IV. FUNCTIONAL ACCOMPLISHMENTS

Flood Damages *Electric Energy* *Licensing* *Irrigation* *Navigation* *Recreation* *Water Quality* *Fisheries Operation* *Special Operations* **WEB Links deactivated**

The hydrologic conditions and the reservoir regulation described in the preceding two chapters have produced significant effects on many aspects of life in the Pacific Northwest. These effects are discussed and quantified within the following benefit categories: flood control, energy generation, irrigation, navigation, recreation, water quality, and fishery operation. These discussions are not intended to be thorough or complete but are cursory and contain only the salient features. For more information contact either the appropriate agency whose Water Management Group members are listed inside the back cover of this report or contact the Group officers, also listed inside the back cover.

A. FLOOD DAMAGES

The effect of reservoir regulation on downstream river flow is determined by routing (the calculation of travel time, diversions, etc) and comparing regulated and unregulated (*ie* natural or pre-project) flows. The flood damages given in Table 18 are for selected sites associated with reservoir flood control operation and show both the observed flows and damages and the unregulated flows (those that would have been observed without the flood control dams) and the damages prevented (the additional damages that would have occurred without the flood control reservoir operation). The reduction in the river stage or flow that resulted from the reservoir regulation was used to index the value of damages prevented. This year both the observed and prevented damages in northwestern Oregon were difficult to determine because of the multiple floods that occurred in the same locations and the damages from the earlier floods that were still unrepaired at the time of the subsequent flood events.

The flood damage prevented by reservoir operation in the Northwest was $89,064,000. Damages prevented in the Willamette Basin constituted 1% of this total and nearly 89% of the total was in the Snake Basin. One-third of the Snake Basin prevented damages occurred in the Boise sub-basin. The high damage prevention in Idaho was due to above normal spring precipitation and short warm spells causing slow snowmelt of a near record snowpack in the upper and middle Snake River Basin. Some of the damages prevented in the Upper Snake Basin result from new development in the flood plain near Jackson, Wyoming.

The damages prevented this year ($0.98 million) were very low compared to the $3.9 billion last year and the $2.1 billion of water year 1996 which included the seawall extension in downtown Portland. There were very few flood events in the Willamette basin, and those that did occur were small and affected mostly uncontrolled tributary. As discussed in Chapter II, El Niño is given the credit for diverting storms away from the Pacific Northwest. The following tables of damages and damages prevented are for Corps projects and do not include damages on uncontrolled streams or at Section 7 projects such as the $13 million damages in Prineville, Oregon.

Table 19 is a tabulation of damages prevented by major flood control projects in the Columbia Basin for the period since 1948 through 1998. Damages prevented for the lower Columbia and for the entire Columbia Basin represent the damage for the cost and development of the year of occurrence. At today's cost and development level, the amounts in past years would be much larger. The damage prevented by control of winter floods on tributary streams is not shown.

B. ELECTRIC ENERGY

Power operations in this report reference two major entities: the Coordinated System and the Federal Columbia River Power System (FCRPS). The former includes most of the generating facilities, hydro and thermal, in the

Pacific Northwest, including the FCRPS projects, which are Federally owned (Appendix A). Washington Public Power Supply System nuclear power plant #2 (WNP-2) contributes its output to the Federal System. Although participants of the Coordinated System operate their own reservoirs, the power system is operated as a "one-owner" system to optimize both energy production and management of the other water resources in the Pacific Northwest.

1. Generation

The Coordinated System storage level at the beginning of the 1997-98 operating year was 99.1% full as of July 31, 1997, as measured in the Pacific Coordination Agreement (PNCA) Actual Energy Regulation (AER). The Treaty Storage operation outlined in the AER is fixed from the Treaty Storage Regulation (TSR) study. Since the System was 99.1% full, first–year firm energy load carrying capability (FELCC) was adopted for the US system from the PNCA critical period studies. Due to above average streamflows throughout the year, the system generally operated to Operating Rule Curve (ORC) or flood control for the entire period, producing large amounts of surplus energy. The system storage energy reached 99.4% full on July 31, 1998, as measured in the AER, and the system adopted first-year FELCC from the 1998-99 PNCA Final Regulation study.

Table 20 shows the breakdown of Federal generation between the Corps, Reclamation, thermal, and miscellaneous energy sources and the changes over the previous year. The large decrease in Corps and Reclamation generation results from the magnitude and timing of the year's runoff. The Corps' portion decreased by 19.0% and Reclamation's decreased by 20.9%. Of the Federal energy marketed by BPA, the Corps projects continued to generate two-thirds of the total and Reclamation projects continued to generate one-fourth.

On April 1, BPA began delivering Canadian Entitlement power from US dams to Canada. The entitlement is Canada's half of the extra power made available as a result of Canada building storage dams under the Columbia River Treaty of 1964. Canada sold its share to a group of US utilities in a series of 30-year deals that have begun to expire. Discussions continue between the two countries on final details, including new ways for BC to market the entitlement in the US.

2. Marketing

Several major factors helped bulk power sales achieve a banner year. First, although the January through July runoff volume was slightly lower than normal, the autumn flows were higher than average. The higher fall streamflows supported large surplus secondary energy sales throughout a high valued period. In addition, FY98 saw several interesting developments in the commodity market that allowed BPA's Bulk Power Group to expand its marketing for secondary power. The California Power Exchange (PX) began operation with its "Day Ahead Market" and "3 Hour Ahead Market", and the California Independent System Operator (Cal-ISO) markets were developed including the Real-Time Imbalance Market Spot Market, Ancillary Services Market, and Congestion Management Market.

Power purchases, shown in Table 21, were moderate. Table 22 shows the abundance of surplus firm power.

3. Northwest-Southwest Intertie

In spring 1998, the Southern Intertie gained approval from the Western Systems Coordinating Council (WSCC) to return to full operating levels for the first time since the August 1996 western system outage. Operational transfer capacity of the Northwest-South-west Intertie ranged from 6200 to 7800 AMW. US District Court ruled in BPA's favor on the first of five legal claims against the agency arising out of the outage. Since 1996, there have been stepped up efforts to safeguard reliability.

4. Industry Changes

Sweeping changes in the West Coast energy market began in late 1996 with the signing of California Law AB1890, calling for deregulation of California's investor-owned electric utilities (IOUs), and opening the state's

$21 billion electricity market to wholesale and retail competition. On March 31, 1998, the California Independent System Operation (ISO) and Power Exchange (PX) began operations, marking the beginning of this new era. The PX facilitates trading of about 80 percent of the electricity in California, including all power consumed by the state's investor-owned utilities. BPA met these new market challenges by certifying as an ISO scheduling coordinator and PX participant. The agency markets surplus energy in California in both the ISO and PX markets. New electronic energy trading, scheduling, account tracking and settlement tools for participating in these emerging market entities was also put on-line in 1998. BPA also implemented a seven-day-per -week generation prescheduling function in response to this new market structure.

5. BPA's Financial Picture

BPA ended the fiscal year with operating revenues that were $48.7 million higher than the previous year. However, operating expenses also were up from the previous year. In October BPA sent the US Treasury a check for $852 million, thus making it 15 continuous years the agency has paid in full and on time. BPA also took advantage of the economy's low interest rates to refinance seven of the agency's Treasury bonds. All in all BPA saved $17.4 million annually for fiscal years 2002 through 2006 thanks to a series of bond refinancings during this year.

BPA and the Corps signed a direct funding agreement that allows BPA to fund repairs and maintenance at 21 Corps' power projects without going through a lengthy congressional appropriations process. A similar agreement had been signed with the Bureau of Reclamation the previous year.

6. Energy Licensing and Regulation

As of the end of the water year, the Federal Energy River Regulatory Commission (Commission or FERC) had a total of 141 outstanding licenses and 112 exemptions in the Columbia River Water Management Group area, which the Commission's Portland Regional Office staff inspects for compliance with its dam safety program and other terms and conditions of project authorization. Also, 22 applications for license involving new hydropower capacity were pending within the area. In all, the Commission has 276 projects under its supervision in the area, consisting of either outstanding licenses, exemptions issued, or applications for license. Table 23 is a breakdown of these categories by state.

Construction inspections were conducted at 19 projects during the reporting period. New generating capacity under construction represents approximately 10 MW which now or will be marketed by either BPA, licensed utilities, or directly used by the hydropower developer.

C. IRRIGATION

Irrigation service from Bureau of Reclamation projects was available to an estimated 2,870,000 acres. Of that total, actual irrigation deliveries were made to approximately 2,735,000 acres. The water came from 52 reservoirs with an active capacity of about 10,090 kaf. This does not include 8,214 kaf of storage in Franklin D. Roosevelt Lake (behind Grand Coulee Dam) and Hungry Horse Reservoir in western Montana. Record high deliveries were made to farms in 1970 and 1974.

D. NAVIGATION

The Corps of Engineers operates navigation locks on three waterways in the Pacific Northwest: the Columbia-Snake River Inland Waterway in Washington, Oregon, and Idaho, the Willamette Falls Lock in western Oregon, and the Lake Washington Ship Canal in Seattle. The Columbia-Snake River Inland Waterway, Figure 13, extending 465 river miles from the Pacific Ocean to Lewiston, Idaho, provides safe passage for ocean-going vessels for more than 100 river miles up to Vancouver, Washington, (on the Columbia River) and Portland (on the Willamette River) and for shallow-draft tugs, barges, log rafts, and recreational vessels from Portland, Oregon, to Lewiston, Idaho. Four of the nation's top 100 ports, based on total domestic and foreign cargo tonnage, are located

on the Columbia/Willamette rivers, downstream of the dams and navigation locks. The combined tonnage of these ports would place them twelfth in the nation, more than that of either Los Angeles or Norfolk Harbor. The major commodities exported through these ports are farm and timber products while the imports are petroleum products and chemicals.

Navigation on the shallow draft portion of the Columbia Inland Waterway from Portland to Pasco, Washington, is made possible by four locks that elevate the river from 8 ft mean sea level (msl) below Bonneville Dam (river mile 146), 42 miles east of Portland, to the mouth of the Snake River (river mile 324) in McNary Reservoir at an elevation of 340 ft msl. This latter pool extends to Pasco on the Columbia and to Ice Harbor Dam (river mile 9.7) on the Snake River. Navigation on the Snake River from its confluence with the Columbia near Pasco, to Lewiston (river mile 140), is made possible by four locks which elevate the river from 340 ft at Ice Harbor Dam to 738 ft at Lewiston on the Lower Granite reservoir.

The nominal size of these eight locks are 86 ft wide and 675 ft long. All the locks were closed simultaneously during March for annual maintenance.

Navigational flow requirements on the Columbia and Snake rivers were met by streamflows and pool levels determined from other project requirements. Cargo was generally transported without any special operational requirements, although occasionally some unusual navigation requirements demand special regulation. However, these special requirements did not generally alter the Columbia River regulation enough to have a significant effect on other project purposes.

The special project operations were necessary to meet navigational requirements during this year had to do with vessel groundings, emergency operation at projects, and for transportation and off loading of decommissioned defueled submarine nuclear reactor cores at Hanford, Washington. The latter special operations were required at both upstream and downstream projects to hold the McNary pool at a constant elevation during the several hours required to off load the reactor cores.

Commercial cargo through the Columbia-Snake locks consists chiefly of farm, lumber, and petroleum products with down-bound cargo consists mostly of the first two and up-bound the latter. March tonnages are less than other months due to the annual closure for maintenance. More information on these projects can be found on the Corps' web site at: *http://www.wrsc.usace.army.mil/ndc/*.

The Willamette Falls Lock, located on the Willamette River at Oregon City, uses four chambers to lock vessels, loaded mainly with sand and gravel or wood by-products, around the 40-foot high Willamette Falls. Efforts to rebuild the locks with a single chamber have never been funded. More information on this project can be found on the Corps' web site at: *http://www.nwp.usace.army.mil/co/st/nl/index.htm*.

The Hiram M. Chittenden Locks at the west end of Lake Washington Ship Canal provides ship travel between the saltwater of Puget Sound and the freshwater of Salmon Bay, Lake Union, and Lake Washington. The major cargo through the locks is sand, gravel, and wood products. However, because of its proximity to the heart of Seattle the majority (54%) of its lockages and 95% of the vessels locked are pleasure craft, especially in the summer. A large portion of the Seattle commercial fishing fleet, consisting of trawlers and gillnetters, is moored in Salmon Bay, immediately above the locks. During the commercial fishing season these vessels are major users of the locks. Tour boats and government vessels, especially NOAA vessels based on Lake Washington, and Coast Guard vessels moored above the locks, also use the locks. More information on this project can be found on the Corps' web site at: *http://www.nws.usace.army.mil/opdiv/lwsc/lakewsc.htm*.

E. RECREATION

Although many agencies provide recreational facilities, the only agencies to also have project operational activities are the Corps of Engineers and the Bureau of Reclamation. These operational activities include not only those activities for which the projects were authorized but also those ancillary activities which benefit the public without adversely impacting the authorized operations. The added benefits include maintaining some reservoirs within certain elevation ranges throughout the recreation season while at other projects it may be regulating

downstream discharges for the activities. Recreational activities include boating, fishing, sailing, hunting, rafting, wind surfing, hydroplane racing, and cross channel swimming. In some cases, the reservoirs are maintained at high elevations during the camping and picnicking season for aesthetic reasons.

Historically, the Corps and Reclamation use different methods to count visitation-days and consequently they could not be directly compared. Now both agencies will be using the visitor-hour/visitor-day method. The difference in the two systems used in the past was that a recreation-day equaled a visit by one person to an area for all of or any part of a 24-hour day; whereas a visitor-hour equated to actual time spent on an area. Twelve visitor-hours equals one visitor day.

1. Corps of Engineers

The total capital investment in recreation develop-ment is over $45 million which generates significant benefits each year. Recreational use at Corps administered water resource projects was an estimated 9.0 million 12-hour visitor-days, or 110 million visitor-hours. Three Corps projects each exceeded half-million visitor-days of use and one project, Bonneville Dam, exceeded 1 million visitor-days.

Sightseeing continues to be the leading recreation activity. Facilities such as visitor centers, overlooks, and interpretive facilities are provided to accommodate this use. Swimming, boating, fishing, and general day use activities are other recreational opportunities sought by visitors to Corps projects. Wind surfing, particularly on the Columbia River projects, has become a highly visible activity over the past several years.

2. Bureau of Reclamation

Reclamation reservoirs provide water-based recreation opportunities unique to the surrounding areas in some of the more arid portions of the region. Reclamation's Pacific Northwest (PN) Region has 79 recreation areas on 66 reservoirs, providing 395,000 acres of water surface and 2,400 miles of shoreline. Reclamation works cooperatively with state, county, irrigation districts, and federal agencies, as well as private concessionaires in developing and managing many of the recreation areas at Reclamation reservoirs. Recreation facilities include 6,250 campsites in 148 campgrounds; 150 picnic areas; 39 swimming beaches, and 196 boat launch ramps. Recreation facilities are evaluated in terms of visitor safety and accessibility and improved as needed.

This recreation season was successful for water dependent recreation activities. Visitor data has not been measured for the past three years. Given the excellent water conditions it is assumed that recreation use remained at the 10.5 million 12-hour visitor day level as reported in 1992.

The major focus and direction of Reclamation is to develop partnerships to manage and administer the recreation areas and resources at Reclamation projects. These partnerships with state and local governments require that Reclamation participate, on a cost-sharing basis, in the planning, development and expansion of the recreation facilities to meet the recreation and resource needs associated with the area.

The PN Region obligated $996,000 which a total of 22 projects were cost shared. Examples of these partnerships include the following.

! Reclamation cost shared with Washington County, Oregon, at Henry Hagg Lake to continue improving access to and safety of recreation facilities, alleviate crowding, and improve sanitation and accessibility problems.

! Reclamation cost shared with Oregon State Parks at Prineville Reservoir in Central Oregon to construct a new boat ramp at Jasper Point Campground. Public safety will be improved and reservoir water quality protected.

! Reclamation cost shared with Washington State Parks and Recreation Commission to renovate and enhance recreation facilities at Banks Lake, including improvements to boat launch facilities at Steamboat Rock State Park, and to bring all launch facilities into compliance with Federal accessibility standards.

! Reclamation and Idaho Department of Parks and Recreation established a management partnership at Lake Cascade State Park (formerly Cascade Reservoir). Idaho Department of Parks and Recreation will manage 11 recreation areas around the lake.

! The PN Region continued to support the Catch A Special Thrill (C.A.S.T.) program through four events for invited children from 7-16 years old that have a variety of physical or developmental disabilities or in some cases, a terminal illness. The C.A.S.T. program is part of an ongoing partnership between the Bureau of Reclamation - Pacific Northwest Regional Office, each Area Office, C.A.S.T. for Kids Foundation, and many local organizations.

F. WATER QUALITY

The Corps of Engineers and the Bureau of Reclamation conducted operations-related water quality activities, checking for impacts of project performance in relation to federal and state water quality standards and their effects on stream water quality. Most of these activities were carried out during the juvenile fish migration season.

1. Total Dissolved Gas (TDG) Monitoring

The Columbia/Snake River Total Dissolved Gas Monitoring Program is an annual continuing activity started in 1984. Its primary objective is to collect total dissolved gas and water temperature data needed to schedule real-time reservoir releases and spill operations during the anadromous fish migration season (April-August). Monitoring also continued at a few stations past August and through the following winter season. Field data collection has been a Districts responsibility since 1996, but program coordination and data handling, dissemination and storage continue to be performed in the Division Headquarters.

In 1998, a total of 41 instruments were used at various forebay and tailwater stations during the juvenile migration season. These included 28 instruments operated by the Corps, four by the Bureau of Reclamation, and nine by the mid-Columbia PUDs (Figure 14). Two new stations (Wells and Hungry Horse tailwater stations) were added, but the Libby tailwater station was never activated for lack of spill at the project. Year-round monitoring involved 11 stations, including International Boundary, Dworshak tailwater, Lower Granite forebay, Lower Granite tailwater, Ice Harbor forebay, Ice Harbor tailwater, McNary forebay (Washington side of the river), McNary forebay (Oregon side), McNary tailwater, Bonneville forebay and Warrendale, Oregon, below Bonneville Dam.

All the data collection instruments were fully automated. All data were compiled and posted along with pertinent reservoir and flow information on the CROHMS data base, and the Technical Management Team (TMT), Portland and Walla Walla District homepages. As was done in the previous four years, the National Marine Fisheries Service (NMFS) obtained waivers from the states and the Nez Perce tribe to allow for the spill to occur at these high TDG levels. Because of the much lower runoff conditions in 1998 than in 1997, the 1998 TDG levels were significantly lower than those measured in 1997 basinwide.

2. Water Temperature Monitoring

Monitoring of water temperature conditions throughout the Columbia and Snake river mainstems was conducted as part of the dissolved gas monitoring. Scroll case water temperature data at Bonneville dating back to the 1930s, when the project was constructed, show an increasing trend over the period of record. It also revealed that the 1998 water temperatures were one of the warmest on record and occurred one month earlier than normal.

A detailed report on the Dissolved Gas (and Water Temperature) Monitoring activities is available at *http://www.nwd-wc.usace.army.mil/TMT/1999/documents* .

3. Other Water Quality Activities

a. BUREAU OF RECLAMATION. The primary emphasis of Reclamation water quality activities is to identify problems associated with management of operating projects and to develop appropriate corrective strategies.

! Data collection and water quality model calibration were initiated for a potential water quality improvement measures on Lake Lowell., an off stream storage facility on the Boise Project.

! Concept designs were for three structural alternatives to abate total dissolved gas at Grand Coulee Dam

were carried forward to feasibility-level investigations.

! The Burnt River Basin Water Temperature Modeling Study continued to provide data for the development of a water temperature plan for the basin.

! Reclamation continued cooperative water quality data gathering and modeling with the University of Idaho and the Mid-Snake Watershed Advisory Group to provide baseline for the quality of irrigation return flows.

! Reclamation participated in multi-agency efforts to develop water quality management plans for the lower Boise and Payette rivers.

! Reclamation conducted sampling of mercury in sediment and water at a number of reservoir locations and stream nodes to define mercury sources and fate and transport within Owyhee Reservoir. This sampling resulted from the high mercury content found in the tissue of fish from the reservoir.

! Injection wells near Minidoka, used for disposal of most irrigation return flows and storm water runoff, are subject to Idaho's increasingly stringent regulations for the quality of injected water. To eliminate the possibility of contamination of domestic wells, an alternative means of disposing of drain water and storm water, without use of injection wells, was implement.

! The reservoir water quality surveillance program focused on reservoirs suppling small projects in eastern Oregon provided chemical, physical, and biological data needed to manage water quality in Reclamation reservoirs and downstream releases.

! Long-term water quality monitoring of irrigation supplies and returns continued on the Boise, Columbia basins, and the Minidoka and Yakima projects. Additional data was gathered for assessment of nonpoint source irrigation impacts in the Owyhee, Malheur, Powder, and Burnt basins.

b. <u>CORPS OF ENGINEERS</u> Other water quality work by the Corps is discussed by districts.

<u>Portland District</u>

! Routine water quality monitoring for nutrients and limnological parameters continued at Lost Creek and Applegate reservoirs in the Rogue River Basin.

! In the Willamette River Basin, sampling of water for mercury continued at Cottage Grove Lake, monitoring of turbidity continued at Detroit Lake, water quality monitoring program continued at Fern Ridge reservoir, and routine surface-to-bottom profiling of reservoirs for limnological parameters continued during the spring and summer at all projects. A report on the downstream effects of surface withdrawal at Cougar and Blue River lakes was completed.

! At Willow Creek Lake routine nutrient, methane, hydrogen sulfide and other limnological data were collected.

<u>Seattle District</u>

! Control of saltwater intrusion continued to be an issue at the Hiram M. Chittenden Locks. Real-time water quality data collection, computer models and *in situ* operations are being used to more efficiently control saltwater to improve smolt passage over the dam.

! The district continued to negotiate with the City of Seattle on a new set of instream flows for the Cedar River, a major tributary to Lake Washington.

! Monitoring of water quality continue at Wynoochee Dam, now owned by the City of Tacoma.

! Study continued on the effects of increased conservation storage at Howard Hanson Dam on both in-reservoir and downstream water quality. A thermal budget model was used to simulate several selective withdrawal and fish bypass system operation alternatives.

! High sediment load in the inflow to Mud Mountain Dam continued to require periodic debris removal operations. An estimated half million cubic yards of sediment passes this project in a normal water year.

! Efforts to refill Lake Koocanusa coincided with operations for the benefit of endangered Kootenai River white sturgeon and Snake River salmon stocks. A flow regime was coordinated through the TMT in an attempt to meet the requirements set forth in the BiOp on sturgeon and salmon. As in the past, numerous sturgeon eggs

were found, but no larval sturgeon were detected.

Walla Walla District

! A series of water quality studies were conducted in 1998 to support the Lower Snake River Juvenile Salmon Migration Feasibility Study (LSRFS), including:

Biological Productivity Study - The district gathered ^{14}C uptake and attached benthic algal (ABA) growth data for developing a model to predict ecological changes brought about by returning the lower Snake River to pre-impoundment water surface elevations. The riverine portion of the model has been completed using data from free flowing reaches upstream of backwater effects on the Snake and Clearwater rivers. Results from simulations of the restored system are being compared to the empirical data collected in the impoundments.

The Baseline Limnological Study continued for the fifth year, as necessary for the affected environment portion of the EIS and to provide existing condition empirical data to compare to the model results.

A sediment GIS database was completed to aid in the evaluation, distribution, and possible redistribution of sediments likely in the case of reservoir drawdown or during and after proposed dam breaching.

Additional sediment studies were made to support the Dredge Material Management Study for the Lower Snake River and McNary Reservoir.

! At Lucky Peak and Dworshak reservoirs, water samples for analysis for nutrients and chlorophyll and vertical water quality profiles were taken quarterly.

G. FISHERY OPERATIONS

Fishery operations were implemented in accordance with the Corps' Fish Passage Plan (FPP), which describes the manner in which the Corps' mainstem pro-jects on the lower Snake and Columbia rivers will operate throughout the year to provide safe fish passage. This was in compliance with National Marine Fisheries Service (NMFS) Biological Opinion (BiOp), dated 1995, which contains other measures, including flow augmentation in the Columbia River, additional 427 kaf from the upper Snake River, in-season water management process, and operating the lower Snake River reservoirs at minimum operating pool (MOP) and John Day reservoir to the minimum level needed for irrigation pumping. In-season management of river operations was again provided by the Technical Management Team (TMT) while dispute resolution and policy guidance was provided by the Implementation Team (IT) and Executive Committee (EC) which are made up of representatives from the Corps, Reclamation, BPA, NMFS, USFWS, ODFW, WDFW, and IDFG. The State of Montana and CRITFC withdrew from the process.

1. Actual Operation

This year's near normal runoff did not have the problems with high total dissolved gas (TDG) levels that had occurred in the past several years. Significant project operation for fish included Bonneville operations for adult tule fall chinook trapping, and special releases for fall chinook and chum salmon spawning, at The Dalles, spill amounts were alternated between 30% and 64% to test juvenile fish passage and survival, at Libby a discharge pulse was provided for sturgeon spawning attraction, and the flood control operations were adjusted at Brownlee to assist flows for fish.

2. Spill for Fish

The spill for juvenile fish passage underwent a major change this year. The 1998 supplemental BiOp changed the juvenile fish spill from a general goal of trying to reach an 80% FPE (fish passage efficiency) to a goal of spilling the maximum amount (up to the TDG cap). Individual projects vary in the timing and amount of spill. The increase in spill was due to a change in flow targets, and installation of flip lips at John Day and Ice Harbor (the 120% gas cap doubled or more in both cases). Because of the increased amount of spill, minimum generation requirements were put in place. Table 24 summarizes the actual spill of the projects this year.

Spring spill for fish started April 6 this year for the lower Snake projects instead of the normal April 10 date

of the past several years. (The 1998 supplemental BiOp has a planning date of April 3 for the lower Snake projects). Spring spill for fish started April 20 for the lower Columbia projects. Spill at projects that were transporting fish (McNary, Lower Monumental, Little Goose, Lower Granite dams) stopped during the summer on April 20 for the lower Snake projects and April 30 for McNary. All other spill for fish stopped at midnight August 31. Unlike previous years, the spill amounts did not change from spring to summer at projects that continued spilling during the summer. The spill at Lower Granite was controlled by the surface bypass tests. Spill occasionally was reduced this year at certain projects due to system stability problems (power generation/ transmission).

The seasonal flow targets were managed on a weekly basis by the TMT and Federal action agencies. Both spring and summer flow targets were exceeded for the Snake River. Weekly flows exceeded the seasonal target eight of ten weeks in the spring and five of ten weeks in the summer. Columbia River flows, measured at McNary Dam, exceeded the seasonal flow target in the spring. Weekly flows exceeded the flow target at McNary in eight of ten weeks. Weekly flows only met or exceeded the summer seasonal target at McNary in three of nine weeks. See Chapter III for more details.

3. Juvenile Fish Runs.

Salmoides are hatched either in hatcheries or in the river (called wild fish) where they grow until their time for migration to the ocean. In some case, selected hatchery fry are placed in the river to grow in a natural setting before they beginning their natural migrating to the ocean. Some species begin their migration in the year of their hatching while others winter in the river before beginning their odyssey to the ocean.

During this travel time the juveniles are subject to many perils from predation from other fish and birds, spill at dams that can cause dissolved gas disease, physical injuries that may occur during dam passage, stress, diseases, and other problems. Depending upon the location in the basin of the hatcheries or redds the young fish will have to traverse up to nine dams on their out-migration. To help mitigate these dangers an alternate method of transportation has been developed for the juveniles. Specially designed barges and tanker trucks transport the young fish past the dams where they are released back into the river downstream of Bonneville Dam. This reduces their travel mortality rate for most species while maintain their biological timing for arrival at the ocean.

a. HATCHERY RELEASES. Hatchery fish released into the Columbia basin streams and rivers totaled approximately 83.5 million juvenile salmon, 16.8 million more than normal and 13 million less than last year. The release of summer chinook from hatcheries on the Snake were less than normal and the spring chinook was also below normal. The release of steelhead was near normal. Limited returns from previous years reduced the number of fish returning to the hatchery for spawning.

b. COLLECTION OF JUVENILES Lower Granite, Little Goose, Lower Monumental, and McNary dams are “collector dams” that are equipped with submersible traveling screens, bypass facilities, and raceways capable of holding large number of fish for later transport past the dams. Operation of the fish collection facilities at Lower Granite, Little Goose, and Lower Monumental continued through October. The facilities at McNary were scheduled to operate as long as fish were present and passing the project and while conditions permitted.

It should be noted in the onset that the number of juveniles collected, bypassed, or transported is not a good indicator of the size of the juvenile fish run. Collection efficiency, spill rate and timing, and other factors all play key rolls in juvenile passage.

With the high flows this year the fish managers decided to let more of the juveniles migrate in the river, despite the higher TDG values. Although the total juveniles collected was 19% greater than in 1996 the number of fish bypassed back to the river increased by 131%. The actual counts of fish collected and bypassed is summarized in Table 25.

c. TRANSPORTATION. Barge transportation of fish on the lower Snake and Columbia rivers began in 1977 replacing most of the truck transportation, which had begun several years earlier. Transportation was initiated to reduce juvenile mortality resulting from passage through powerhouse turbines and project reservoirs.

Juveniles are transported from upstream collector projects to a location downstream of Bonneville, the most downstream dam.

This year the juvenile transport season began March and ended in October at Lower Granite, Little Goose, and Lower Monumental. Collection facilities at McNary remained in operation as long as juvenile fish continued to arrive at the project or until the facilities had to be closed for safety. In general trucking was limited to periods when daily collection was less than 20,000 fish per day. The total count of juveniles listed by transport mode and project is given in Table 26.

The total number of fish transported by barge and truck was 68% greater than last year, with all the collector projects on both the Snake and Columbia exceeding last year's counts. The highest count was in 1990, the second highest in 1988, 1998 was third highest, and 1995 was fourth highest.

4. Adult Runs

Adult fish counts were obtained at twelve of the thirteen mainstream Columbia and Snake river dams that have fish passage facilities. Although many species were counted only the salmonid races and species counts at three major dams are reported here, with their 10-year averages and with the counts of the previous six years (Table 27). The difference between the McNary and Ice Harbor counts is an index to the mid-Columbia return.

Most species that entered the Columbia /Snake system showed decreases over the previous year's counts, with only fall chinook and coho counts near or greater than in 1997. Returning spring chinook were slightly over half the 10-year average and less than half last year's run at Bonneville and two-thirds average at McNary and Ice Harbor. The summer chinook run, although smaller than last year, was about average, with a greater than average count going up the Snake River. The counts of fall chinook were near normal at Bonneville and above normal on the Snake, but below normal at McNary. The steel-head and sockeye runs were both down, with the former near 75% of normal and sockeye about 25% of normal.

More detailed information on fish passage can be found on the web at the following web sites.
http://www.fpc.org/FPC1998.pdf or
http://www/fpc.org/adlthist/ or
ftp://ftp.fpc.org/98weekley/adltcnts/adlt1106.txt .

H. SPECIAL OPERATIONS

1. Vernita Bar

As in the past, flows were provided at Vernita Bar to encourage fall chinook spawning at low elevations in the channel as required by agreement between Grant County PUD and the Federal Energy Regulatory Commission. During mid-October through late November, daytime discharges at Priest Rapids were kept below 65 kcfs as much as possible to minimize redd building above that level on Vernita Bar. This was accomplished by reverse load factoring at the project, with reduced power generation during daylight hours and higher generation at night to pass the daily average inflow.

2. Libby Arrow Swap

The Canadian and United States entities of the Columbia River Treaty Operation Committee entered into an agreement to store and release water in Libby and Arrow reservoirs in an optimal manner. They agreed to store water in Libby during August 1-31, 1998, and return water to Arrow between September 1, 1998, and January 16, 1999. This operation is discussed in greater detail in Chapter III, sections B-3 and B-14.