATIONAL WEATHER SERVICE, SOIL CONSERVATION SERVICE AND THE B.C. HYDRO AND POWER AUTHORITY. FOR VARIOUS PROJECT INFLOWS, THE FORECASTS HAVE BEEN COORDINATED WITH THE COLUMBIA RIVER FORECAST SERVICE AND THE U.S. BUREAU OF RECLAMATION.

ALL FORECASTS ARE IN THOUSANDS OF ACRE-FEET

ALL AVERAGES ARE FOR THE PERIOD 1961 THROUGH 1980

END.....NOAA/NWS/NORTHWEST RFC.....

DXESGPDR
TPAPC KPDR 102038

PEAK FLOW AND CREST STAGE FORECASTS (COLUMBIA BASIN)
ISSUED BY
USDA, NATIONAL WEATHER SERVICE, NORTHWEST RIVER FORECAST CENTER
ISSUED ON MARCH 10 , 1986

TREAP AND STATION	FLOOD STAGE (FEET)	PROBABLE RANGE STAGE (FEET)			PEAK FLOW (KCFS)	
OLUMBIA RIVER						
PRIEST RAPIDS, WASH	422	411.2	TO	414.8	195	255
THE DALLES					290	380
VANCOUVER	16	10	TO	13		
ILLAMETTE RIVER						
PORTLAND, OREG.	18	9.5	TO	12.5		
OOTENAI RIVER						
BONNER S FERRY, ID.	74	58	TO	60	19	37
LARK FORK						
MISSOULA (AEV), MT.	11	8.1	TO	11.3	12	22
ST. REGIS, MT.	19	13.9	TO	16.2	31	43
LATHEAD RIVER						
COLUMBIA FALLS, MT.	13	11.4	TO	13.6	35	49
END OREILLE RIVER						
NEWPORT, WASH.	106,000CFS				46	66
POKANE RIVER						
SPOKANE, WA.	27	24.1	TO	25.4	19	25
KANOGAN RIVER						
TONASKET, WA.	15	13.4	TO	15.6	15	21
NATCHEE RIVER						
PESHASTIN, WA.	13	9.7	TO	11.8	14	20
AKIMA RIVER						
PARKER (NR), WA.	10	7.0	TO	9.4	7	14
NAKE RIVER						
LOWER GRANITE, WA.	--				150	220
ENRYS FORK						
REXBURG, ID.	9	9.0	TO	10.0	7.1	9.6
AYETTE RIVER						
EMMETT, ID.	15,000 CFS				11	14
ELMON RIVER						
WHITEBIRD, ID.	32	27.1	TO	30.0	64	84
LEARWATER RIVER						
SPALDING, ID.	18	11.4	TO	12.8	45	67
ILVIES R.						
BURNS	9	7.9	TO	8.4	1.5	2.0

MALHEUR LAKE FORECAST

HE CURRENT MALHEUR LAKE PEAK FORECAST IS 4102.3 FT.
HIS WILL COVER 175800 ACRES.
IGH PRECIPITATION DURING FEBRUARY CAUSED THE LAKE TO RISE ABOVE PREVIOUS
ORECAST PEAK (4101.5) LAKE ELEVATION AS OF 2/27/86 WAS 4101.6 FT.

HESE PEAK FORECASTS INDICATE THE RANGE OF THE 50-50 CHANCE OF OCCURRENCE.
IGHLY ABNORMAL WEATHER DURING THE CRITICAL MELTING PERIOD MAY CAUSE THE
EAK TO BE OUTSIDE THE INDICATED RANGE.
ND/NWRFC

Encl 2

SNAKE RIVER AT LOWER GRANITE

GUIDELINE FOR DETERMINING ON 1 APRIL DWORSHAK OUTFLOW FOR WATER BUDGET USAGE

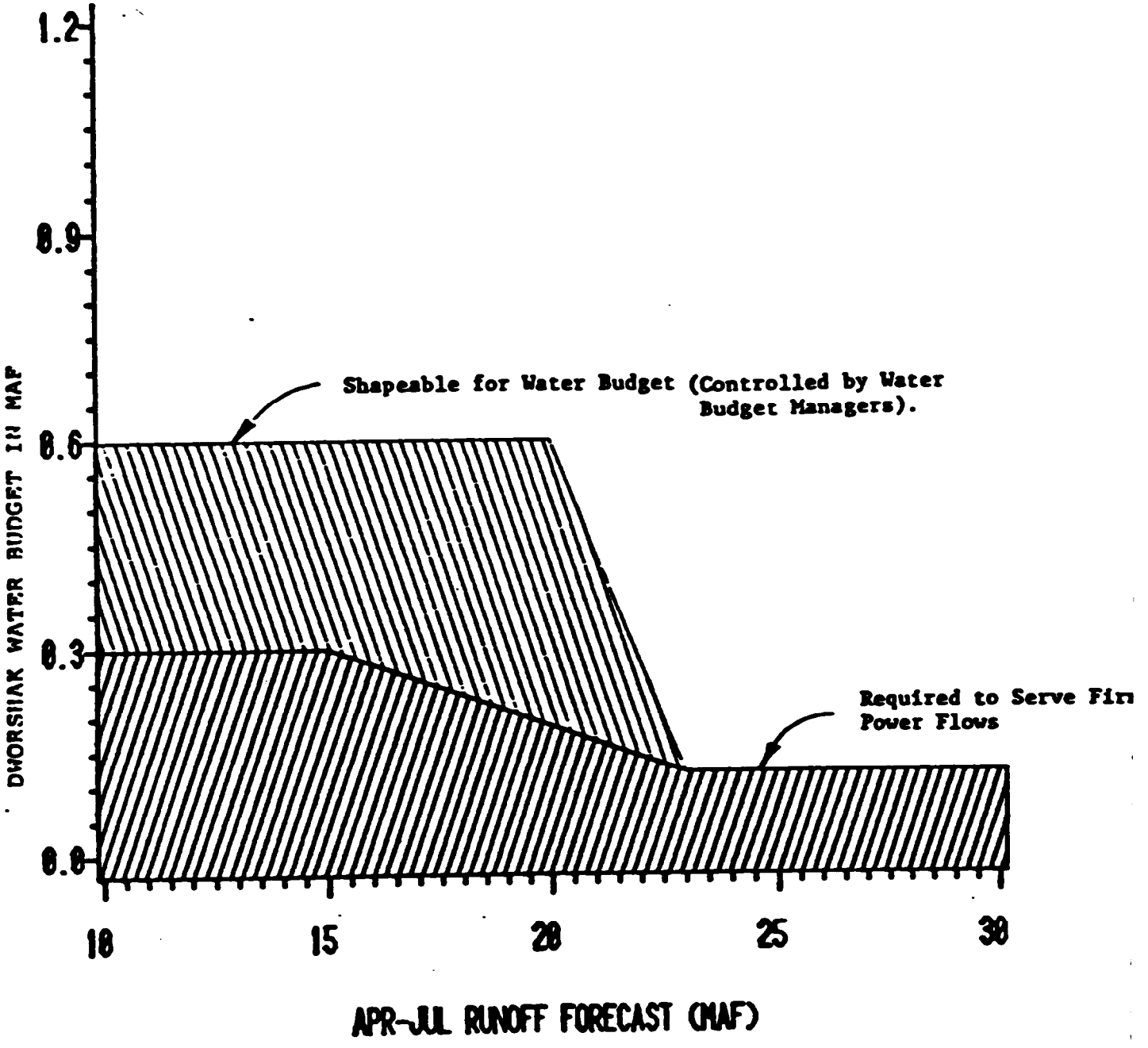


FIGURE 7

14DEC83

NPDEN-AM
Encl 3

APPENDIX B

COMMENTS

Note:

Written comments on the draft report were received from the Bonneville Power Administration, National Marine Fisheries Service, Northwest Power Planning Council, and the Mid-Columbia Public Utility Districts. These are included herein.

Additional comments were received in the form of annotated copies of the draft report from the Northwest Power Planning Council, Corps of Engineers, Columbia River Inter-Tribal Fish Commission, and Washington Department of Fisheries.

All comments were carefully reviewed and, for the most part, were very constructive. Accommodation of the comments where feasible resulted in considerable improvement in the report. A few of the comments were not accommodated because of lack of time and staff to commit to the extensive analytical work that would be required. These will be filed and considered as a means of further improving future annual reports.

A few other comments which suggested much more detail on smolt migration and timing were not acconodated because, as stated in the report, these analyses are underway and will be presented in the 1986 Smolt Monitoring Report to be published February 1, 1987. The intent at this time is to present a summary overview using examples to the extent permitted by preliminary evaluations undertaken to-date.

The authors appreciate the comments and thank the reviewers for their efforts in preparing comments.

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

OCT 21 1986

In reply refer to PJI

Malcolm Karr
Water Budget Manager
Columbia Basin Tribes
825 NE 20th Ave., Suite 336
Portland, OR 97232-2295

Michele DeHart
Acting Water Budget Manager
Fish and Wildlife Agencies
825 NE 20th Ave., Suite 336
Portland, OR 97232-2295

RE: Bonneville Power Administration's comments to the draft 1986 Annual Report From the Water Budget Managers

Rear Mr. Karr and Ms. DeHart:

We have reviewed your draft Water Budget Managers Annual Report, provided to Bonneville Power Administration (BPA) in partial fulfillment of contracts for Projects 83-536 and 83-491. We submit the following comments.

A. General Comments

We suggest that the report can be strengthened considerably by providing the reader with comparisons to 1983 and 1984 in areas such as the runoff volumes, runoff forecasts and percent actual achieved and spill implementation. The report can be improved by clarifying Table 1, completing the data points in Figures 12-14, and listing runoff forecasts and achieved for the Dalles, Lower Granite and Grand Coulee (page 3, par. 1).

The Water Budget managers could advance the technical merits of the report by including data to substantiate their views in the areas noted in the following section on specific comments. The Council, and all interested parties, could benefit from an enhancement of the data presented in this report. Also, while we do understand that the managers are concerned with the Water Budget negotiation process, we believe that it is more important that the report focus on what did occur in 1986 rather than what didn't. This year some major accomplishments were negotiated or accomplished:

1. Mid-Columbia weekly flows were projected by the Corps and guaranteed by BPA, enabling the managers to use the Water Budget more efficiently.
2. In the mid-Columbia the Corps did agree (and BPA followed through) to provide weekend flow protection if the weekly average flow was above 110 kcfs and there was no Water Budget augmentation. The flows provided were at least 85 kcfs.
3. The Corps and BPA provided weekend flow protection of at least 80% when there was a Water Budget flow augmentation in effect.

It would be a benefit to the reader to understand how these significant changes aided the managers, what the results of these actions were, how the outmigrations were benefited because of these new procedures, and if the Water Budget was used more efficiently and effectively. We suggest that the report be expanded accordingly.

Section 304(c)(3) of the Northwest Power Planning Council's (Council) Fish and Wildlife Program specifies that "the Water Budget managers will submit a single report to the Council which explains the scheduling of the Water Budget and supporting rationale for that calendar year. This report will include:

1. The actual flows achieved for that calendar year.
2. A record of the estimated number of smolts which passed Lower Granite and Priest Rapids dams, and the period of time over which the migration occurred; and
3. A description of the flow shaping used for that calendar year to achieve improved smolt survival."

BPA's contracts require that the subject report be that specified in Section 304(c)(3). The draft of the subject report is not fully responsive to the terms and conditions of the contract. The draft report dose not provide a description of how the flows that ware shaped improved smolt survival, or an estimate of the number of smolts which passed Lower Granite and Priest Rapids dams. The managers do explain why indices should substitute for estimates. The report does not contain abstract and conclusion sections, as required by the contract. These sections are intended to outline and summarize the activities of the year, and more importantly, to provide recommendations as to how the system can be improved. We believe the report would be strengthened considerably if the conclusions included recommendations as to how the system could be improved in 1987 and beyond.

B. Specific Comments

Page 3, paragraph 4: We do not understand why the format for the forecast versus observed runoff is reversed from last year. Last year the actual flows were less than forecasted, and were represented as being negative in the 1985 annual report. This year the flows were more than forecasted, and were represented as being negative. We recommended that the reports be consistant in format, and that 1986 should be represented as being positive. That is, the actual flows were better than the forecasted flows.

Page 6, paragraph 4: We request that you provide analysis to support the statement that the flexibility to extend beyond the 45-day period specified in the 1985 mid-Columbia CPO would not impact power marketing or other operational considerations.

Page 7. paragraph 1: We reccommend the final report not speculate as to BPA's interpretation of the Fish and Wildlife Program.

Page 7, paragraph 2: The report needs to document with data how the BPA proposal to shape flows during non-Water Budget weeks severely limited the flexibility in water budget use needed to try to cover 802 of the juvenile fish migration.

Page 7, paragraph 3: Item 1 contradicts itself, since using the Water Budget on a daily basis is not in the Program.

Page 8. paragraph 1: The fixed flow schedule similar to the 1985 CPO was not consistent with the Program, and exceeded the Program's Water budget volume by 600,000 AF.

Page 8, paragraph 1: We recommend that you specify that the Corps' version of the BPA flow shaping proposal was to provide at least 85 kcfs if the weekly average was above 110 kcfs. If flows were below 110 kcfs the weekend protection could not be guaranteed.

Page 9, paragraph 2: We wish to point out that even though BPA did not officially support the COE position, we provided all forecasts and complied fully with the COE's Coordinated Plan of Operation (CPO).

Page 9, paragraph 4: An accurate description of the Idaho Power Company (IPC) issue is that IPC has discussed potential proposals. They declined to sign storage agreement offers in 1983, 1984 and 1985. BPA and IPC are presently in negotiations and both parties have stated they want agreements by January 1, 1987. IPC participation in the Water Budget has not been officially offered to BPA to date, only discussions conducted.

Page 10, paragraph 1: The accounting stipulations you refer to here were worked out informally. A draft plan was never formalized because the COE intended, as we understand it, to use 1986 as a trial period. Additionally, we request that you explain the phrase "small amount of shapeable water available". The 400,000 AP available is 20% of the total Dworshak storage (2 MAP).

Page 10, paragraph 2: It is unclear whether the project where Water Budget accounting takes place is at Dworshak or Lower Granite, and we request that the final report clarify this issue.

Page 10, paragraph 3: We disagree that daily usage and accounting of the Water Budget were agreed upon, since Item 6b of the CPO states weekly average.

Page 11, paragraph 2: BPA requests that you document the statement "a large secondary **power** demand did not exist so reservoirs were not being drawn down additionally for power purposes".

Page 14, paragraph 1: BPA requests that you reference the statement that "a decision was made by the project operators to provide the Water Budget exclusively from Grand Coulee". To our knowledge this was never stipulated, only that Grand Coulee would be the control point from which Water Budget flows would be controlled.

Page 14, paragraph 4: The entire paragraph is not relevant, since BPA guaranteed the projected flows, regardless of "an assumed sequence of weather events". We request that you delete the paragraph.

Page 17, paragraph 3: The point of this paragraph is not clear, nor does the paragraph accurately reflect FTOT guidelines. Transportation is always maximized at Lower Granite, therefore, the term "trigger" is not accurate. At Little Goose 100 kcfs triggers fish to be bypassed, not transported.

Page 17, paragraph 4: We agree in principle that flows trigger movement, but the statement that Figure 5 illustrates this relationship is not accurate. Chinook movements do seem to correlate well. Steelhead, however appear to be responding more to hatchery releases than flows. We suggest that further analysis of how correlated these variables are will help the reader and support the managers viewpoint.

Page 19, paragraph 3: We request that you clarify the statement which pertains to the Corps not incorporating "all of the criteria submitted by the fishery agencies and Tribes into its plan, although this requirement is specified in the NPPC Program". We interpret the Program to require the Corps to incorporate the criteria which pertains to spill to protect 802 of the summer migration. The Program does not guide the Corps to incorporate "all" spill criteria. Perhaps the Corps correctly incorporated all criteria which were applicable under the Program, but some of the criteria developed were outside the 802. Further documentation is needed to support such a statement, and we request that the final report provide that documentation.

Page 19. paragraph 3: Both statements on the bottom of the page are taken out of context. The first one pertains to spill requests following the Corps' Juvenile Fish Passage Plan. It was proposed as a draft, to be negotiated, and has never been formalised. This report does not represent this. The second statement was taken from a letter to the Water Budget Managers from BPA, which recommended that they go beyond the minimum with the "Distribution of Surplus Spill" list, not that spill be limited to the minimum. We request that you clarify the report to reflect our concerns.

Page 21, paragraph 3: The statement "a relatively low secondary power market and no concern over reservoir refill" needs to be documented. In addition, Table 2 does not indicate to the reader how the requests for spill were modified. We request that the report document the spill levels/volumes requested and provided.

Page 25, paragraph 1: The report should support with data the statement that "these 1986 data indicate that the spill request was both appropriate and consistent with the NPPC Program which calls for the protection of 80% of the juvenile migration*'.

Page 25, 'paragraph 2: The paragraph is very unclear as to which dam the authors are discussing. We can assume it to be The Dalles, and if this is the case, the decisions to spill were based on FGE results. The agencies and Tribes were informed of the Corps intent in the Juvenile Fish Passage Plan. We request that the managers clarify this paragraph accordingly.

Page 26, paragraph 2: We wish to point out that the Fish Passage Data Information System is not the Fish Passage Center Data Information System. The FPDIS is seen by BPA as a regional resource, to be used by all parties, not just the Water Budget Managers, and not just for the purpose of the Council's Program.

Page 26, Section V: BPA has requested that the Water Budget Managers document how and to what extent they use the smolt monitoring data to call for Water Budget flows and spill. We do not interpret this section to have responded adequately to our request. We emphasize again, that budget reductions in the Program are requiring us to be prudent and responsive to existing data needs. We request, therefore, that the final report explicitly document how this data helps you to call on flows and spill.

Page 32: The issue remains unresolved of whether to use estimates of the site of the smolt outmigrations or indices at Lower Granite and Priest Rapids . The smolt outmigrations have been estimated in the past, yet the report indicates these estimates to be unreliable. The report provides an index at Lower Granite, based upon FGE, which is not static nor reliable. This is because FGE changes with time at Lower Granite, especially for spring chinook. We do not understand why the managers favor indices, when the Council has asked for estimates. The indices provided in the report are not comparable between projects and species. More importantly, it is questionable whether the indices are even comparable between years. The report points to the problems associated with this issue. We recommend that the managers solicit comments from all appropriate parties, set up meetings to resolve the issue, and work out a mutually accepted and usable value for the smolt outmigrations.

Page 41, paragraph 2: Please document the statement that the migration was "greatly protracted," and "much lower" with percentages, numbers, in essence, with factual data.

Page 42, Section VIII: This section on adult fish passage is funded by the fish agencies and Tribes, and not by BPA. We do not require it to be a portion of this report, because it is not a element of the contract. We believe that the section is important, that it does have merit, but that it does not belong in a report which deals with Water Budget management, spills, smolt monitoring, etc. Many programs are involved with the resultant product being improved adult returns, some of which are addressed in this report. We require that this section be eliminated from the report, and request that the fisheries agencies and Tribes cover this subject in a forum or report which is more applicable.

These comments are offered in the arena of trying to improve upon the report. If you have and questions regarding these comments please don't hesitate to contact me.

Sincerely,

John Ferguson

John Ferguson
Fisheries Integration Branch

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
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Ms. Michele DeHart
Mr. Malcolm Karr
Fish Passage Center
825 NE 20, Suite 336
Portland, OR 97323-2295

Dear Ms. DeHart and Mr. Karr

We have reviewed the draft 1986 "Annual Report from the Water Budget Managers" and offer the following comments.

1. The table on page 2 showing the Jan.-Jul. runoff above The Dalles, in 1986 and in each of the different periods of record, provides an interesting comparison. Adding high and low years for each of the periods would also provide perspective.

2. The discussion of runoff forecasts in section IIB is interesting but lacks a conclusion. As a result, the point of the discussion is unclear. Could the magnitude and the direction of the error described be considered typical? Can the difference be explained in terms of any natural or, more importantly, operational factors that were unique to 1986 (as opposed to the generalizations cited on page 3, paragraph 3)? It would be helpful to discuss specific causes that are known. It would also be helpful to show a comparison with previous years.

3. BPA's interpretation of the Water Budget as a maximum is discussed on page 7. The NPPC response, if any, to this interpretation should also be discussed.

4. Page 7, paragraph 2, line 8: We recommend the following editorial revision: "This was not accepted by the water budget managers...'

5. Page 7, paragraph 2: We suggest that you elaborate on how the BPA proposal would have limited the flexibility needed to cover 80 percent of the migration.

6. Page 8, paragraph 1: Pertinent details of the Corps' compromise proposal and how it compared with the managers' proposal should be included in this discussion. We recommend the following revision to sentence 2:

It provided for a minimum weekend flow of 85 kcfs during non-water budget weeks that, although lower than the 80 percent flow level proposed by the water budget managers (equating to roughly 88-112 kcfs), this level was considered high enough to prevent a repeat...

7. Page 8, paragraph 2: The amount of water that resulted in BPA not accepting the CPO is described as insignificant. If it can be quantified, it should be specifically listed.

8. Page 8, paragraph 3: This section says that the Corps assumed the role of providing advance weekly average flow projections. On page 17, paragraph 1 refers to a short-term streamflow forecast prepared by the NOM River Forecast Center. The report should clarify relationship between the two forecasts and how ***their*** uses differ.

9. Page 9, paragraph 3: The figure depicting the sliding scale at Dworshak Reservoir should be included. The maximumvolume allowable from Dworshak and its size relative to the Snake River Water Budget should also be made clear in the text. Additionally, it is our understanding that there is a 10 kcfs limit on the outflow from Dworshak. If there is such a constraint, it should be discussed.

10. Page 9, paragraph 4: The reference to ongoing negotiations between BPA and Idaho Power Company should be expanded to reflect the fact that these are not new discussions but discussions that have been going on for quite some time with no apparent progress.

11. For those willing to take the time to figure it out, table 1 provides an excellent record of forecasts, requests, flows and accounting. We believe that it would be a great deal less confusing if the projection and the request on the left side were aligned with the week that they affected rather than the week in which they occurred. This would also allow the table to include the prediction and request for the first week which, unless we have misinterpreted the table, do not appear in this draft.

12. Figures 3 and 4 provide an excellent comparison of projected, requested and actual flows. We would like to see more discussion of figure 4. For example, did operation to provide the Water Budget result in departure from refill or other rule curves that could have adversely affected the other purposes for operation of Grand Coulee? To what extent were these risks (if any) attributable to BPA's decision, for power purposes, to take all of the Water Budget from Grand Coulee? We also recommend that a similar discussion of reservoir operations in the Snake River be added to this section.

13. Page 14, paragraph 1: We recommend the following editorial revision to sentence 2: 'This was to prevent releases from reservoirs higher in the system that would result in more power generation, and thus require more spill at downstream reservoirs to avoid overgeneration."

14. Figure 5 should highlight the Water Budget period but should also show what occurred outside of that period, especially since much of the early chinook migration occurred before April 15. Figure 5 is also difficult to read, we recommend separate figures for chinook and steelhead. We also recommend the addition of similar figures to compare fish movement with daily flow at Priest Rapids Dam.

15. Page 16, paragraph 3: We recommend the following revision to sentence 2: "It should be noted, however, that with runoff slightly above average it took nearly the entire Water Budget to maintain flows for just four weeks. If additional low flow periods..."

16. Page 17, paragraph 2: While there is no doubt an advantage to flexibility, it is unclear how the events in the Snake River in 1986 illustrate that advantage.

17. Page 17, paragraph 3: Your concern about the difference between the 100 kcfs trigger used for spring chinook transportation and the 85 kcfs minimum flow that is used as the objective for Water Budget management is understandable. Based on these two flow levels, we would continue to remove fish from the river for transport even when our apparent objectives for flow enhancement were being met. *We* disagree, however, that the two values represent a contradiction. If there is a point to be *made* here we believe it is that the Water Budget in the Snake River can at best provide only a minimally acceptable level of juvene fish survival.

    In making this point, we also recommend that you present a comparison of the flows that we were able to maintain using the Water Budget, and the flows that would have occurred under our December, 1981 sliding scale recommendation. For example, based on the March 1, 1986 forecast of 30.9 MAF at Lower Granite, flows in Way, using the sliding scale, would have been 140 kcfs.

18. Page 17, paragraph 4: While a detailed analysis may be beyond the scope of this report, we recommend that you consider means to more clearly and quantitatively describe the relationship alluded to in this paragraph between daily fish counts and flows.

19. We recommend additional figures in section IV "1986 Spill Implementation" to illustrate spill conditions at The Dalles Dam and at the Mid-Columbia projects. We also recommend that

figures 6-11 (and the additional figures) be extended until August 15 to show the Corps' summer spill program.

20. The flow data for figure 6 appears to be inconsistent with figure 5. We have reviewed the flow data for Lower Granite and do not see the spike that appears in the second week of June in figure 6.

21. Page 25, paragraph 1: This section describes problems experienced in 1986 with spill requests that were either modified or rejected. We recommend that additional detail be provided. For example there is a discussion of the dispute over start-up dates at The Dalles, but there is no indication of the number of days that passed before spill was initiated or how that delay affected the target of -hitting the 10th percentile.

22. We are also concerned about the lack of any detailed comparison between the level of spill requested and the level provided. At a minimum, we recommend that you include figures that compare the daily average spill at each project with the recommended spill levels included in the DFOP (see the enclosed draft figure shwing spill at The Dalles Dam in 1985). We recognize that it would be preferable to also incorporate hours of spill and some breakdown of spill due to overgeneration or flow in excess of hydraulic capacity. We would be willing to work with you to develop improved formats for reporting these data.

23. We recommend that the spill section be expanded to include a discussion of the operation at Bonneville Dam including a summary of the operation of the second powerhouse.

24. Bonneville Dam should be added to the list of 1986 smolt monitoring sites in table 3.

25. Page 28, last paragraph: The report should explain why the 1986 daily plots were compared only with 1985.

26. We recommend that the report include additional discussion of figures 12, 13 and 14 including a more detailed explanation of how they were interpreted, what decisions were made, and how those decisions now appear in retrospect. For example, what was determined to be the 10 percent point based on figure 123 Was it accurate? Why do the 1986 lines extend beyond the 10 percent point in figures 13 and 14? Was this same method applied for projects and species other than those presented?

27. Page 32, paragraph 2: We recommend that you include a discussion of the potential error included in the passage indices calculated by dividing by the proportion of flow through the powerhouse. For example, if the relationship

between the proportion of water spilled and the proportion of fish spilled is non linear, how could that affect a comparison of indices between high and low spill years?. Likewise, what would be the effect of a change in fish guidance efficiency (FGE) between or within years? For example, at Lower Granite Dam in 1984 and 1985 FGE for spring chinook increased from about 30 to over 70 percent during the course of the outmigrations. How would this phenomenon affect the indices reported in Figure 5 or table 4?

Additionally, referring to table 4, the data shws a three-fold increase in the subyearling chinook index and a four-fold increase in the coho index between 1985 and 1986 at Rock Island Dam. Do we know for certain that this is an indication of the relative magnitude of the migration of these two species in these years, or is it possible that some significant portion of this difference is due to the way the index is calculated?

28. Tables 4, 5, 6, and 7 and figures 15, 16, and 17 all compare 1986 to 1985. Except in cases where earlier data would not be considered comparable to current conditions, we recommend the use of a longer time series for these comparisons. We also recommend that the headings on tables 5, 6 and 7 be revised to show that duration refers only to the middle 80 percent of the migration.

29. Page 35, paragraph 2: The section on juvenile fish timing at Lower Granite Dam should include a discussion of the possible reasons for the differences between 1985 and 1986 comparable to that included under Rock Island and McNary dams.

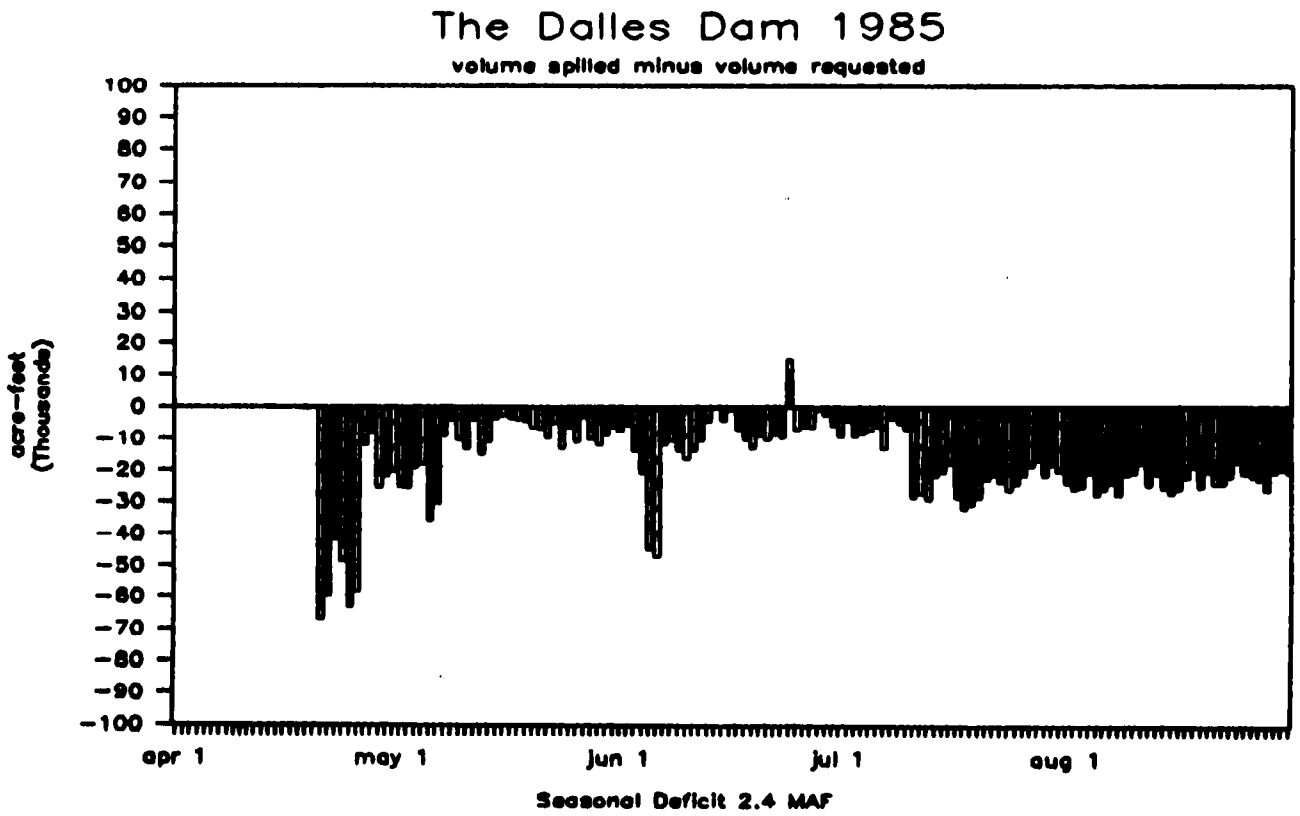
Sincerely,

Dale

Dale R. Evans
Division Chief

Enclosure

cc: Al Giorgi - F/NWC5


The Dalles Dam 1985
volume spilled minus volume requested
acre-feet (Thousands)
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
apr 1
may 1
jun 1
jul 1
aug 1
Seasonal Deficit 2.4 MAF

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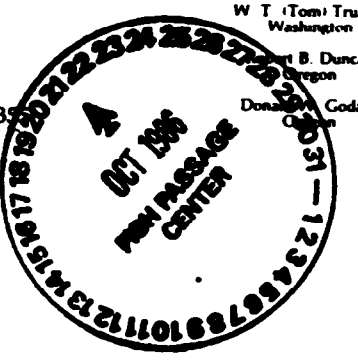
Toll free number for Idaho, Montana & Washington: 1-800-222-335
Toll free number for Oregon: 1-800-452-2324



October 16, 1986

Malcolm H. Karr
Michele DeHart
Water Budget Managers
Fish Passage Center
2705 E. Burnside St., Suite 213
Portland, OR 97214

Dear Mal and Michele:

I have reviewed the draft 1986 Water Budget Managers Annual Report and have found it to meet generally the requirements of Fish and Wildlife Program section 304(c)(3). Most of my comments are editorial and are indicated in red on the attached draft report. I also have indicated questions or concerns which should be addressed in the final report.

There are several items, however, which need to be included in the report. First, there is no discussion of precipitation or presentation of monthly average streamflow information as presented in past years' reports. This is useful information which would help to explain the timing and occurrence of the 1986 runoff.

Second, an attempt should be made to integrate sections V and VI into section III.B. Specifically, the rationale for in-season flow requests should be included in the section on implementation of the 1986 Water Budget. The reader would have a better understanding for the Water Budget requests if the rationale and supporting data were included.

Third, any preliminary 1986 smolt travel time and/or survival data also should be summa rized and included, if at all possible.

Finally, the report is lacking a conclusions and recommendations for future action section. Such a section has been provided in past reports and has been useful to guide future planning efforts.

If you have any questions about my comments, give me a call. Thank you for the opportunity to comment on your draft report.

Sincerely,

James Ruff

James Ruff
Water Budget Advisor

Attachment.

MID-COLUMBIA PUBLIC UTILITY DISTRICTS
CHELAN, DOUGLAS, GRANT COUNTIES, WASHINGTON
REGIONAL COORDINATION OFFICE

520 S.W. SIXTH AVENUE, SUITE 1100
PORTLAND, OREGON 97204 (503) 222-3317

October 21, 1986

Malcolm H. Carr
Water Budget Manager
Columbia Basin Tribes
Fish Passage Center
825 N.E. 20th Ave, Suite 336
Portland, Oregon 97232-2295

Michele DeHart
Acting Water Budget Manager
Fish and Wildlife Agencies
Fish Passage Center
825 N.E. 20th Ave, Suite 336
Portland, Oregon 97232-2295

Dear Mal and Michele:

The following line-in/line-out comments are in regard to the Draft 1986 Water Budget Managers Annual Report. Thank you for the opportunity to provide comments.

Page 8: Deliberations by the work group of the pros and cons of each option resulted in endorsement of the COE compromise version by all parties, except BPA, which held to its position that it would not support any implementation procedure that could be construed as providing more than 3.45MAF of water for fish~~, even though the additional amount of water at risk was insignificant~~. (This should be deleted if it is drawing a conclusion as to what is or is not significant.)

Page 16: ~~Fortunately for the fish, which~~ The fish were exhibiting a prolonged migration for the second year in a row. The late May warming trend of 20-25°F above normal and accompanying increased streamflows occurred just as the water budget allocation was about used up, and extended through the remainder of the water budget period. (Needs modification to avoid appearance of editorializing.)

Page 20: (Table 2 should clearly delineate the April 15 to June 15 time period in order to clearly reflect actions within and without this time frame.)

Page 32: They ~~are~~ may be useful for comparing the size of the outmigration between years within a species.

Page 37: Sampling of the second powerhouse bypass system at Rock Island began on April 1 and continued through August ~~30~~ 31.

Again, thank you for the opportunity to comment.

Sincerely,

Dennis E. Rohr
Regional Coordinator

DR:ghr 104

Distribution: CCPUD
DCPUD
CCPUD

c c Fish Passage Center file

DEPARTMENT OF THE ARMY
NORTH PACIFIC DIVISION. CORPS OF ENGINEERS
P.O. BOX 2870
PORTLAND, OREGON 97208-2870

REPLY TO
ATTENTION OF: Reservoir Control Center

October 22, 1986

Mr. Malcolm H. Karr
Fish Passage Center
825 NE 20th Avenue, Suite 336
Portland, Oregon 97232-2295

Dear Mal:

Thanks for your memorandum of October 3, 1986 giving us the opportunity to review a draft copy of the 1986 Water Budget Managers' Annual Report. Enclosed is said report with the Reservoir Control Center's comments shown on the text of the report.

Sincerely,

Russell L. George
Chief, Reservoir Control Center

Enclosure

APPENDIX C

DOCUMENTATION FOR SPILL REQUESTS
AT THE DALLES DAM
AND
AT JOHN DAY DAM

FISH PASSAGE CENTER

825 N.E. 20TH AVENUE • SUITE 336 • PORTLAND, OR 97232-2295
PHONE (503) 230-4099

MEMORANDUM

TO: Jim Cayanus

FROM: Michele DeHart & Malcolm Karr

DATE: May 12, 1986

SUBJECT: Spill at The Dalles

We are responding to your April 25, 1986 denial of Fish Passage Center System Operation Request number 86-11, related to commencing planned spill for fish passage at The Dalles Dam. Although it is now a moot point since the start of spill at The Dalles has long past, and because the COE spill effectiveness study is determining the spill, we believe it is important to clarify our reques and the fishery agencies and tribes criteria to facilitate future implementation This is particularly important because the agencies and tribes spill criteria at John Day for summer migrants is based on airlift count passage indices, which was referred to in our request for spring migrants which the COE denied.

The agencies and tribes request was based on the spill criteria submitted to the NPPC in accord with the amended program. Those criteria identify the typical dates of 80% passage for the spring run at The Dalles Dam as April 15 to June 11. The criteria further state that spill will commence at The Dalles five days after the first 10% of the spring migration has passed McNary Dam. We estimate that this occurred on April 12 or 13 at McNary Dam. This would put the 10% of the migration at The Dalles according to the agencies' and tribes criteria on or about April 18. The agencies and tribes decided to delay request of spill at The Dalles until April 23 so that scheduled Fish Guidance Efficiency Tests could be completed.

Travel Time

In 1984, 10% of the spring migration passed John Day on or by April 18. Median travel time for yearling chinook was 3.8 days at a rate of 21.7 miles per day between McNary and John Day Dams. Travel time ranged from 3 to 6 days.

In 1985, average travel time for yearling chinook between McNary and John Day was 4.3 days at an average speed of 17.8 miles per day.

Hatchery Releases

This year, major hatchery releases had taken place and fish from upstream releases had been captured at John Day and McNary before April 23. Specifically, a total of approximately 13 million fish were released above McNary before April 23, consisting in part of 420,000 spring chinook from Warm Springs hatchery on April 10; 1,300,000 chinook yearlings from Ringold hatchery on April 1 - 6; 196,000 yearling chinook from Priest Rapids hatchery on April 1; and 481,950 fall chinook from Lyons Ferry on April 2. Fish from these releases were captured at McNary beginning on April 4, and at John Day beginning on April 10.

John Day Gatewell Sample

Attached is a graph showing the gatewell passage index at John Day, with significant passage occurring before April 23. A major release from Deschutes Hatchery took place on April 10 with researchers conducting fish guidance tests reporting the capture of these fish. Passage increased sharply at John Day on April 10 and remained at high levels through April 14. This was primarily composed of Lyons Ferry, Priest Rapids, and Ringold releases of yearling chinook salmon. Passage declined for one day and began to increase again to high levels from the 17 through the 20. Again this peak was composed largely of Lyons Ferry and Ringold releases, but recaptures from upriver facilities such as Rapid River and Dworshak were present.

The fishery agencies and tribes initially recommended a 7,500 fish per day spill trigger for summer migrants at John Day Dam using the Unit 3 airlift index. Since the Corps subsequently decided to restore hydroacoustic monitoring at John Day Dam in summer, we revised our spill criteria for summer migrants to use a 30,000 fish per day hydroacoustic estimate as a trigger. We left the 7,500 fish airlift index trigger in our criteria only to be used during periods of the summer migration when hydroacoustic estimates may be unavailable.

The Corps' 1986 Juvenile Fish Passage Plan includes spill criteria, including the trigger at The Dalles Dam, that are inconsistent with spill criteria identified by the fishery agencies and tribes. In addition to this inconsistency with the requirements of the Fish and Wildlife Program, we are concerned that the Corps' criteria and the interpretation of those criteria in your April 25, 1986 response indicate a general misunderstanding of how the 7,500 trigger was developed. First, the data used to develop the trigger was the airlift index, as reported in the Fish Passage Center's weekly report, not the raw gatewell counts as your letter stated. The airlift index is the number of fish collected at Unit 3 adjusted for flow and spill conditions by dividing by the proportion of total project discharge passing through Unit 3. No spring migrant data were included in the analysis. A COE draft plan had included the 7,500 fish trigger for spring migrants. The original request noted that early draft. Sonar monitoring is similarly adjusted on the basis of powerhouse flow.

We believe that the current passage index as we calculate it is appropriate and we will continue to use it. We do not agree with the COE's use of raw gatewell counts.

Sonar Monitoring At The Dalles

The COE passage plan identifies the typical period of passage for the spring migration at the Dalles as April 15 through June 11. All indications at Snake River projects were that the migration was early. Migration timing at McNary appeared typical for mid-April. The COE plan relies on sonar monitoring at the Dalles to initiate spill. However, sonar monitoring was not in place and operational at the Dalles until April 28, well after the typical 10% point of passage identified in the COE plan.

The NPPC Program

The NPPC program calls for protection of the mid-80% of spring migrants. Spill is to be initiated when 10% of the migrants have passed the Dalles. The Corps initiated spill at the Dalles on April 29 based on hydroacoustic

monitoring. At that time John Day gatewell indices were at about the same levels as when the agencies and tribes request was denied on the basis of John Day gatewell samples.

We do not believe that your action was consistent with the NPPC program. Your use of hydroacoustics was initiated late relative to the 80% typical passage period and, therefore, did not take into account the fish which passed the project prior to initiation of sonar monitoring at the Dalles, but which do count in the first 10% of the spring migration.

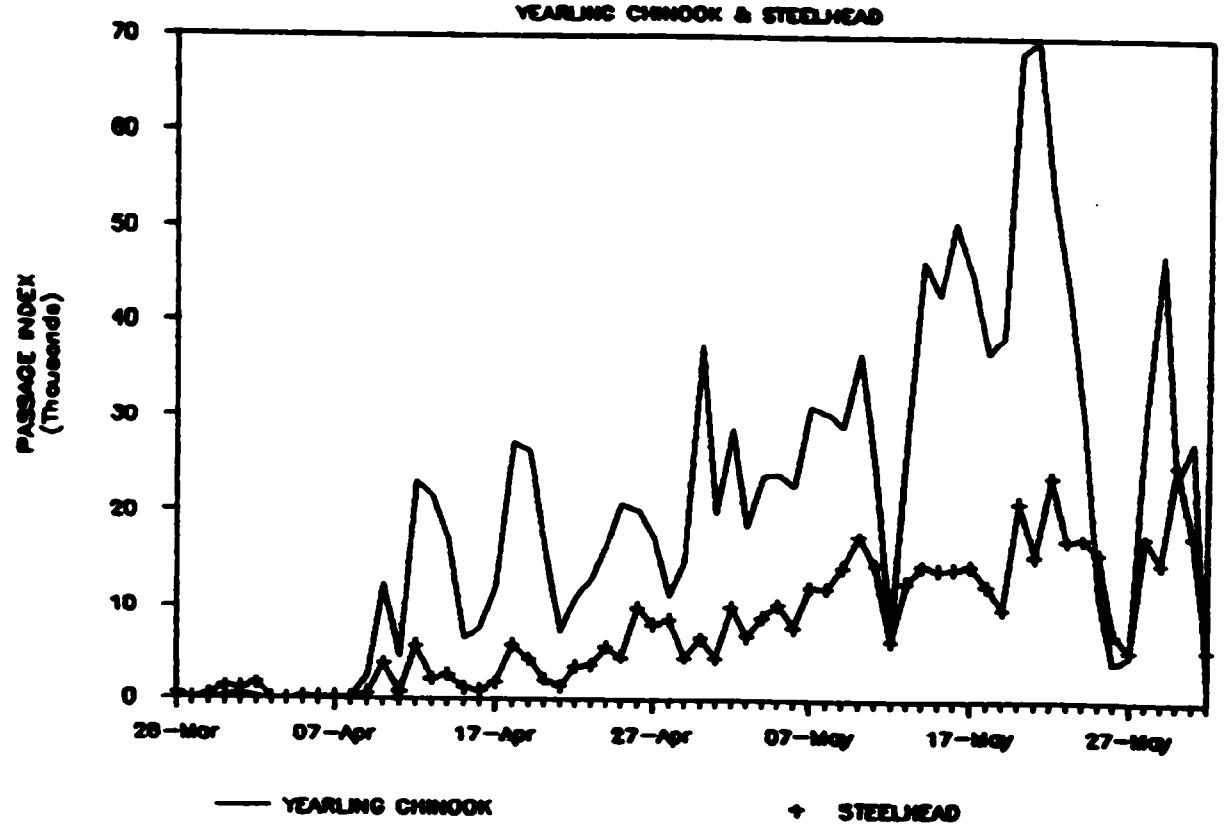
The Corps began to implement its own spill plan on April 29, on the basis of projection of hydroacoustic monitoring, but refused to implement the agencies and tribes request on the basis of passage indices developed from raw gatewell counts. Raw gatewell counts at John Day on the days previous to the 29th were of the same magnitude as those previous to the agencies and tribes request on the 23rd. Of the 14 days beginning with April 10, when indices increased at John Day, through April 23, only 6 days had gatewell counts below 1,000, and two of those were not full sample days. Two of the 6 days were above 800. This indicates that sonar monitoring was operational too late to determine the appropriate date to commence spill.

We hope this will clarify the use of the 7,500 gatewell passage index for summer migrants, which will be implemented when summer migrants arrive.

as of 6/1/86

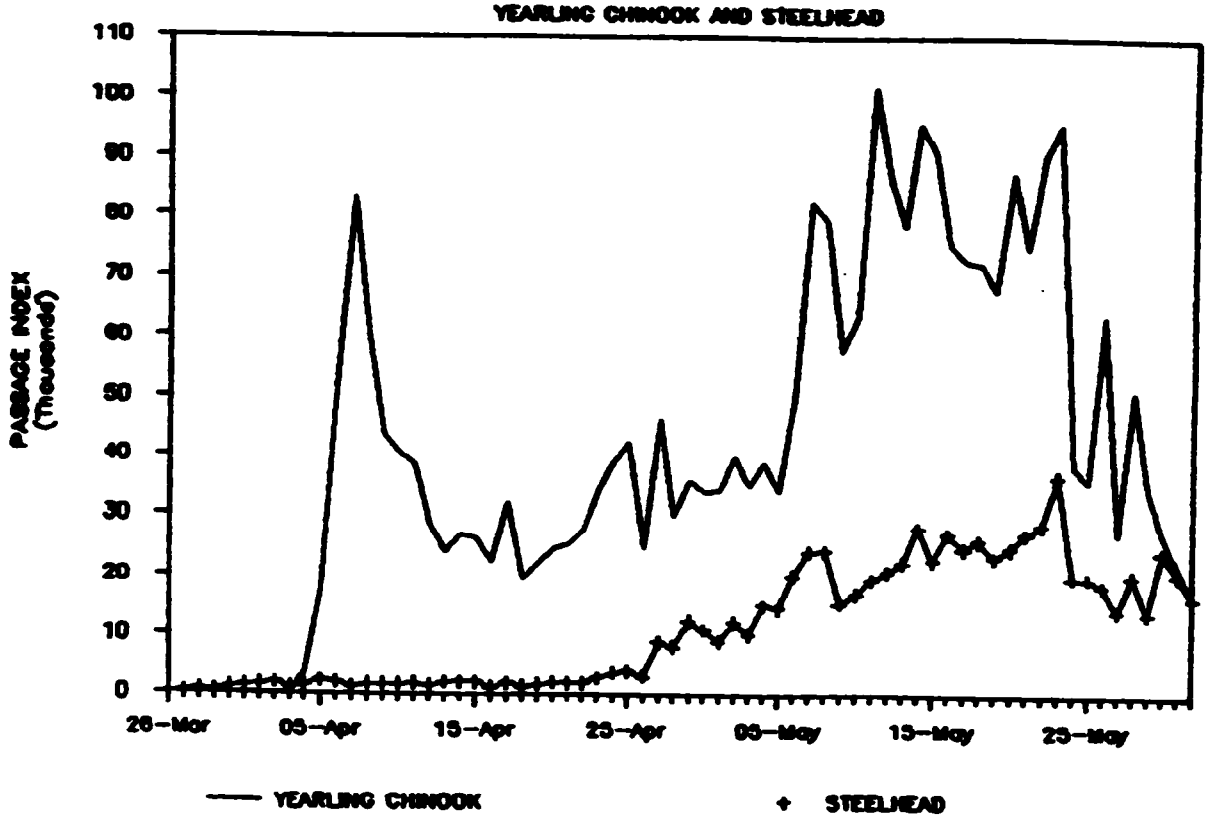
1986 MIGRATION TIMING: JOHN DAY

YEARLING CHINOOK & STEELHEAD



1986 MIGRATION TIMING: MCNARY

YEARLING CHINOOK AND STEELHEAD



FISH PASSAGE CENTER
825 N.E. 20TH AVENUE • SUITE 336 • PORTLAND, OR 97232-2295
PHONE (503) 230-4099

MEMORANDUM

DATE: July 10, 1986

TO: Jim Cayanus, COE-RCC

FROM: Michele DeHart

RE: Spill for Fish Passage at John Day Dam

I am writing to reiterate our telephone conversation of July 3, 1986. At that time you advised me that the COE had decided to reduce spill for summer migrants at John Day from 36% instantaneous to 18% instantaneous, based on results of Fish Guidance Efficiency tests conducted on 6/17, 6/18, 6/19, 6/23, 6/24, 6/25, and 6/26. At that time I advised you that the agencies and tribes did not agree with your decision. I also suggested and you agreed that if the COE reduced the instantaneous spill, that the spill volume be concentrated over a shorter time period, to increase the effectiveness of spill. You agreed to spill 30% instantaneous for seven hours from 2100 to 0400.

We have reviewed the guidance tests in question, and do not believe they can be used to adjust spill as the COE has done. This approach utilized the Fish Pass model with a constant mean FGE value to predict spill needed to attain 90% project survival. However, the Fish Pass model does not recognize the variability of the FGE results. The guidance test results ranged from 20% to 42%. The COE pooled the data which is equivalent to taking the weighted average of proportions to determine the constant guidance efficiency.

We do not think this is appropriate. The data was collected with full net arrays and single net arrays. The full net array tests consistently resulted in higher guidance efficiency estimates. We compared the full net and single net array tests using a chi-square analysis, and determined that the data was not homogeneous, and should not be pooled.

We disagree with utilizing the weighted mean, rather than an unweighted mean. We understand that the weighted mean is used, because on days when a large sample is captured, it is more representative of the migration passing the project. However, in comparing total test captures to daily passage indices, this does not appear to be true. We believe that using the unweighted mean is preferable. We used the inverse sine transformation (arcsin $\sqrt{P}$) on the proportions to make the data approximately normally distributed before calculating means and confidence intervals, and then transformed the results back to the original binomal scale.

Although the confidence limits on individual fyke net tests is ±3%, the individual test results are not used; the weighted mean of several tests is utilized. Confidence intervals on the mean should be calculated. We calculated a ±23% confidence interval on the 32.6% unweighted mean of the 7 June fyke net tests. Had we restricted the computation to the 5 fyke net tests with total sample sizes greater than 250, a ±34% confidence interval on a 31.9% unweighted mean would have resulted. A mean estimate with this degree of variance does not lend itself to management as utilized by the Corps.

In addition, it appeared from reviewing test results that guidance estimates are somewhat a function of the duration of the test. The tests start between 9:00 and 9:30 p.m. We know from other studies that vertical distribution shifts from day to night, with night distributions being deeper in the water column. It is logical then to conclude that guidance estimates would be higher in tests that were conducted for a short duration, because vertical distribution would be higher in the water column. As the evening progressed, vertical distribution would be lower and resulting guidance would be lower. This appears to be true, because single net arrays were fished longer and they result in lower guidance estimates. The higher guidance estimates resulted from shorter duration, full net array tests. It is reasonable to assume that the 42% guidance estimate which resulted from the 1½ hour full net array test would have been lower if it was of longer duration, and would have sampled more of the nighttime vertical distribution.

This illustrates the problem of using the model with a constant mean FGE value to manage fish passage. Because the model does not account for variance, it does not accurately reflect reality. It would be better to run the model several times so that survival estimates with values of the upper and lower limit of the FGE confidence interval as well as the unweighted mean. This would provide a partial measure of the variability about the estimate of survival for a given FGE level. Before the model and FGE estimates are further utilized to manage passage, the variance around estimates should be calculated and addressed.

cc: AFPC
Jim Ruff, NPPC
Chip McConnaha, NPPC
Stephanie Burchfield, CRITFC
Dale Evans, NMFS
Brian Brown, NMFS

580.86/MD2