

IV. FUNCTIONAL ACCOMPLISHMENTS

*Flood Damages Electric Energy Irrigation Navigation Recreation Water Quality
Fisheries Operation*

The hydrological 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.

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 (*i.e.*, natural or pre-project) flows. The flood damages given in [Table 17](#) 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.

The flood damages prevented by reservoir operation for this drought year in the Northwest was \$21,559,000. Damages prevented in the Snake Basin constituted 100% of this total. Almost 100 percent of the Snake Basin prevented damages occurred in the upper Snake River sub-basin near Idaho Falls and in Wyoming.

The damages prevented for the drought year WY-2001, about \$0.02 billion, was very low compared to WY-2000 (about \$0.8 billion), WY-98 (\$0.98 billion), WY-97 (\$3.9 billion) and \$2.1 billion for WY-96 which included the seawall extension in downtown Portland. These tables of damages and damages prevented are for Corps projects and do not include damages on uncontrolled streams or at Section 7 projects.

[Table 18](#) is a tabulation of damages prevented by major flood control projects in the Columbia Basin for the period since 1948 through 2001. 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. The Columbia Generating Station (formerly 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 water resources in the Pacific Northwest. The west-coast shortages and huge price spikes jump-started several renewable-energy projects, most notably wind energy, and BPA acquisitions further stimulated this new power source.

1. Generation

Columbia-basin runoff in 2001 was the second lowest on record; January-July volume was 58.2 million acre-feet at the Dalles. Because of the drought, federal reservoirs did not refill this year and were about 75 percent full on July 31, the end of the operating year. Continued careful management brought the primary federal storage reservoirs - Grand Coulee, Libby, Hungry Horse, and Dworshak - to near-normal levels by the end of August. The normal levels are defined in a 2002 Biological Opinion for hydro system operations to protect endangered and threatened fish.

The Coordinated System storage level at the beginning of the 2000-01 operating year was 97.1 percent full 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. The extremely low water levels, combined with California's supply and price issues, led to operations which drafted Canadian projects below the ORC, and several system-emergency declarations suspended flow requirements in order to meet regional loads. As a result, the system storage energy dropped to 67.1 percent full on 31 July 2001, as measured in the AER.

Due to fall and winter reliability concerns, BPA also was "banking" water in Canadian reservoirs by not exercising its full draft rights under the Columbia River Treaty with Canada. Absent BPA actions, Canadian reservoirs in the Columbia River system normally would have been less than half full on July 31. However, under a newly created summer storage agreement with B.C. Hydro, BPA stored water for fall and winter needs whenever possible, such that Canadian reservoirs ended the water year nearly 65 percent full.

Federal agencies released a limited amount of water through spillways at The Dalles and Bonneville dams from late July through August to help juvenile salmon and steelhead. Approximately 600 megawatt-months of spill, or roughly 15 percent of the amount that would otherwise have been provided, occurred between mid-May and June 15. About 450 megawatt-months of spill were provided between the last week in July and the end of August. The summer spill primarily benefited Hanford Reach fall chinook juveniles, which are not listed as endangered. Most of the fish listed as endangered were barged from the Snake River, so the reduced spill did not affect them.

Table 19 shows the breakdown of Federal generation sources: the COE, USBR, thermal, and miscellaneous energy sources. Also tabulated are the percentage changes over the previous year.

Table 19

SOURCES OF BPA ENERGY

Source	Amount (MWh)	Percentage	Change from last year (%)
COE	41,148,879	63.0%	-19.0%
USBR	14,219,825	21.8%	-20.9%
THERMAL	8,695,743	13.3%	11.3%
MISC.	1,207,596	1.9%	-61.3%
TOTAL	65,272,043		-17.3%

2. Marketing

The second lowest January-July runoff on record, coupled with high energy prices and high price volatility, combined to make FY 01 a very challenging year for BPA marketing. Despite BPA purchases of large quantities of power, it also declared a system power emergency on several occasions and ran the system to meet load. Beyond actual energy purchases, BPA also purchased load-reduction agreements from aluminum smelters and irrigators; some of these agreements continued into 2002. These agreements were less costly than the energy needed to meet those loads, thereby reducing costs in the current year and also expense levels affecting future power rates. Savings were also achieved by sending power to California (when available) for twice as much off-peak energy in return, helping California to meet its peak loads and improving BPA's overall energy and reliability picture.

Table 20

HISTORICAL POWER PURCHASES

<i>Fiscal Year</i>	<i>\$(million)</i>
F.Y. 2001	\$3,046
F.Y. 2000	\$368
F.Y. 1999	\$223
F.Y. 1998	\$118
F.Y. 1997	\$39
F.Y. 1996	\$55
F.Y. 1995	\$155
F.Y. 1994	\$207
F.Y. 1993	\$216
F.Y. 1992	\$137
F.Y. 1991	\$21

Note: Purchases do not include storage costs.

Table 21

BPA Market Purchases and Sales
(MW-Months)

	Purchases	Sales
Oct-00	1850	1449
Nov-00	2110	1322
Dec-00	2355	1683
Jan-01	3202	2611
Feb-01	2461	2457
Mar-01	2522	3014
Apr-01	2312	2907
May-01	3074	2766
Jun-01	3709	2689
Jul-01	4757	2826
Aug-01	4473	3114
Sep-01	3964	2384
TOTAL	36789	29222

*Sales do not include totals from non-scheduling utilities

3. Intertie / Transmission

On March 29 2002, BPA and nine other Northwest utilities asked the Federal Energy Regulatory Commission to find that RTO West as now outlined meets FERC's minimum characteristics and functions for a regional transmission organization. Pursuant to FERC Order 2000, Bonneville Power Administration is participating with other transmission providers in the formation of a regional transmission organization known as "RTO West." RTO West would be an independent non-profit corporation that would operate the region's electric transmission lines as a common carrier of wholesale electricity. The service area includes the Northwest, Nevada and Utah.

4. Subscription / Power Rates

The subscription process was completed in 2001 and made available to BPA's customers during operating year 2002. For the first time BPA will offer separate power and transmission contracts under separate rate schedules. BPA's old 20-year power sales contracts will be replaced by wide range of contract terms. Nearly all the new power contracts run for 10 years. Some public utilities will get all their power and power management services from BPA; some will take only part of their requirements while others buy blocks of power. Power rates will be in effect for five years and allow for a series of cost recovery adjustments to be calculated during each year. Transmission costs will be recovered under separate rate schedules.

Perhaps the most dramatic departure among BPA's new 2002 power sales contracts is the "Slice of the System" product. This new concept in BPA power sales was proposed by several BPA customer utilities and developed through a public process. Slice participants will share BPA's power costs, risks and rewards, and receive firm power plus a proportional share of any surplus power a good water year might produce. They also will take the risk of poor water conditions and they have to pay their percentage share of the maintenance and upkeep costs of the system.

5 . BPA's Financial Picture

After a year of record power prices and near-record drought, BPA met its annual repayment obligation to the U.S. Treasury of \$729 million in full and on time. Most of this obligation was satisfied with credits, including \$592.7 million in fish credits and \$85.5 million in other credits. The fish credit amount includes an estimated \$342 million in 4(h)10(C) credits, plus a \$12.2 million true-up from previous years, and \$238.5 million in Fish Cost Contingency Fund credits. Beyond these credits, BPA paid the Treasury \$51 million.

BPA's FY 2001 Treasury payment included \$458 million in interest, \$210 million in principal and \$57 million for operations, maintenance, fish and wildlife projects and other obligations. BPA also paid \$173 million directly to the U.S. Army Corps of Engineers and Bureau of Reclamation to fund operation and maintenance of federal power projects and another \$4 million to the Treasury in bond premiums.

C. IRRIGATION

Irrigation service from Bureau of Reclamation projects was available to an estimated 2,870,000 acres in 2001. The water came from 52 reservoirs with 10,090,000 acre-ft (af) of active capacity. This does not include 8,214,000 af of storage in Franklin D. Roosevelt Lake (behind Grand Coulee Dam) and Hungry Horse Reservoir in western Montana.

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, 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 that 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 is 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>

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 development is over \$45 million that 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 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 upgraded as needed.

The Bureau of Reclamation's general legislative authority to manage recreation on Reclamation lands is the Federal Water Project Recreation Act, (PL 89-72) as amended by the Recreation Management Act of 1992 (Title 28). The major focus and direction of this legislation is developing 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. These partnerships are critical to the continued efficient management of Reclamation lands for public recreation purposes. In general, Reclamation has been able to minimize O&M costs and insure high quality recreation facilities under these authorities. A GAO audit in 1993

directed Reclamation to find non-Federal management partners for recreation areas that did not have them.

F. WATER QUALITY

1. Corps of Engineers

The Corps of Engineers lower four Snake River dams and the Corps lower Columbia River dams were operated for consistency with the total dissolved gas variance standards for Oregon and Washington. Operations to meet 115 percent in the project forebays and 120 percent in the project tailwaters were excellent for 2001. Water temperature compliance was poor, but similar to average water years, despite drought conditions.

Water year 2001 was characterized by drought conditions. The unregulated runoff from January through July at The Dalles was 58.2 Maf, only 55% of the 1961-1990 average. The unregulated runoff during August through July operating year at The Dalles was the lowest in the 1878-2001 historic record at 82.6 Maf.

Total dissolved gas (TDG) exceedances were very few for the water year. Oregon and Washington State variance standards were slightly exceeded for 6 days in the McNary forebay and 2 days at the Camas/Washougal monitoring station during the spring/summer spill season. The exceedances were mostly individual days rather than a block of days. Idaho State water quality standards were exceeded for 17 individual hours during the entire 2001 water year.

Water temperature compliance exceedances ranged between 17 and 68 days at the monitoring sites on the Columbia River, between 8 and 85 days at the Snake River sites, and 0 days at the Clearwater sites. Dworshak Dam was able to provide waters that cooled the lower Snake River. The interpretation of how much the Dworshak releases cooled the river is obfuscated by the apparent stratification of the Lower Granite forebay. The Lower Granite tailwater only registered 8 days where the 24 hour average was above State standards, partially due to the releases from Dworshak.

Due to the low water year and limited spill throughout the spill season, there were no chronic exceedance problems at the fixed monitoring sites. It is interesting to note that even with little spill in the Columbia River system there were still elevated TDG levels in the McNary forebay and at Camas/Washougal, which were attributed to warm weather conditions.

b. 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.

+ Reclamation completed a reconnaissance level study of potential Lake Lowell water quality improvement measures in fiscal year 2001. Lake Lowell is an off stream storage facility on the Boise Project, and is included in Deer Flat National Wildlife Refuge. The reservoir is 303(d)listed for nutrient and dissolved oxygen problems. Water Quality conditions impact reservoir recreation aesthetics and impairs the suitability of waters to support a warm water fishery. The State of Idaho is currently scheduled to complete a TMDL for Lake Lowell in December 2006. Reclamation initiated the Lake Lowell Water Quality Management Study to develop a current data base on water quality conditions in the reservoir, calibrate a water quality model, and conduct an appraisal level evaluation of irrigation system alternatives for maintaining or improving water quality in the reservoir. Study findings indicate that automation of canals that waste into the lake, and pump-back reuse of drain water could reduce

phosphorus loading of the lake by 25 percent. Feasibility-level costs and designs for these projects may be developed under the ongoing Boise Project Drain Water Management Study.

+ Reclamation was directed under the 1998 Biological Opinion on operation of the Federal Columbia Power System to investigate structural gas abatement measures at Grand Coulee Dam. Structural changes at Grand Coulee were evaluated with and without joint Chief Joseph and Grand Coulee Dam operations to reduce Grand Coulee spills by shifting generation to Grand Coulee. A System Configuration Team subcommittee evaluated the potential for reducing spill at Grand Coulee through joint operations with Chief Joseph Dam in 2001. The study concluded that the joint operation, in combination with installation of flow deflectors at Chief Joseph, would result in near elimination of spills at Grand Coulee at discharge levels less than the 7 day, 10 year high flow.

+ In response to concerns of the eastern Oregon agricultural community regarding the State of Oregon's 64 degrees F water temperature criterion, the Oregon Water Resources Congress initiated discussions on the temperature standard issue in March 1997. The Burnt River was selected as a case study basin, and the Burnt River Water Quality Studies Steering and Technical Committees were established to address stream temperature issues in the Burnt River basin and other eastern Oregon watersheds. Reclamation agreed to provide technical assistance in this effort by developing a water temperature model for the Burnt River system. The model was to be used to identify and evaluate land and water management strategies for improving stream temperatures in the Burnt River. An extensive temperature and flow database was developed by the Technical Service Center, in cooperation with the Burnt River Irrigation District and Oregon State University. A report summarizing data and model findings was completed in 2001. The findings of the Reclamation study and concurrent investigations by Oregon State University will be combined in a summary report under direction of the steering committee in 2002..

+ The Umatilla Basin Watershed Council requested Reclamation technical assistance in evaluating opportunities for use of McKay Reservoir storage to manage water temperature in McKay Creek and the mainstem Umatilla River. McKay Reservoir water is a significant source of cool water for fish in the Umatilla River during warm, low flow summer periods. The McKay temperature study evaluated potential operational alternatives for improving temperature regimes in the Umatilla River and will be utilized to assist in evaluating Umatilla Basin Phase III planning alternatives. McKay Reservoir temperature and nutrient studies may be completed as part of the Umatilla Basin Phase III planning program. The PN Regional Laboratory and McKay Dam Field Office are providing assistance in gathering field data.

+ Reclamation continued cooperative water quality data gathering and modeling with the University of Idaho and the Mid-Snake Watershed Advisory Group in the Middle Snake River area between Minidoka Dam and King Hill in 2001. Data provide baseline information on water quality in the Middle Snake River and irrigation returns to the river for use in nutrient management planning, and evaluating impacts of the salmon migration flow augmentation program on threatened and endangered snail populations in the Snake River.

+ An interagency project team made up of the Environmental Protection Agency, the Idaho and Oregon Departments of Environmental Quality are developing a TMDL for the Snake River mainstem from the Oregon/Idaho border to the confluence with the Salmon River. The TMDL will address nutrients, sediment, temperature, and total dissolved gas issues. Nutrient (phosphorus) allocations are expected for the mainstem Snake River and the Owyhee, Malheur, Boise, Payette, Weiser, Powder, and Burnt River basins. Reclamation is providing technical assistance in quantifying irrigation withdrawals and returns to the mainstem Snake River within the study reach in 2001, and is providing laboratory

services in support of an Idaho Water Users initiative to develop a database on water quality in tributaries to the mainstem Snake River.

+ Reclamation initiated limnological investigations in Arrowrock and Beulah Reservoirs as required in the 1998 Supplemental Biological Opinion for the Upper Snake River Operations. The purpose of the studies is to develop information to describe the aquatic environment of bull trout populations in Arrowrock and Beulah reservoirs, and relate environmental conditions in wet and dry years to reservoir pool contents. Two years of water quality data have been collected at Beulah Reservoir, and one year of data has been collected at Arrowrock Reservoir. A water quality model was developed for Beulah Reservoir by Technical Service Center staff in 2001 to assist in the evaluation.

+ Reclamation designed and constructed the North Side Pumping Division utilizing 77 drainwells for disposal of irrigation returns and storm runoff. Drainwater, which is discharged directly into a sole source aquifer, fails to comply with Idaho Underground Injection Control standards for injected water. Under this project, which was initiated in 1996, the injection wells are being replaced with drainwater reuse facilities or wetlands systems for treatment and disposal of return flows and storm runoff. The project, which is nearing one-third complete, was interrupted in 2000 because the construction ceiling for the division was exceeded; the ceiling was increased through re-authorization in October, 2000, and work resumed in 2001.

+ Cascade Reservoir is a feature of the Boise Project, and is located on the North Fork of the Payette River in central Idaho. The reservoir is designated as water quality limited under section 303(d) of the Clean Water Act because of high levels of phosphorus loading which result in algal blooms that are an aesthetic nuisance, contribute to fish kills, and are occasionally toxic to livestock. Studies indicate that the City of McCall Sewage Treatment Plant effluent represents 6 to 9 percent of the phosphorus loading to Cascade Reservoir, and the TMDL for the reservoir calls for complete removal of McCall City effluent from the North Fork Payette River. Treated effluent will be used for irrigation of agricultural lands. Reclamation has provided financial assistance for an effluent storage facility for use in the non-irrigation season. Construction was completed in the summer of 2001.

+ Work on Reclamation's reservoir water quality surveillance program focused on reservoirs supplying small projects in eastern Oregon in 2001. The program provides for long-term systematic collection of chemical, physical, and biological data needed to manage water quality in Reclamation reservoirs and downstream releases. Information is stored on the EPA's STORET database.

+ Long-term water quality monitoring of irrigation supplies and returns continued in 2001. The primary emphasis was on the Boise, Columbia Basin, Minidoka, Tualatin, and Yakima Projects. Additional data was gathered for assessment of nonpoint source irrigation impacts in the Owyhee, Grande Ronde, Malheur, Powder, and Burnt River basins in cooperation with the Oregon Watershed Councils. Reclamation's Boise laboratory also cooperated in water monitoring activities of the Wallowa Soil Conservation District. An evaluation of long term monitoring data from the Snake Plain Aquifer underlying the Minidoka North Side Pumping Division supports concerns regarding groundwater nitrate contamination associated with current water and fertilizer management practices in the area.

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 projects on the lower Snake and Columbia Rivers will operate throughout the year to provide safe, efficient fish passage. This was in compliance with National Marine Fisheries Service (NMFS) and U. S. Fish and Wildlife Service (USFWS) 2000 Biological Opinions (BiOps) which contain other measures, including flow augmentation in the Columbia River, additional 427 cfs from the upper Snake River, in-season water management process, flows for chum spawning below

Bonneville, and operating the lower Snake River reservoirs at minimum operating pool (MOP) and John Day reservoir to the minimum level needed for irrigation pumping. The Technical Management Team (TMT) again provided in-season management of river operations, while dispute resolution and policy guidance was provided by the Implementation Team (IT), which are made up of representatives from the Corps, Reclamation, BPA, NMFS, USFWS, ODFW, WDFW, IDFG, and the state of Montana. Because of the low flows along with the power emergency, the Regional Executives also made decisions on river operations in 2001. CRITFC still remained withdrawn from the in-season process although they participated in some meetings and made system operations requests.

More detail information on the BiOps can be found at <http://www.salmonrecovery.gov/>

1. Actual Operations

This water year, the Columbia Basin runoff was the second lowest ever recorded (as described elsewhere). The low flows combined with the power emergency caused us to modify our normal fishery operations. Spill for juvenile fish passage was limited and some planned research was canceled for the year. Also because of the low flows and poor in-river conditions it was decided by the region to maximize juvenile fish transport. On the plus side the most of the adult runs were record setters.

2. Spill and Flows for Fish

As stated in the paragraph above due to the low flows and the power emergency only a limited amount of spill was provided for juvenile fish passage. For the annual Spring Creek Hatchery release 50 kcfs was spilled for 3 nights. No spill for juvenile fish passage was provided at the four Lower Snake projects. (Note the NMFS BiOp provides for no spill at Lower Granite, Little Goose and Lower Monumental dams when flow is projected to be lower than 85 kcfs in spring, in order that juvenile fish passage is maximized). Limited spill for juvenile fish passage was provided at Bonneville and The Dalles from 5/16/01 to 6/15/01 and from 7/24/01 to 8/31/01. Limited spill for juvenile fish passage was also provided at John Day, and McNary from 5/25/01 to 6/15/01. See [Table 22](#) for details.

Flows were below the flow objectives stated in the BiOps. At Lower Granite the springtime flow objective was 85 kcfs. The actual average flow was 47 kcfs. The summertime flow objective was 50 kcfs. The actual average flow was 25 kcfs. There were 2 days in the spring when flow met or exceeded the flow objective and none in the summer. At McNary the springtime flow objective was 220 kcfs. The actual average flow was 124 kcfs. The summertime flow objective was 200 kcfs. The actual average flow was 91 kcfs. There were no days in which flow met or exceeded the flow objectives. At Priest Rapids the springtime flow objective was 135 kcfs. The actual average flow was 77 kcfs. There were no days in which flow met or exceeded the flow objective

3. Juvenile Fish Runs

Salmonids are hatched either in hatcheries or in rivers (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 beginning their natural migration to the ocean. Some species begin their migration in the year of their hatching while others winter in the river before beginning their migration to the ocean. Juveniles are subjected to many perils while migrating, including predation from other fish and birds, spill at dams that can cause high levels of total dissolved gas and gas bubble 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, young fish 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 in-river travel mortality rate for most species while maintaining their biological timing for arrival at the ocean.

a. Hatchery Releases

Hatchery fish released into the Columbia basin streams and rivers above Bonneville Dam totaled approximately 71 million juvenile salmon, about 15 million less than in 2000. The primary factors affecting the 2001 hatchery release numbers were:

1. Hatchery spring chinook released in 2000 decreased by 3.3 million.
2. Tule fall chinook released from Spring Creek NFH totaled 10.6 million, about 5.0 million below normal production for the facility, and the upriver bright fall chinook numbers were also decreased by 3.7 million.
3. Coho production was reduced about 1 million from the previous year.
4. The only substantial gain in release numbers by species was the 1.6 million increase in production releases of hatchery summer chinook in the combined Snake and Mid-Columbia rivers.

The data above are from the Fish Passage Center's 2001 annual report. A summary of the hatchery releases for the Columbia River basin can be obtained from the FPC website. <http://www.fpc.org/>

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 in barges or trucks. 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 very accurate 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. In 2001 the number of juvenile fish collected was 5% higher than the number collected in 2000. The number of juvenile fish bypassed was 6% lower than the number bypassed in 2000. This year's counts of juvenile fish collected, transported and bypassed are summarized in [Table 23](#). The last several years' counts of juvenile fish collected, transported and bypassed are summarized in [Table 24](#).

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. With the low flows in 2000 it was decided to maximize to transportation of juvenile fish (as mentioned above). The juvenile transport season began in late March/ early April and ended in October at Lower Granite, Little Goose, and Lower Monumental. In 2001 juvenile fish were collected and transported at McNary starting in the later part of April, on an every other day basis in the spring. In normal years juvenile fish are not collected or transported until conditions are "no longer spring like". 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 number of fish transported by barge and truck was 7% greater than last year.

4. Adult Fish Runs

Adult fish counts were obtained at twelve of the thirteen mainstream Columbia and Snake River dams that have fish passage facilities (all except Little Goose). Although many species were counted only the salmonid race and species counts at three major dams are reported here, showing their 10-year averages and counts of the previous four years (Table 25). The difference between the McNary and Ice Harbor counts is an index to the mid-Columbia return. This was a very excellent year for adult fish passage. As shown on Table 25 all counts except for sockeye at Ice Harbor were higher than last year. Again this year, as was the case last year, there was a high number of chinook jacks returning. This indicates a potential for a large adult run next year. All counts shown in Table 25 were higher than the 10-year averages. As shown in Table 25 most of the counts are the highest recorded since 1977. In fact chinook passage at Bonneville was the highest recorded since the project was completed and fish counting began in 1938.

More detailed information on fish passage can be found on the World Wide Web at the following sites.
<http://www.nwp.usace.army.mil/op/fishdata/adultfishcounts.htm> (the Corps' new adult count page site)
or <http://www.fpc.org/adult.html> (the Fish Passage Center's adult count page)
or <http://www.cqs.washington.edu/dart/adult.html> (University of Washington adult count page)

Table 17

SUMMARY OF FLOOD DAMAGE OBSERVED AND PREVENTED
Columbia River and Tributaries
2001 Water Year

POINT	RIVER	UNREGULATED ¹			OBSERVED			CALCULATED DAMAGES	
		Flow (kcfs)	Stage (ft)	Date	Flow (kcfs)	Stage (ft)	Date	\$1000	
								Obsv'd	Prev'd ²
Bonnars Fry, ID	Kootenai		60.7	29-MAY		52.1	11-DEC	0	0
Columbia Falls, MT	Flathead	41.3		27-MAY	23.5		26-MAY	0	0
Hope, ID	Pend Oreille		2054.9	2-JUN		2062.5	20-JUL	0	0
Newport, WA	Pend Oreille	47.3		2-JUN	27.5		30-MAY	0	0
Cle Elum, WA	Yakima	6.7		24-MAY	3.2		11-JUL	0	0
Parker, WA	Yakima	12.8		25-MAY	2.3		28-APR	0	0
Flat Creek, WY	Snake	17.2		16-MAY	10.6		16-MAY	0	5,100
Heise, ID	Snake	25.8		17-MAY	12.3		7-JUL	0	116
Shelly, ID	Snake	30.8		17-MAY	6.4		14-MAY	0	15,473
Carey, ID	L Wood	0.8		1-NOV	0.3		16-MAY	0	9
Boise, ID	Boise	6.2		16-MAY	1.7		19-APR	0	335
Owyhee, OR	Owyhee	6.7		23-MAR	0.25		12-OCT	0	0
Emmett, ID	Payette	9.1		16-MAY	3.8		15-MAY	0	17
Weiser, ID	Snake	44.1		22-MAY	14.9		11-NOV	0	518
Spalding, ID	Clearwater	54.8		15-MAY	42.0		15-MAY	0	0
Lwr Granite, WA	Snake	128		17-MAY	91.3		16-MAY	N/A	N/A
The Dalles, OR ³	Columbia	326.8		30-MAY	173.7		13-DEC	0	
Vancouver, WA	Columbia		10.5	31-MAY		5.5	1-JUN	0	0
					COLUMBIA BASIN SUBTOTAL			0	21,559
Salem, OR	Willamette				34.7		24-DEC	0	0
					GRAND TOTAL			0	21,559

¹ In the Columbia River Basin, flows are those which would have resulted without regulation by Mica, Libby, Duncan, Arrow Lakes, Hungry Horse, Flathead, Noxon Rapids, Pend Oreille, Grand Coulee, Chelan, Jackson Lake, Palisades, American Falls, Dworshak, run-of-river projects, Grand Coulee pumping, and major irrigation diversions in the Snake and Yakima River Basins.

In the Willamette River basin, flows are those which would have resulted without regulation by Hills Creek, Lookout Point, Fall Creek, Cottage Grove, Dorena, Fern Ridge, Blue River, Cougar, Detroit, Green Peter, and Foster.

² Damages prevented are those prevented by reservoirs and diversions noted above. Additional damages prevented by levees and channel improvements are not included in the prevented amounts. Observed damages in uncontrolled tributaries are not included.

³ Damages prevented are included in the Vancouver, WA values.

Table 18

**EFFECT OF RESERVOIR REGULATION ON FLOOD PEAKS AND DAMAGES
Columbia River Basin**

Water Year	Maximum Annual Mean Daily Peak ¹ @The Dalles (kcfs)		Damages Prevented (\$1 million)		Water Year	Maximum Annual Mean Daily Peak ¹ @The Dalles (kcfs)		Damages Prevented (\$1 million)	
	Unreg	Observed	Lower Columbia ²	Columbia Basin ³		Unreg	Observed	Lower Columbia ²	Columbia Basin ³
1948	1010	1010	*	*	1976	637	419	15.65	43.08
1949	660	624	0.67	*	1977 ⁵	276	183	0.00	0.00
1950	823	744	9.80	*	1978	565	313	6.00	30.61 ⁴
					1979	482	306	1.50	4.65
1951	672	602	0.80	*	1980	544	341	5.16	15.26 ^R
1952	579	561	0.34	*					
1953	672	612	1.18	*	1981	579	436	10.91	45.26 ^R
1954	590	560	0.26	*	1982	759	422	15.22	78.62
1955	614	551	0.62	*	1983	732	400	18.48	131.00 ^R
					1984	628	376	10.71	107.29
1956	940	823	25.00	37.67	1985	550	274	10.45	23.46
1957	820	705	6.60	11.11					
1958	735	593	3.55	7.83	1986	719	388 ^R	0.24 ^R	72.06 ^R
1959	642	555	0.88	2.6	1987 ⁵	439	284	0.00	9.09
1960	493	470	0.08	0.58	1988 ⁵	342	236	0.00	2.74
					1989	512	312	6.30	37.10
1961	789	699	6.50	7.7	1990	511	372	1.66	15.75
1962	503	460	0.09	1.79					
1963	481	437	0.03	0.65	1991	568	348	2.64	101.16
1964	764	662	7.60	22.91	1992 ⁵	328	232	0.00	0.71
1965	669	520	1.44	7.18	1993	602	382 ^R	0.00 ^R	81.37
					1994 ⁵	381	224	0.00	11.74
1966	455	396	0.00	0.43	1995	552	296	0.03	61.54
1967	781	622	14.21	20.80					
1968	533	404	0.26	1.07	1996	719	456	4.32 ^R	227.03 ^R
1969	628	449	2.61	5.51	1997	898	571	48.33	378.64
1970	634	429	1.16	6.34	1998	617	442	1.44	88.09
					1999	715	379	0.17	95.97
1971	740	557	8.49	25.76	2000 ⁵	450	375	0.00	35.33
1972	1053	618	213.10	260.49					
1973 ⁵	402	221	0.00	0.52	2001 ⁵	327	174	0.00	21.56
1974	1010	590	239.73	306.36					
1975	669	423	9.41	40.97					

¹ Observed discharges are preliminary values calculated from project data.

² Damages are for the Columbia River below McNary Dam. [Dollar values are for the year of the flood. Willamette excluded.]

³ Totals are damages prevented by major projects above The Dalles during the spring and summer runoff. Damages prevented in Canada and/or by levees and channel improvements are not included.

⁴ Damages are based on the flood of December 1977.

⁵ No flood control operations [i.e., unregulated flow does not exceed 450 kcfs at The Dalles].

^R Revised

Table 22

Actual Spill Operation for Juvenile Fish Passage

For Water Year 2001

	LWG	LGS	LMN	IHR	MCN	JDA	TDA	BON
Spring								
Ave Outflow	47.47	48.42	50.73	49.93	123.94	126.67	126.82	135.51
Spill Days	0	0	0	1	22	22	31	31
Ave Spill Kcfs	0.00	0.00	0.00	0.12	1.99	4.87	15.40	18.08
%Spill	0.00%	0.00%	0.00%	0.25%	1.60%	3.84%	12.14%	13.34%
Spill Days > 120%	0	0	0	0	0	0	0	0
Summer								
Ave Outflow	25.39	25.74	26.49	25.82	90.89	89.58	90.86	97.36
Spill Days	4	1	3	0	0	0	39	39
Ave Spill Kcfs	0.20	0.02	0.13	0.00	0.00	0.00	18.62	20.66
%Spill	0.78%	0.08%	0.48%	0.00%	0.00%	0.00%	20.50%	21.22%
Spill Days > 120%	0	0	0	0	0	0	0	0

Notes

1. Spill Days > 120% is the number of days that the daily average spill was above the 120% spill cap
2. Due to Low Water Supply and System Power Emergency Normal BiOp Spill was not done in 2001
3. At LWG, LGS, and LMN no spill would have occurred because average flow was below 85 kcfs.
4. The time periods for spring and summer are based on the BiOp planning dates instead of actual dates as in previous years. For the Snake River projects the planning dates are 4/3 - 6/20 for spring and 6/21 - 8/31 for summer. For Columbia River projects the planning dates are 4/10 - 6/30 for spring and 7/1 - 8/31 for summer.
5. At MCN Limited spill for juvenile fish passage occurred from 5/25 to 6/15.
Spill was 30 Kcfs every other night.
6. At JDA limited spill for juvenile fish passage occurred from 5/25 to 6/15.
Spill was 30% of project outflow at night.
7. At TDA limited spill for juvenile fish passage occurred from 5/16 to 6/15 and from 7/24 to 8/31
Spill 30% 24 hours a day in Spring. In Summer spill was 30% with a 15 Kcfs spill min
8. At BON limited spill for juvenile fish passages occurred from 5/16 to 6/15 and from 7/24 to 8/31
Spill was 50 KCFS in the Spring. In the Summer spill started at 45 Kcfs from 2000 to 0100 was later increased to 50 Kcfs around the clock.

Table 23

Summary of Fish Disposition at Collector Dams

For Water Year 2001

	Chinook		Steelhead	Coho	Sockeye	Total
	yearlings	subyearlings				
LWR GRANITE						
Collected	1,958,273	739,851	5,580,471	58,256	4,852	8,341,703
Bypassed	79,198	1	270,824	976	222	351,221
Trucked	6,895	84,987	37,106	1,845	463	131,296
Barged	1,867,739	635,458	5,284,962	55,289	4,998	7,848,446
Total Transported	1,874,634	720,445	5,322,068	57,134	5,461	7,979,742
LITTLE GOOSE						
Collected	751,905	180,471	841,570	21,433	10,312	1,805,691
Bypassed	53	2,253	6,485	44	1	8,836
Trucked	1,104	27,652	4,446	1,550	127	34,879
Barged	747,028	144,995	825,366	20,046	9,658	1,747,093
Total Transported	748,132	172,647	829,812	21,596	9,785	1,781,972
LWR MON'TAL						
Collected	553,393	55,743	363,703	2,986	1,036	976,861
Bypassed	16,485	338	8,640	293	0	25,756
Trucked	5,822	9,403	5,529	508	36	21,298
Barged	530,674	48,782	352,989	2,443	1,012	935,900
Total Transported	536,496	58,185	358,518	2,951	1,048	957,198
McNary						
Collected	2,232,095	10,734,211	556,035	142,813	271,732	13,936,928
Bypassed	1,187,589	540,575	312,903	61,603	140,950	2,231,554
Trucked	489	383,810	1,709	125	1,260	387,393
Barged	1,037,629	9,728,580	237,330	80,195	128,948	11,224,763
Total Transported	1,038,118	10,112,390	239,039	80,320	130,208	11,612,156
Total						
Collected	5,495,666	11,710,276	7,341,779	225,488	287,932	25,061,183
Bypassed	1,283,325	543,167	598,852	62,916	141,173	2,617,367
Trucked	14,310	505,852	48,790	4,028	1,886	574,866
Barged	4,183,070	10,557,815	6,700,647	157,973	144,616	21,756,202

Table 24

Juvenile Fish Transported by Project, 1998 - 2001

Year	Lower Granite	Little Goose	Lower Monumental	McNary	Total
1998	6,729,743	2,508,221	1,487,417	8,030,574	18,755,955
1999	5,466,071	6,789,775	3,657,227	3,444,979	19,358,052
2000	7,939,056	2,809,463	1,536,149	8,488,634	20,773,302
2001	7,979,742	1,781,972	957,198	11,612,156	22,331,068
2001% relative to 2000	100.51%	63.43%	62.31%	136.80%	107.50%

Collection numbers

Year	Lower Granite	Little Goose	Lower Monumental	McNary	Total
1998	6,977,250	2,527,245	1,509,562	10,302,068	21,316,125
1999	5,879,114	7,004,421	4,068,558	7,840,938	24,793,031
2000	8,295,958	2,818,520	1,587,203	11,045,266	23,746,947
2001	8,341,703	1,805,691	976,861	13,936,928	25,061,183
2001% relative to 2000	100.55%	64.07%	61.55%	126.18%	105.53%

Bypass numbers

Year	Lower Granite	Little Goose	Lower Monumental	McNary	Total
1998	236,414	64	19,798	2,086,902	2,343,178
1999	399,354	182,295	407,965	4,350,349	5,339,963
2000	336,384	0	47,171	2,400,354	2,783,909
2001	351,221	8,836	25,756	2,231,554	2,617,367
2001% relative to 2000	104.41%	#DIV/0!	54.60%	92.97%	94.02%

Table 25

Yearly Adult Fish Counts, 1997 to 2001

2001	2000	1999	1998	1997	10-YR Avg	Last Hghr Year	% of 10 year avg
405,539	199,561	47,360	39,117	114,963	75,422	*	538%
90,879	44,170	30,191	24,111	29,865	24,775	*	367%
474,913	248,197	265,625	217,716	242,260	208,980	*	227%
266,536	97,127	45,152	49,920	27,267	36,641	*	727%
633,464	275,273	206,512	185,094	258,385	227,186	*	279%
114,934	93,398	17,875	13,218	47,008	46,485	85	247%
265,372	75,483	13,232	19,752	58,236	33,221	*	799%
77,514	27,696	21,618	17,634	22,351	18,431	*	421%
146,898	87,891	87,096	77,218	82,359	82,405	86	178%
24,730	12,178	4,935	6,173	2,580	3,446	*	718%
398,784	130,063	84,088	99,705	129,817	122,089	*	327%
97,188	60,242	11,794	9,391	38,043	37,166	77	261%
174199	48296	8008	12564	41473	18569	*	938%
17667	7420	5211	5777	9318	5089	*	347%
23686	16349	10021	7711	4478	6617	*	358%
1360	1142	126	15	101	139	77	978%
255720	120254	80267	77644	94802	97143	*	263%
38	216	8	3	15	31	77	123%

- * None higher back to 1977
- 1 Data for 2001 - 1997 is from The Corps Adult Fish Count database
- 2 10-Yr Average is also from The Corps Adult Fish Count database
- 3 I used data from Fish Passage Center to find the last year greater data
- 4 Data is preliminary
- 5 **Bold** typeface shows increase over 1999
- 6 Chinook and Coho counts include both Adults and Jacks