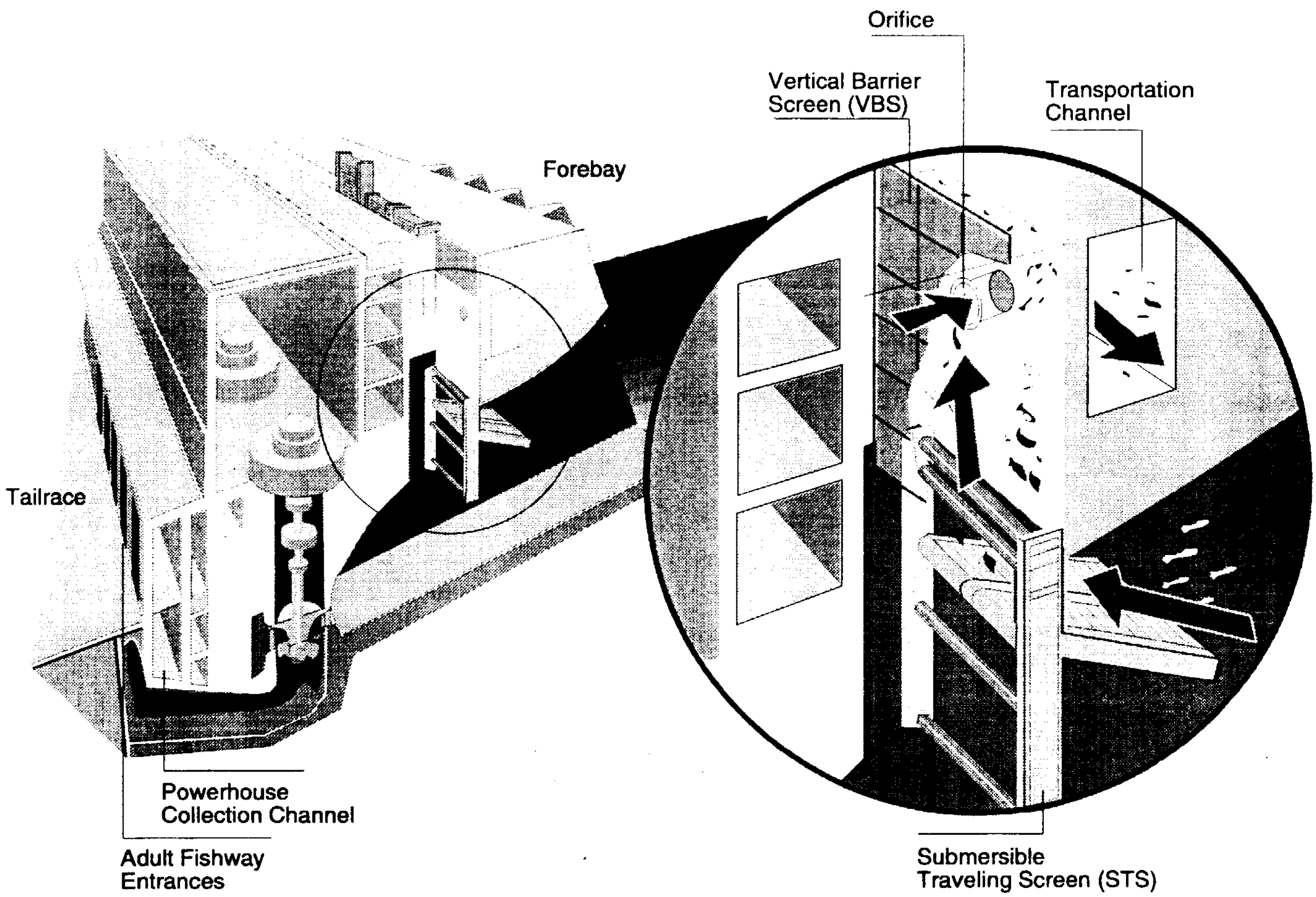
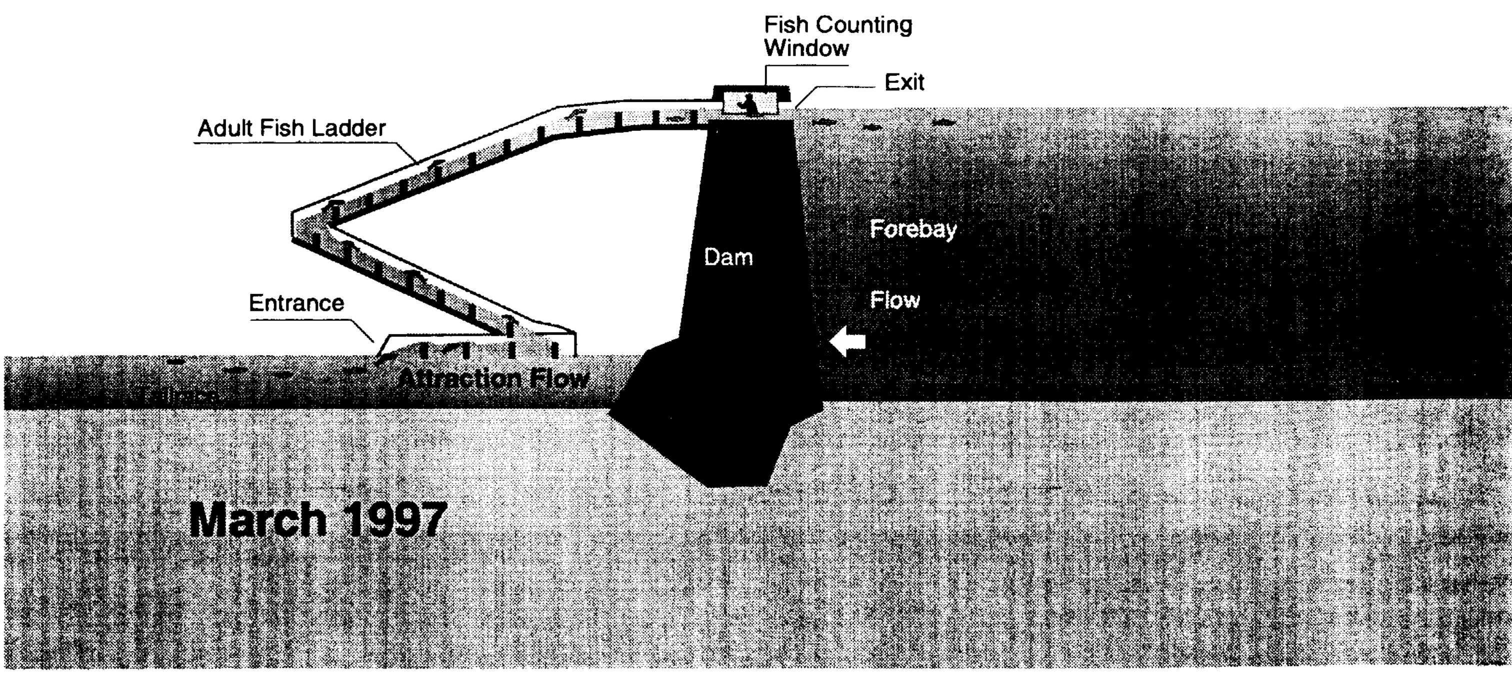
Fish Passage Plan

Corps of Engineers Projects

US Army Corps
of Engineers ®
North Pacific Division

CENPD-ET-PR





March 1997

FISH PASSAGE PLAN

FOR

CORPS OF ENGINEERS PROJECTS

U.S. ARMY CORPS OF ENGINEERS

NORTH PACIFIC DIVISION

PORTLAND, OREGON

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SECTION 1

OVERVIEW AND COORDINATION

OF FISH PASSAGE PLAN

1. Fish Passage Plan.

1.1. Overview.

The Fish Passage Plan (FPP) is developed by the US Army Corps of Engineers (COE) in coordination with the region's fisheries agencies, Indian tribes, Bonneville Power Administration (BPA), and other participants through the Corps' Fish Passage O&M Coordination Team. The FPP describes year-round project operations necessary to protect and enhance ESA-listed salmon species as well as other anadromous fish species. The FPP guides Corps actions in regard to providing fish protection and passage at the eight Corps mainstem Columbia and Snake river projects. Other Corps documents and agreements related to fish passage at these projects are consistent with the FPP.

The FPP is revised as necessary to incorporate changes to project operations and maintenance as a result of new facilities or changes in operational procedures. Revisions will incorporate changes adopted through coordination with the National Marine Fisheries Service (NMFS) as part of the Endangered Species Act (ESA) Section 7 consultation, Recovery Plan, or Section 10 permit processes, and through consideration of other regional input and plans. The current revisions reflect provisions contained in the NMFS' Biological Opinion issued 2 March 1995 (<u>Reinitiation of Consultation on 1994 - 1998 Operation of the Federal Columbia River Power System and Juvenile Transportation Program in 1995 and Future Years</u>) and in the Corps' Record of Decision signed 10 March 1995 (<u>U.S. Army Corps of Engineers North Pacific Division Record of Decision, Reservoir Regulation and Project Operations, 1995 and Future Years</u>). When revising the FPP, the Corps considers the amended Northwest Power Planning Council (NPPC) Columbia River Basin Fish and Wildlife Program to the fullest extent practicable.

Comments on the FPP are welcome. They may be directed either to the Fish Passage O&M Coordination Team or the Reservoir Control Center (RCC) [North Pacific Division, COE] office in Portland, Oregon. Unresolved differences between FPP criteria and prior recommendations of the fisheries agencies and tribes are highlighted within Sections 2 through 9.

1.2. Emergency Deviations from FPP. River operations emergencies may occur which require projects to deviate temporarily from the FPP. To the extent possible, these operations will be conducted to minimize fish impacts and coordinated with fisheries agencies and tribes. Normally, coordination occurs prior to an action. However, if an emergency situation requires immediate attention, coordination will be done as soon as possible after the fact.

1.3. Technical Management Team. Decisions on river operations to achieve fish passage efficiency (FPE) or survival goals for spring and summer outmigrants will be made in coordination with the Technical Management Team (TMT). Coordination of special operations identified in the FPP will occur through the TMT and they will be identified in the Water Management Plan. These may include maintenance activities requiring unit outages that affect other river operations, operation of turbines outside of the 1% best efficiency range, zero nighttime flow, and implementation of the juvenile fish transportation program.

1.4. Spill at Corps Mainstem Projects. Corps mainstem projects will provide spill for juvenile fish passage according to the NMFS Biological Opinion (specifications in Appendix E) to protect ESA-listed salmon species. Target spill levels were developed through consultation with NMFS and may be adjusted during the fish migration season as recommended by the TMT. Continuous spill is provided at Bonneville, The Dalles, and Ice Harbor Dams for spring and summer outmigrants to meet Biological Opinion requirements. Nightly spill is also provided at John Day and McNary Dams (spring season only at McNary), and may be provided in the spring at the Snake River collector dams (Lower Monumental, Little Goose, and Lower Granite) under certain conditions (see Appendix E). Spill may also be provided under special circumstances for non-listed fish species, if recommended by the fisheries agencies and tribes and if the recommendations are consistent with regional operational agreements (i.e., Spring Creek Hatchery release in March).

1.5. Total Dissolved Gas Monitoring. Total dissolved gas (TDG) saturation levels are monitored at the forebay and tailrace of each mainstem project during the fish passage season. The water quality standard and criterion developed by the states and EPA is 110% of saturation at ambient temperature and pressure. The Corps policy is to operate each mainstem projects to meet state standards insofar as physically possible unless other overriding reasons cause temporary deviations. The NMFS Biological Opinion calls for fish spill to be provided at levels that create higher TDG levels (Appendix E). Also, implementation of fish spill requests from fish agencies and Indian tribes have in the past resulted in TDG levels of 120% or greater. Therefore, fish spill implementation will be subject to further coordination with appropriate entities if excessive TDG levels occur or if evidence of gas bubble disease is observed in fish. Any spill requests that will cause exceedance of the state TDG standard must include prior coordination with state water quality agencies, including waivers of state water quality standards obtained in advance by the requester (see Appendix F, NPD Policy on Spill and Total Dissolved Gas).

1.6. System Load Shaping. Guidelines coordinated by BPA on system load shaping to consider fish impacts are included in Appendix C. The guidelines describe procedures BPA follows to make hydropower load requests that enable the Corps to operate turbine units within 1% of best operating efficiency.

1.7. Juvenile Fish Transportation Plan (JFTP). Juvenile fish will be transported in accordance with the NMFS Biological Opinion and Section 10 permit. Transportation criteria are contained in the JFTP, Appendix B. The JFTP covers collection, holding, and transport of juvenile fish. Other project criteria on operation of the juvenile fish bypass facilities are contained in Sections 2 through 9. Additional criteria may be developed as part of the ESA Section 10 permit process and/or in coordination with the TMT. Implementation of juvenile fish transportation, including deviation from the plan described in Appendix B, will be coordinated through the TMT and with NMFS (ESA).

1.8. Project Fish Passage Facilities Inspection and Reporting Criteria.

1.8.1. General. Sections 2 through 9 contain the detailed criteria for inspection and reporting for fish passage facilities at the Corps projects on the lower Snake and lower Columbia rivers. The Corps provides weekly written inspection reports to NMFS Environmental and Technical Division describing out-of-criteria situations, adjustments made to resolve problems, and a detailed account of how out-of-criteria situations affected project fish passage and survival. The weekly inspection reports also include summaries of equipment calibrations, adult fish collection channel velocity monitoring, and water temperature monitoring. Equipment which does not require calibrating will not routinely be included in the weekly report. The Corps also provides an annual report to NMFS which summarizes project operations and maintenance and fish passage facility inspections and monitoring.

1.8.2. Criteria for Reporting Excursions Outside the 1% Best Turbine Operating Efficiency Range. Reporting excursions outside the 1% best turbine operating efficiency will be performed by BPA on a semi-monthly basis with a monthly synopsis. These reports will record instances where lower Columbia river and lower Snake river turbines were operated outside 1% best efficiency ranges for significant periods, as defined under the guidelines in Appendix C. BPA will prepare the reports by consolidating data provided by Corps project operators at LCOL and LSN projects. Reports will be sent to NMFS by BPA. The intent of excursion reporting is to provide a means for quality assurance for project operations, as specified in Appendix C.

1.9. Implementation of the Fish Passage Plan.

Implementation of the FPP requires information from and coordination with NMFS, BPA, other federal and state fish agencies, and Indian tribes. RCC coordinates operation of Corps projects that affect system water management, spill, unit availability, or other project uses through the TMT. District biologists may coordinate directly with the fish agencies and tribes on other project-specific operations that do not have system impacts.

Daily RCC briefings are held at 1300 hours, Monday through Friday, in the U.S. Custom House, Portland, Oregon. RCC also participates in weekly meetings of the Federal interagency TMT which recommends river operations to implement the Biological Opinion and other recommendations from fish interests. Corps representatives are available at these meetings to discuss the latest weather and runoff forecasts, as well as fish, hydrologic, water quality, and power information to assist in the planning of operations for fish passage for the next few days. Fish operation recommendations are evaluated by the Corps to determine impact on overall system operations. The Corps also coordinates with NMFS and U.S. Fish and Wildlife Service (FWS) to meet ESA requirements for endangered species.

1.9.1. Agency Responsibilities.

1.9.1.1. U.S. Army Corps of Engineers.

- Coordinate with NMFS and FWS on operational actions that might impact threatened, endangered, or candidate species.

- Prepare a Water Management Plan for in-season management, in coordination with TMT members, which implements the Corps Record of Decision.

- In cooperation with the fish agencies and tribes, provide fish passage monitoring, surveillance, and reporting at Corps projects throughout the migration period.

- Provide timely information on all proposed and/or scheduled studies or special operations which may negatively impact or otherwise constrain fish passage or energy production. Discuss unforeseen changes in fish passage operation with fish agencies and tribes.

- Carry out routine and emergency fish passage operations and maintenance procedures in accordance with criteria in Sections 2 through 9 and in Appendix A.

- Conduct the Dissolved Gas Monitoring Program as described in Appendix D.

1.9.1.2. Fish agencies and Indian tribes.

- Request spill for fish through TMT to protect endangered species or other species in accordance with the TMT Guidelines.

- Through TMT, provide RCC with a spill priority list and recommendations for modifications.

- Provide biological monitoring and surveillance reports throughout the migration period from predetermined locations, such as Smolt Monitoring Program sample sites.

- Provide status reports on the timing of the downstream migration, including pertinent marked fish release and recovery data, with weekly written reports estimating percentage of run past key projects.

- Where biologically and logistically feasible, coordinate hatchery releases to ensure they are protected by regulated fish flows and spills while minimizing impacts on endangered species. Provide and update hatchery release schedules weekly.

- Provide recommendations to the operating agencies for maintaining acceptable fish passage conditions. This information can be used to maximize other project uses, including power generation.

- Provide information on all proposed and scheduled studies or special operations designed to improve fish passage operations which may affect energy production or project operation. Discuss unforeseen changes with the Corps.

- Recommend viable methods and procedures to reduce mortality to resident and migratory fish. This may include such operations as collection and transportation of migrants, use of alternate bypass strategies, or other methods to reduce fish mortality.

1.9.1.3. Bonneville Power Administration.

- Report to RCC on updated load-resource studies during the April-to-September period to supplement the National Weather Service River Forecast Center's runoff volume forecast for fish passage planning assistance.

- Provide to RCC, NMFS, other fish agencies and tribes, the BPA estimate of power market impacts of requested spill operations.

- Utilize available flexibility of the Federal Columbia River Power System to shape flow requirements, spill priorities, and plant generation consistent with BPA policies and statutory requirements related to fish protection.

- Adjust system generation to provide adequate water to meet fish operations requirements in accordance with the NMFS Biological Opinion on hydrosystem operations.

- Provide project load requests on a real-time, hourly basis that enable the Corps to implement spill priorities.

- Provide information on unit operation within 1% of best efficiency, as indicated in Appendix C.

1.9.1.4. Mid-Columbia Public Utility Districts.

Operate projects for spill transfer in accordance with provisions of the FPP with at least one and one-half hours notification to start or stop spill.

1.9.2. Coordination Procedures.

1.9.2.1. Coordination of the FPP.

The FPP is effective year-round and revisions are coordinated with the Fish Passage O&M Coordination Team, which includes NMFS, other Federal and state fisheries agencies, Indian tribes, and other interested parties. Different parts of the FPP may be revised at different times. Suggested revisions should be submitted to the Committee for consideration by the Corps. Draft FPP revisions will be provided for a two-week regional review. FPP revisions will be published two weeks after the close of the regional review period. FPP revisions are provided to TMT for use as part of the overall river operation plan. Sections dealing with special operational requirements will be included in the Water Management Plan.

1.9.2.2. Day-to-day coordination of river system.

a. Flow augmentation and reservoir operations recommendations. Procedures described in the Water Management Plan will be used for fish operations. Coordination for system and project operations will occur through TMT. This will include requests for operations of turbine units outside of the 1% best efficiency range, zero nighttime flow in the Snake River, and special operations for implementation of approved research projects as identified in Appendix A.

b. Fish spill management. The Corps will implement fish spill provisions contained in Section VIII.A.2. of the NMFS Biological Opinion, consistent with state water quality standards including applicable TDG waivers which are in effect at the time. The TDG and gas bubble trauma signs in fish will be monitored and evaluated during the spill season by the Corps, NMFS, other fisheries agencies, tribes, BPA, and water quality agencies. Recommendations on adjusting spill levels based on physical and biological monitoring results will be forwarded to the TMT for discussion at their weekly meetings.

c. Special operation recommendations (fish-related and for project O&M activities). Recommendations for special fish operations outside the Water Management Plan may be made to RCC. Coordination of these recommendations will be made through the TMT. Recommendations related to project O&M activities requiring special operations will be evaluated for impacts on fish migration. Sufficient lead time will be given on a planned operation, whenever practical, to allow coordination with the TMT and NMFS (ESA). As much lead time as possible will be provided for activities requiring immediate action. After-action coordination will occur when advance notice is not possible, such as in emergency actions.

d. Other operational requests. As with Corps O&M requests, all other operational recommendations will be evaluated for impacts on fish migration and effects on other project O&M requirements. Coordination of special operations with NMFS, other fish agencies and tribes, will occur through the TMT. Except as necessary for emergency actions, adequate time will be allowed for evaluation of all project and fish impacts prior to implementation.

SECTION 2

BONNEVILLE DAM

Bonneville Dam

1. Fish Passage Information. The locations of fish passage facilities are shown on the following general site plans for Bonneville Lock and Dam (p. BON-2 through BON-4). Dates for project operations for fishery purposes and special operations are listed in Table I.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description, First Powerhouse. Juvenile fish passage facilities at the Bonneville first powerhouse consist of STSs, VBSs, 12" gatewell orifices, fish bypass channel, excess water elimination facility, fish sampler, and a 24" fish transport pipe to the tailrace. All 10 main turbine units have STSs. A small unit (unit "O") is located at the south end of the powerhouse and is not equipped with screens. It is used for back-up station service.

There are also small channels associated with the auxiliary water intakes for adult fishways at the south end of the powerhouse and at both ends of the spillway. These older juvenile fish passage channels discharge into the adult fishways at the ends of the spillway and into the ice & trash sluiceway at the south end of the powerhouse. These facilities are no longer operated on a regular basis.

1.1.2. Facilities Description, Second Powerhouse. Juvenile fish passage facilities at the Bonneville second powerhouse comprise turbine intake extensions (TIEs), streamlined trash racks, STSs (recently lowered for more effectiveness), VBSs, two 12" orifices per gatewell (with only one operating per gatewell) flowing into a fish bypass channel, an excess water elimination facility, and a 36" fish transport pipe which connects the bypass channel to the tailrace. A juvenile fish sampling facility is included in the bypass. All eight main turbine units have STSs, TIEs, and streamlined trashracks. Two smaller turbines that supply adult fishway auxiliary water do not have STSs, TIEs, or streamlined trashracks.

1.1.3. Juvenile Migration Timing. Maintenance of juvenile fish facilities is scheduled for the period of 16 December through February to reduce the impact on downstream migrants. Maintenance activities will be coordinated to minimize potential impacts on juvenile migrants that may be present during this time period.

1.1.4. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities

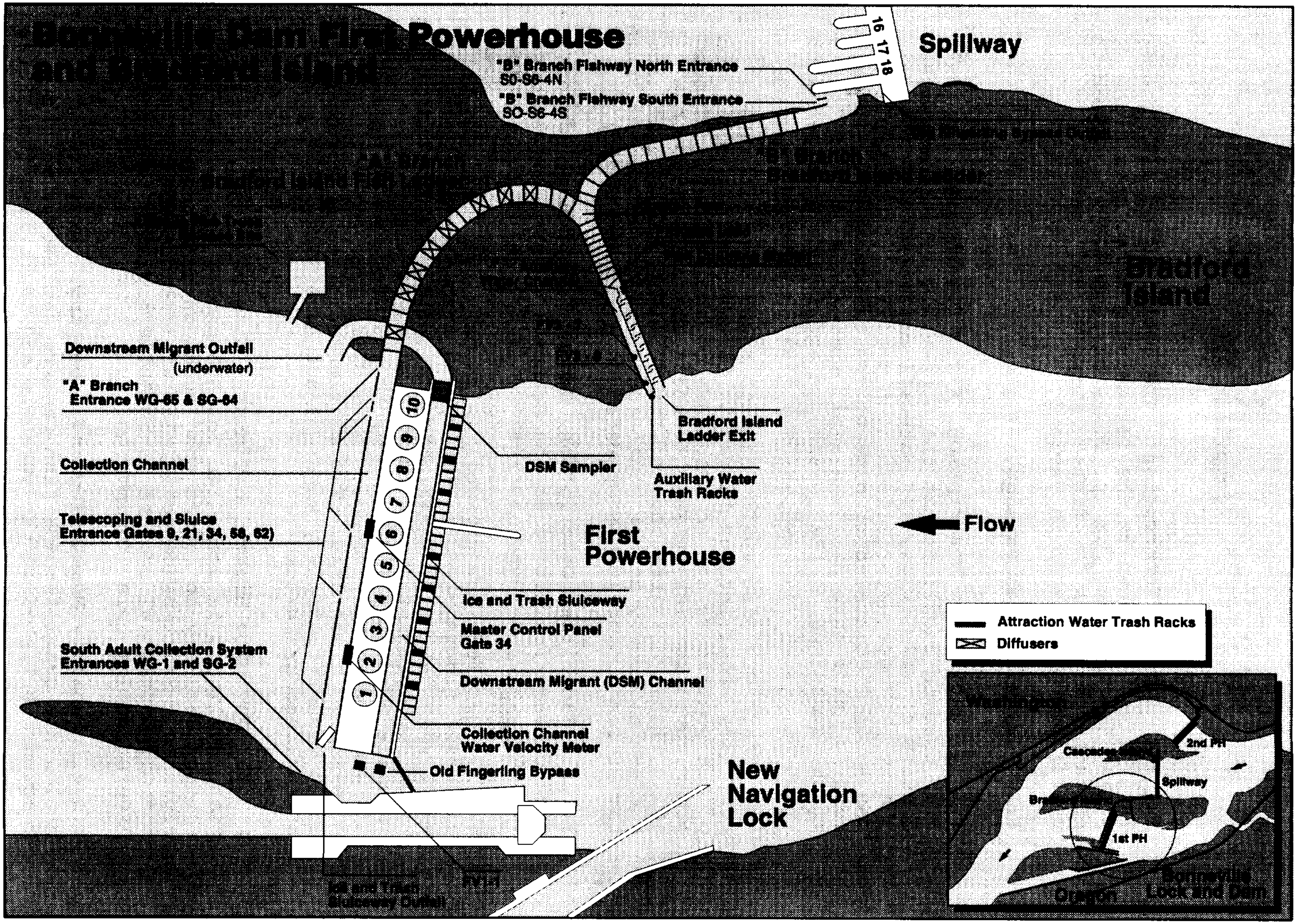


Figure 1 Bonneville Dam First Powerhouse and Bradford Island Fish Ladder

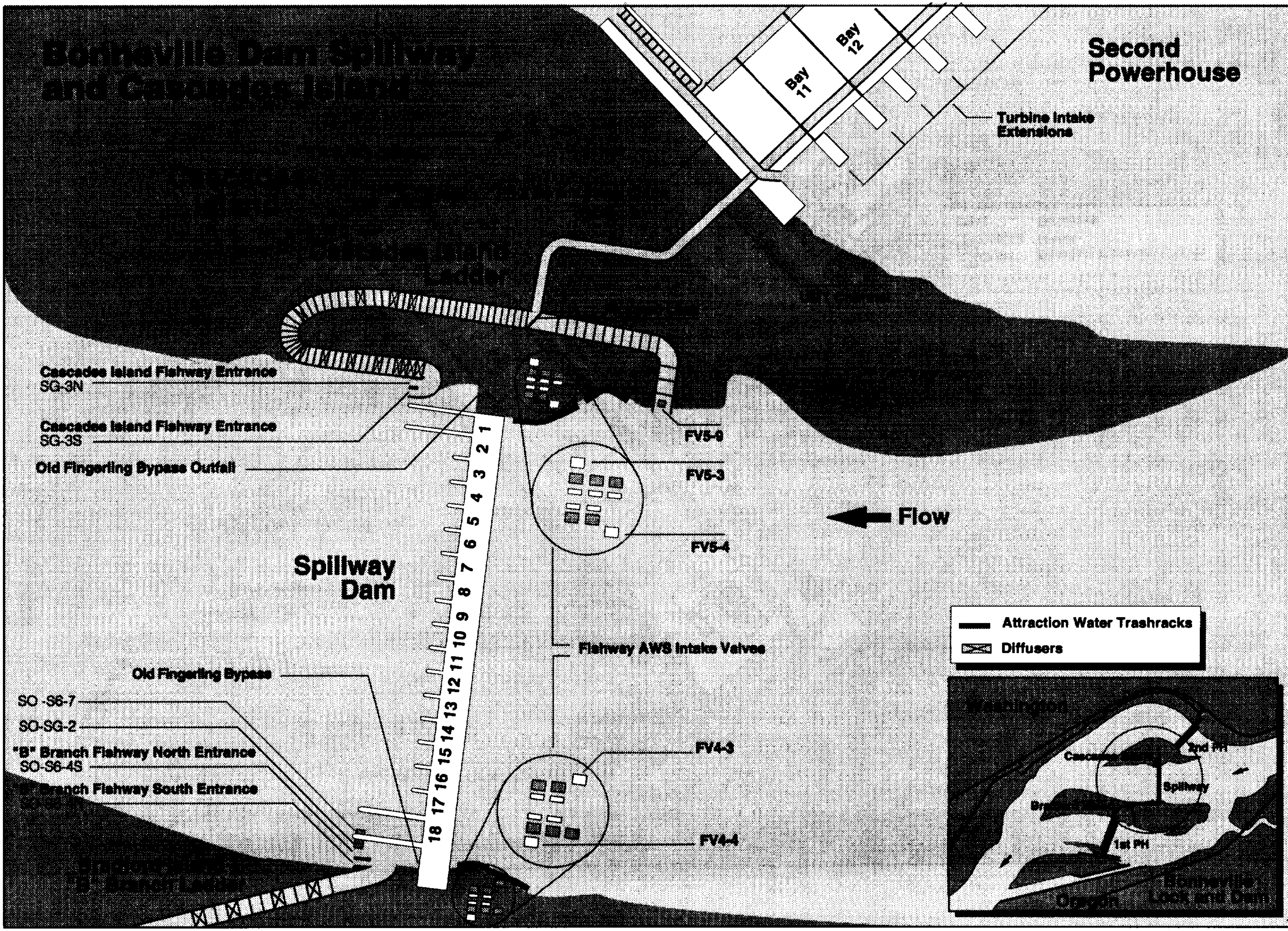


Figure 2 Bonneville Dam Spillway, Cascades Island Fish Ladder and Upstream Migrant Transportation Channel (UMT)

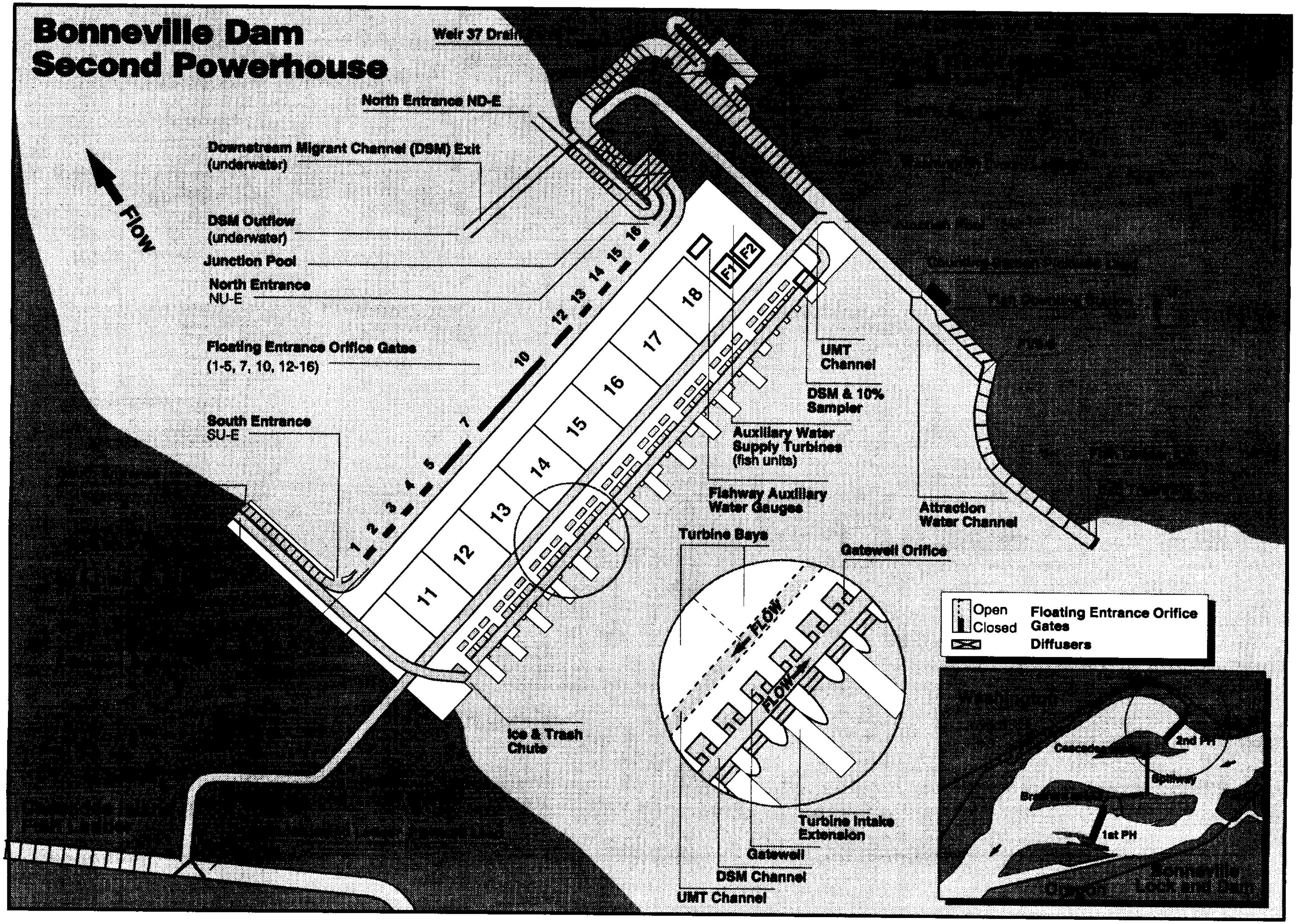
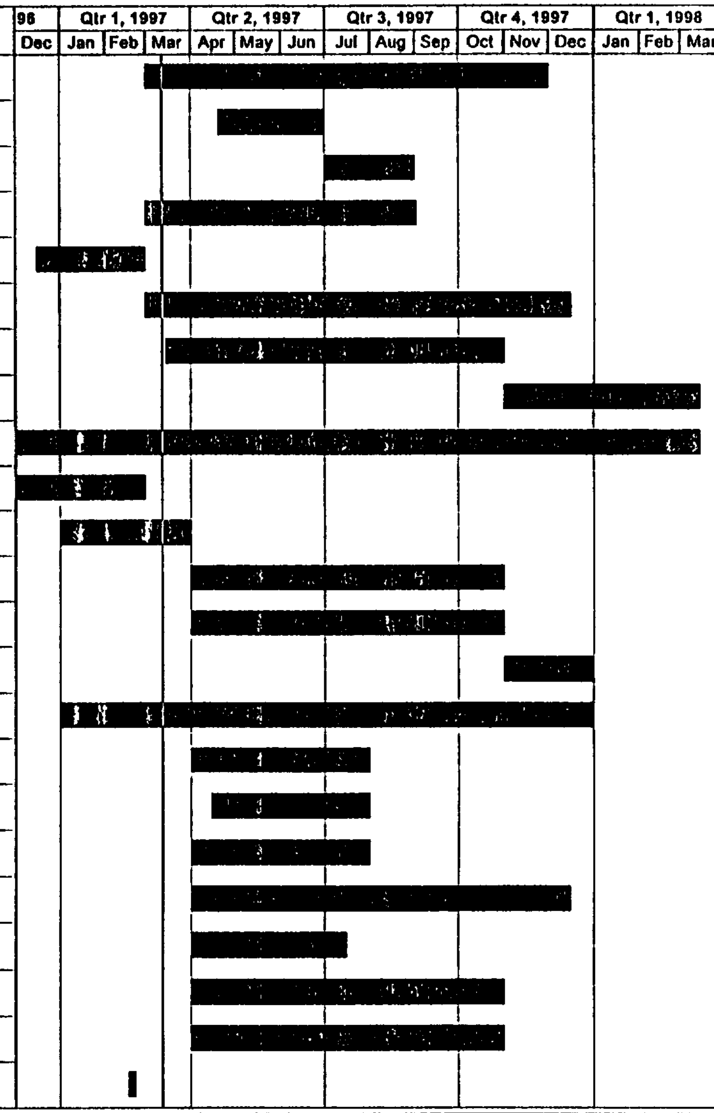


Figure 3 Bonneville Dam Second Powerhouse and Washington (North) Fish Ladder.

Table I. Dates of Project Operations for Fishery Purposes at Bonneville Dam, 1997.

ID	Name	Start	Finish	Notes
1	Juvenile Fish Passage Period	3/1/97	11/30/97	exact start dates vary - see App. A, 12/1-12/15 - operate facilities for
2	Spill spring	4/20/97	6/30/97	amounts vary - see App. F
3	Spill summer	7/1/97	8/31/97	amounts vary - see App. F
4	Dissolved Gas Monitoring	3/1/97	9/1/97	Forebay and tailrace stations - start dates vary
5	Bypass Facility Maintenance	12/16/96	2/28/97	
6	Turbine Operation for Adult/Juvenile Fish	3/1/97	12/15/97	Unit priorities vary during this time
7	Turbine 1% operation	3/15/97	10/31/97	
8	Turbine 1% operation Dev	11/1/97	3/14/98	May deviate if power is required
9	Adult Passage Period	12/1/96	3/14/98	Critical period 3/1 - 11/30
10	Adult Facility Maintenance	12/1/96	2/28/97	dates vary - see BON-7
11	Adult Fish Counting 0000-2400	1/1/97	3/31/97	0000-2400 PST (video)
12	Adult Fish Counting 0400-2000	4/1/97	10/31/97	0400-2000 PST (visual)
13	Adult Fish Counting 2000-0400	4/1/97	10/31/97	2000 - 0400 PST (video)
14	Adult Fish Counting 0000-2400	11/1/97	12/31/97	0000-2400 PST (video)
15	Weekly Reporting	1/1/97	12/31/97	Sunday - Saturday
16	Hydroacoustic Evaluation	4/1/97	7/31/97	See App. A for additional details
17	FGE Evaluation	4/15/97	7/31/97	See App. A for additional details
18	Radio Telementry Study	4/1/97	7/31/97	See App. A for additional details
19	Flat Plate PIT Tag Detection	4/1/97	12/15/97	See App. A for additional details
20	Radio Tracking Sqawfish	4/1/97	7/15/97	See App. A for additional details
21	Adult Fish Passage Evaluation	4/1/97	10/31/97	See App. A for additional details
22	Predator/Prey Study (BPA)	4/1/97	10/31/97	See App. A for additional details
23	Spill Test	2/17/97	2/21/97	See App. A for additional details



BON FPP 97

Table II. Juvenile Fish Migration Timing at Bonneville Dam, 1989-1995.

% PAST PROJECT[a]	YEAR/DATE 1989	1990	1991	1992	1993	1994	1995
Yrlg. Chinook							
10%	4/21	4/16	4/22	4/16	4/22	4/19	4/18
90%	5/21	5/22	5/31	5/15	5/28	5/31	5/26
Subyrlg. Chinook[b]							
10%	6/6	6/7	3/24	4/19	N/A	6/9	6/5
90%	7/29	7/12	7/23	7/8	N/A	7/26	7/15
Steelhead							
10%	4/22	5/1	5/9	4/25	5/10[c]	5/3[c]	5/4[c]
90%	5/29	6/4	5/31	5/29	5/26[c]	6/4[c]	5/29[c]
Coho							
10%	4/21	4/23	5/3	4/25	5/5	5/9	4/28
90%	5/29	6/9	6/1	6/3	5/25	6/5	5/29
Sockeye							
10%	5/10	5/8	5/19	5/11	5/17	5/13	5/10
90%	6/4	6/5	5/31	5/31	5/27	6/2	5/27

[a] Measured at the first powerhouse bypass trap.

[b] Large spring releases of tule stock subyearling chinook in Bonneville pool overshadow the summer upriver stock migration. To avoid this, these dates are for the middle 80 percent of the subyearling chinook run which occurs after this June 1.

[c] Dates are for hatchery steelhead. Wild steelhead averaged a few days earlier for the 10% passage, and nearly the same for 90% passage.

operating criteria sections. Project biologists shall prepare weekly reports, throughout the year, summarizing project operations. The weekly reports will provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any unusual activities which occurred at the project which may affect fish passage. The weekly reports shall cover a Sunday through Saturday time period and shall be sent to CENPP-CO as soon as possible the following week. The project biologist shall prepare an annual report by 31 January, summarizing the operation of the project fish passage facilities for the previous year. The report will cover from the beginning of one adult fish facility winter maintenance period to the beginning of the next.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. Adult fish passage facilities at Bonneville Dam are composed of two main fishway segments. The first powerhouse collection system with A-branch ladder and the south spillway collection system with B-branch ladder join together at The Bradford Island ladder to form the Bradford Island fishway segment. The Cascades Island ladder at the north side of the spillway is connected to the Washington shore ladder by the Upstream Migrant Transportation (UMT) channel. The second powerhouse collection system/ladder join together at the Washington shore to form the Washington Shore fishway segment. Both the Bradford Island and the Washington Shore fishways have counting stations. The second powerhouse ladder has an adult fish sampling facility. All four collection systems have auxiliary water supplies for fish attraction.

1.2.2. Adult Migration Timing. Upstream migrants are present at the project throughout the year. Adult passage facilities are operated year round. However, passage through the winter months is relatively light, and fish counting consists of video-taping with no visual counting from 1 November through 31 March, primarily to account for winter steelhead passage. The fish counting schedule appears in appendix A. Annual winter maintenance of adult fish facilities is scheduled from 1 December through February (In-water work period) to minimize the impact on upstream migrants, and to minimize adult fall chinook and steelhead fallback.

Adult migration count data for Bonneville Dam have been collected since 1938. Table III. summarizes adult fish passage timing through 1995. The primary passage period and the earliest and latest peaks of migration recorded are listed for each species, from fish counts compiled by the Corps.

Table III. Adult Migration Timing from Fish Counts, 1938-1995.

Species	Passage Period	Earliest Peak	Latest Peak
Spring Chinook	3/14 - 5/31	4/15	5/27
Summer Chinook	6/1 - 7/31	6/5	7/31
Fall Chinook	8/1 - 11/15	9/1	9/17
Steelhead	3/15 - 11/15	7/16	9/12
Coho	7/15 - 11/15	8/29	9/20
Sockeye	6/1 - 8/15	6/22	7/13

2. Project Operation.

2.1. General.

2.1.1. Low FGE at the second powerhouse has been improved by implementation of three measures; full installation of turbine intake extensions (TIEs) in front of alternate intake slots, replacing the top three standard trash racks in each intake slot with streamlined trash racks, and lowering the STSs. These improvements were first fully installed at the beginning of the 1993 fish passage season. Guidance for spring and summer general flow distribution between powerhouses and spill is provided in the main text of the Fish Passage Plan and in appendix A.

2.1.2. Summer operation: Yearling chinook and most other juvenile salmonids migrate downstream in the spring, whereas during the summer, after mid-June, sub-yearling chinook dominate. Studies specific to Bonneville Project indicate that fish survival rates for passage through various routes differ between spring and summer. For this reason, distribution of flow between powerhouses and spill will change (see description in the main text of this plan and in appendix A).

2.1.3. Research, non-routine maintenance, and other fishery related activities will not be conducted within 100' of any fishway entrance or exit, or directly in, above, or adjacent to any fishway, unless concurred with by regional fisheries managers through ESA and other fish passage issues. Alternate actions will be considered by district and project biologists in conjunction with the fishery managers on a case by case basis. Emergency situations should be dealt with immediately by the project in consultation with the project or district biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident.

2.2. Spill Management.

2.2.1. General.

2.2.1.1. Regardless of time of day, only one spill schedule will be used at Bonneville Dam (See Spill Schedule, p. BON-10 through BON-12).

2.2.1.2. Nighttime spill is limited as necessary to control gas supersaturation. Adjustments of the nighttime spill level may be granted on a case-by-case basis by the Reservoir Control Center, dependent upon dissolved gas saturation readings at stations downstream of the dam, and upon fish movement. The hours of nighttime spill are the daily complements of the periods of daytime spill (see 2.2.3.1., below). However, changing spill gate positions takes some time, particularly for the gates which can't yet be operated remotely. So, the transition to the daytime cap should begin early enough in the day to minimize chances of violating the defined daytime spill maximum. The transition to the nighttime spill period should not start until after the daytime cap period is over.

2.2.2. Juvenile Fish.

2.2.2.1. Spill will be provided according to guidance described in appendices A and E.

2.2.2.2. The second powerhouse ice and trash chute will be operated for ice and trash removal and for emergency auxiliary adult transportation channel water supply only as outlined in 3.4.2.1.c. Second Powerhouse., (second paragraph).

2.2.3. Adult Fish.

2.2.3.1. During the adult fish passage period, daytime spill will be limited to 75 kcfs whenever possible. Normally, this restriction will be from one hour before sunrise to one half hour before sunset. However, during the sockeye passage season, beginning when at least 10 fish pass the project per day (in combined ladder counts), but no later than 1 June, through 15 August, the cap will apply until one hour after sunset.

2.3. Dissolved Gas Management and Control. Implementation of spill requests will take into account dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Total dissolved gas monitoring will be conducted by the Corps from a station in the Bonneville

SPILL SCHEDULE FOR BONNEVILLE DAM

updated 8 June 1993

BAY NUMBER																		DOGS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
4"	1																4"	1	
4"	1															1	4"	2	
4"	1	1														1	4"	3	
4"	1	1													1	1	4"	4	
4"	1	1	1												1	1	4"	5	
4"	1	1	1											1	1	1	4"	6	
4"	1	1	1	1										1	1	1	4"	7	
4"	1	1	1	1									1	1	1	1	4"	8	
4"	1	2	1	1									1	1	1	1	4"	9	
4"	3	2									2				1	2	4"	10	33.6
4"	3	2									2				2	2	4"	11	37.2
4"	3	2			1						2				2	2	4"	12	40.3
4"	3	2			2						2				2	2	4"	13	43.9
4"	3	2	1		2						2				2	2	4"	14	47.0
4"	3	2	1		2						2			1	2	2	4"	15	50.1
4"	3	2	1		2				1		2			1	2	2	4"	16	53.8
4"	3	2	1		2				2		2			1	2	2	4"	17	56.9
4"	3	2	2		2				2		2			1	2	2	4"	18	60.5
4"	3	2	2		2		1		2		2			1	2	2	4"	19	63.6
4"	3	2	2		2		2		2		2			1	2	2	4"	20	67.2
4"	3	2	2		2		2		2		2		1	1	2	2	4"	21	70.3
4"	3	2	2		2		2		2		2		2	1	2	2	4"	22	74.0
4"	3	2	2		2		2		2		2		2	1	2	3	4"	23	77.5
4"	3	2	2		2		2		2		2		2	2	2	3	4"	24	81.1
4"	3	3	2		2		2		2		2		2	2	2	3	4"	25	84.6
4"	3	3	2		2		2	1	2		2		2	2	2	3	4"	26	87.7
4"	3	3	2		2		2	2	2		2		2	2	2	3	4"	27	91.3
4"	4	3	2		2		2	2	2		2		2	2	2	3	4"	28	94.8
4"	4	3	2		2		2	2	2		2		2	2	3	3	4"	29	98.4
4"	4	3	2		2		2	2	2		2		2	2	3	4	4"	30	102
4"	4	3	3		2		2	2	2		2		2	2	3	4	4"	31	105
4"	4	3	3	1	2		2	2	2		2		2	2	3	4	4"	32	109
4"	4	3	3	2	2		2	2	2		2		2	2	3	4	4"	33	112
4"	4	3	3	2	2		2	2	2		2	1	2	2	3	4	4"	34	115

SPILL SCHEDULE FOR BONNEVILLE DAM

updated 8 June 1993

BAY NUMBER																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	DOGS	KCFS
4"	4	3	3	2	2		2	2	2		2	2	2	2	3	4	4"	35	119
4"	4	3	3	2	2	1	2	2	2		2	2	2	2	3	4	4"	36	122
4"	4	3	3	2	2	2	2	2	2		2	2	2	2	3	4	4"	37	126
4"	4	3	3	2	2	2	2	2	2	1	2	2	2	2	3	4	4"	38	129
4"	4	3	3	2	2	2	2	2	2	2	2	2	2	2	3	4	4"	39	133
4"	4	4	3	2	2	2	2	2	2	2	2	2	2	2	3	4	4"	40	135
4"	4	4	3	2	2	2	2	2	2	2	2	2	2	3	3	4	4"	41	139
4"	4	4	3	2	2	2	2	2	2	2	2	2	2	3	4	4	4"	42	143
4"	4	4	3	3	2	2	2	2	2	2	2	2	2	3	4	4	4"	43	146
4"	4	4	3	3	2	2	2	2	2	2	3	2	2	3	4	4	4"	44	150
4"	4	4	3	3	2	2	2	2	2	2	3	2	3	3	4	4	4"	45	153
4"	4	4	3	3	2	3	2	2	2	2	3	2	3	3	4	4	4"	46	157
4"	4	4	3	3	2	3	2	2	3	2	3	2	3	3	4	4	4"	47	160
4"	4	4	3	3	2	3	2	3	3	2	3	2	3	3	4	4	4"	48	164
4"	5	4	3	3	2	3	2	3	3	2	3	2	3	3	4	4	4"	49	167
4"	5	4	3	3	2	3	2	3	3	2	3	2	3	3	4	5	4"	50	171
4"	5	4	4	3	2	3	2	3	3	2	3	2	3	3	4	5	4"	51	174
4"	5	5	4	3	2	3	2	3	3	2	3	2	3	3	4	5	4"	52	178
4"	5	5	4	3	2	3	2	3	3	2	3	2	3	3	5	5	4"	53	181
4"	5	5	4	3	2	3	2	3	3	3	3	2	3	3	5	5	4"	54	185
4"	5	5	4	3	2	3	3	3	3	3	3	2	3	3	5	5	4"	55	188
4"	5	5	4	3	2	3	3	3	3	3	3	2	3	4	5	5	4"	56	192
4"	5	5	4	4	2	3	3	3	3	3	3	2	3	4	5	5	4"	57	195
4"	6	5	4	4	2	3	3	3	3	3	3	2	3	4	5	5	4"	58	199
4"	6	5	4	4	3	3	3	3	3	3	3	2	3	4	5	5	4"	59	203
4"	6	5	4	4	3	3	3	3	3	3	3	3	3	4	5	5	4"	60	206
4"	6	5	4	4	3	3	3	3	3	3	3	3	3	4	5	6	4"	61	210
4"	6	5	5	4	3	3	3	3	3	3	3	3	3	4	5	6	4"	62	213
4"	6	6	5	4	3	3	3	3	3	3	3	3	3	4	5	6	4"	63	217
4"	7	6	5	4	3	3	3	3	3	3	3	3	3	4	5	6	4"	64	220
4"	7	6	5	4	3	3	3	3	3	3	3	3	4	4	5	6	4"	65	223
4"	7	6	5	4	3	4	3	3	3	3	3	3	4	4	5	6	4"	66	227
4"	7	6	5	4	3	4	3	3	3	3	3	3	4	4	6	6	4"	67	230
4"	7	6	5	4	3	4	3	3	3	3	3	3	4	5	6	6	4"	68	234

SPILL SCHEDULE FOR BONNEVILLE DAM

updated 8 June 1993

BAY NUMBER																		DOGS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
4"	7	6	5	4	3	4	3	3	3	3	3	3	4	5	6	7	4"	69	237
4"	7	6	5	5	3	4	3	3	3	3	3	3	4	5	6	7	4"	70	240
4"	7	6	5	5	3	4	3	3	3	3	4	3	4	5	6	7	4"	71	244
4"	7	6	5	5	3	4	3	4	3	3	4	3	4	5	6	7	4"	72	247
4"	7	6	5	5	4	4	3	4	3	3	4	3	4	5	6	7	4"	73	251
4"	7	6	6	5	4	4	3	4	3	3	4	3	4	5	6	7	4"	74	254
4"	7	7	6	5	4	4	3	4	3	3	4	3	4	5	6	7	4"	75	258
4"	7	7	6	5	4	4	3	4	4	3	4	3	4	5	6	7	4"	76	261
4"	7	7	6	5	4	4	4	4	4	3	4	3	4	5	6	7	4"	77	265
4"	7	7	6	5	4	4	4	4	4	4	4	3	4	5	6	7	4"	78	268
4"	8	7	6	5	4	4	4	4	4	4	4	3	4	5	6	7	4"	79	272
4"	8	7	6	5	4	4	4	4	4	4	4	4	4	5	6	7	4"	80	275
4"	8	7	6	5	4	4	4	4	4	4	4	4	4	5	7	7	4"	81	279
4"	8	7	6	5	4	4	4	4	4	4	4	4	4	6	7	7	4"	82	282
4"	8	7	6	5	5	4	4	4	4	4	4	4	4	6	7	7	4"	83	285
4"	8	7	6	5	5	4	4	4	4	4	4	4	4	6	7	8	4"	84	289
4"	8	7	6	6	5	4	4	4	4	4	4	4	4	6	7	8	4"	85	292
4"	8	7	7	6	5	4	4	4	4	4	4	4	4	6	7	8	4"	86	296
4"	8	8	7	6	5	4	4	4	4	4	4	4	4	6	7	8	4"	87	299
																		0	

Gate settings, or "dogs", create the following openings.

1 = 1.0'; 2 = 2.9'; 3 = 4.9'; 4 = 6.8'; 5 = 8.7';
6 = 10.6'; 7 = 12.6'; 8 = 14.5'; 9 = 16.4'; 10 = 18.3';
11 = 20.2'; 12 = 22.1'; 13 = 24.1"; 14 = 26.0'

forebay and from several stations located below Bonneville Dam. Dissolved gas data will be reported every four hours starting prior to an early Spring Creek NFH fish release, but not later than 10 March for stations below Bonneville and on 1 April for the station at Bonneville and those further upriver. Collection will continue until Labor Day. Related data for Bonneville Dam reported at the same time will be spill volume and total project flow. The dissolved gas monitoring system is described in detail in appendix D.

Excessive Total Dissolved Gas levels, which may harm fish, will be controlled to the extent possible, subject to river flow conditions. Control measures will include system spill allocations through the spill priority list issued by RCC, nighttime or daytime spill limits, and shaping of spill discharge.

2.4. Juvenile Fish Passage Facilities.

2.4.1. Operating Criteria, First Powerhouse.

2.4.1.1. Prior to the Juvenile Fish Passage Season.

a. Remove debris from forebay, trash racks, and gatewell slots such that these areas are free of debris.

b. Inspect VBSs for damage, holes, debris accumulations and protrusions (video inspection acceptable). Clean and repair as necessary, such that all VBSs are functional.

c. Inspect each STS and operate on trial run (dogged off at deck level). Install STS in each intake of operational turbine units by the end of February. However, see 2.4.1.2. Juvenile Fish Passage Season., about accommodations when there is an early fish release from Spring Creek NFH.

d. Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting systems such that the orifices and associated systems are fully functional.

e. Inspect and, where necessary, clean and/or repair dewatering screens and associated equipment.

f. Inspect and correct any deficiencies of DSM channel and outfall conduit walls and floor.

g. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical. Avian abatement measures shall be operable by 1 March.

h. The results of all inspections and the readiness of the facilities for operation will be verbally reported to the Fish Passage O&M Coordination Team at the meeting immediately prior to the juvenile fish passage season.

2.4.1.2. Juvenile Fish Passage Season. (1 March through 30 November). Juvenile fish protection devices (STSs, etc.) will be in place for an early fish release from Spring Creek NFH, if scheduled to occur before 1 March. Screens will remain in operation through 15 December to protect adult fallbacks.

a. Gatewell drawdown will be measured a minimum of once per week. Remove debris from forebay and trashracks as required to maintain less than 1.5 feet of total drawdown in gatewell, as indicated by fish condition (e.g., higher than expected descaling), or as determined by the project biologist. STSs in units being raked will be run in continuous mode during raking operation. Gatewell orifices of the unit being raked must be closed during the procedure.

b. Operate STSs at 55 degree angle from vertical.

c. Inspect each STS once per month and each VBS a minimum of once every two months (video is acceptable). Frequency of monthly inspections may be based on individual turbine unit run time. Inspect STSs and VBSs within a time frame to minimize damage to screens following the arrival of heavy debris at the dam. Summaries of STS and VBS inspections will be included in weekly operation monitoring reports. VBS inspections will occur immediately prior to peaks in juvenile fish migrations, which begin about 1 May, mid-July, and 1 September. Inspections will be concentrated on the priority units and others with the longer operating time. More frequent inspections may be required by the project biologist or under the following conditions; deterioration of fish conditions, increased debris load in bypass system, and other indications of STS or VBS malfunctions or failure. Records of inspections or summary of such records will be made available to the Fish Passage Center (FPC) by 31 January.

CBFWA recommends that VBS inspections be conducted once per month through the fish passage season.

d. Operate all gatewell orifice systems. Inspect each daily to assure that the orifice valves and lights are operating correctly. Back-flush at least every day or more often if indicated by debris accumulations. Replace all burned out orifice lights within 24 hours.

e. In the DSM downwell area[1]:

1. Maintain between 0.9 and 1.3 feet of depth, 1.0 foot preferred, over the end of the DSM inclined dewatering screen.

2. Maintain differential between forebay and dewatering screen between 5.3 and 5.7 feet.

3. Maintain drop from dewatering screen to water surface in downwell between 3.0 and 4.5 feet.

4. Operate dewatering screen trash sweep one (1) revolution at 20 minute intervals. The interval between operations may be doubled when the amount of debris passing is light.

f. Observe each STS watt and/or amp gauge reading at least once each day and record readings once per day. If an STS failure occurs, then follow procedures in 3. Fish Facilities Maintenance.

g. Inspect all STS gatewells daily. The project will clean before gatewell water surface becomes one-half covered with debris. If due to the volume of debris, it is not possible to keep the gatewell surfaces half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except to be in compliance with other coordinated fishery measures, and then only on a last on/first off basis. The first powerhouse gatewell orifices will be closed during the debarking operation. After debarking a gatewell, back-flush the orifice in that gatewell. Check gatewell drawdown.

h. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams, etc. But, when unusual accumulations of oil (eg. oil slick) occur in gate slots, they will be removed within 24 hours. When this is not possible, the JBS orifice will be closed and the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in consultation with FPC and NMFS. Regardless of unit operating status, oil accumulations will be dealt with promptly.

[1] Standards listed are for normal operation. During smolt sampling, depth of water over the inclined screen and elevation of the water surface in the downwell are lowered.

i. Coordinate gatewell cleaning with personnel operating downstream migrant sampling facilities.

j. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical.

k. Turbine units without full compliments of STSs will not operate, except to be in compliance with other coordinated fishery measures.

CBFWA recommends no operation of unscreened or partially screened turbines unless otherwise agreed.

l. During the juvenile fish passage season, open sluice gate 7A to a depth of 3.5 feet and 10C to a depth of 2.5 feet below the daily expected forebay elevation[1] (see 6. Endnotes.). The ice and trash sluiceway may be closed for a two month period beginning October 1, if it is determined, through Regional coordination, that migrating juvenile salmonid numbers are low enough that closure will not adversely affect fish migration or fish condition. This closure is subject to annual Regional evaluation, and may be terminated at any time if problems arise that negatively impact salmonid migration or fish condition. Whenever the old juvenile fish bypass located at the south end of the powerhouse operates, some flow must be maintained through the ice & trash sluiceway, since the bypass flows into the sluiceway. However, the old fingerling bypass is no longer operated as a juvenile fish passage system.

m. Inspect juvenile fish passage facilities twice per day, except where other guidance is provided elsewhere within this plan for specific facilities.

2.4.1.3. Winter Maintenance Season. (16 December through February). The end of the season may be shortened for an early fish release from Spring Creek National Fish Hatchery.

a. All STSs removed.

b. Once STSs are removed, DSM channel may be dewatered throughout most of this period if STSs must be stored beneath the intake deck, which places the STSs directly in front of the gatewell orifices (see 5. Dewatering Plans.).

2.4.2. Operating Criteria, Second Powerhouse.

2.4.2.1. Prior to the Juvenile Fish Passage Season.

a. Remove debris from forebay, trash racks, and gatewell slots such that these areas are free of debris.

b. Inspect VBSs for damage, holes, debris accumulations, or protrusions (video inspection acceptable). Clean and repair as necessary, such that all VBSs in operable units are functional.

c. Inspect each STS and operate on trial run (dogged off at deck level). Install STS in each intake of operational units by the end of February. However, see 2.4.2.2. Juvenile Fish Passage Season., about accommodations when there is an early fish release from Spring Creek NFH.

d. Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting systems such that the orifices and associated systems are fully functional.

e. Inspect and, where necessary, clean and/or repair dewatering screens and associated equipment.

f. Inspect and correct any deficiencies of DSM channel and conduit outfall walls and floor.

g. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical. Avian abatement measures shall be operable by 1 March.

h. The results of all inspections ant the readiness of the facilities for operation will be verbally reported to the Fish Passage O&M Coordination Team at the meeting immediately prior to the juvenile fish passage season.

2.4.2.2. Juvenile Fish Passage Season. (1 March through 30 November). Juvenile fish protection devices (STSs, TIES, etc.) will be in place for an early fish release from Spring Creek NFH, if scheduled to occur before 1 March. Screens will remain in operation through 15 December to protect adult fallbacks.

a. Main unit gatewell drawdown will be measured a minimum of once per week. Remove debris from forebay and trash racks as required to maintain less than 1.5 feet of drawdown in gatewell or as indicated by fish condition (eg., higher than expected descaling) or as determined by the project biologist. STSs in units being raked will be run in continuous operating mode during raking operation. Gatewell orifices of the unit being raked must be closed during the procedure.

b. Measure fish unit gatewell drawdown at least once per week. When head across trash racks exceeds 1.5', the trash racks will be cleaned that day. This may be done by raking late in the work day or by turning the unit off at night and letting the debris float off the racks. However, if the head exceeds 3' or if the adult fishway head is reduced, the unit's racks will be raked immediately, even if it is early in the day. When debris accumulation is persistent, unit 18 may be operated while the fish unit is off at night to help draw loosened debris away.

c. Operate STSs at angle of 60 degrees from vertical.

d. Inspect each STS once per month and each VBS a minimum of once every two months (video is acceptable). Frequency of monthly inspections may be based on individual turbine unit run time. STS inspections will not be scheduled when they will cause excessive dissolved gas due to increased forced spill. Summaries of STS and VBS inspections will be included in weekly operation monitoring reports. VBS inspections will occur immediately prior to peaks in juvenile fish migrations, which begin about 1 May, mid-July, and 1 September. Inspections will be concentrated on the priority units and others with the longer operating time. More frequent inspections may be required by the project biologist or under the following conditions; deterioration of fish conditions, increased debris load in bypass system, and other indications of STS or VBS malfunctions or failure. Prior to pulling VBSs for inspections, shut off units and dip gatewells.

CBFWA recommends that VBS inspections be conducted once per month through the fish passage season.

If STS or VBS damage or plugging is detected, follow procedures in 3. Fish Facilities Maintenance. Records of inspections or summary of such records will be made available to the FPC by 31 January upon request.

e. Operate all gatewell orifice systems. Inspect each daily to assure that the orifice valves and lights are operating correctly. Orifices with less than a clear flow jet will be cleaned at least once per day. Replace all burned out orifice lights within 24 hours. Electrical modifications were made in 1995 which allow central, automatic lighting control in the PH2-DSM. The DSM is now darkened on a schedule as determined through coordination with the Corps' Fish Passage O&M Coordination Team in 1994. The PH2-DSM lights should be left off, per this guidance, except when people are in the gallery. Investigation has shown that darkening the channel results in faster fish evacuation.

f. Inspect each STS watt and/or amp gauge at least once each day and record reading once per day. If an STS failure occurs, then follow procedures in 3. Fish Facilities Maintenance.

g. Inspect all STS gatewells daily. The project will clean before gatewell water surface becomes one-half covered with debris. If due to the volume of debris, it is not possible to keep the gatewell surfaces half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except to be in compliance with other coordinated fishery measures, and then only on a last on/first off basis. After debarking a gatewell, inspect and if necessary, clean the orifice in that gatewell. Check gatewell drawdown.

CBFWA recommends the gatewells be cleaned before they become half covered with debris. The Corps is currently attempting to resolve this situation. A gatewell orifice sluice to remove debris and reduce fish handling is being developed for implementation in 1997.

h. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams, etc. But, when unusual accumulations of oil (e.g., oil slick) occur in gate slots, they will be removed within 24 hours. When this is not possible, the JBS orifice will be closed and the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in consultation with FPC and NMFS. Regardless of unit operating status, oil accumulations will be dealt with promptly.

i. Coordinate gatewell cleaning with personnel operating downstream migrant sampling facilities.

j. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical.

k. Turbine units without full compliments of STSs may not operate except to be in compliance with other coordinated fishery measures.

CBFWA recommends no operation of partially or fully unscreened turbines unless otherwise agreed.

l. Maintain DSM water surface between elevations 64.7 and 65.2 as measured at the south end of the channel.

m. Maintain water surface on dewatering screen between elevations 60.8 and 61.2.

n. Maintain water surface in downwell between elevations 56.0' and 58.0'under the automatic control system.

o. Inspect facilities twice per day.

p. Operation of the Emergency Relief Gate (ERG) may strand juvenile fish that are near the dewatering screen when the water recedes. Training and maintenance operation of the ERG during the juvenile fish passage season should be minimized. As much as practical, all operation of the ERG should be coordinated through the project biologist. To ensure that the ERG is operable when needed, operation should be tested at the beginning of the juvenile fish passage season and once mid-season. Tests will be done at such a time as to create the least impact to migrating fish.

q. Turbine intake extensions (TIEs) will be removed following the spring juvenile yearling chinook outmigration period, usually in early July. TIEs will be re-installed just prior to the start of the juvenile fish passage season, including, when practicable, prior to early fish releases from Spring Creek National Fish Hatchery.

2.4.2.3. Winter Maintenance Season. (16 December through February). The end of the season may be shortened for an early fish release from Spring Creek National Fish Hatchery.

To reduce adult fallback mortality, the juvenile bypass system, or DSM channel will operate from 30 November through 15 December. STSs in priority units will be left in place during this period. Screens from non-priority units may be removed between 1 and 15 December, but only if scheduled for maintenance. In all units, screens that are not being serviced shall be left in place during this period. Unscreened units will not be operated. Beginning 16 December, all remaining STSs may be removed. DSM may be dewatered (see 5. Dewatering Plans.) only when required for maintenance. The period of maintenance will be minimized to the extent practicable. Facilities, when operating, are to be inspected at least once per day to assure criteria are being met.

2.4.3. Operating Criteria, Spillway.

2.4.3.1. Prior to Juvenile Fish Passage Season.

a. Inspect and, where necessary, repair spill gates and control systems. The spillway, except for coordinated exceptions, must be able to achieve spill patterns on the first day of the juvenile fish passage season.

b. The results of all inspections and the readiness of the facilities for operation will be verbally reported to the Fish Passage O&M Coordination Team at the meeting immediately prior to the juvenile fish passage season.

2.4.3.2. Juvenile Fish Passage Season. (1 March through 30 November).

Bonneville Dam uses a single spill schedule for use both day and night (See 2.2. Spill Management., and 2.2.2. Juvenile Fish. for guidance).

2.4.3.3. Winter Maintenance Season. (16 December through February).

Refer to appendix E for spill guidance during non-passage periods at Bonneville Project.

2.5. Adult Fish Passage Facilities.

2.5.1. Operating Criteria.

2.5.1.1. Prior to Adult Passage Period.

a. Inspect and calibrate all staff gauges and water level indicators; repair and/or clean where necessary.

b. Unless specially coordinated, dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or slow their progress up the ladder. Repair deficiencies.

c. Inspect for, and when necessary, clear debris in the ladder exits.

d. Reinstall picket leads at counting stations prior to watering up the ladders during maintenance.

e. The results of all inspections and the readiness of the facilities for operation will be verbally reported at the Corps' Fish Passage O&M Coordination Team meeting immediately prior to the passage season.

2.5.1.2. Adult Fish Passage Period. (1 March through 30 November).

a. All Adult Facilities.

1. Water depth over fish ladder weirs: 1.0' +/- 0.1'. During shad passage (15 May through 15 August): 1.3' +/- 0.1'.

2. Water temperature will be measured in an adult fishway at each project.

3. Head on all entrances: 1.0 to 2.0 feet (1.5 feet preferred). A head of approximately 1.0 to 2.0 feet at the NUE entrance is indicated by a 1.2 to 2.2 foot (1.7 feet preferred) entrance head calculated using the fishway and tailwater staff gauges closest to NUE. Refer to 3.4.1. Adult Fish Passage Facilities, Scheduled Maintenance., (p. BON-30) when unable to achieve head criterion.

4. A transportation velocity of 1.5 to 4.0 feet per second (2.0 fps preferred) shall be maintained for the full length of the powerhouse collection channel, the lower ends of the fish ladders which are below the tailwater, and the Upstream Migrant Transportation (UMT) channel. Water velocities will be measured directly, and monitored during fishway inspections to verify channels are operating between 1.5 and 4.0 feet per second.

5. Maximum of 1.0' head will be allowed on the first powerhouse attraction water intakes and trash racks at all the ladder exits, with a 4" maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

6. Staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period. Stillwells used in lieu of staff gauges will be checked for calibration once per week, and summaries of these stillwell calibrations will be included in weekly operation monitoring reports.

7. The current fish counting program is conducted 24 hours per day year around. Count station crowders shall remain in the operating position while visual counting and/or video taping is being conducted. If counting is temporarily discontinued due to unscheduled events, or the fishway is dewatered, the crowder shall be fully opened,

except during the counters' hourly ten minute break period. Leave fish passage slot lighted overnight.

8. Inspect facilities twice per day.

9. Upstream light banks in both count stations shall remain off in an attempt to facilitate fish passage through the count slot and help reduce the number of fish impacting the count window framework, unless other passage problems result, or count accurracy is compromised.

10. Inspect and ensure that optimum passage conditions are maintained at fishway entrances, exits, and in the count slots.

b. Spillway Ladders.

1. Spill bay gates 1 and 18 shall be open 4" to attract adult migrating fish to the adjacent fishway entrances, throughout the adult fish passage season.

2. Side entrances SW-SG-5 and SO-SG-7 and downstream entrances SW-SG-1 and SO-SG-2 shall operate as continuously open free-flowing vertical slots. Downstream entrances SW-SG-3 and SO-SG-4 (adjacent to shore) consist of pairs of sluice gates. When the tailwater is below 9 feet, sluice gates SW-SG-3N, SW-SG-3S, SO-SG-4N, and SO-SG-4S shall be open. When the tailwater is between 9 and 17 feet, the south sluice gate shall close. When the tailwater exceeds 17 feet, sluice gates SW-SG-3N, SW-SG-3S, SO-SG-4N, and SO-SG-4S shall be closed.

c. First Powerhouse.

1. General. The PLC receives analog signals representing the 4 weir gate positions, the 5 orifice gate positions, the north, central, and south tailwater and collection channel water elevations, and the water pressure at the south end of the auxiliary water conduit. It also receives inputs from the bulkhead upper/lower limit switches. From this information, the PLC control program determines when to activate outputs which serve to raise or lower the weir gates, bulkheads, orifice gates, sluice gates, "A" branch diffusion gates, and fish valves FV1-1 and FV3-7.

2. Weir Gates and Bulkheads: Differential/ Submergence Requirements. Weir gates 1 and 2 are operated to maintain a differential of 1.4 to 1.6 feet between collection channel and tailwater. When the differential falls outside this desired range, weir gates 1 and 2 are moved for 7 seconds, which corresponds to a 0.2 foot gate

movement, and then remain inoperable for the remainder of 1.5 minutes.

Weir gates 64 and 65 are operated to maintain a 7.8 to 8.2 foot submergence below tailwater. When weir gates 64 and 65 fall outside this desired range, they are simply moved to 8 foot submergence. However, when tailwater is below 13.5 feet, the available auxiliary water is less than that required to maintain the 8 foot submergence and 1.5 foot differential requirements simultaneously. Therefore, when tailwater is below 13.5 feet, weir gate 64 is operated to maintain a 1.5 foot differential.

3. Gate Pairing. The 4 weir gates are operated as 2 pairs. Only one gate pair is allowed to operate for a given tailwater. Weir gates 1 and 65 are operated together as the active pair for tailwater greater than 23 feet, while weir gates 2 and 64 are operated together as the active pair for tailwater less than 24.5 feet. For tailwater inside this range, the previous active gate pair will remain active. If a weir gate is active, its entrance is opened; the weir gate is operated to meet the appropriate requirements and, in the case of entrances 2 or 64, its respective bulkhead is also fully raised. If a weir gate is inactive, its entrance is closed; the weir gate is fully raised and, in the case of entrances 2 or 64, its respective bulkhead is also fully lowered. A transition occurs when control is passed from one active pair to the other.

4. Transition Positioning. During a transition, the former active pair entrance is closed and the new active pair entrance is opened. Of the two gates which are active, the active gate which maintains differential is initially positioned according to tailwater, while the active gate which maintains submergence is initially positioned to 8 feet below tailwater. Once each of the active gates is in its respective position, there is a 5 minute delay in which the gate may not be operated (by the PLC program). This delay is instituted to allow the conditions in the collection channel to settle before resuming normal gate operation.

5. Operate powerhouse entrance gates 9, 21, 34, 58, and 62.

Orifice A (lower sluice gate) operates (opens) from tailwater elevation 7.0' to 16.0' on a rising tailwater and elevation 15.0' to 7.0' on a falling tailwater.

Orifice B (upper telescoping gate) operates (opens) from tailwater elevation 16.0' to 38.0' on a rising tailwater and elevation 38.0' to 15.0' on a falling tailwater.

6. First powerhouse collection channel diffusers are open according to the schedule in Table IV., (below).

d. Second Powerhouse.

1. Operate all north (NUE and NDE) and south (SUE and SDE) entrances. Operate weir crests at elevation 1.0' (fully lowered) for tailwater elevations up to 14.0'. For tailwater elevations greater than 14.0', operate weir crest 13.0' or greater below tailwater.

2. Operate all 12 powerhouse floating gate fishway entrances.

Table IV. PH1 Adult Fish Collection Diffusion System Valves.

FG2-1.....closed	FG2-13.....closed
FG2-2.....closed	FG2-14.....closed
FG2-3.....closed	FG2-15*....closed
FG2-4.....open	FG2-16.....closed
FG2-5.....closed	FG2-17.....closed
FG2-6.....closed	FG2-18.....closed
FG2-7*....closed	FG2-19.....open
FG2-8.....open	FG2-20.....open
FG2-9.....closed	FG2-21.....open
FG2-10....closed	FG2-22A....open
FG2-11*...closed	FG2-21*....open
FG2-12....open	FG2-21B....open

* Gate has manual electric operation. No automatic controls.

e. Spillway Operations.

Bonneville Dam uses a single spill schedule for use both day and night. See 2.2. Spill Management., and 2.2.3. Adult Fish. for guidance.

2.5.2. Winter Operating Period, or In-water Work Period, (1 December through February).

2.5.2.1. Operate the adult fish passage facilities according to the fish passage period standards above, except systems may be dewatered or operated out of criteria for repair and maintenance. Adult facilities will be inspected once per day to assure operation as per standards above. Only one of the ladders servicing the two powerhouses and the associated powerhouse collection system (including the auxiliary water supply system) may be out of service or operating out of standard operating criteria at any one time unless specifically coordinated. The units in the powerhouse with the fully operating fish facility will be first on/last off to meet power demand, except when the powerhouse 1 collection facility is out of service, units 1, 2 and 10 will continue to operate. One of the two ladders servicing the spill channel will be in full operation at all times unless specially coordinated. Outage periods will be minimized to the extent practicable.

2.5.2.2. Spill bays 1 and 18 may be on seal throughout the winter operating period.

2.5.2.3. Adjust crowders at fish counting stations to full open if video taping is temporarily discontinued due to unscheduled events, or during the winter maintenance (dewatering) period only.

3. Fish Facilities Maintenance.

3.1. General.

3.1.1. Scheduled Maintenance.

3.1.1.1. Staff gauges will be installed, cleaned, and/or repaired as required.

3.1.1.2. A zebra mussel monitoring program will continue. These organisms have become a serious problem elsewhere in the country and are expected to eventually become introduced to the Columbia River.

3.1.1.3. Scheduled fishway maintenance, to the extent practicable, will be conducted during periods when passage has been documented to be at its lowest during the regular scheduled workday, to minimize impacts to migrating salmonids.

3.2. Juvenile Fish Passage Facilities.

3.2.1. Scheduled Maintenance.

3.2.1.1. Submersible Traveling Screens. The STS system will receive preventive maintenance or repair at all times of the year including the winter maintenance period. Whenever a generator malfunctions or is scheduled for maintenance, the three STSs in that turbine may be maintained, repaired, or exchanged for other STSs needing maintenance or repair. One third of the STSs at Bonneville are scheduled for complete overhaul each year resulting in a three year maintenance cycle unless future developments indicate that longer life expectancy is possible.

3.2.1.2. Juvenile Bypass System. The Bonneville juvenile bypass facilities will receive preventive maintenance at all times of the year. During the juvenile fish passage season this will normally be above-water work such as maintenance of automatic systems, air lines, electrical systems, and monitoring equipment. During the winter maintenance period the systems may be dewatered downstream of the gatewell orifices. The systems will then be visually inspected in all accessible areas for damaged equipment and areas that may cause problems to the juvenile fish. Any problem areas identified are to be repaired if the project is able. In extreme cases the work will be contracted as soon as possible or repaired during the next winter maintenance period. Modifications and general maintenance to the channels are also to be completed at this time.

The trash racks are to be raked just prior to the juvenile fish passage season and whenever trash accumulations are suspected because of increased head across the trash racks (>1.5') or increased juvenile fish descaling. Additional raking of trash racks may be necessary when a storm brings large quantities of debris down river to the project. Gatewell orifices of the unit being raked will be closed during the procedure (applies only to the first powerhouse).

3.2.1.3. Turbines and Spillways. The maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires that units be shut down for up to two months (see 5. Dewatering Plans.). The maintenance schedules for these turbines and spillways will be coordinated with the fisheries agencies through the Corps' Fish Passage O&M Coordination Team. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the areas of fishway entrances, to keep predator fish from accumulating in the area of juvenile release sites, and to move juveniles downstream away from the project. The maintenance schedules for these turbines and spillways will reflect equal weighting given to fish, power, and water management and will be coordinated with the appropriate resource agencies.

Some types of maintenance on turbines will result in the requirement to operate the turbine throughout its full capability before returning the turbine to normal service. These operations will be coordinated.

3.2.2. Unscheduled Maintenance.

3.2.2.1. Submersible Traveling Screens. If an STS or VBS is found to be damaged or inoperative in an operating unit, the unit will be regarded as an unscreened unit. The screen will be repaired or replaced before returning the unit to normal service.

3.2.2.2. Juvenile Bypass System.

a. Bonneville Project's juvenile bypass systems are controlled by automatic systems. When an automatic system fails, it can usually be operated manually. This allows either facility to operate according to criteria while repair of the automatic system is completed. Orifices allow fish out of the gatewells into a bypass channel. If an orifice valve system becomes inoperative, it will be repaired expeditiously. When the orifices become plugged with debris they are pneumatically cleaned out (Powerhouse 1 is automatic; Powerhouse 2 is manual).

b. Inspect all STS gatewells daily. The project will clean them before they become half covered with debris. If, due to volume of debris, it is not possible to keep the gatewell surfaces at least half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated, except on a last on/first off basis, if required to be in compliance with other coordinated fishery measures. This is to maintain clean orifices and minimize fish injury. The first powerhouse gatewell orifices will be closed during the debarking operation. After debarking a gatewell, back-flush the orifice in that gatewell. Check gatewell drawdown.

CBFWA recommends the gatewells be cleaned before they become half covered by debris. The Corps is currently attempting to resolve this situation. A gatewell orifice sluice to remove debris and reduce fish handling is being developed.

c. **Bonneville First Powerhouse.** If any part of the dewatering screen, downwell, or juvenile release conduit fails, making this portion of the system unsafe for juvenile fish, the juveniles will be diverted to the ice and trash sluiceway. This operating mode will require the gate at the south end of the downstream migrant (DSM) channel to be removed and a stop-log installed at the north end so migrants will flow down into the ice and trash sluiceway channel. Assure that sluiceway gate 7A is opened to 72.0' msl, gate 10C is opened fully, and the ice and trash sluiceway end gate is open to provide safe transportation flows for juveniles. Forebay elevation will be kept above 74.0' msl. to the extent practicable. The bypass will then continue operating while repairs are completed. In either operating mode, the orifices will be cleaned with the air pressure system at least once per day, when plugged orifices are indicated, or after trash rack raking and gatewell debarking.

d. **Bonneville Second Powerhouse.** If the bypass system fails in the dewatering section, downwell, or release pipe, fish may be released through the emergency relief conduit. This operation will continue until repairs are accomplished or until the end of the fish passage season. Any decision on whether or not to shut this system down for dewatering and repairs will be made in consultation with the Fish Passage O&M Coordination Team. During this emergency operating mode, power generation will be minimized at the second powerhouse. Repairs will receive high priority.

e. During fishway inspection the VBSs may be found to be plugged or damaged. In these cases, the associated unit will be regarded as if unscreened and repairs will be made before returning the unit to normal service.

3.2.2.3. Turbines and Spillways.

If a spill gate becomes inoperable, the operator will immediately notify the Operations supervisor and project biologist to determine the best pattern to follow until repairs are completed. This interim operation shall be coordinated with the Fish Passage O&M Coordination Team.

3.3. Adult Fish Passage Facilities.

3.3.1. Scheduled Maintenance.

3.3.1.1. Fishway auxiliary water systems. Bonneville Project auxiliary water systems consist of gravity flow and hydroelectric generating systems. Preventive maintenance and normal repair are carried out as needed throughout the year. Trash racks for the AWS intakes will be raked when drawdown exceeds criteria. When practicable, rake trash racks during the time of day when fish passage is least affected.

3.3.1.2. Powerhouse and Spillway Adult Fish Collection Systems. Preventive maintenance and repair occurs throughout the year. During the adult fish passage season this maintenance will not involve any operations which will cause failure to comply with the adult fishway criteria except as specially coordinated or as needed for semi-annual maintenance. Inspection of those parts of the adult collection channel systems which require dewatering, such as diffusion gratings, leads, and entrance gates, will be scheduled once per year during the winter maintenance season while the system is dewatered, with one additional inspection during the fish passage season, unless a channel must be dewatered for fishway modifications or to correct observed problems (see 5. Dewatering Plans.). Inspection by a diver or underwater video system may be used for the underwater inspections. This scheduled inspection and any associated maintenance will occur during the winter maintenance period (in-water work period) unless specially coordinated. Any non-routine maintenance and fishway modifications will be handled on a case by case basis.

The project biologist or alternate Corps fisheries personnel will attend all dewatering activities potentially involving fish, as well as inspections, to provide fishery input (see 5. Dewatering Plans.).

3.3.1.3. Adult Fish Ladders and Counting Stations. The adult fish ladders will be dewatered once each year during the winter maintenance period. During this time the ladders will be inspected for blocked orifices, projections into the fishway that may injure fish, stability of the weirs, damaged picket leads, exit gate problems, loose diffusion gratings, unreadable or damaged staff gauges, defective diffusion valves, and malfunctioning operating equipment at the counting stations, as well as other potential problems. Problems identified throughout the passage year that do not affect fish passage, as well as those identified during the dewatered period, may then be repaired. Trash racks at the ladder exits will be raked when criteria is exceeded. When practicable, rake trash racks during the time of day when fish passage is least affected. Fish count station windows, light panels, and crowder panels will be cleaned as needed to achieve accurate counts, and when practicable, during the time of day when fish passage is least affected.

3.3.2. Unscheduled Maintenance.

3.3.2.1. Fishway auxiliary water systems. Most fishway auxiliary water systems are operated automatically. If the automatic system fails, then the system will be manually operated by project personnel to maintain operation according to standards. This will allow the fish facility to operate according to criteria while repair of the automatic system is carried out. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met.

a. First Powerhouse. If any of the valves or any other part of the system fails, then the project is to attempt to maintain criteria by adjusting those valves which continue to function. Conduit pressure must be monitored and not allowed to exceed the established limits. If this maneuver fails to keep the facility operating according to the adult fishway criteria and repairs cannot be made within 24 hours, then close powerhouse entrances 9, 21, 34, 58, and 62, one at a time, starting with gate 9 and proceed north.

If closing the orifice gate fails to achieve a minimum fishway head of 1.0 feet when tailwater is greater than 17.0 feet, then operation of newly modified gate 1 and gate 65 weirs becomes necessary. Operational guidelines of these gates appear in 2.5.1.2.c. First Powerhouse., 1. through 5.

When tailwater elevation is less than 17.0 feet and the gate 65 weir crest is at least 6.0 feet below tailwater, then operation of newly modified gates 1, 2, 64, and 65 becomes necessary. Operational guidelines of these gates is referenced in the paragraph above..

b. Spillway. Two separate fishway auxiliary water valves add water to each spillway ladder (Cascades Island and B-Branch ladders). If one of these valves or any other part of the system malfunctions, the functioning parts of the system are to be adjusted to compensate. If repairs cannot be made in 24 hours, close the sluice gate entrance, if open. This will divert the reduced available water to the entrance slots. If a head of 1.0 foot is still not achieved, stoplogs are to be added to the entrance slots until the desired head or a weir depth of not less than 6.0 feet below the tailwater surface is reached. At this point maintain the gate positions until the auxiliary water system is repaired.

c. Second Powerhouse. If either or both of the fishway auxiliary water turbines are unable to provide water sufficient to meet full criteria between 1 April and 31 August, raise the North Upstream Entrance (NUE) in 1.0 foot increments until the weir crest is 6.0 feet below the tailwater or a fishway head of at least 1.0 foot is achieved. If this fails to achieve the above criteria then apply the same procedure, until the criteria are achieved, using in addition the North Downstream Entrance (NDE), then the South Upstream Entrance (SUE), and finally the South Downstream Entrance (SDE). The weir crests for these entrances will not be raised above 6.0 feet below tailwater. If the correct fishway head is still not achieved after this procedure, then fully close NUE and operate in this configuration until repairs can be made to the system.

If one of the fishway water supply turbine units fails between 1 September and 31 March, during a time when tailwater is high enough that normal operation can't be maintained using the remaining fish unit, and repairs can't be made within 24 hours, then the ice and trash sluiceway will be used to supplement discharge to allow operation of the fishway according to the above standards. Between September 1 and 15, the juvenile and adult runs will be evaluated to decide if the sluice chute should be operated when one fish unit is out of service. Care will be taken to keep the trash chute screen free of debris. The downstream end gate will be raised briefly at least once weekly to flush trapped fish and debris out of the chute, or more frequently as coordinated with the Region.

If both of the fishway auxiliary water turbines fail between 1 September and 31 March, and repairs can't be made within 8 hours, then the ice and trash chute will be started up. The adult facility will be operated as follows:

1. Close NDE, SUE, and NUE.

2. Operate the SDE weir crest at 8.0 feet below tailwater.

3. Operate the floating orifice gates. However, if the backup fishway auxiliary water system must be used for a period exceeding 30 days, then block off as many of the center floating orifice gates as possible and open NDE with a weir depth of 8.0 feet below the tailwater surface. While under this configuration, power generation at the second powerhouse will be minimized to reduce fish attraction into this area.

If all auxiliary water systems fail or malfunction, then close SUE, NDE, and NUE and raise SDE weir crest to 6.0 feet below tailwater elevation with the floating orifice gates open. Maintain this configuration until the system is repaired. While under this configuration, power generation at the second powerhouse will be minimized to the extent practicable to reduce fish attraction into this area unless the first powerhouse facilities are dewatered.

Powerhouse 2 adult fishway diffusion system valves A3 and A4 have been found damaged and were removed. These valves were designed to be closed when tailwater drops below 11' and 9', respectively. Even though the valves cannot be closed, velocity in the channel has not been observed to exceed criteria.

3.3.2.2. Powerhouse and Spillway Adult Fish Collection Systems. Bonneville Project contains several types of fishway entrances. In most cases, if failures occur, the entrance can and will be operated manually by project personnel until repairs are made. If this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met. In those cases in which the failure will not allow the entrance to be operated manually, the gate will be maintained, to the extent possible, in an operational position. If this is not possible, the entrance will be repaired expediently, and the entrance will be returned to manual or automatic control at the earliest possible date.

3.3.2.3. Adult Fish Ladders and Counting Stations. The Bonneville first powerhouse ladder was completed in 1937 and the Bonneville second powerhouse ladder in 1981. Modification of the first powerhouse ladder was completed during the winter of 1981-82. The structures of the ladders include picket leads, counting stations, fishway exits, and overflow weirs with orifices. Picket leads can cause problems. Pickets with excessive spacing (greater than 1"), erosion of concrete around the leads, or missing pickets can allow fish into areas where escape is difficult. In some instances of picket lead failure, spare leads and spare installation slots are available. In these cases the spare leads are installed and the damaged leads are removed and repaired. In the remaining instances of picket lead failure or concrete erosion, the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problems will be made in consultation with the Fish Passage O&M Coordination Team.

4. Turbine Unit Operation and Maintenance.

4.1. Unit operating priority during the fish passage seasons.

Table V. Bonneville Dam Fish Passage Season Unit Operating Priority.

1st POWERHOUSE UNIT OPERATING PRIORITY	TIMES	2nd POWERHOUSE UNIT OPERATING PRIORITY
1,10,9,2,3,(5-8),4.	0500 - 2000	18,**11**,**17**,12,16,13,14,15.
	2000 - 0500	18,**17**,**11**,12,16,13,14,15.

- Flow distribution between powerhouses will be determined by CENPD-ET-WM.
- Unit 16 will follow unit 17 in priority if unit 18 is out of service.
- If unit 1 is out of service, replace it with unit 2 to maintain station service.

4.2. During the winter maintenance season, when powerhouse fish collection systems are operating, the operating priority sequence is unit 1, 10, 2, 18, and 11. Additional units will be selected in any sequence at the discretion of the powerhouse operators. Generally, when a unit in this list is not available, then an adjacent unit will be operated. When a fish collection channel is out of service the unit operating sequence will change accordingly, within the limitations of the project's power distribution requirements.

4.3. Guidelines for operation of the turbine units within 1% of peak efficiency and within cavitation limits at various head ranges are provided in Bonneville Dam Peak Turbine Efficiency Ranges, (p. BON-36)[2] .

4.4. To the extent technically feasible, turbines will be operated within +/-1% of peak turbine efficiency (appendix C), unless operation outside of that range is necessary to meet load requirements of the BPA administrator, whose load requests will be consistent with BPA's System Load Shaping Guidelines, avoid excess daytime spill (during the time of year when the 75 kcfs spill cap applies), or to comply with other coordinated fishery measures. BPA's System Load Shaping Guidelines (appendix C) apply between 15 March and 31 October. However, during the rest of the year the project will continue to operate units within the peak turbine efficiency range, except as specifically requested by BPA to do otherwise as power requirements demand.

CBFWA recommends operation of all units within 1% of peak turbine efficiency unless otherwise agreed.

4.5. If it is necessary to operate outside the +/- 1% peak efficiency range, then units which pass the least fish should be selected first. Assuming a preference to pass fish through the juvenile bypass system, units which pass the least fish will be selected first. Therefore, when units must be selected to operate outside the peak efficiency range, they will be chosen according to the following prioritized list, where not constrained by specific project limitations: (5-8), 3, 9, 10, 2, 1, 15, 14, 13, 16, 12, 17, 11, 18.

4.6. The project's turbine unit maintenance schedules will be reviewed by Project and Operations Division biologists for fishery impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project.

4.6.1. Unit 10 provides important attraction flow for adult fish and helps move juvenile fish out of an area of high

[2] The guidance provided is based on an assumption of greater control and gauging accuracy than was originally possible. Elements of Passage Improvements for Endangered Species (PIES) program, completed in 1994, addressed achieving greater actual turbine efficiency.

predation in the tailrace. Therefore, long-term outages will be avoided after the beginning of the juvenile fish passage season, particularly the first Spring Creek NFH fish release, until after the adult fall chinook and coho runs at the end of October.

4.6.2. Unit 1 provides important attraction flow for adult fish, and when the juvenile bypass system flow is reversed, it helps move juvenile fish downstream also. Therefore, long-term outages will be avoided after the beginning of the juvenile fish passage season, particularly the first Spring Creek NFH fish release, until after the adult fall chinook and coho runs at the end of October.

4.6.3. In the event of long-term outages at Bonneville powerhouses, out of service (OOS) units will be exercised periodically. Each unit will be operated 4-8 hours every two weeks to exercise governor components and clean wetted surfaces of corrosion, so that if needed, fish injury will be minimized and the units will be in good operating condition. This may be performed at night, daytime, or whenever unit cycling will have the least effect on fish passage.

4.7. Until problems with the PH2 hydraulic head gate operating system are corrected, the gates at units 11 through 18 will be set onto the latches. Oil leaks develop frequently when the system operates with normal pressure. Further related instructions are described in a memorandum from the project operations superintendent. [3]

[3] Memorandum for All Operations, from BON Chief of Operations, dated 23 September 1993. Subject: Powerhouse 2 Hydraulic Head Gate Operation.

BONNEVILLE DAM PEAK TURBINE EFFICIENCY RANGES

	FIRST POWERHOUSE				SECOND POWERHOUSE			
Head (ft)	Lower MW Limit	Lower Limit cfs	Upper MW Limit	Upper Limit cfs	Lower MW Limit	Lower Limit cfs	Upper MW Limit	Upper Limit cfs
34	14	6,116	26	11,258	29	12,047	39	16,478
35	14	6,114	27	11,278	29	12,055	40	16,578
36	15	6,112	28	11,297	30	12,063	41	16,578
37	16	6,158	29	11,328	31	12,070	43	16,627
38	16	6,205	30	11,360	32	12,078	44	16,677
39	17	6,251	31	11,391	33	12,086	45	16,727
40	17	6,318	32	11,422	34	12,044	47	16,777
41	18	6,371	33	11,464	35	12,022	49	16,826
42	19	6,424	34	11,506	36	11,960	51	16,876
43	19	6,476	35	11,547	37	11,918	53	16,926
44	20	6,529	36	11,589	38	11,881	55	17,008
45	21	6,582	37	11,631	39	11,844	56	17,090
46	22	6,646	38	11,646	39	11,807	58	17,173
47	22	6,711	39	11,661	40	11,770	59	17,255
48	23	6,775	40	11,677	41	11,733	61	17,337
49	24	6,839	41	11,692	42	11,747	63	17,338
50	25	6,904	41	11,707	43	11,760	65	17,338
51	25	6,968	42	11,722	44	11,774	66	17,339
52	26	7,030	43	117,379	45	11,787	68	17,339
53	27	7,091	44	11,752	46	11,801	70	17,340
54	28	7,153	45	11,768	47	11,842	72	17,340
55	29	7,214	46	11,783	48	11,884	73	17,341
56	29	7,276	46	11,798	49	11,925	75	17,342
57	30	7,337	47	11,813	51	11,967	76	17,342
58	31	7,399	48	11,828	52	12,008	77	17,343
59	32	7,427	49	11,844	53	12,050	77	17,343
60	32	7,455	50	11,859	54	12,091	77	17,344
61	33	7,482	51	11,874	55	12,103	77	16,967
62	33	7,510	52	11,889	56	12,115	77	16,590
63	34	7,538	53	11,904	57	12,128	77	16,214
64	34	7,566	54	11,919	58	12,140	77	15,837
65	35	7,593	55	11,935	59	12,152	77	15,460
66	36	7,621	56	11,950	60	12,164	77	15,083
67	36	7,649	58	11,965	61	12,176	77	14,706
68	37	7,677	58	11,951	62	12,189	77	14,330
69	38	7,704	59	11,937	63	12,201	77	13,953
70	39	7,732	59	11,923	64	12,213	77	13,576

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best information currently available.

5. Dewatering Plans.

5.1. Guidelines for Dewatering and Fish Handling Plans (appendix G) have been developed and are followed for most project facilities dewaterings. These plans include consideration for fish safety and are consistent with the following general guidance. The appropriate plans are reviewed by participants before each salvage operation. Although it isn't a complete dewatering, the procedure for reversing flow in the PH1 DSM is also included in appendix G.

5.2. The project fish biologist and/or alternate Corps fisheries personnel will attend all project activities involving fish handling.

5.3. The fisheries agencies and tribes will be will be invited to assist in any dewatering, and at a minimum, will be represented at all ladder dewaterings by the WDFW fish counting program supervisor or an alternate.

5.4. Juvenile bypass systems. Key elements of the Guidelines for Dewatering and Fish Handling Plans (appendix G) for JBS flow reversal are shown in 5.4.1. through 5.4.5., below.

5.4.1. With some exceptions, a project biologist or biological technician will attend all activities which involve dropping the JBS water surface below the end of the dewatering screen. One exception is when an operator with recent successful experience reverses PH1 JBS flow, as when required for research which requires flow through the outlet to be stopped and started repeatedly. Another similar exception is under the same circumstances at the PH2 JBS when the ERG gate is opened and closed.

5.4.2. Personnel involved in use of the sampling facilities will be advised before facilities are drained.

5.4.3. The trash sweeps will be turned off of automatic control.

5.4.4. Flow through the dewatering screen will be minimized before the water level drops below the upper end of the screen.

5.4.5. The area beneath the dewatering screen will be filled before allowing water in the channel to rise to the elevation of the dewatering screen.

5.5. Adult Fish Ladder.

5.5.1. Scheduled Maintenance.

5.5.1.1. When possible, operate the ladder to be dewatered at a reduced flow for at least 24 hours, and up to 96 hours prior to dewatering. Reduced flow is defined as less than criterion operation, but more than orifice flow.

5.5.1.2. Discontinue all fishway auxiliary water supply at least 24 hours but no more than 96 hours prior to dewatering.

5.5.1.3. The project biologist will assure that fish rescue equipment is available, and will coordinate to ensure adequate numbers of personnel will be available to move fish out of the dewatered ladder.

5.5.1.4. Project personnel will install head gates to shut down ladder flow. Where possible, a minimum flow of 1-2 inches will be maintained in the ladder until fish are rescued.

5.5.1.5. The project biologist or alternate Corps fisheries personnel will oversee fish rescue when the ladders are dewatered. The project biologist will invite fishery agency and/or tribal biologists' participation in the dewatering. Rescue personnel will walk the inside of the ladder from the head gates down to tailwater, salvaging all fish either by moving fish to tailwater within the ladder flow, or capturing and placing the fish in a large water filled tank, which is then transported to the forebay or tailrace depending on the fish' life stage (adults to forebay, juveniles to tailrace) for release.

5.5.2. Unscheduled Maintenance.

5.5.2.1. When possible, discontinue fishway auxiliary water and operate ladder at orifice flow as long as possible (prefer 3-24 hours) prior to dewatering.

5.5.2.2. Follow steps 5.5.1.3. through 5.5.1.5. above.

5.6. Powerhouse Fish Collection System.

5.6.1. Scheduled Maintenance.

5.6.1.1. During the pumping or draining operation to dewater a portion or all of the collection channel, the water level will not be allowed to drop to a level which strands fish. Adequate inspections will be conducted to ensure that stranding does not occur.

5.6.1.2. The project biologist will assure that rescue equipment is available if needed.

5.6.1.3. The project biologist will provide technical guidance for fish safety and will assist directly as needed in rescue operations.

5.7. Turbines.

5.7.1. Immediately before setting the head gates, remove juvenile fish from the gatewell(s) which will be drained. This is done by use of a special dipping basket. Typically, one of the three gatewells is drained to allow ventilation into the draft tube.

5.7.2. When possible, place head gates and tail logs immediately after turbine unit is shut down if draft tube is to be dewatered.

5.7.3. Gatewells which will be drained when the turbine units are dewatered will have fish dipped out before draining.

5.7.4. If a turbine unit draft tube is to be dewatered and the turbine unit has been idle, it will be operated when possible at "speed/no load", and stop logs will then be placed immediately.

5.7.5. Water levels in the draft tube will not be allowed to drop to a level which strands fish. Adequate inspections will be conducted to ensure that stranding does not occur.

5.7.6. Fish rescue personnel will inspect dewatered turbine draft tubes and intakes as soon as the water levels reach a depth permitting visual inspection and the hatch cover is opened. The project biologist and/or alternate Corps fisheries personnel will provide technical guidance for fish safety and will directly participate in fish salvage.

5.7.7. The project biologist will invite Fish Passage O&M Coordination Team fishery biologists' participation in the dewatering, and will assure that rescue equipment is available if needed.

5.7.8. If the unit is planned to be out of service and partially drained for less than 4 days and low numbers of fish are trapped, then it will not be necessary to remove fish from draft tubes as long as an adequate "safety pool" is maintained. Adequate inspections will be conducted to ensure the safety pool is maintained and fish are in good condition.

6. Endnotes.

[1] Evaluation of Ice and Trash Sluiceway at Bonneville Dam as a Bypass System for Juvenile Salmonids, 1981. Calculated from hydraulic equation to achieve approximately 475 cfs (3.7 feet of head).

[2] Downstream Movements of Salmonids at Bonneville Dam. Gauley, Anas, and Schlotherbeck, BCF, USFWS. Special Scientific Report, Fisheries No. 236 (January, 1958).

SECTION 3

THE DALLES DAM

The Dalles Dam

1. Fish Passage Information. The locations of fish passage facilities are shown on the following general site maps for The Dalles Dam (p. TDA-2 through TDA-4). Dates for project operations for fishery purposes and special operations are listed in Table I.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. Turbine units at The Dalles Dam are not screened. Juvenile fish passage facilities at The Dalles Dam consist of the ice and trash sluiceway and one 6" orifice in each gatewell. The ice and trash sluiceway is a rectangular channel extending along the total length of the 22 unit powerhouse and is located in the forebay side of the powerhouse. Gatewell orifices allow flow into the sluiceway, providing a potential means of passing fish from the gatewells to the sluiceway. When any of the sluiceway gates (located in the forebay side of the sluiceway) are opened, water and juvenile migrants are skimmed from the forebay into the sluiceway and deposited in the tailrace downstream of the project.

1.1.2. Juvenile Migration Timing. The dates of peak passage of Snake River steelhead at The Dalles Dam have ranged from 11 May in 1978 to 21 June in 1977. Peak passage of Snake River spring chinook at The Dalles Dam ranged from 8 May in 1976 to 17 June in 1977. Travel time from the upper Snake River to The Dalles Dam ranges from 12 to 39 days for yearling chinook and 10 to 40 days for steelhead[1] (See 6. Endnotes.). The primary juvenile passage period at The Dalles Dam is April through November. The following passage timing data were generated from studies of The Dalles Dam sluiceway in 1977-79, and 1981-82. NMFS conducted smolt monitoring at The Dalles in 1989, 1990, and 1991. The data include Snake River and Columbia River migrants.

Diel passage at The Dalles sluiceway is affected by spill and flow conditions. In 1977, peak passage occurred from 0500 to 2200[2] (See 6. Endnotes.); in 1981, from 1200 to 1300; in 1982, from 0600 to 2200 (Willis, 1982). Average April-June flows at The Dalles was 121 kcfs in 1977, 253 kcfs in 1981, and 325 kcfs in 1982. In years of consistently high flow and spill, fish may be distributed higher in the water column and daytime passage may increase.

1.1.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, throughout the year, summarizing project operations. The weekly reports will provide an overview of how the project and the fish

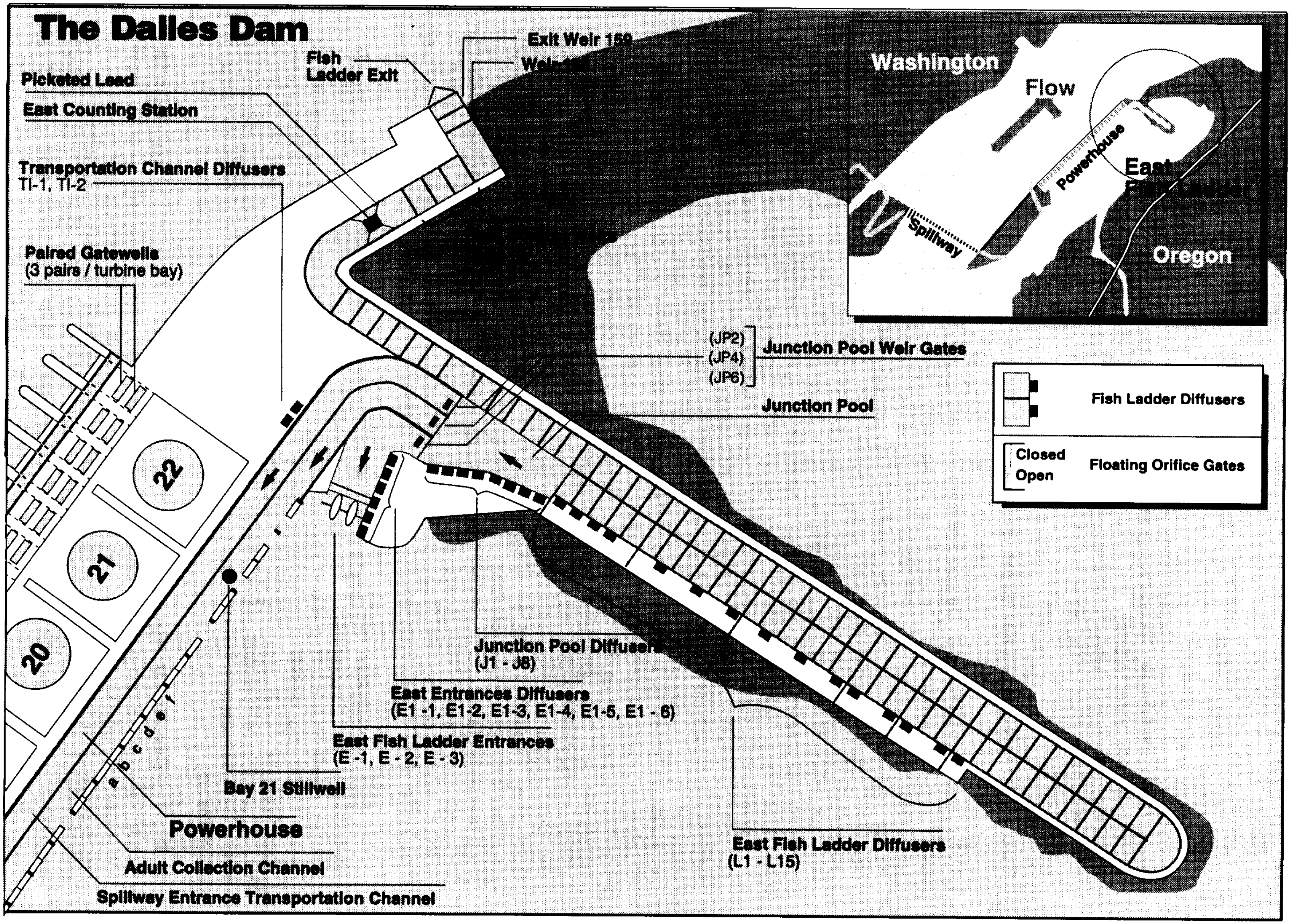


Figure 4 The Dalles Dam East Fish Ladder

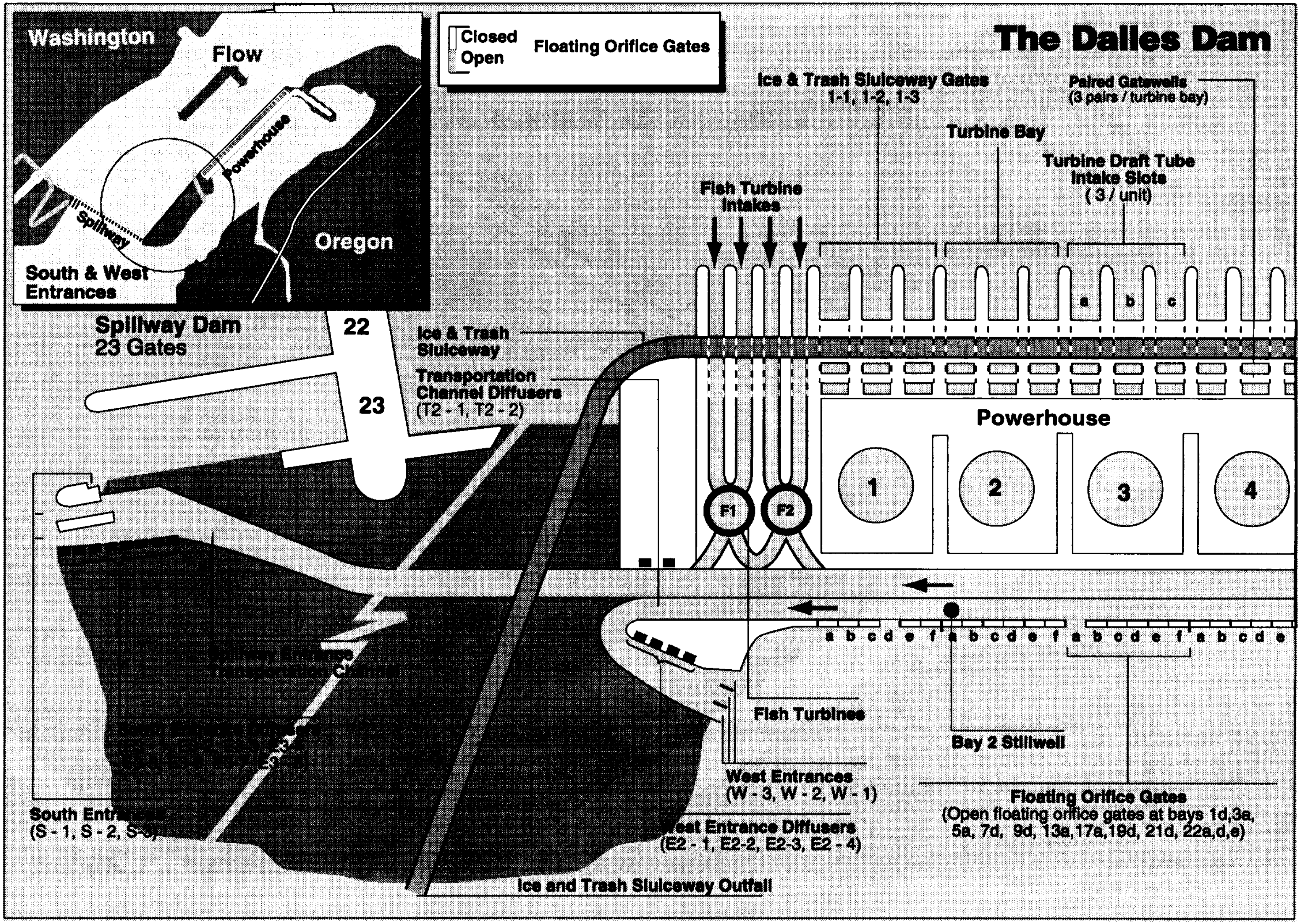
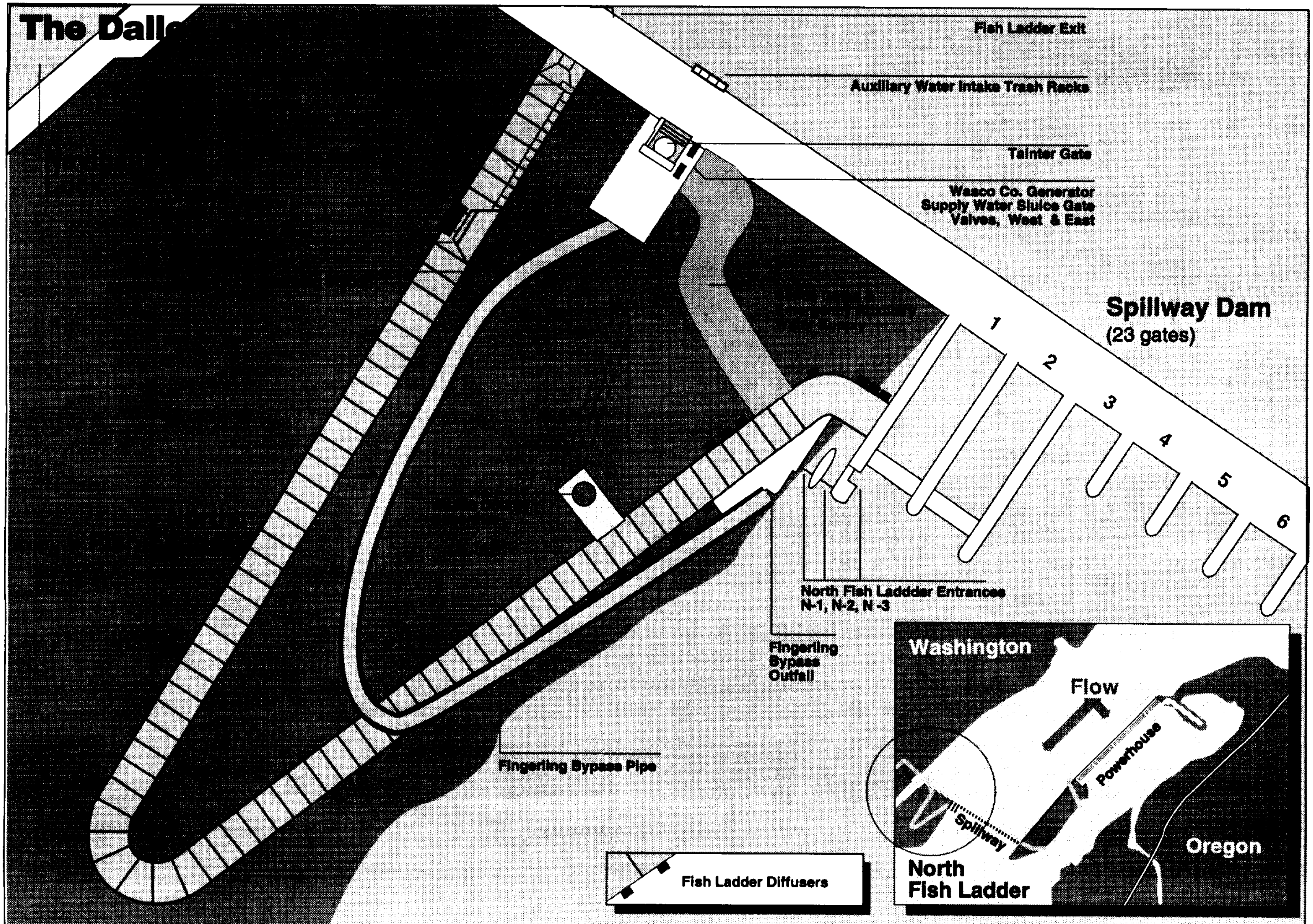


Figure 5 The Dalles Dam South and West Fish Ladder Entrances

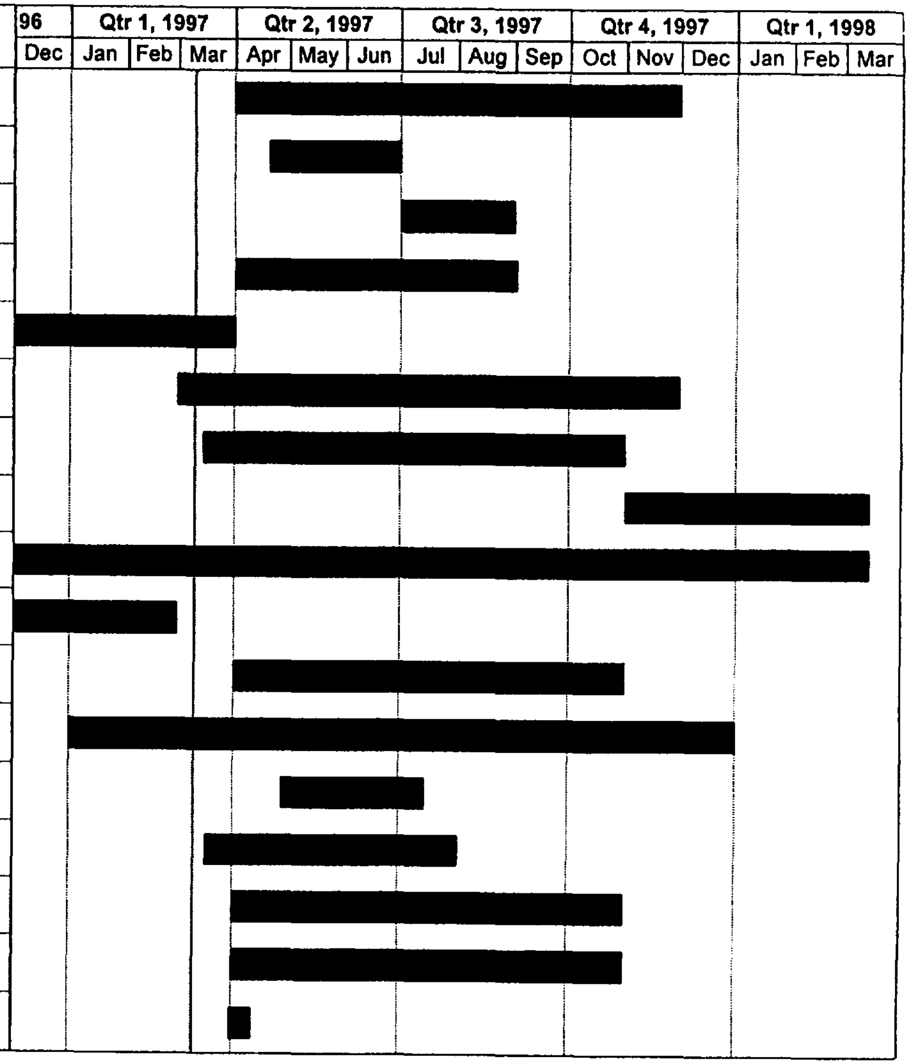
Revised March 1, 1997



Figur~ 6 The Dalles Dam North Fish Ladder and Spillway

Table I. Dates of Project Operations for Fishery Purposes at The Dalles Dam, 1997.

ID	Name	Start	Finish	Notes
1	Juvenile Fish Pasage Period	4/1/97	11/30/97	
2	Spill Spring	4/20/97	6/30/97	64% for 24 hours
3	Summer Spill	7/1/97	8/31/97	64% for 24 hours
4	Dissolved Gas Monitoring	4/1/97	9/1/97	Forebay and tailrace stations
5	Bypass Facility Maintence	12/1/96	3/31/97	
6	Turbine Operation for Adult/Junvenile Fish	3/1/97	11/30/97	Unit priorities vary during this time
7	Turbine 1% Operation	3/15/97	10/31/97	
8	Turbine 1% Operation Dev	11/1/97	3/14/98	May deviate if power is required
9	Adult Passage Period	12/1/96	3/14/98	
10	Adult Facilty Maintence	12/1/96	2/28/97	
11	Adult Fish Counting	4/1/97	10/31/97	0400-2000 PST
12	Weekly Reporting	1/1/97	12/31/97	Sunday - Saturday
13	Spill Efficiency Test	4/28/97	7/14/97	See App. A for additional details
14	Hydroacoustic Evaluation	3/17/97	8/1/97	See App. A for additional details
15	Adult Fish Passage Evaluation	4/1/97	10/31/97	See App. A for additional details
16	Predator/Prey Study (BPA)	4/1/97	10/31/97	See App. A for additional details
17	Spillway Survival Study	3/31/97	4/11/97	See App. A for additional details



passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any unusual activities which occurred at the project which may affect fish passage. The weekly reports shall cover a Sunday through Saturday time period and shall be sent to CENPP-CO as soon as possible the following week. The project biologist shall prepare an annual report by 31 January, summarizing the operation of the project fish passage facilities for the previous year. The report will cover from the beginning of one adult fish facility winter maintenance season to the beginning of the next.

Table II. The Dalles Dam Juvenile Migration Timing, 1981, 1982, and 1989 - 1991.

% PAST PROJECT	YEAR/DATE				
	1981	1982	1989[a]	1990[b]	1991
Yearling Chinook					
10%	5/2	5/2	----	4/17	4/23
90%	5/31	5/30	----	5/28	6/19
Sub-yearling Chinook					
10%	----	----	6/13	----	4/17
90%	----	----	8/01	----	8/1
Sockeye					
10%	5/8	5/2	----	----	5/22
90%	6/6	5/30	----	----	6/5
Steelhead					
10%	5/1	5/1	----	4/26	5/10
90%	5/31	5/30	----	6/2	6/7

No monitoring in 1992.

Fall chinook are not included due to incomplete sampling.

Source: ODFW sluiceway passage research 1981, 1982. NMFS smolt monitoring 1989, 1990, 1991.

[a] NMFS gatewell sampling terminated on 9/1 in 1989; gatewell and airlift operations terminated on 8/31/90.

[b] Recapture of Corps barge release fish on 5/29 is not included in determination of 10 and 90% migration timing for yearling chinook and steelhead.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. Adult fish passage facilities at The Dalles Dam are composed of a north shore fish ladder which passes fish collected at the north end of the spillway, and an east fish ladder which passes those fish collected at the south end of the spillway and across the downstream face of the powerhouse. A fish lock exists at the east end of the powerhouse but is not operated.

A small hydropower facility utilizing the north fishway ladder auxiliary water supply was constructed in 1991 and is monitored by the North Wasco PUD. Possible impacts of this facility on operation of the fish passage facilities are monitored closely by The Dalles project personnel.

1.2.2. Adult Migration Timing. Upstream migrants are present at The Dalles Dam throughout the year. However, passage through the winter months is relatively light and there is no regular fish counting. The fish counting schedule at The Dalles Dam is described in appendix A. Annual winter maintenance of adult fish facilities is scheduled from 1 December through February (In-water work period) to minimize impacts on upstream migrants. Table III. shows the passage period by species and the earliest and latest recorded dates of peak passage since 1957[3] (See 6. Endnotes.).

Table III. The Dalles Dam Adult Migration Timing, 1957-1995.

Species	Count Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 -5/31	4/17	5/13
Summer Chinook	6/1 - 8/1	6/6	8/1
Fall Chinook	8/4 - 10/31	9/3	9/16
Sockeye	4/1 - 10/31	6/20	7/10
Steelhead	4/1 - 10/31	7/9	9/22
Coho	4/1 - 10/31	9/3	9/27

2. Project Operation.

2.1. General.

2.1.1. Research, non-routine maintenance, and other fishery related activities will not be conducted within 100' of any fishway entrance or exit, or directly in, above, or adjacent to any fishway, unless concurred with by regional fisheries managers through ESA and other fish passage issues. Alternate actions will be considered by district and project biologists in conjunction with the fishery managers on a case by case basis. Emergency situations should be dealt with immediately by the project in consultation with the project or district biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident.

2.2. Spill Management.

2.2.1. The spill schedule on p. TDA-9 through TDA-13 will be used for juvenile fish passage during 2000-0500 hours (Juvenile Passage Period).

2.2.2. The spill schedule on pp. TDA-14 through TDA-18 will be used for adult fish passage during 0500-2000 hours. (Adult Passage Period).

2.3. Dissolved Gas Management and Control. Additional spill management will be based on dissolved gas monitoring data and the observed condition of migrant juvenile and adult fish, along with juvenile migration data. Total dissolved gas monitoring will be conducted by the Corps at The Dalles Dam forebay automated station and reported every four hours from 1 April until Labor Day. The dissolved gas monitoring system is described in detail in appendix D.

Excessive Total Dissolved Gas levels, which may harm fish, will be controlled to the extent possible, subject to river flow conditions. Control measures will include system spill allocations through the spill priority list issued by RCC, nighttime or daytime spill limits, and shaping of spill discharge.

SPILL SCHEDULE FOR JUVENILE FISH AT THE DALLES DAM
(2000-0500)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
1																							1	1.5
2																							2	3.0
2	1																						3	4.5
2	2																						4	6.0
2	2	1																					5	7.5
2	2	2																					6	9.0
2	2	2	1																				7	10.5
2	2	2	2																				8	12.0
2	2	2	2	1																			9	13.5
2	2	2	2	2																			10	15.0
2	2	2	2	2	1																		11	16.5
2	2	2	2	2	2																		12	18.0
2	2	2	2	2	2	1																	13	19.5
2	2	2	2	2	2	2																	14	21.0
2	2	2	2	2	2	2	1																15	22.5
2	2	2	2	2	2	2	2																16	24.0
2	2	2	2	2	2	2	2	1															17	25.5
2	2	2	2	2	2	2	2	2															18	27.0
2	2	2	2	2	2	2	2	2	1														19	28.5
2	2	2	2	2	2	2	2	2	1	1													20	30.0
2	2	2	2	2	2	2	2	2	2	1													21	31.5
2	2	2	2	2	2	2	2	2	2	1	1												22	33.0
2	2	3	2	2	2	2	2	2	2	1	1												23	34.5
2	2	3	3	2	2	2	2	2	2	1	1												24	36.0
2	2	3	3	3	2	2	2	2	2	1	1												25	37.5
2	2	3	3	3	2	2	2	2	2	2	1												26	39.0
2	2	3	3	3	3	2	2	2	2	2	1												27	40.5
2	2	3	3	3	3	3	2	2	2	2	1												28	42.0
2	2	3	3	3	3	3	2	2	2	2	2												29	43.5
2	2	3	3	3	3	3	3	2	2	2	2												30	45.0
2	2	3	3	3	3	3	3	3	2	2	2												31	46.5
2	2	3	3	3	3	3	3	3	2	2	2	1											32	48.0
2	2	3	3	3	3	3	3	3	3	2	2	1											33	49.5

SPILL SCHEDULE FOR JUVENILE FISH AT THE DALLES DAM

(2000-0500)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
2	2	4	3	3	3	3	3	3	3	2	2	1											34	51.0
2	3	4	3	3	3	3	3	3	3	2	2	1											35	52.5
3	3	4	3	3	3	3	3	3	3	2	2	1											36	54.0
3	3	4	3	3	3	3	3	3	3	2	2	1	1										37	55.5
3	3	4	3	3	3	3	3	3	3	3	2	1	1										38	57.0
3	3	4	4	3	3	3	3	3	3	3	2	1	1										39	58.5
3	3	4	4	3	3	3	3	3	3	3	3	1	1										40	60.0
3	3	4	4	4	3	3	3	3	3	3	3	1	1										41	61.5
3	3	4	4	4	3	3	3	3	3	3	3	2	1										42	63.0
3	3	4	4	4	4	3	3	3	3	3	3	2	1										43	64.5
3	3	4	4	4	4	4	3	3	3	3	3	2	1										44	66.0
3	3	4	4	4	4	4	4	3	3	3	3	2	1										45	67.5
3	3	4	5	4	4	4	4	3	3	3	3	2	1										46	69.0
3	3	4	5	5	4	4	4	3	3	3	3	2	1										47	70.5
3	3	4	5	5	4	4	4	4	3	3	3	2	1										48	72.0
3	3	4	5	5	4	4	4	4	3	3	3	2	2										49	73.5
3	3	4	5	5	5	4	4	4	3	3	3	2	2										50	75.0
3	3	5	5	5	5	4	4	4	3	3	3	2	2										51	76.5
3	3	5	5	5	5	4	4	4	3	3	3	2	2	1									52	78.0
3	4	5	5	5	5	4	4	4	3	3	3	2	2	1									53	79.5
4	4	5	5	5	5	4	4	4	3	3	3	2	2	1									54	81.0
4	4	5	5	5	5	4	4	4	4	3	3	2	2	1									55	82.5
4	4	5	5	5	5	5	4	4	4	3	3	2	2	1									56	84.0
4	4	5	5	5	5	5	4	4	4	4	3	2	2	1									57	85.5
4	4	5	6	5	5	5	4	4	4	4	3	2	2	1									58	87.0
4	4	5	6	5	5	5	4	4	4	4	3	3	2	1									59	88.5
4	4	5	6	5	5	5	5	4	4	4	3	3	2	1									60	90.0
4	4	5	6	6	5	5	5	4	4	4	3	3	2	1									61	91.5
4	5	5	6	6	5	5	5	4	4	4	3	3	2	1									62	93.0
5	5	5	6	6	5	5	5	4	4	4	3	3	2	1									63	94.5
5	5	5	6	6	6	5	5	4	4	4	3	3	2	1									64	96.0
5	5	5	6	6	6	5	5	4	4	4	3	3	2	2									65	97.5
5	5	5	6	6	6	5	5	5	4	4	3	3	2	2									66	99.0
5	5	5	6	6	6	5	5	5	4	4	4	3	2	2									67	100.5

SPILL SCHEDULE FOR JUVENILE FISH AT THE DALLES DAM

(2000-0500)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
5	5	5	6	6	6	5	5	5	4	4	4	3	3	2									68	102.0
5	5	5	6	6	6	5	5	5	5	4	4	3	3	2									69	103.5
5	5	5	6	6	6	6	5	5	5	4	4	3	3	2									70	105.0
5	5	6	6	6	6	6	5	5	5	4	4	3	3	2									71	106.5
5	5	6	7	6	6	6	5	5	5	4	4	3	3	2									72	108.0
5	6	6	7	6	6	6	5	5	5	4	4	3	3	2									73	109.5
5	6	6	7	6	6	6	6	5	5	4	4	3	3	2									74	111.0
6	6	6	7	6	6	6	6	5	5	4	4	3	3	2									75	112.5
6	6	6	7	7	6	6	6	5	5	4	4	3	3	2									76	114.0
6	6	7	7	7	6	6	6	5	5	4	4	3	3	2									77	115.5
6	6	7	7	7	7	6	6	5	5	4	4	3	3	2									78	117.0
6	6	7	7	7	7	6	6	5	5	5	4	3	3	2									79	118.5
6	6	7	7	7	7	6	6	6	5	5	4	3	3	2									80	120.0
6	6	7	8	7	7	6	6	6	5	5	4	3	3	2									81	121.5
6	6	7	8	7	7	7	6	6	5	5	4	3	3	2									82	123.0
6	6	7	8	7	7	7	6	6	6	5	4	3	3	2									83	124.5
6	6	7	8	8	7	7	6	6	6	5	4	3	3	2									84	126.0
6	6	8	8	8	7	7	6	6	6	5	4	3	3	2									85	127.5
6	7	8	8	8	7	7	6	6	6	5	4	3	3	2									86	129.0
7	7	8	8	8	7	7	6	6	6	5	4	3	3	2									87	130.5
7	7	8	8	8	8	7	6	6	6	5	4	3	3	2									88	132.0
7	7	8	9	8	8	7	6	6	6	5	4	3	3	2									89	133.5
7	7	8	9	8	8	7	6	6	6	5	4	4	3	2									90	135.0
7	7	8	9	8	8	7	7	6	6	5	4	4	3	2									91	136.5
7	7	8	9	8	8	7	7	7	6	5	4	4	3	2									92	138.0
7	7	8	9	9	8	7	7	7	6	5	4	4	3	2									93	139.5
7	7	8	9	9	8	8	7	7	6	5	4	4	3	2									94	141.0
7	7	8	9	9	8	8	7	7	6	5	5	4	3	2									95	142.5
7	7	8	9	9	9	8	7	7	6	5	5	4	3	2									96	144.0
7	7	8	9	9	9	8	7	7	6	6	5	4	3	2									97	145.5
7	8	8	9	9	9	8	7	7	6	6	5	4	3	2									98	147.0
7	8	8	9	9	9	8	7	7	7	6	5	4	3	2									99	148.5
7	8	9	9	9	9	8	7	7	7	6	5	4	3	2									100	150.0
8	8	9	9	9	9	8	7	7	7	6	5	4	3	2									101	151.5

SPILL SCHEDULE FOR JUVENILE FISH AT THE DALLES DAM

(2000-0500)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
8	8	9	10	9	9	8	7	7	7	6	5	4	3	2									102	153.0
8	8	9	10	9	9	8	7	7	7	6	5	5	3	2									103	154.5
8	8	9	10	9	9	8	7	7	7	6	5	5	4	2									104	156.0
8	8	9	10	9	9	8	7	7	7	6	5	5	4	3									105	157.5
8	8	9	10	9	9	8	7	7	7	6	5	5	4	3	1								106	159.0
8	8	9	10	9	9	8	7	7	7	6	5	5	4	3	2								107	160.5
8	8	9	10	9	9	8	8	7	7	6	5	5	4	3	2								108	162.0
8	8	9	10	9	9	8	8	8	7	6	5	5	4	3	2								109	163.5
8	8	9	10	10	9	8	8	8	7	6	5	5	4	3	2								110	165.0
8	8	9	10	10	9	9	8	8	7	6	5	5	4	3	2								111	166.5
8	8	9	10	10	9	9	8	8	7	6	6	5	4	3	2								112	168.0
8	8	9	10	10	10	9	8	8	7	6	6	5	4	3	2								113	169.5
8	8	9	10	10	10	9	8	8	7	7	6	5	4	3	2								114	171.0
8	9	9	10	10	10	9	8	8	7	7	6	5	4	3	2								115	172.5
8	9	9	10	10	10	9	8	8	8	7	6	5	4	3	2								116	174.0
8	9	10	10	10	10	9	8	8	8	7	6	5	4	3	2								117	175.5
8	9	10	10	10	10	9	9	8	8	7	6	5	4	3	2								118	177.0
8	9	10	10	10	10	9	9	9	8	7	6	5	4	3	2								119	178.5
8	9	10	10	10	10	9	9	9	8	7	6	5	4	3	2	1							120	180.0
8	9	10	10	10	10	9	9	9	8	7	6	5	4	3	2	2							121	181.5
8	9	10	10	10	10	9	9	9	8	7	6	5	4	3	3	2							122	183.0
8	9	10	10	10	10	9	9	9	8	7	6	5	4	4	3	2							123	184.5
8	9	10	10	10	10	9	9	9	8	7	6	5	5	4	3	2							124	186.0
8	9	10	10	10	10	9	9	9	8	7	6	6	5	4	3	2							125	187.5
8	9	10	10	10	10	9	9	9	8	7	7	6	5	4	3	2							126	189.0
8	9	10	10	10	10	10	9	9	8	7	7	6	5	4	3	2							127	190.5
8	9	10	10	10	10	10	10	9	8	7	7	6	5	4	3	2							128	192.0
8	9	10	10	10	10	10	10	9	8	8	7	6	5	4	3	2							129	193.5
8	9	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2							130	195.0
8	9	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	1						131	196.5
8	9	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2						132	198.0
8	9	10	10	10	10	10	10	9	9	8	7	6	5	4	3	3	2						133	199.5
8	9	10	10	10	10	10	10	9	9	8	7	6	5	4	4	3	2						134	201.0
8	9	10	10	10	10	10	10	9	9	8	7	6	5	5	4	3	2						135	202.5

SPILL SCHEDULE FOR JUVENILE FISH AT THE DALLES DAM
(2000-0500)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
8	9	10	10	10	10	10	10	9	9	8	7	6	6	5	4	3	2						136	204.0
8	9	10	10	10	10	10	10	9	9	8	7	7	6	5	4	3	2						137	205.5
8	9	10	10	10	10	10	10	9	9	8	8	7	6	5	4	3	2						138	207.0
8	9	10	10	10	10	10	10	9	9	9	8	7	6	5	4	3	2						139	208.5
8	9	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2						140	210.0
																							0	0.0

SPILL SCHEDULE FOR ADULT FISH AT THE DALLES DAM
(0500-2000)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
																						1	1	1.5
1																						1	2	3.0
1																					1	1	3	4.5
1	1																				1	1	4	6.0
1	1																			1	1	1	5	7.5
1	1	1																		1	1	1	6	9.0
1	1	1																	1	1	1	1	7	10.5
1	1	1	1																1	1	1	1	8	12.0
1	1	1	1															1	1	1	1	1	9	13.5
1	1	1	1	1														1	1	1	1	1	10	15.0
1	1	1	1	1													1	1	1	1	1	1	11	16.5
1	1	1	1	1	1												1	1	1	1	1	1	12	18.0
1	1	1	1	1	1											1	1	1	1	1	1	1	13	19.5
1	1	1	1	1	1	1										1	1	1	1	1	1	1	14	21.0
1	1	1	1	1	1	1									1	1	1	1	1	1	1	1	15	22.5
1	1	1	1	1	1	1	1								1	1	1	1	1	1	1	1	16	24.0
1	1	1	1	1	1	1	1							1	1	1	1	1	1	1	1	1	17	25.5
1	1	1	1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	18	27.0
1	1	1	1	1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	19	28.5
1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	20	30.0
1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	21	31.5
1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	22	33.0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	23	34.5
1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	24	36.0
1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	25	37.5
1	1	1	1	1	1	1	1	1	1	2	1	2	1	2	1	1	1	1	1	1	1	1	26	39.0
1	1	1	1	1	1	1	1	2	1	2	1	2	1	2	1	1	1	1	1	1	1	1	27	40.5
1	1	1	1	1	1	1	1	2	1	2	1	2	1	2	1	2	1	1	1	1	1	1	28	42.0
1	1	1	1	1	1	2	1	2	1	2	1	2	1	2	1	2	1	1	1	1	1	1	29	43.5
1	1	1	1	1	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	1	1	30	45.0
1	1	1	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	1	1	31	46.5
1	1	1	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	32	48.0
1	1	1	1	2	1	2	1	2	2	2	1	2	1	2	1	2	1	2	1	2	1	1	33	49.5
1	1	1	1	2	1	2	1	2	2	2	2	2	1	2	1	2	1	2	1	2	1	1	34	51.0

SPILL SCHEDULE FOR ADULT FISH AT THE DALLES DAM

(0500-2000)

BAY NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	FEET	KCFS
1	1	1	1	2	1	2	2	2	2	2	2	2	1	2	1	2	1	2	1	2	1	1	35	52.5
1	1	1	1	2	1	2	2	2	2	2	2	2	2	2	1	2	1	2	1	2	1	1	36	54.0
1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	1	2	1	1	37	55.5
1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	1	1	38	57.0
1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	39	58.5
1	1	1	1	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	1	2	1	1	40	60.0
1	1	1	1	2	2	2	2	2	2	3	2	3	2	2	2	2	2	2	1	2	1	1	41	61.5
1	1	1	1	2	2	2	2	2	2	3	2	3	2	3	2	2	2	2	1	2	1	1	42	63.0
1	1	1	1	2	2	2	2	3	2	3	2	3	2	3	2	2	2	2	1	2	1	1	43	64.5
1	1	1	1	2	2	2	2	3	2	3	2	3	2	3	2	2	2	2	2	2	1	1	44	66.0
1	1	1	1	2	2	3	2	3	2	3	2	3	2	3	2	2	2	2	2	2	1	1	45	67.5
1	1	1	1	2	2	3	2	3	2	3	2	3	2	3	2	3	2	2	2	2	1	1	46	69.0
1	1	1	1	2	2	3	2	3	2	3	3	3	2	3	2	3	2	2	2	2	1	1	47	70.5
1	1	1	1	2	2	3	2	3	2	3	3	3	2	3	2	3	2	3	2	2	1	1	48	72.0
1	1	1	1	2	2	3	2	3	3	3	3	3	2	3	2	3	2	3	2	2	1	1	49	73.5
1	1	1	1	2	2	3	2	3	3	3	3	3	3	3	2	3	2	3	2	2	1	1	50	75.0
1	1	1	2	2	2	3	2	3	3	3	3	3	3	3	2	3	2	3	2	2	1	1	51	76.5
1	1	1	2	2	2	3	2	3	3	3	3	3	3	3	3	3	2	3	2	2	1	1	52	78.0
1	1	2	2	2	2	3	2	3	3	3	3	3	3	3	3	3	2	3	2	2	1	1	53	79.5
1	1	2	2	2	2	3	2	3	3	3	3	3	3	3	3	3	3	3	2	2	1	1	54	81.0
1	1	2	2	2	2	3	2	3	3	3	3	4	3	3	3	3	3	3	2	2	1	1	55	82.5
1	1	2	2	2	3	3	2	3	3	3	3	4	3	3	3	3	3	3	2	2	1	1	56	84.0
1	1	2	3	2	3	3	2	3	3	3	3	4	3	3	3	3	3	3	2	2	1	1	57	85.5
1	1	2	3	2	3	3	2	3	3	4	3	4	3	3	3	3	3	3	2	2	1	1	58	87.0
1	1	2	3	2	3	3	2	3	3	4	3	4	3	4	3	3	3	3	2	2	1	1	59	88.5
1	1	2	3	2	3	3	2	4	3	4	3	4	3	4	3	3	3	3	2	2	1	1	60	90.0
1	1	2	3	2	3	3	3	4	3	4	3	4	3	4	3	3	3	3	2	2	1	1	61	91.5
1	1	2	3	2	3	4	3	4	3	4	3	4	3	4	3	3	3	3	2	2	1	1	62	93.0
1	1	2	3	2	3	4	3	4	3	4	3	4	3	4	3	3	3	3	2	2	2	1	63	94.5
1	1	2	3	2	3	4	3	4	3	4	4	4	3	4	3	3	3	3	2	2	2	1	64	96.0
1	1	2	3	2	3	4	3	4	4	4	4	4	3	4	3	3	3	3	2	2	2	1	65	97.5
1	1	2	3	2	3	4	3	4	4	4	4	4	4	4	3	3	3	3	2	2	2	1	66	99.0
1	2	2	3	2	3	4	3	4	4	4	4	4	4	4	3	3	3	3	2	2	2	1	67	100.5
1	2	2	3	2	3	4	3	4	4	4	4	4	4	4	3	3	3	3	2	3	2	1	68	102.0

SPILL SCHEDULE FOR ADULT FISH AT THE DALLES DAM
(0500-2000)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
1	2	2	3	2	3	4	3	4	4	4	4	4	4	4	4	3	3	3	2	3	2	1	69	103.5
1	2	2	3	2	3	4	4	4	4	4	4	4	4	4	4	3	3	3	2	3	2	1	70	105.0
1	2	2	3	2	3	4	4	4	4	4	4	5	4	4	4	3	3	3	2	3	2	1	71	106.5
1	2	2	3	2	3	4	4	4	4	5	4	5	4	4	4	3	3	3	2	3	2	1	72	108.0
1	2	2	3	2	3	4	4	5	4	5	4	5	4	4	4	3	3	3	2	3	2	1	73	109.5
1	2	2	3	2	3	4	4	5	4	5	4	5	4	4	4	4	3	3	2	3	2	1	74	111.0
1	2	2	3	2	3	4	4	5	4	5	5	5	4	4	4	4	3	3	2	3	2	1	75	112.5
1	2	2	3	2	3	4	4	5	4	5	5	5	4	5	4	4	3	3	2	3	2	1	76	114.0
1	2	2	3	3	3	4	4	5	4	5	5	5	4	5	4	4	3	3	2	3	2	1	77	115.5
1	2	2	3	3	3	4	4	5	4	5	5	5	5	5	4	4	3	3	2	3	2	1	78	117.0
1	2	3	3	3	3	4	4	5	4	5	5	5	5	5	4	4	3	3	2	3	2	1	79	118.5
1	2	3	3	3	3	4	4	5	5	5	5	5	5	5	4	4	3	3	2	3	2	1	80	120.0
1	2	3	3	4	3	4	4	5	5	5	5	5	5	5	4	4	3	3	2	3	2	1	81	121.5
1	2	3	3	4	3	4	4	5	5	5	5	5	5	5	4	4	3	3	3	3	2	1	82	123.0
1	2	3	3	4	3	4	5	5	5	5	5	5	5	5	4	4	3	3	3	3	2	1	83	124.5
1	2	3	3	4	3	4	5	5	5	5	5	5	5	5	4	4	3	4	3	3	2	1	84	126.0
1	2	3	3	4	4	4	5	5	5	5	5	5	5	5	4	4	3	4	3	3	2	1	85	127.5
1	2	3	3	4	4	4	5	5	5	5	5	5	5	5	5	4	3	4	3	3	2	1	86	129.0
1	2	3	3	4	4	5	5	5	5	5	5	5	5	5	5	4	3	4	3	3	2	1	87	130.5
1	2	3	3	4	4	5	5	5	5	5	5	5	5	5	5	4	3	4	4	3	2	1	88	132.0
1	2	3	3	5	4	5	5	5	5	5	5	5	5	5	5	4	3	4	4	3	2	1	89	133.5
1	2	3	3	5	4	5	5	5	5	5	5	5	5	5	5	4	4	4	4	3	2	1	90	135.0
1	2	3	4	5	4	5	5	5	5	5	5	5	5	5	5	4	4	4	4	3	2	1	91	136.5
1	2	3	4	5	4	5	5	5	5	5	5	5	5	5	5	4	5	4	4	3	2	1	92	138.0
1	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	4	5	4	4	3	2	1	93	139.5
1	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	3	2	1	94	141.0
1	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	3	2	1	95	142.5
1	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	2	1	96	144.0
1	2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	2	1	97	145.5
1	2	3	4	5	5	5	5	5	5	6	5	5	5	5	5	5	5	5	5	4	2	1	98	147.0
1	2	3	4	5	5	5	5	5	5	6	5	6	5	5	5	5	5	5	5	4	2	1	99	148.5
1	2	3	4	5	5	5	5	6	5	6	5	6	5	5	5	5	5	5	5	4	2	1	100	150.0
1	2	3	4	5	5	5	5	6	5	6	6	6	5	5	5	5	5	5	5	4	2	1	101	151.5
1	2	3	4	5	5	5	5	6	5	6	6	6	6	5	5	5	5	5	5	4	2	1	102	153.0

SPILL SCHEDULE FOR ADULT FISH AT THE DALLES DAM

(0500-2000)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
1	2	3	4	5	5	5	5	6	6	6	6	6	6	5	5	5	5	5	5	4	2	1	103	154.5
1	2	3	4	5	5	5	5	6	6	6	6	6	6	6	5	5	5	5	5	4	2	1	104	156.0
1	2	4	4	5	5	5	5	6	6	6	6	6	6	6	5	5	5	5	5	4	2	1	105	157.5
1	2	4	4	5	5	5	5	6	6	6	6	6	6	6	5	5	5	5	5	4	3	1	106	159.0
1	2	4	4	5	5	6	5	6	6	6	6	6	6	6	5	5	5	5	5	4	3	1	107	160.5
1	2	4	4	5	5	6	5	6	6	6	6	6	6	6	5	6	5	5	5	4	3	1	108	162.0
1	2	4	4	5	5	6	6	6	6	6	6	6	6	6	5	6	5	5	5	4	3	1	109	163.5
1	2	4	4	5	5	6	6	6	6	6	6	6	6	6	6	6	5	5	5	4	3	1	110	165.0
1	2	4	4	5	5	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4	3	1	111	166.5
1	2	4	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4	3	1	112	168.0
1	2	4	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4	3	1	113	169.5
1	2	4	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4	3	2	114	171.0
1	2	4	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	4	4	2	115	172.5
1	2	4	5	5	6	6	6	6	6	7	6	6	6	6	6	6	6	5	5	4	4	2	116	174.0
1	2	4	5	5	6	6	6	6	6	7	6	7	6	6	6	6	6	5	5	4	4	2	117	175.5
1	2	4	5	5	6	6	6	7	6	7	6	7	6	6	6	6	6	5	5	4	4	2	118	177.0
1	2	4	5	5	6	7	6	7	6	7	6	7	6	6	6	6	6	5	5	4	4	2	119	178.5
1	2	4	5	5	6	7	6	7	6	7	6	7	6	7	6	6	6	5	5	4	4	2	120	180.0
1	2	4	5	5	6	7	7	7	6	7	6	7	6	7	6	6	6	5	5	4	4	2	121	181.5
1	2	4	5	5	6	7	7	7	7	7	6	7	6	7	6	6	6	5	5	4	4	2	122	183.0
1	2	4	5	5	6	7	7	7	7	7	7	7	6	7	6	6	6	5	5	4	4	2	123	184.5
1	2	4	5	5	6	7	7	7	7	7	7	7	7	7	6	6	6	5	5	4	4	2	124	186.0
1	2	4	5	5	6	7	7	7	7	7	7	7	7	7	6	6	6	6	5	4	4	2	125	187.5
1	2	4	5	6	6	7	7	7	7	7	7	7	7	7	6	6	6	6	5	4	4	2	126	189.0
1	2	4	5	6	6	7	7	7	7	7	7	7	7	7	6	6	6	6	5	5	4	2	127	190.5
1	2	5	5	6	6	7	7	7	7	7	7	7	7	7	6	6	6	6	5	5	4	2	128	192.0
1	2	5	5	6	6	7	7	7	7	7	7	7	7	7	7	6	6	6	5	5	4	2	129	193.5
1	3	5	5	6	6	7	7	7	7	7	7	7	7	7	7	6	6	6	5	5	4	2	130	195.0
1	3	5	5	6	7	7	7	7	7	7	7	7	7	7	7	6	6	6	5	5	4	2	131	196.5
1	3	5	5	6	7	7	7	7	7	7	7	7	7	7	7	7	6	6	5	5	4	2	132	198.0
1	3	5	6	6	7	7	7	7	7	7	7	7	7	7	7	7	6	6	5	5	4	2	133	199.5
1	3	5	6	6	7	7	7	7	7	7	7	7	7	7	7	7	7	6	5	5	4	2	134	201.0
1	3	5	6	6	7	7	7	7	7	8	7	7	7	7	7	7	7	6	5	5	4	2	135	202.5
1	3	5	6	6	7	7	7	7	7	8	7	7	7	7	7	8	7	6	5	5	4	2	136	204.0

SPILL SCHEDULE FOR ADULT FISH AT THE DALLES DAM
(0500-2000)

BAY NUMBER																							FEET	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
1	3	5	6	6	7	7	7	8	7	8	7	7	7	7	7	8	7	6	5	5	4	2	137	205.5
1	3	5	6	6	7	7	7	8	7	8	7	8	7	7	7	8	7	6	5	5	4	2	138	207.0
1	3	5	6	6	7	8	7	8	7	8	7	8	7	7	7	8	7	6	5	5	4	2	139	208.5
1	3	5	6	6	7	8	7	8	7	8	7	8	7	8	7	8	7	6	5	5	4	2	140	210.0
1	3	5	6	6	7	8	7	8	8	8	7	8	7	8	7	8	7	6	5	5	4	2	141	211.5
1	3	5	6	6	7	8	7	8	8	8	8	8	7	8	7	8	7	6	5	5	4	2	142	213.0
1	3	5	6	6	7	8	8	8	8	8	8	8	7	8	7	8	7	6	5	5	4	2	143	214.5
1	3	5	6	6	7	8	8	8	8	8	8	8	7	8	7	8	7	6	6	5	4	2	144	216.0
1	3	5	6	7	7	8	8	8	8	8	8	8	7	8	7	8	7	6	6	5	4	2	145	217.5
1	3	5	6	7	7	8	8	8	8	8	8	8	7	8	7	8	7	7	6	5	4	2	146	219.0
1	3	5	7	7	7	8	8	8	8	8	8	8	7	8	7	8	7	7	6	5	4	2	147	220.5
1	3	5	7	7	7	8	8	8	8	8	8	8	8	8	7	8	7	7	6	5	4	2	148	222.0
1	3	5	7	7	8	8	8	8	8	8	8	8	8	8	7	8	7	7	6	5	4	2	149	223.5
1	3	5	7	7	8	8	8	8	8	8	8	8	8	8	8	8	7	7	6	5	4	2	150	225.0

An approved spill schedule which incorporates raising spill bay gates in blocks of four will be implemented when changes in spill discharge are frequent.

Feet of opening required to pass desired amounts of spill vary slightly depending on project operating head.

2.4. Juvenile Fish Passage Facilities.

2.4.1. Operating Criteria.

2.4.1.1. Prior to Juvenile Fish Passage Season.

a. Remove debris from forebay, trashracks, and gatewell slots, such that these areas are free of debris on 1 April.

b. Inspect and, where necessary, clean gatewell orifices of debris, such that the orifices are free of debris on 1 April.

c. Inspect, lubricate, and test hoist-operated chain gates, end gates, and hoists for operation as needed.

d. Inspect and correct any epoxy or concrete deficiencies on walls and floors of ice and trash sluiceway.

e. Inspect and where necessary, repair spill gates and control system. Spillway, except for coordinated exceptions, must be able to achieve spill patterns on 1 April.

f. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical. Avian abatement measures shall be operable by 1 April.

g. The results of all inspections and the readiness of the facility for operation will be verbally reported to the Corps' Fish Passage O&M Coordination Team immediately prior to the fish passage season.

2.4.1.2. Juvenile Fish Passage Season. (1 April through 30 November).

a. Measure gatewell drawdown a minimum of once per week. Clean trashracks as flow conditions dictate, or when drawdown in gatewell slots exceeds 1.5 feet or as indicated by fish condition at The Dalles and Bonneville (e.g., higher than expected descaling). Rake trashracks in front of turbine units FU-1 through at least main unit 5 again between 1 June and 15 June.

b. Remove debris from forebay when needed.

c. Inspect all gatewells daily. The project will clean before gatewell water surface becomes one-half covered with debris. If, due to the volume of debris, it is not possible to keep the gatewell surfaces at least half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except on a last on/first off basis, to be in compliance with other coordinated fishery measures.

CBFWA recommends the gatewells be cleaned before they become half covered with debris.

d. Operate all gate slot orifices full time.

e. Operate ice and trash sluiceway gates 1-1, 1-2, and 1-3 from 0400 - 2000 hrs, including daylight hours after 1 September, with full surface flow (lower or raise sluice gates completely). During nighttime hours operate the ice and trash sluiceway as a plunge pool for the gate slot orifices. During periods of involuntary spill, sluice gates may be operated continuously. Operate the sluiceway end gate full open from sunrise to sunset. During periods when gates do not operate, set top of bottom end gate at 142.0' elevation to create orifice plunge pool.

f. Once each week and more frequently if accumulations of debris are observed in the sluiceway, close gates 1-1, 1-2, & 1-3, and open gates 17-3, 18-1, & 18-2 for two hours to flush debris and fish being held in the sluiceway channel east of unit 1. When units are being dewatered, set top of bottom end gate at elevation 142.0' to create an orifice plunge pool, and install orifice gill posts.

g. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams, etc. But, when unusual accumulations of oil (e.g., oil slick) occur in gate slots, they will be removed within 24 hours. When this is not possible the orifice will be closed and the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in consultation with FPC and NMFS. Regardless of unit operating status, oil accumulations will be dealt with promptly.

h. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical.

2.4.1.3. General.

a. The chain gates may be fully raised to exclude flow from the forebay.

b. During chain gate operation, maintain forebay level above elevation 158.0' to the extent practicable.

c. Maintain orifices clear of debris.

d. Inspect facilities twice each day.

e. Follow the schedule starting at p. TDA-9 for nighttime spill (2000-0500). This schedule was developed for juvenile fish passage.

2.4.1.4. Winter Maintenance Season. (1 December through 31 March).

a. Maintain orifices clear of debris.

b. Set top of bottom end gate at 142.0' elevation to create orifice plunge pool.

c. Inspect facilities once per day.

2.5. Adult Fish Passage Facilities.

2.5.1. Operating Criteria.

2.5.1.1. Prior to Adult Passage Period.

a. Inspect and calibrate all staff gauges and water level indicators. Repair and/or clean where necessary.

b. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or slow their progress up the ladder. Repair deficiencies.

c. Inspect for, and when necessary, clear debris in the ladder exits.

d. Reinstall picket leads at counting stations prior to watering up the ladders during maintenance.

c. The results of all inspections and the readiness of the facilities for operation will be verbally reported at the Corps' Fish Passage O&M Coordination Team meeting immediately prior to the passage season.

2.5.1.2. Adult Fish Passage Period. (1 March through 30 November).

a. All Adult Facilities.

1. Water depth over fish ladder weirs: 1.0' +/- 0.1'. During shad passage (15 May through 15 August): 1.3' +/- 0.1'.

2. Water temperatures will be measured in an adult

fishway at each project.

3. Head on all entrances: 1.0 to 2.0 feet (prefer 1.3 to 1.5 feet). Refer to 3.3.1. Scheduled Maintenance., when unable to achieve head criteria.

4. A transportation velocity of 1.5 to 4.0 feet per second (prefer 2.0 fps) shall be maintained for the full length of the powerhouse collection channel and the lower ends of the fish ladders which are below the tailwater. Water velocities will be measured directly, and monitored during fishway inspections to verify channels are operating between 1.5 and 4.0 feet per second.

5. Remove debris as required to maintain head below 0.5' on attraction water intakes and trash racks at all the ladder exits, with a 0.3' maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

6. Necessary staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period, and calibrated weekly.

7. Main entrance weir depths: 8.0 feet or greater below tailwater. When possible, set gates at 8.5 feet of depth so that even with water fluctuation, the gates will more often exceed 8.0 feet. Maintain tailwater at 70.0' msl or greater. Entrance weirs bottom out at 70.0' msl tailwater. If tailwater is below this level, the entrance weir depth criteria of 8.0' cannot be obtained. Weirs will be lowered to bottom when 8.0 feet depth is not possible.

8. Count station crowders shall remain in the operating position while visual counting and/or video taping is being conducted. If counting is temporarily discontinued due to unscheduled events, or the fishway is dewatered, the crowder shall be fully opened, except during the counters' hourly ten minute break period. Leave fish passage slot lighted overnight.

9. Inspect facilities twice each day.

10. Inspect and ensure that optimum passage conditions are maintained at fishway entrances, exits, and count slots.

b. East Fishway.

1. Removable weirs #154 -#157 will drop into the ladder at a differential (water surface at respective weir location v forebay) of 2.5' +/- 0.1'.

2. Telescoping weir #159 will adjust to maintain 1.0' +/- 0.1' depth over the weirs, measured below the counting

station. During shad passage season (15 May through 15 August): 1.3' +/- 0.1'.

3. Telescoping weir #158 will track 1.0' +/- 0.1' below weir #159 at all times during fishway operation.

c. North Fishway.

1. North Fishway Entrance: Operate only entrance N1 regardless of spill.

CBFWA recommends operating both north shore fishway entrances during periods with spill. They further recommend that entrance N2 may be closed during periods without spill, at the discretion of the Fishery Managers.

2. Spill through bay 1 as follows: In the summer (1 June through 15 August), spill 1500 cfs from 0400 to 2000 hours. Curtail attraction spill after 15 August.

d. Powerhouse.

1. West Powerhouse Entrance: Operate two entrances (W1 and W2).

2. East Powerhouse Entrance: Operate entrances E2 and E3 to maintain gate crest at 8.0' or greater below tailwater. Set E1 with gate crest at 81.0'.

3. Operate east ladder junction pool weirs at the following minimum depths in relation to east entrance tailwater surface elevation, +/- 0.5'. Note that weirs rest on sills when tailwater is below 74.0'.

JP2.........................7.0'
JP4.........................6.0'
JP6.........................7.0'

4. Operate 12 submerged orifices along the powerhouse collection system. Orifice numbers are: 1d, 3a, 5a, 7d, 9d, 13a, 17a, 19d, 21d, 22a, 22b, and 22c.

5. The cul-de-sac entrance will remain closed.

6. South Spillway Entrance: Operate both downstream entrances (S1 and S2).

7. A minimum of 5000 cfs discharge (if possible within 595 amps) will be supplied to the fishway by the two fishwater units. The amperage limit will be further investigated after fish unit windings have been repaired.

2.5.1.3. Winter Operating Period, or In-water Work Period. (1 December through February).

a. Operate the powerhouse and south spillway adult fish passage facilities according to the fish passage period standards above except the system may be dewatered or operated out of criteria for repair and maintenance. Adjust the counting station fish crowder to full open and rotate picket leads to the open position at counting station at the end of the counting season.

b. Operate the north spillway adult fish passage facilities according to fish passage season standards above, except the system may be dewatered or operated out of criteria for repair and maintenance. Adjust the counting station fish crowder to full open and pull picket leads at counting station at the end of the counting season.

c. Only one of the two fish facilities may be out of service at any one time unless specially coordinated. The operating facility will be able to be operated at full fish passage season criteria unless specially coordinated. Outage periods will be minimized to the extent practicable.

d. Inspect operational facilities once per day.

3. Fish Facilities Maintenance.

3.1. General.

3.1.1. Scheduled Maintenance.

3.1.1.1. Staff gauges will be installed, cleaned, and/or repaired as required.

3.1.1.2. A zebra mussel monitoring program will continue. These organisms have become a serious problem elsewhere in the country and are expected to eventually become introduced to the Columbia.

3.1.1.3. Scheduled fishway maintenance, to the extent practicable, will be conducted during periods when passage has been documented to be at its lowest during the regular scheduled workday, to minimize impacts to migrating salmonids.

3.2. Juvenile Fish Passage Facilities.

3.2.1. Scheduled Maintenance.

3.2.1.1. Collection and Transportation Systems. The Dalles Dam ice and trash sluiceway will receive preventive maintenance at all times of the year. During the juvenile fish passage season this will normally be above water work such as maintenance of automatic systems, air lines, electrical systems, and monitoring equipment. During the winter maintenance period the systems are dewatered downstream of the gatewell orifices. The system is then visually inspected in all accessible areas for damaged equipment and areas that may cause problems to the juvenile fish. Any problem areas identified are repaired and modifications to the channel and general maintenance are completed. The trash racks are raked just prior to the juvenile fish passage season (1 April) and between 1 June and 15 June, whenever trash accumulations are suspected because of increased head across the trash racks, or increased descaling of juvenile fish is noted at The Dalles or Bonneville dams and Bonneville's trash racks are clean.

3.2.1.2. Turbines and Spillways. The maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires that units be shut down for up to two months (see 5. Dewatering Plans.). The schedule for this maintenance is reviewed by the project and district biologists and coordinated within NPP, NPD, BPA, and among fishery agencies and tribes through the Corps' Fish Passage O&M Coordination Team. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the area of fishway entrances. The maintenance schedules for these turbines and spillways will reflect equal weighting given to fish, power, and water management, and will be coordinated with the appropriate resource agencies. No other fish related restrictions regarding maintenance will be placed on any units at this project, except to coordinate research activities.

Some types of maintenance on turbines will result in the requirement to test operate the turbine throughout it's full range of capability before returning the turbine to normal service.

3.2.2. Unscheduled Maintenance.

3.2.2.1. Collection and Transportation Systems. The ice and trash sluiceway is now being used as a juvenile bypass system.

a. The chain gates are fully opened during normal operation. If a chain gate fails, an adjacent gate can be operated until repairs can be made.

b. Orifices allow fish a passage route out of the gatewells into the sluiceway. If orifices become plugged with debris they will be manually cleaned.

c. Inspect all gatewells daily. The project will clean before gatewell water surface becomes half covered with debris. If due to the volume of debris, it is not possible to keep the gatewell surfaces at least half clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except on a last on/first off basis, if required to be in compliance with other coordinated fishery measures. This is to maintain clean orifices and minimize fish injury.

CBFWA recommends the gatewells be cleaned before they become half covered with debris.

d. If a gate hoist fails, it will be repaired promptly. The gate will be removed when there are problems with the seal and the difficulty cannot be repaired promptly. If the epoxy lined section of the sluiceway is found to be damaged, it will be repaired.

3.2.2.2. Turbines and Spillways.

Spill gate Failure. If a spill gate becomes inoperable, the operators will immediately notify the Operations supervisor and the project biologist to determine the best pattern to follow until repairs can be made.

3.3. Adult Fish Passage Facilities.

3.3.1. Scheduled Maintenance.

3.3.1.1. Fishway Auxiliary Water Systems. The Dalles Project fishway auxiliary water is provided by discharge from hydroelectric turbine systems. Preventive maintenance and normal repair are carried out throughout the year. Trashracks for the AWS intakes will be raked when drawdown exceeds criteria. When practicable, rake trashracks during the time of day when fish passage is least affected.

3.3.1.2. Powerhouse and Spillway Collection Systems. Preventive maintenance and repair occurs throughout the year. During the adult fish passage season the maintenance will not involve any operations which will cause a failure to comply with the fishway criteria, unless specially coordinated. Inspection of those parts of the adult collection channel systems, such as diffusion gratings, picket leads, and entrance gates, will be scheduled once per year during the winter maintenance season while the system is dewatered, with one additional inspection during the fish passage season, unless a channel must be dewatered for fishway modifications or to correct observed problems (see 5. Dewatering Plans.). Inspection by a diver or underwater video system may be used for the underwater inspections. This scheduled inspection and any associated maintenance will occur during the winter maintenance period (in-water work period), unless specially coordinated. Any non-routine maintenance and fishway modification will be handled on a case by case basis.

The project biologist or alternate Corps fisheries personnel will attend all dewatering activities potentially involving fish, as well as inspections to provide fishery input (see 5. Dewatering Plans.).

3.3.1.3. Adult Fish Ladders and Counting Stations. The adult fish ladders will be dewatered once each year during the winter maintenance period. Unless specially coordinated, only one ladder will be dewatered at a time, with the other ladder capable of operating at full season criteria. During this time the ladders are inspected for blocked orifices, projections into the fishway that may injure fish, stability of the weirs, damaged picket leads, exit gate problems, loose diffusion valves, ladder orifice reduction plates, malfunctioning operation equipment at the counting stations, and other potential problems. Problems identified throughout the passage year that do not affect fish passage, as well as those identified during the dewatered period are then repaired. Trashracks at the ladder exits will be raked when criteria is exceeded. When practicable, rake trash racks during the time of day when fish passage is least affected. Fish count station windows will be cleaned when necessary, and when practicable, during the time of day when fish passage is least affected.

3.3.2. Unscheduled Maintenance.

3.3.2.1. Fishway Auxiliary Water Systems. Most fishway auxiliary water systems operate automatically. If the automatic system fails, the system will be manually operated by the project personnel. This will allow the fish facility to operate according to criteria while the automatic system is repaired. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met.

a. Powerhouse. If one of the two fishway auxiliary water turbines fails or malfunctions during the spring/summer adult migration season (1 March - 31 July), use the following sequential procedure until a fishway head of 1.0 feet is achieved:

1. Raise the open West Powerhouse Entrance weirs W1 and W2 (W3 stationary at 78.0') in 1.0 foot increments until the weirs reach 6.0 feet of depth below the tailwater surface.

2. Raise the East Entrance weirs E2 and E3 (E1 closed at tailwater below 81.0 `) in 1.0 foot increments to 6.0 feet of depth below the tailwater surface.

3. Close West Powerhouse Entrance weir W2.

4. Close one East Entrance weir E2.

5. Raise the South Spillway Entrance weirs S1 and S2 in 1.0 foot increments to 6.0 feet of depth below the tailwater surface.

6. Close one South Spillway Entrance (S2).

7. Close alternating floating orifices starting from the west end of the powerhouse.

8. If a fishway head of 1.0 foot is still not achieved, leave in this configuration until more auxiliary water becomes available. Then reverse the above procedure.

If one of the fishway auxiliary water turbines fails, malfunctions, or is out of service for necessary maintenance during the fall adult migration or winter maintenance season (1 August through February), assuming no spill during this period, use the following sequential procedure until a fishway head of 1.0 feet is achieved:

9. Close the South Spillway Entrance weirs and all diffusers associated with these entrances, including those adjacent to the entrances and those at the east and west ends of the powerhouse.

10. Close entrance E2 (leaving E3 open at 8.0' depth).

11. Close West Entrance weir W2, leaving W1 open to 8.0 feet below tailwater surface elevation.

12. Raise entrance weir W1 to 6.0 feet below tailwater surface elevation.

13. Raise entrance weir E3 to 7.0 feet below tailwater. If 1.0 foot of head is still not achieved, then raise it an additional 1.0 foot to a 6.0 foot minimum below tailwater surface.

14. For long term outages, close every other floating orifice starting at the west end of the powerhouse.

15. If a fishway head of 1.0 foot is still not achieved, then leave in this configuration until more auxiliary water becomes available.

If both of the fishway auxiliary water turbines fail or malfunction, regardless of fish passage season, the adult fish passage facility will be operated as follows:

16. S1 open with the weir crest 6.0 feet below the tailwater surface, S2 closed.

17. The junction pool weir supplying the powerhouse collection system and west powerhouse entrances will be closed.

18. E3 will be open with the weir crest 6.0 feet below the tailwater surface and E1 and E2 will be closed.

b. North Ladder. If the North Wasco County Power unit auxiliary water system fails, the backup auxiliary water system will be started and the system operated at criteria. If the backup auxiliary water system fails, N1 will remain open with a weir depth of 6.0 feet below the tailwater surface and N2 will be closed.

3.3.2.2. Powerhouse and Spillway Adult Fish Collection Systems. The Dalles Dam contains several types of fishway entrances. In most cases, if failures occur, the entrance can and will be operated manually by project personnel until repairs are made. If this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure criteria are being met. In those cases in which the failure will not allow the entrance to be operated manually, the gate will be maintained, to the extent possible, in an operational position. If this is not possible, the entrance will be repaired expediently, and it will be returned to manual or automatic control at the earliest possible date.

3.3.2.3. Adult Fish Ladders and Counting Stations. The structures of the ladders include picket leads, counting stations, fishway exits, and overflow weirs with orifices. Picket leads can cause problems. Pickets with excessive spacing (greater than 1"), erosion of concrete around the picket leads or missing pickets can allow fish into areas where escape is not possible. If picket lead failure or concrete erosion occurs, then the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problem will be made in consultation with the fishery agencies and tribes through the Corps' Fish Passage O&M Coordination Team.

4. Turbine Unit Operation and Maintenance.

4.1. Through the juvenile fish passage season, either turbine unit 1 or unit 2 or both units will operate during daylight hours unless specially coordinated.

4.2. The project's turbine unit maintenance schedules will be reviewed by project and district biologists for fishery impacts.

4.3. Guidelines for operation of the turbine units within 1% peak efficiency at various head ranges are shown in The Dalles Dam Peak Turbine Efficiency Ranges (p. TDA-30).

THE DALLES DAM PEAK TURBINE EFFICIENCY RANGES								
	UNITS 1-14				UNITS 15-22			
Head (ft)	Lower MW Limit	Lower Limit cfs	Upper MW Limit	Upper Limit cfs	Lower MW Limit	Lower Limit cfs	Upper MW Limit	Upper Limit cfs
61	38	8,919	63	14,822	39	9,025	65	14,909
62	39	8,933	65	14,875	40	9,082	66	14,920
63	40	8,947	66	14,927	42	9,139	68	14,920
64	40	8,961	68	14,980	42	9,122	70	14,998
65	41	8,975	69	15,032	43	9,079	71	15,076
66	42	8,989	71	15,085	43	9,036	73	15,154
67	43	9,003	72	15,137	44	8,993	74	15,232
68	43	9,011	74	15,192	44	8,966	76	15,378
69	44	9,019	75	15,246	45	8,939	78	15,524
70	45	9,027	77	15,301	45	8,913	80	15,669
71	46	9,035	78	15,355	46	8,886	82	15,815
72	46	9,026	79	15,343	46	8,873	84	15,947
73	47	9,018	80	15,330	47	8,860	86	16,080
74	48	9,009	81	15,318	48	8,847	87	16,212
75	48	9,001	83	15,305	48	8,834	89	16,344
76	49	8,992	84	15,293	49	8,821	91	16,476
77	50	9,022	85	15,219	50	8,813	93	16,603
78	50	9,052	85	15,145	50	8,805	95	16,730
79	50	9,082	86	15,071	51	8,797	97	16,857
80	50	9,111	87	14,997	52	8,788	99	16,983
81	54	9,141	88	14,923	52	8,780	99	16,381
82	54	9,109	89	14,915	53	8,770	99	16,181
83	[illegible]	9,076	90	14,907	53	8,765	99	15,986
84	55	9,044	90	14,714	54	8,757	99	15,760
85	55	9,013	90	14,541	54	8,749	99	15,610
86	56	8,979	90	14,372	55	8,742	99	15,429
87	56	8,946	90	14,207	56	8,734	99	15,251

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best information currently available.

4.4. To the extent technically feasible, turbines will be operated within +/- 1% of peak turbine efficiency, (appendix C), unless operation outside of that range is necessary to meet load requirements of the BPA administrator, whose load requests will be consistent with BPA's System Load Shaping Guidelines, or to comply with other coordinated fishery measures. BPA's System Load Shaping Guidelines (appendix C) apply between 15 March and 31 October. However, during the rest of the year the project will continue to operate units within the peak turbine efficiency range, except as specifically requested by BPA to do otherwise as power requirements demand.

CBFWA recommends operation of all units within 1% of peak turbine efficiency unless otherwise agreed.

4.5. When it is necessary to operate turbines outside of peak efficiency, the units will be selected according to the following guidance: Units 7 through 14 will be selected first, spacing by at least one unit. For example, assuming they're available to operate, the following sequence might be used: 7, 9, 11, 13, 15, 5, 3, 1, 8, etc.

5. Dewatering Plans.

5.1. Guidelines for Dewatering and Fish Handling Plans (appendix G) have been developed and are followed for most project facilities dewaterings. These plans include consideration for fish safety and are consistent with the following general guidance. The appropriate plans are reviewed by participants before each salvage operation.

5.2. The project fish biologist and/or alternate Corps fisheries personnel will attend all project activities involving fish handling.

5.3. The fisheries agencies and tribes will be invited to assist in any dewatering, and at a minimum, will be represented at all ladder dewaterings by the WDFW fish counting program supervisor or an alternate.

5.4. Adult Fish Ladder.

5.4.1. Scheduled maintenance.

5.4.1.1. When possible, operate ladder to be dewatered at a reduced flow for at least 24 hours, but not more than 96 hours prior to dewatering. Reduced flow is defined as less than criterion operation, but more than orifice flow.

5.4.1.2. Discontinue all fishway auxiliary water supply at least 24 hours, but no more than 96 hours prior to dewatering.

5.4.1.3. The project biologist will assure that fish rescue equipment is available, and will coordinate to ensure adequate numbers of personnel will be available to move fish out of the dewatered ladder.

5.4.1.4. Project personnel will install head gates to shut down ladder flow. Where possible, a minimum flow of 1-2 inches will be maintained in the ladder until fish are rescued.

5.4.1.5. The project biologist or alternate Corps fisheries personnel will oversee fish rescue when the ladders are dewatered. The project biologist will invite fishery agency and/or tribal biologists' participation in the dewatering. Rescue personnel will walk the inside of the ladder from the head gates down to tailwater salvaging all fish either by moving fish to tailwater within the ladder flow or capturing and placing the fish in a large water filled tank which is then transported to the forebay or tailwater, depending on the fish' life stage (adults to forebay, juveniles to tailrace), for release.

5.4.2. Unscheduled Maintenance.

5.4.2.1. When possible, discontinue fishway auxiliary water and operate ladder at reduced flow as long as possible (prefer 3-24 hours) prior to dewatering.

5.4.2.2. Follow steps 5.4.1.3. through 5.4.1.5. above.

5.5. Powerhouse Collection System.

5.5.1. Scheduled Maintenance.

5.5.1.1. During the pumping or draining operation to dewater a portion or all of the collection channel, the water level will not be allowed to drop to a level which strands fish. Adequate inspections will be conducted to ensure stranding does not occur.

5.5.1.2. The project biologist will assure that rescue equipment is available if needed.

5.5.1.3. The project biologist or alternate Corps fisheries personnel, will provide technical guidance on fish safety and will assist directly in rescue operations.

5.6. Turbines.

5.6.1. When units with STSs and VBSs installed are drained, gatewells which will be drained will have fish removed by dipping with an appropriate basket.

5.6.2. When a unit which has not yet been equipped with a VBS is to be drained, its gatewells need not be dipped, as is required at other projects. Instead, the following procedure may be used. The unit will be shut down for at least 24 hours before it is drained. Then, immediately before draining it will be operated very briefly to flush fish out of the draft tube.

5.6.3. When possible, place head gates and tail logs immediately after turbine unit is shut down if draft tube is to be dewatered.

5.6.4. If turbine unit draft tube is to be dewatered and the unit has been idle for any length of time, it will be operated when possible, at "speed/no load" and stop logs will then be placed immediately.

5.6.5. Water levels in the draft tube will not be allowed to drop to a level which strands fish. Adequate inspections will be conducted to ensure that stranding does not occur.

5.6.6. Fish rescue personnel will inspect dewatered turbine draft tubes and intakes as soon as the water levels reach a depth permitting visual inspection and the hatch cover is opened. The project biologist or alternate Corps fisheries personnel will provide technical guidance on fish safety, and will directly participate in fish salvage.

5.6.7. The project biologist will assure that rescue equipment is available if needed.

5.6.8. If the turbine unit is planned to be out of service and partially dewatered for less than 4 days and low numbers of fish are trapped, then removal of fish from draft tubes will not be necessary as long as an adequate "safety pool" is maintained. Adequate inspections will need to be conducted to ensure the safety pool is maintained and fish are in good condition.

6. Endnotes.

[1] Migrations of Juvenile Chinook Salmon and Steelhead Trout in the Snake River from 1973 to 1979. Sims & Ossiànder, NMFS, CZES, June 1981. 31 pp.

[2] Evaluation of The Dalles Dam Ice-Trash Sluiceway as a Downstream Migrant Bypass During 1977. Nichols, D., et. al., ODFW, 1978. 15 pp.

[3] Annual Fish Passage Report - 1994. Columbia and Snake River Projects. US COE.

SECTION 4

JOHN DAY DAM

John Day Dam

1. Fish Passage Information. The locations of fish passage facilities are shown on the following general site plans for John Day Lock and Dam (pp. JDA-2 and JDA-3).

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. Juvenile fish bypass facilities at John Day Dam, completed in 1987, include the following:

1.1.1.1. One (1) VBS and STS per gatewell, and two (2) 14 inch diameter orifices per gatewell in each of the project's 16 turbine units.

1.1.1.2. An enlarged orifice bypass collection conduit.

1.1.1.3. A transportation channel to carry fish from the collection conduit to the river below the dam.

1.1.1.4. A fingerling sampler and juvenile fish evaluation facility is located in the lower portion of the transportation channel. This facility is normally not operated, pending improvements for fish safety.

1.1.2. New Juvenile Bypass/Monitoring Facility. Currently, in FY97, a new juvenile bypass/monitoring facility is being constructed at John Day Dam, and is planned to be operational sometime in FY98.

1.1.3. Juvenile Migration Timing. Juvenile passage timing has been determined by gatewell sampling at John Day Dam (Table II.). Hydroacoustic monitoring has been conducted but has generally been concentrated on peak days and hours of passage, and therefore, cannot be used to evaluate seasonal or diel passage patterns. Extended monitoring conducted into December at John Day Dam in 1982 and 1983 showed that less than 3 percent of subyearling chinook migrants move past John Day Dam after 31 October. As a result, smolt monitoring under the Water Budget Measures Program is now discontinued on 31 October. Maintenance of juvenile fish facilities is scheduled for approximately 16 December through 31 March to minimize impact on downstream migrants, and reduce the possibility of adult fallbacks through turbine units.

Diel passage was monitored by hydroacoustics and gatewell sampling (see 6. Endnotes.)[1 2 3 4]. Peak

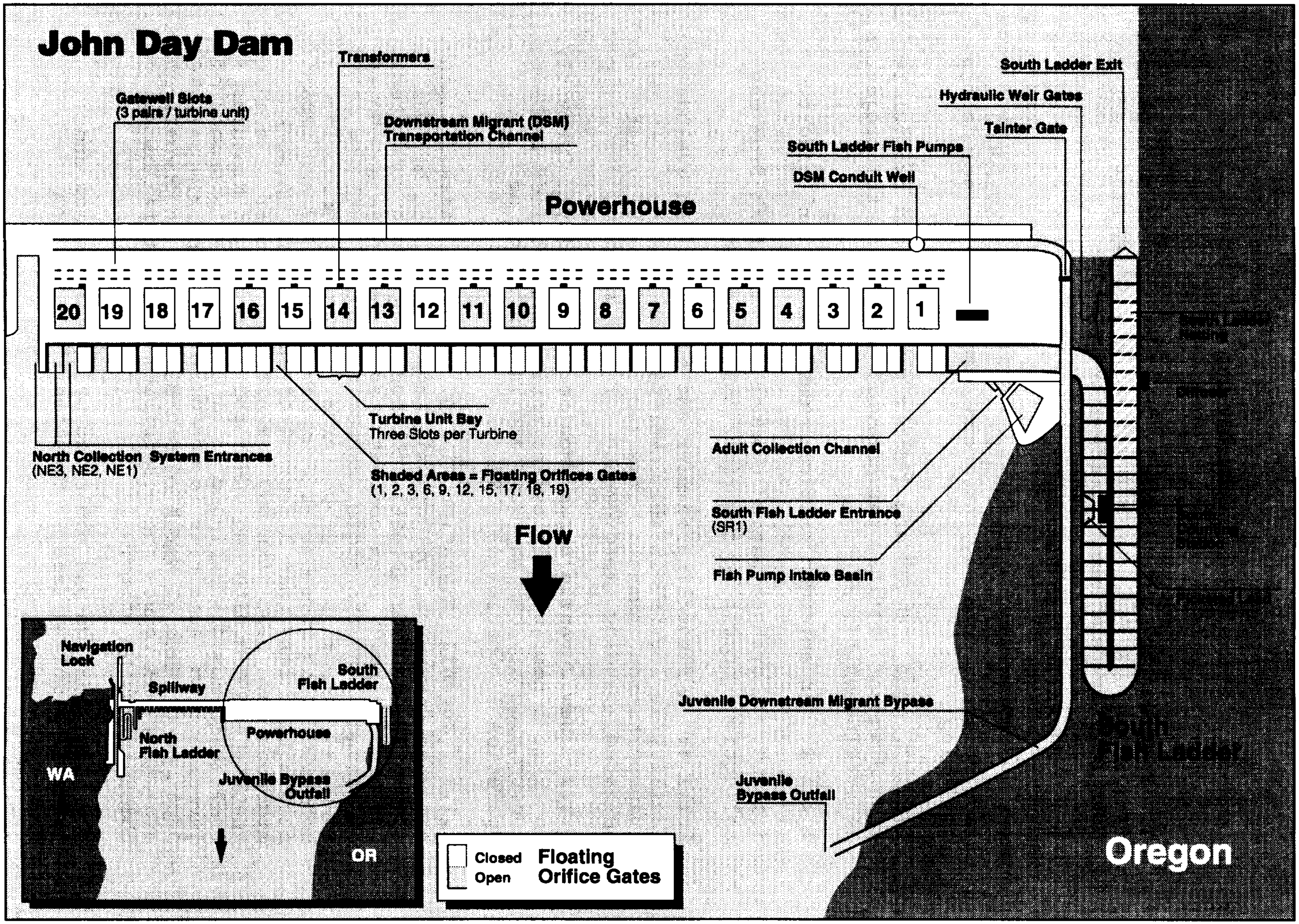


Figure 7 John Day South Fish Ladder and Powerhouse Collection System.

JDA-2

Revised March 1, 1997

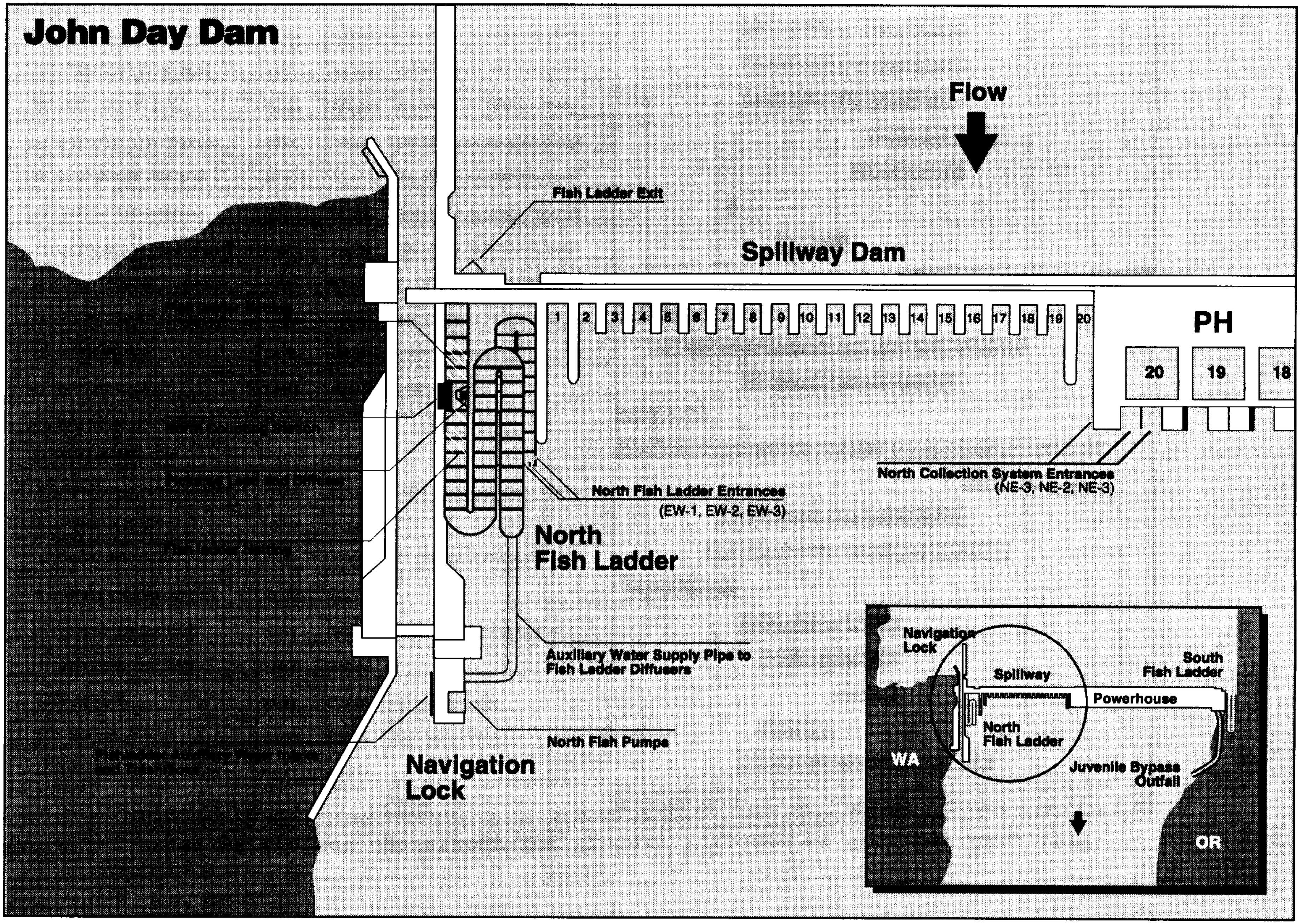
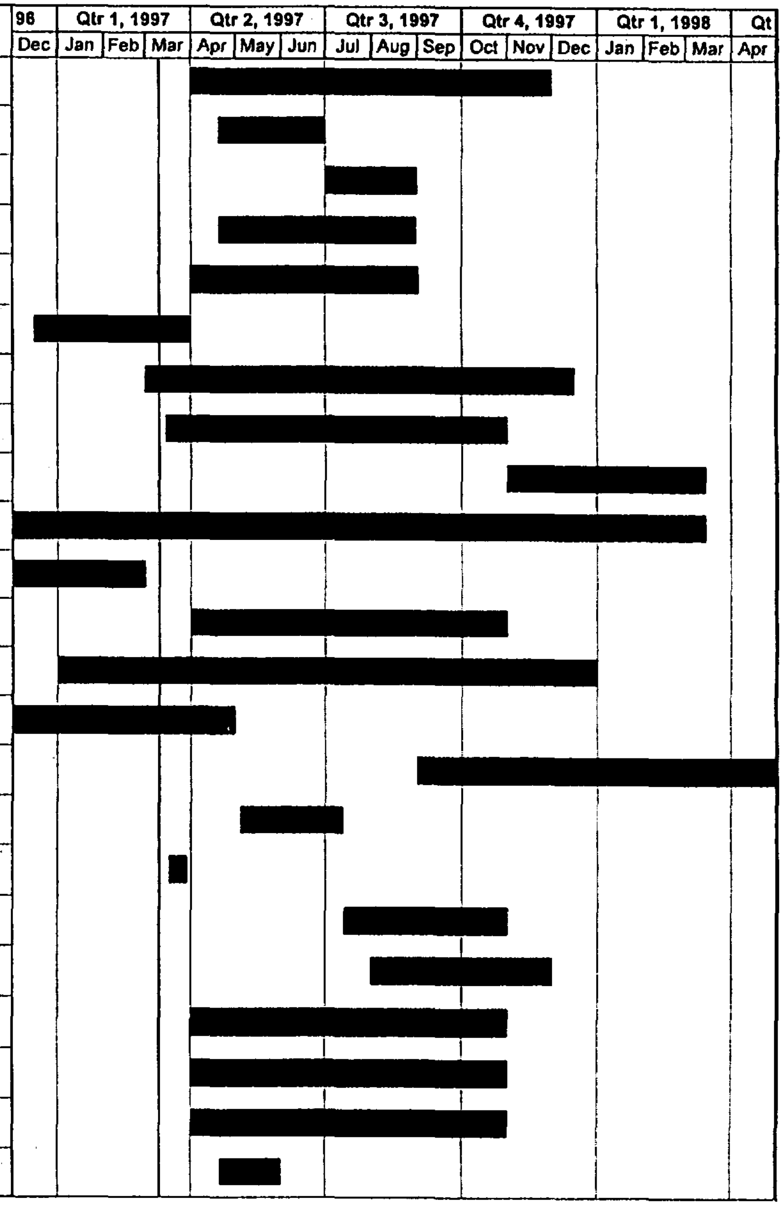


Figure 8 John Day Dam Spillway and North Fish Ladder.

Table I. Dates of Project Operations for Fishery Purposes at John Day Dam, 1997.

ID	Name	Start	Finish	Notes
1	Juvenile Fish Passage Period	4/1/97	11/30/97	
2	Spill Spring	4/20/97	6/30/97	33% 1800 to 0600
3	Spill Summer	7/1/97	8/31/97	86% 1800 to 0600
4	Special Reservoir Operation	4/20/97	8/30/97	
5	Dissolved Gas Monitoring	4/1/97	9/1/97	Forebay and tailrace stations
6	Bypass Facility Maintenance	12/16/96	3/31/97	
7	Turbine Operation for Adult/Juvenile Fish	3/1/97	12/15/97	Unit priorites vary during this time
8	Turbine 1% Operation	3/15/97	10/31/97	
9	Turbine 1% Operation may dev	11/1/97	3/14/98	may deviate if power is required
10	Adult Passage Period	12/1/96	3/14/98	
11	Adult Facility Maintenance	12/1/96	2/28/97	
12	Adult Fish Counting	4/1/97	10/31/97	0400-2000 PST
13	Weekly Reporting	1/1/97	12/31/97	Sunday - Saturday
14	Spillway Deflector Construction	12/1/96	4/30/97	See App. A for additional details
15	Spillway Deflector Construction	9/1/97	4/30/98	See App. A for additional details
16	Surface Bypass Collector Study	5/5/97	7/12/97	See App. A for additional details
17	Hydroacoustic Evaluation	3/17/97	3/28/97	See App. A for additional details
18	Adult Attraction Spill Study	7/14/97	10/31/97	See App. A for additional details
19	Evaluations of Hydraulic Sills	8/1/97	11/30/97	See App. A for additional details
20	Radio Telemetry Study	4/1/97	10/31/97	See App. A for additional details
21	Predator/Prey Study (BPA)	4/1/97	10/31/97	See App. A for additional details
22	Adult Fish Passage Evaluation	4/1/97	10/31/97	See App. A for additional details
23	Gas Bubble Disease Study (BPA)	4/21/97	5/31/97	See App. A for additional details



passage occurred between the hours of 2300 and 2400 with a long period of elevated passage until dawn when passage decreases. Passage increases dramatically at dusk, about 2000. Gatewell sampling data indicate that roughly 80 percent of the juvenile migrants pass John Day Dam between 2100 and 0600. For example, the weighted average passage for subyearling chinook in July and August 1986 was 82 percent. However, some variation from this pattern has been noted such as in 1984. In that year, daytime passage at John Day Dam increased beginning on 23 May. During the peak of the spring juvenile migration period at John Day Dam, 40 percent of the spring chinook and steelhead daily passage occurred between 0700 and 2200. Unit 3 gatewell sampling and hydroacoustic sampling confirmed the diel pattern.

Table II. John Day Dam Juvenile Migration Timing, 1987-1995.

% PAST PROJECT	YEAR/DATE								
	1987	1988	1989	1990[a]	1991	1992	1993	1994	1995
Yearling chinook									
10%	5/2	4/24	5/2	4/25	4/26	5/2	5/6	5/2	4/29
90%	5/31	6/1	5/27	NA	6/7	6/10	6/1	6/18	5/29
Subyearling chinook									
10%	6/7	6/22	6/7	NA	6/6	6/24	6/21	7/8	6/8
90%	9/18	9/7	8/16	NA	8/15	8/15	8/17	8/2	7/24
Steelhead (all)									
10%	5/1	4/26	4/24	4/29	5/4	5/3	----	----	----
90%	5/29	6/2	5/27	NA	5/29	5/28	----	----	----
Steelhead (wild)									
10%	----	----	----	----	----	----	4/30	4/27	5/3
90%	----	----	----	----	----	----	5/26	5/26	5/25
Steelhead (hatchery)									
10%	----	----	----	----	----	----	5/10	5/9	5/7
90%	----	----	----	----	----	----	5/26	6/1	5/26
Coho									
10%	5/6	5/6	4/28	4/27	5/11	5/2	5/9	5/12	5/8
90%	5/30	5/31	5/29	NA	6/4	5/27	5/30	5/29	5/21
Sockeye									
10%	5/14	5/12	5/8	5/4	5/16	5/8	5/16	5/11	5/9
90%	6/6	6/3	6/3	NA	6/1	5/27	5/31	6/5	5/26

[a] Fish sampling was done at unit 5 at John Day Dam. Outages of this unit during the periods April 16-19, May 30-June 10, June 21-23, and August 13-16, make computed percentiles gross approximations only. It is likely that dates would be up to several days later if uninterrupted sampling had occurred. Dates where not even gross estimation is feasible are denoted by "NA".

1.1.4. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, throughout the year, summarizing project operations. The weekly reports will provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any usual activities which occurred at the project which may affect fish passage. The weekly reports shall cover a Sunday through Saturday time period and shall be sent to CENPP-CO as soon as possible the following week via electronic mail. The project biologist shall prepare an annual report by 31 January summarizing the operation of the project fish passage facilities for the previous year. It will cover from the beginning of an adult fish facilities winter maintenance season to the beginning of the next.

1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at John Day Dam comprise a north shore fish ladder which passes fish from entrances at the north end of the spillway, and a south shore fish ladder which passes fish from entrances along a collection channel which extends the full length of the powerhouse.

Auxiliary water is provided to all collection systems by pumping from the tailrace. Counting stations are provided in both fishways.

1.2.2. Adult Migration Timing. Upstream migrant fish are present at John Day Dam throughout the year. Adult passage facilities are operated year round. However, passage through the winter months is relatively light and there is no regular fish counting. Fish counting at John Day Dam normally extends from 1 April through 31 October. The schedule is described appendix A. Annual winter maintenance of adult fish facilities is scheduled from 1 December through February (In-water work period) to minimize the impact on upstream migrants and to minimize adult fall chinook and steelhead fallback. Table III. shows fish counting periods by species and earliest and latest recorded dates of peak passage, from fish count data compiled by the Corps.

2. Project Operation.

2.1. General.

2.1.1. Research, non-routine maintenance, and other fishery

Table III. John Day Dam Adult Migration Timing, 1968-1995.

Species	Counting Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/5	4/17	5/22
Summer Chinook	6/6 - 8/5	6/7	8/2
Fall Chinook	8/6 - 10/31	9/5	9/25
Steelhead	4/1 - 10/31	9/6	10/6
Sockeye	4/1 - 10/31	6/23	7/10
Coho	4/1 - 10/31	9/4	10/12

related activities will not be conducted within 100' of any fishway entrance or exit, or directly in, above, or adjacent to any fishway, unless concurred with by Regional fishery managers through ESA and other fish passage issues. Alternate actions will be considered by district and project biologists in conjunction with the fishery managers on a case by case basis. Emergency situations should be dealt with immediately by the project in consultation with the project or district biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident.

2.2. Spill Management.

2.2.1. The spill schedule on pp. JDA-8 through JDA-11 will be used for juvenile fish passage during 2000-0500 hours.

2.2.2. The spill schedule on pp. JDA-12 through JDA-17 will be used for adult fish passage during 0500-2000 hours.

2.3. Dissolved Gas Management and Control. Spill management requests will be based upon dissolved gas monitoring data and the observed condition of migrating juveniles and adults, along with juvenile migration monitoring data. Total dissolved gas monitoring will be conducted by the Corps at the John Day Dam forebay automated station and reported every four hours from 1 April through Labor Day. Related data reported at the same time will be spill volume and total project flow. The dissolved gas monitoring system is described in detail in appendix D. Excessive Total Dissolved Gas levels, which may harm fish, will be controlled to the extent possible, subject to river flow conditions. Control measures will include system spill allocations through the spill priority list issued by RCC, nighttime or daytime spill limits, and shaping of spill discharge.

SPILL SCHEDULE FOR JUVENILE FISH AT JOHN DAY DAM
(2000-0500)

BAY NUMBER																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	STOPS	KCFS
																			6	6	9.6
																			7	7	11.2
																			8	8	12.8
																			9	9	14.4
																		5	5	10	16.0
																		5	6	11	17.6
																		6	6	12	19.2
																		6	7	13	20.8
																		7	7	14	22.4
																		7	8	15	24.0
																		8	8	16	25.6
																		8	9	17	27.2
																		9	9	18	28.8
																	6	6	7	19	30.4
																	6	7	7	20	32.0
																	7	7	7	21	33.6
																	7	7	8	22	35.2
																	7	8	8	23	36.8
																	8	8	8	24	38.4
																	8	8	9	25	40.0
																	8	9	9	26	41.6
																	9	9	9	27	43.2
																7	7	7	7	28	44.8
																7	7	7	8	29	46.4
																7	7	8	8	30	48.0
																7	8	8	8	31	49.6
																8	8	8	8	32	51.2
																8	8	8	9	33	52.8
																8	8	9	9	34	54.4
																8	9	9	9	35	56.0
																9	9	9	9	36	57.6
															7	7	7	8	8	37	59.2
															7	7	8	8	8	38	60.8

SPILL SCHEDULE FOR JUVENILE FISH AT JOHN DAY DAM
(2000–0500)

BAY NUMBER																				STOPS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
															7	8	8	8	8	39	62.4
															8	8	8	8	8	40	64.0
															8	8	8	8	9	41	65.6
															8	8	8	9	9	42	67.2
															8	8	9	9	9	43	68.8
															8	9	9	9	9	44	70.4
															9	9	9	9	9	45	72.0
														7	7	8	8	8	8	46	73.6
														7	8	8	8	8	8	47	75.2
														8	8	8	8	8	8	48	76.8
														8	8	8	8	8	9	49	78.4
														8	8	8	8	9	9	50	80.0
1														8	8	8	8	9	9	51	81.6
1	1													8	8	8	8	9	9	52	83.2
1	1	1												8	8	8	8	9	9	53	84.8
1	1	1	1											8	8	8	8	9	9	54	86.4
1	1	1	2											8	8	8	8	9	9	55	88.0
1	1	2	2											8	8	8	8	9	9	56	89.6
1	2	2	2											8	8	8	8	9	9	57	91.2
2	2	2	2											8	8	8	8	9	9	58	92.8
2	2	2	3											8	8	8	8	9	9	59	94.4
2	2	3	3											8	8	8	8	9	9	60	96.0
2	3	3	3											8	8	8	8	9	9	61	97.6
3	3	3	3											8	8	8	8	9	9	62	99.2
3	3	3	3	1										8	8	8	8	9	9	63	100.8
3	3	3	3	1										8	8	8	9	9	9	64	102.4
3	3	3	3	1										8	8	9	9	9	9	65	104.0
3	3	3	3	1										8	9	9	9	9	9	66	105.6
3	3	3	3	1										9	9	9	9	9	9	67	107.2
3	3	3	3	2										9	9	9	9	9	9	68	108.8
3	3	3	3	2									7	8	8	8	8	8	8	69	110.4
3	3	3	3	2									8	8	8	8	8	8	8	70	112.0
3	3	3	3	2									8	8	8	8	8	8	9	71	113.6
3	3	3	3	2									8	8	8	8	8	9	9	72	115.2

SPILL SCHEDULE FOR JUVENILE FISH AT JOHN DAY DAM
(2000-0500)

BAY NUMBER																				STOPS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
3	3	3	3	3									8	8	8	8	8	9	9	73	116.8
3	3	3	3	3									8	8	8	8	9	9	9	74	118.4
3	3	3	3	3									8	8	8	9	9	9	9	75	120.0
3	3	3	3	3									8	8	9	9	9	9	9	76	121.6
3	3	3	3	3									8	9	9	9	9	9	9	77	123.2
3	3	3	3	3	1								8	9	9	9	9	9	9	78	124.8
3	3	3	3	3	1								9	9	9	9	9	9	9	79	126.4
3	3	3	3	3	1							8	8	8	8	8	8	8	8	80	128.0
3	3	3	3	3	1							8	8	8	8	8	8	8	9	81	129.6
3	3	3	3	3	1							8	8	8	8	8	8	9	9	82	131.2
3	3	3	3	3	2							8	8	8	8	8	8	9	9	83	132.8
3	3	3	3	3	2							8	8	8	8	8	9	9	9	84	134.4
3	3	3	3	3	2							8	8	8	8	9	9	9	9	85	136.0
3	3	3	3	3	2							8	8	8	9	9	9	9	9	86	137.6
3	3	3	3	3	2							8	8	9	9	9	9	9	9	87	139.2
3	3	3	3	3	3							8	8	9	9	9	9	9	9	88	140.8
3	3	3	3	3	3							8	9	9	9	9	9	9	9	89	142.4
3	3	3	3	3	3							9	9	9	9	9	9	9	9	90	144.0
3	3	3	3	3	3						8	8	8	8	8	8	8	8	9	91	145.6
3	3	3	3	3	3						8	8	8	8	8	8	8	9	9	92	147.2
3	3	3	3	3	3	1					8	8	8	8	8	8	8	9	9	93	148.8
3	3	3	3	3	3	1					8	8	8	8	8	8	9	9	9	94	150.4
3	3	3	3	3	3	1					8	8	8	8	8	9	9	9	9	95	152.0
3	3	3	3	3	3	1					8	8	8	8	9	9	9	9	9	96	153.6
3	3	3	3	3	3	1					8	8	8	9	9	9	9	9	9	97	155.2
3	3	3	3	3	3	2					8	8	8	9	9	9	9	9	9	98	156.8
3	3	3	3	3	3	2					8	8	9	9	9	9	9	9	9	99	158.4
3	3	3	3	3	3	2					8	9	9	9	9	9	9	9	9	100	160.0
3	3	3	3	3	3	2					9	9	9	9	9	9	9	9	9	101	161.6
3	3	3	3	3	3	2				8	8	8	8	8	8	8	8	9	9	102	163.2
3	3	3	3	3	3	3				8	8	8	8	8	8	8	8	9	9	103	164.8
3	3	3	3	3	3	3				8	8	8	8	8	8	8	9	9	9	104	166.4
3	3	3	3	3	3	3				8	8	8	8	8	8	9	9	9	9	105	168.0
3	3	3	3	3	3	3				8	8	8	8	8	9	9	9	9	9	106	169.6

SPILL SCHEDULE FOR JUVENILE FISH AT JOHN DAY DAM
(2000-0500)

BAY NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	STOPS	KCFS
3	3	3	3	3	3	3				8	8	8	8	9	9	9	9	9	9	107	171.2
3	3	3	3	3	3	3	1			8	8	8	8	9	9	9	9	9	9	108	172.8
3	3	3	3	3	3	3	1			8	8	8	9	9	9	9	9	9	9	109	174.4
3	3	3	3	3	3	3	1			8	8	9	9	9	9	9	9	9	9	110	176.0
3	3	3	3	3	3	3	1			8	9	9	9	9	9	9	9	9	9	111	177.6
3	3	3	3	3	3	3	1			9	9	9	9	9	9	9	9	9	9	112	179.2
3	3	3	3	3	3	3	2			9	9	9	9	9	9	9	9	9	9	113	180.8
3	3	3	3	3	3	3	2		8	8	8	8	8	8	8	8	9	9	9	114	182.4
3	3	3	3	3	3	3	2		8	8	8	8	8	8	8	9	9	9	9	115	184.0
3	3	3	3	3	3	3	2		8	8	8	8	8	8	9	9	9	9	9	116	185.6
3	3	3	3	3	3	3	2		8	8	8	8	8	9	9	9	9	9	9	117	187.2
3	3	3	3	3	3	3	3		8	8	8	8	8	9	9	9	9	9	9	118	188.8
3	3	3	3	3	3	3	3		8	8	8	8	9	9	9	9	9	9	9	119	190.4
3	3	3	3	3	3	3	3		8	8	8	9	9	9	9	9	9	9	9	120	192.0
3	3	3	3	3	3	3	3		8	8	9	9	9	9	9	9	9	9	9	121	193.6
3	3	3	3	3	3	3	3		8	9	9	9	9	9	9	9	9	9	9	122	195.2
3	3	3	3	3	3	3	4		8	9	9	9	9	9	9	9	9	9	9	123	196.8
3	3	3	3	3	3	3	4		9	9	9	9	9	9	9	9	9	9	9	124	198.4
3	3	3	3	3	3	3	4	8	8	8	8	8	8	8	8	9	9	9	9	125	200.0
3	3	3	3	3	3	3	4	8	8	8	8	8	8	8	9	9	9	9	9	126	201.6
3	3	3	3	3	3	3	4	8	8	8	8	8	8	9	9	9	9	9	9	127	203.2
3	3	3	3	3	3	4	4	8	8	8	8	8	8	9	9	9	9	9	9	128	204.8
3	3	3	3	3	3	4	4	8	8	8	8	8	9	9	9	9	9	9	9	129	206.4
3	3	3	3	3	3	4	4	8	8	8	8	9	9	9	9	9	9	9	9	130	208.0
3	3	3	3	3	3	4	4	8	8	8	9	9	9	9	9	9	9	9	9	131	209.6

Spill bay openings are expressed in gate stops.

Use the same pattern trend for spill levels exceeding 210 kcfs (i.e. 80% at south bays, 20% at north bays).

SPILL SCHEDULE FOR ADULT FISH AT JOHN DAY DAM
(0500–2000)

BAY NUMBER																				STOPS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
1																				1	1.6
1																			1	2	3.2
1	1																		1	3	4.8
1	1																	1	1	4	6.4
1	1	1																1	1	5	8.0
1	1	1															1	1	1	6	9.6
1	1	1															2	1	1	7	11.2
1	2	1															2	1	1	8	12.8
1	2	1														1	2	1	1	9	14.4
1	2	2														1	2	1	1	10	16.0
1	2	2	1													1	2	1	1	11	17.6
1	2	2	1													2	2	1	1	12	19.2
1	2	2	2													2	2	1	1	13	20.8
1	2	2	2													2	2	2	1	14	22.4
1	2	2	2	1												2	2	2	1	15	24.0
1	2	2	2	2												2	2	2	1	16	25.6
1	2	2	2	2											1	2	2	2	1	17	27.2
1	2	2	2	2											2	2	2	2	1	18	28.8
1	2	2	2	2	1										2	2	2	2	1	19	30.4
1	2	2	2	2	2										2	2	2	2	1	20	32.0
1	2	2	2	2	2									1	2	2	2	2	1	21	33.6
1	2	2	2	2	2									2	2	2	2	2	1	22	35.2
1	2	2	2	2	2	1								2	2	2	2	2	1	23	36.8
1	2	2	2	2	2	2								2	2	2	2	2	1	24	38.4
1	2	2	2	2	2	2							1	2	2	2	2	2	1	25	40.0
1	2	2	2	2	2	2							2	2	2	2	2	2	1	26	41.6
1	2	2	2	2	2	2	1						2	2	2	2	2	2	1	27	43.2
1	2	2	2	2	2	2	2						2	2	2	2	2	2	1	28	44.8
1	2	2	2	2	2	2	2					1	2	2	2	2	2	2	1	29	46.4
1	2	2	2	2	2	2	2					2	2	2	2	2	2	2	1	30	48.0
1	2	2	2	2	2	2	2	1				2	2	2	2	2	2	2	1	31	49.6
1	2	2	2	2	2	2	2	2				2	2	2	2	2	2	2	1	32	51.2
1	2	2	2	2	2	2	2	2			1	2	2	2	2	2	2	2	1	33	52.8
1	2	2	2	2	2	2	2	2			2	2	2	2	2	2	2	2	1	34	54.4

SPILL SCHEDULE FOR ADULT FISH AT JOHN DAY DAM
(0500-2000)

BAY NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	STOPS	KCFS
1	2	2	2	2	2	2	2	2	1		2	2	2	2	2	2	2	2	1	35	56.0
1	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	1	36	57.6
1	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	1	37	59.2
1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	38	60.8
1	2	2	2	2	2	2	2	2	2	3	2	2	2	2	2	2	2	2	1	39	62.4
1	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	1	40	64.0
1	2	2	2	2	2	2	2	2	3	3	3	2	2	2	2	2	2	2	1	41	65.6
1	2	2	2	2	2	2	2	3	3	3	3	2	2	2	2	2	2	2	1	42	67.2
1	2	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2	2	2	1	43	68.8
1	2	2	2	2	2	2	3	3	3	3	3	3	2	2	2	2	2	2	1	44	70.4
1	2	2	2	2	2	2	3	3	3	3	3	3	3	2	2	2	2	2	1	45	72.0
1	2	2	2	2	2	3	3	3	3	3	3	3	3	2	2	2	2	2	1	46	73.6
1	2	2	2	2	2	3	3	3	3	3	3	3	3	3	2	2	2	2	1	47	75.2
1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	2	2	2	2	1	48	76.8
1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2	2	2	1	49	78.4
1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	1	50	80.0
1	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	1	51	81.6
1	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	1	52	83.2
1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	1	53	84.8
1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1	54	86.4
1	2	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	2	1	55	88.0
1	2	3	3	3	3	3	3	3	4	4	3	3	3	3	3	3	3	2	1	56	89.6
1	2	3	3	3	3	3	3	3	4	4	4	3	3	3	3	3	3	2	1	57	91.2
1	2	3	3	3	3	3	3	4	4	4	4	3	3	3	3	3	3	2	1	58	92.8
1	2	3	3	3	3	3	3	4	4	4	4	4	3	3	3	3	3	2	1	59	94.4
1	2	3	3	3	3	3	4	4	4	4	4	4	3	3	3	3	3	2	1	60	96.0
1	2	3	3	3	3	3	4	4	4	4	4	4	4	3	3	3	3	2	1	61	97.6
1	2	3	3	3	3	4	4	4	4	4	4	4	4	3	3	3	3	2	1	62	99.2
1	2	3	3	3	3	4	4	4	4	4	4	4	4	4	3	3	3	2	1	63	100.8
1	2	3	3	3	4	4	4	4	4	4	4	4	4	4	3	3	3	2	1	64	102.4
1	2	3	3	3	4	4	4	4	4	4	4	4	4	4	4	3	3	2	1	65	104.0
1	2	3	3	4	4	4	4	4	4	4	4	4	4	4	4	3	3	2	1	66	105.6
2	3	4	4	3	3	3	3	4	4	4	4	4	3	3	3	4	4	3	2	67	107.2
2	3	4	4	3	3	3	4	4	4	4	4	4	3	3	3	4	4	3	2	68	108.8

SPILL SCHEDULE FOR ADULT FISH AT JOHN DAY DAM
(0500-2000)

BAY NUMBER																				STOPS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
2	3	4	4	3	3	3	4	4	4	4	4	4	4	3	3	4	4	3	2	69	110.4
2	3	4	4	3	3	4	4	4	4	4	4	4	4	3	3	4	4	3	2	70	112.0
2	3	4	4	3	3	4	4	4	4	4	4	4	4	4	3	4	4	3	2	71	113.6
2	3	4	4	3	4	4	4	4	4	4	4	4	4	4	3	4	4	3	2	72	115.2
2	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2	73	116.8
2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2	74	118.4
2	3	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4	3	2	75	120.0
2	3	4	4	4	4	4	4	4	5	5	4	4	4	4	4	4	4	3	2	76	121.6
2	3	4	4	4	4	4	4	4	5	5	5	4	4	4	4	4	4	3	2	77	123.2
2	3	4	4	4	4	4	4	5	5	5	5	4	4	4	4	4	4	3	2	78	124.8
2	3	4	4	4	4	4	4	5	5	5	5	5	4	4	4	4	4	3	2	79	126.4
2	3	4	4	4	4	4	5	5	5	5	5	5	4	4	4	4	4	3	2	80	128.0
2	3	4	4	4	4	4	5	5	5	5	5	5	5	4	4	4	4	3	2	81	129.6
2	3	4	4	4	4	5	5	5	5	5	5	5	5	4	4	4	4	3	2	82	131.2
2	3	4	4	4	4	5	5	5	5	5	5	5	5	5	4	4	4	3	2	83	132.8
2	3	4	4	4	5	5	5	5	5	5	5	5	5	5	4	4	4	3	2	84	134.4
2	3	4	4	4	5	5	5	5	5	5	5	5	5	5	5	4	4	3	2	85	136.0
2	3	4	4	5	5	5	5	5	5	5	5	5	5	5	5	4	4	3	2	86	137.6
2	3	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	3	2	87	139.2
2	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	3	2	88	140.8
2	4	4	5	5	5	5	5	5	5	6	5	5	5	5	5	4	4	3	2	89	142.4
2	4	4	5	5	5	5	5	5	6	6	5	5	5	5	5	4	4	3	2	90	144.0
2	4	4	5	5	5	5	5	5	6	6	6	5	5	5	5	4	4	3	2	91	145.6
2	4	4	5	5	5	5	5	6	6	6	6	5	5	5	5	4	4	3	2	92	147.2
2	4	4	5	5	5	5	5	6	6	6	6	6	5	5	5	4	4	3	2	93	148.8
2	4	4	5	5	5	5	6	6	6	6	6	6	5	5	5	4	4	3	2	94	150.4
2	4	4	5	5	5	5	6	6	6	6	6	6	6	5	5	4	4	3	2	95	152.0
2	4	4	5	5	5	6	6	6	6	6	6	6	6	5	5	4	4	3	2	96	153.6
2	4	4	5	5	5	6	6	6	6	6	6	6	6	6	5	4	4	3	2	97	155.2
2	4	4	5	5	6	6	6	6	6	6	6	6	6	6	5	4	4	3	2	98	156.8
2	4	4	5	5	6	6	6	6	6	6	6	6	6	6	6	4	4	3	2	99	158.4
2	4	4	5	6	6	6	6	6	6	6	6	6	6	6	6	4	4	3	2	100	160.0
2	4	5	5	6	6	6	6	6	6	6	6	6	6	6	6	4	4	3	2	101	161.6
2	4	5	5	6	6	6	6	6	6	6	6	6	6	6	6	5	4	3	2	102	163.2

SPILL SCHEDULE FOR ADULT FISH AT JOHN DAY DAM
(0500-2000)

BAY NUMBER 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	STOPS	KCFS
2	4	5	6	6	6	6	6	6	6	6	6	6	6	6	6	5	4	3	2	103	164.8
2	4	5	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	3	2	104	166.4
2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	3	2	105	168.0
2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	3	2	106	169.6
2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	4	2	107	171.2
2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	2	108	172.8
2	4	6	6	6	6	6	6	6	6	7	6	6	6	6	6	6	6	4	2	109	174.4
2	4	6	6	6	6	6	6	6	7	7	6	6	6	6	6	6	6	4	2	110	176.0
2	4	6	6	6	6	6	6	6	7	7	7	6	6	6	6	6	6	4	2	111	177.6
2	4	6	6	6	6	6	6	7	7	7	7	6	6	6	6	6	6	4	2	112	179.2
2	4	6	6	6	6	6	6	7	7	7	7	7	6	6	6	6	6	4	2	113	180.8
2	4	6	6	6	6	6	7	7	7	7	7	7	6	6	6	6	6	4	2	114	182.4
2	4	6	6	6	6	6	7	7	7	7	7	7	7	6	6	6	6	4	2	115	184.0
2	4	6	6	6	6	7	7	7	7	7	7	7	7	6	6	6	6	4	2	116	185.6
2	4	6	6	6	6	7	7	7	7	7	7	7	7	7	6	6	6	4	2	117	187.2
2	4	6	6	6	7	7	7	7	7	7	7	7	7	7	6	6	6	4	2	118	188.8
2	4	6	6	6	7	7	7	7	7	7	7	7	7	7	7	6	6	4	2	119	190.4
2	4	6	6	7	7	7	7	7	7	7	7	7	7	7	7	6	6	4	2	120	192.0
2	4	6	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	4	2	121	193.6
2	4	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	4	2	122	195.2
2	4	6	7	7	7	7	7	7	7	8	7	7	7	7	7	7	6	4	2	123	196.8
2	4	6	7	7	7	7	7	7	8	8	7	7	7	7	7	7	6	4	2	124	198.4
2	4	6	7	7	7	7	7	7	8	8	8	7	7	7	7	7	6	4	2	125	200.0
2	4	6	7	7	7	7	7	8	8	8	8	7	7	7	7	7	6	4	2	126	201.6
2	4	6	7	7	7	7	7	8	8	8	8	8	7	7	7	7	6	4	2	127	203.2
2	4	6	7	7	7	7	8	8	8	8	8	8	7	7	7	7	6	4	2	128	204.8
2	4	6	7	7	7	7	8	8	8	8	8	8	8	7	7	7	6	4	2	129	206.4
2	4	6	7	7	7	8	8	8	8	8	8	8	8	7	7	7	6	4	2	130	208.0
2	4	6	7	7	7	8	8	8	8	8	8	8	8	8	7	7	6	4	2	131	209.6
2	4	6	7	7	8	8	8	8	8	8	8	8	8	8	7	7	6	4	2	132	211.2
2	4	6	7	7	8	8	8	8	8	8	8	8	8	8	8	7	6	4	2	133	212.8
2	4	6	7	8	8	8	8	8	8	8	8	8	8	8	8	7	6	4	2	134	214.4
2	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	7	6	4	2	135	216.0
2	4	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	6	4	2	136	217.6

SPILL SCHEDULE FOR ADULT FISH AT JOHN DAY DAM
(0500-2000)

BAY NUMBER																				STOPS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
2	4	6	8	8	8	8	8	8	8	9	8	8	8	8	8	8	6	4	2	137	219.2
2	4	6	8	8	8	8	8	8	9	9	8	8	8	8	8	8	6	4	2	138	220.8
2	4	6	8	8	8	8	8	8	9	9	9	8	8	8	8	8	6	4	2	139	222.4
2	4	6	8	8	8	8	8	9	9	9	9	8	8	8	8	8	6	4	2	140	224.0
2	4	6	8	8	8	8	8	9	9	9	9	9	8	8	8	8	6	4	2	141	225.6
2	4	6	8	8	8	8	9	9	9	9	9	9	8	8	8	8	6	4	2	142	227.2
2	4	6	8	8	8	8	9	9	9	9	9	9	9	8	8	8	6	4	2	143	228.8
2	4	6	8	8	8	9	9	9	9	9	9	9	9	8	8	8	6	4	2	144	230.4
2	4	6	8	8	8	9	9	9	9	9	9	9	9	9	8	8	6	4	2	145	232.0
2	4	6	8	8	9	9	9	9	9	9	9	9	9	9	8	8	6	4	2	146	233.6
2	4	6	8	8	9	9	9	9	9	9	9	9	9	9	9	8	6	4	2	147	235.2
2	4	6	8	9	9	9	9	9	9	9	9	9	9	9	9	8	6	4	2	148	236.8
2	4	6	9	9	9	9	9	9	9	9	9	9	9	9	9	8	6	4	2	149	238.4
2	4	6	9	9	9	9	9	9	9	10	9	9	9	9	9	8	6	4	2	150	240.0
2	4	6	9	9	9	9	9	9	10	10	9	9	9	9	9	8	6	4	2	151	241.6
2	4	6	9	9	9	9	9	9	10	10	10	9	9	9	9	8	6	4	2	152	243.2
2	4	6	9	9	9	9	9	10	10	10	10	9	9	9	9	8	6	4	2	153	244.8
2	4	6	9	9	9	9	9	10	10	10	10	10	9	9	9	8	6	4	2	154	246.4
2	4	6	9	9	9	9	10	10	10	10	10	10	9	9	9	8	6	4	2	155	248.0
2	4	6	9	9	9	9	10	10	10	10	10	10	10	9	9	8	6	4	2	156	249.6
2	4	6	9	9	9	10	10	10	10	10	10	10	10	9	9	8	6	4	2	157	251.2
2	4	6	9	9	9	10	10	10	10	10	10	10	10	10	9	8	6	4	2	158	252.8
2	4	6	9	9	10	10	10	10	10	10	10	10	10	10	9	8	6	4	2	159	254.4
2	4	6	9	9	10	10	10	10	10	10	10	10	10	10	10	8	6	4	2	160	256.0
2	4	6	9	10	10	10	10	10	10	10	10	10	10	10	10	8	6	4	2	161	257.6
2	5	6	9	10	10	10	10	10	10	10	10	10	10	10	10	8	6	4	2	162	259.2
2	5	6	9	10	10	10	10	10	10	10	10	10	10	10	10	9	6	4	2	163	260.8
2	5	6	9	10	10	10	10	10	10	11	10	10	10	10	10	9	6	4	2	164	262.4
2	5	6	9	10	10	10	10	10	11	11	10	10	10	10	10	9	6	4	2	165	264.0
2	5	6	9	10	10	10	10	10	11	11	11	10	10	10	10	9	6	4	2	166	265.6
2	5	6	9	10	10	10	10	11	11	11	11	10	10	10	10	9	6	4	2	167	267.2
2	5	6	9	10	10	10	10	11	11	11	11	11	10	10	10	9	6	4	2	168	268.8
2	5	6	9	10	10	10	11	11	11	11	11	11	10	10	10	9	6	4	2	169	270.4
2	5	6	9	10	10	10	11	11	11	11	11	11	11	10	10	9	6	4	2	170	272.0

SPILL SCHEDULE FOR ADULT FISH AT JOHN DAY DAM
(0500-2000)

BAY NUMBER																				STOPS	KCFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
2	5	6	9	10	10	11	11	11	11	11	11	11	11	10	10	9	6	4	2	171	273.6
2	5	6	9	10	10	11	11	11	11	11	11	11	11	11	10	9	6	4	2	172	275.2
2	5	6	9	10	11	11	11	11	11	11	11	11	11	11	10	9	6	4	2	173	276.8
2	5	6	9	10	11	11	11	11	11	11	11	11	11	11	11	9	6	4	2	174	278.4
2	5	6	9	11	11	11	11	11	11	11	11	11	11	11	11	9	6	4	2	175	280.0
																				0	0.0

Continue as in rows above, opening from ends toward center, using 1 stop increments on innermost gate of gates 5 through 16 if necessary.

Gates 1, 2, 18, 19 and 20 limit at 9 stops.

2.3. Juvenile Fish Passage Facilities.

2.3.1. Operating Criteria.

2.3.1.1. Prior to Juvenile Fish Passage Season.

a. Remove debris from forebay, all trash racks, and gatewell slots, such that these areas are free of debris on 1 April.

b. Inspect all VBSs for damage, holes, debris accumulations, or protrusions (video inspection acceptable). Clean and repair when necessary.

c. Inspect each STS and operate on trial run (dogged off at deck level).

d. By 1 April, place STS in each intake of all operational units, unless otherwise coordinated with regional fishery agencies and tribes.

e. Inspect and, where necessary, clean and/or repair all gatewell orifices and orifice lighting systems, such that these systems are clear of debris and operable on 1 April.

f. Check calibration of automatic control of DSM tainter gate and other necessary sensors weekly and recalibrate as necessary. Report summaries of equipment recalibration in the weekly operation monitoring reports.

g. Inspect, maintain and, where necessary, repair the DSM conduit tainter gate.

h. Inspect and correct any deficiencies of walls and floor of DSM conduit, raceway, and outfall.

i. Inspect and where necessary, repair spill gates, and the associated control system. Spillways, except for coordinated exceptions, must be able to achieve standard spill patterns on 1 April.

j. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical. Install and test operate avian water cannon on the JBS outfall. Avian abatement measures shall be operable by 1 April.

k. The results of all inspections and the readiness of the facility for operation will be verbally reported at the Corps' Fish Passage O&M Coordination Team meeting immediately prior to the start of the juvenile fish passage season.

2.3.1.2. Juvenile Fish Passage Season. (1 April through 30 November).

a. Measure gatewell drawdown a minimum of once per week. Remove debris from forebay and trash racks as required to maintain less than 1.5 feet of drawdown in gatewell.

b. Main units one through five will be raked every two weeks between 1 April and 1 July.

c. Units six through ten or units eleven through sixteen will be alternately raked with units one through five (above) from 1 April through 1 July.

d. NMFS will inspect the airlift sampler at least weekly or more frequently if sudden increases in descaling are noted.

e. Debris accumulations in the forebay of 500 square feet or more will be removed within 48 hours. Efforts should continue until the debris load has been removed.

f. If debris loads are obvious in the forebay, trash will be raked in front of the affected units weekly until the debris load has been removed.

g. Additional raking will occur whenever trash accumulations are suspected because of increased differential (1.5') across the trash racks, or as determined by the project biologist in reference to indicators such as increased juvenile fish descaling at the dam or increased accumulations of tumbleweeds in the forebay. STSs in units being raked will run continuously during raking operation. Gatewell orifices of the unit being raked must be closed during the raking operation.

h. Inspect each STS once per month, except for unit 3B slot, which should be inspected visually every other month by pulling the screens, and each VBS a minimum of once every two months (video is acceptable). VBS inspections will occur immediately prior to peaks in the juvenile fish migrations (early-May and early-July). Inspections will be concentrated on the priority units and those others with the longer operating time. More frequent inspections may be required under the following conditions; deterioration of fish condition, increased debris load in bypass system, and other indications of STS or VBS malfunction or failure. Prior to pulling VBS' for inspections, shut off units and dip gatewells. If STS or VBS damage or plugging is detected, follow procedures in the following maintenance plan. Records of inspections or summary of such records will be made available to the FPC by 1 January. Screen inspections will not occur in main unit 1 until after 1200 hours. Main unit 2 will operate (within 1%, but not regulated by the 100 MW criteria) for the duration of the outage.

CBFWA recommends that VBS inspections be conducted once per month through the fish passage season.

i. Operate all gatewell orifices. Inspect daily to assure that the orifice lights are operating. Replace all burned out orifice lights within 24 hours. Close and open each orifice at least once daily or more frequently, if necessary, due to debris accumulations in the gatewells.

j. Inspect each STS amp and/or watt meter readings at least once per shift. If an STS failure occurs, then follow procedures in 3. Fish Facilities Maintenance.

k. Inspect all STS gatewells daily. The project will clean before gatewell water surface becomes half covered with debris. If, due to the volume of debris, it is not possible to keep the gatewell surfaces at least clear, they will be cleaned at least once daily. Turbines with a gatewell fully covered with debris will not be operated except to be in compliance with other coordinated fishery measures, and then only on a last on/first off basis. The powerhouse gatewell orifices will be closed during the debarking operation. After debarking a gatewell, cycle the orifice in that gatewell. Check gatewell drawdown.

CBFWA recommends that the gatewells be cleaned before they become half covered with debris.

l. A slight oily sheen is commonly found in many gatewells. This may come from sources such as lubricated lifting beams, etc. But, when unusual accumulations of oil (e.g., oil slick) occur in gate slots, they will be removed within 24 hours. When this is not possible, the JBS orifice will be closed and the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in consultation with FPC or NMFS. Regardless of unit operating status, oil accumulations will be dealt with promptly.

m. Coordinate gatewell cleaning with personnel operating downstream migrant sampling facilities.

n. Reinstall or repair avian predator control lines in present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines in locations determined to be significantly impacted by avian predators. Implement other avian abatement measures as necessary in areas where avian lines are not practical. Maintain operation of the avian water cannon on the JBS outfall.

o. Turbine units without full complements of STSs will not operate, except to be in compliance with other coordinated fishery measures.

CBFWA recommends no operation of partially or fully unscreened turbine units unless otherwise agreed.

p. Inspect facilities twice each day, unless other guidance is provided elsewhere within this plan for specific facilities.

2.3.1.3. Winter Maintenance Season. (16 December through 31 March).

a. To reduce adult fallback mortality, the juvenile bypass system, or DSM channel will operate from 30 November to 15 December. STSs will remain installed during this period. After 15 December, all STSs may be removed.

b. Dewater DSM channel (see 5. Dewatering Plans.; also, item 3.2.1.2. Juvenile Bypass System.) only when required for inspection, maintenance, or structural modifications. The outage period will be minimized to the extent practicable.

c. All units are available to meet power demands.

d. Inspect facilities once per day.

2.4. Adult Fish Passage Facilities.

2.4.1. Operating Criteria.

2.4.1.1. Prior to Adult Passage Period.

a. Inspect and calibrate all staff gauges, water level sensors, and indicators. Repair and/or clean where necessary.

b. Dewater and inspect all ladders and all other dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or slow their progress up the ladder. Repair deficiencies.

c. Inspect for and, when necessary, clear debris in ladder exits.

d. Reinstall picket leads at counting stations prior to watering up ladders during maintenance.

e. Repair or, when necessary, upgrade netting at top of both fish ladders to keep fish from leaping out of the ladders.

f. The results of all inspections and the readiness of the facility for operation will be verbally reported at the Corps' Fish Passage O&M Coordination Team meeting immediately prior to the fish passage season.

2.4.1.2. Adult Fish Passage Period. (1 March through 30 November).

a. All Adult Facilities.

1. Water depth over fish ladder weirs: 1.0' +/- 0.1'. If shad passage becomes a problem, water depth should be increased to 1.3' +/- 0.1'.

2. Measure water temperature within each ladder system and at associated forebay and tailwater locations daily to reveal if temperature variances exist between locations. Summaries of water temperature measurements will be included in weekly operation monitoring reports.

3. Head on all entrances: 1.0 to 2.0 feet (prefer 1.5'). Refer to 3.3.1. Scheduled Maintenance. when unable to achieve head criteria.

4. A transportation velocity of 1.5 to 4.0 feet per second (prefer 2.0 fps) shall be maintained in all channels and the lower ends of the fish ladders which are below the tailwater.

5. Maximum of 0.5' head on attraction water intakes and trashracks at all the ladder exits, with a 0.3' maximum head on all picket leads. Debris shall be removed when significant amounts accumulate.

6. Staff gauges and water level indicators will be readable at all water levels encountered during the fish passage period, and calibrated weekly.

7. Main entrance weir depths: 8.0 feet or greater below tailwater. When possible, set gates at 8.5 feet of depth so that even with water fluctuation, the gates will more often exceed 8.0 feet. Maintain tailwater at 158.0' msl or greater. The entrance weirs bottom out at 158.0' msl

tailwater. If tailwater is below that level, an entrance depth criteria of 8.0' cannot be obtained. Weirs will be lowered to bottom when 8.0 feet of depth is not possible.

8. Count station crowders shall remain in the operating position while visual counting and/or video taping is being conducted. If counting is temporarily discontinued due to unscheduled events, or the fishway is dewatered, the crowder shall be fully opened, except during the counters' hourly ten minute break period. Leave fish passage slot lighted overnight after counting ends each day.

9. Inspect facilities twice each day.

10. Inspect and ensure that optimum passage conditions are maintained at fishway entrances, exits, and count slots.

b. North Fishway.

1. Operate two downstream gates (EW-1 and EW-2). Use staff gauge nearest entrance weirs to calculate entrance head.

2. Spill through bay 1 as follows: In the summer and fall (1 June through 31 October), spill 1800 cfs from 0400 - 2000 hours.

c. South Fishway.

1. Operate downstream gate SE-1. Use staff gauge in the Fish Pump Intake Stilling Basin for tailwater elevation, and staff gauge in the channel immediately upstream from gate SE-1 to calculate entrance head.

d. Powerhouse.

1. Operate entrances NE-1 and NE-2.

2. Operate ten powerhouse floating orifices, numbers 1, 2, 3, 6, 9, 12, 15, 17, 18, and 19 (open associated auxiliary water diffusers).

3. Operate SE-1

4. From 0400-2000 PST, operate powerhouse turbine unit #1 near 100 megawatts (+/- 10MW) to facilitate best entrance conditions, unless additional load is required to meet the load requirements of the BPA administrator, whose load requests will be made in accordance with BPA's load shaping guidelines, be in compliance with other coordinated fishery measures, or to avoid forcing an unscreened unit to operate to provide required load.

2.4.1.3. Winter Operating Period, or In-water Work Period (1 December through February).

a. Adult Fish Facilities.

1. Operate according to fish passage season standards, except facility may be dewatered or operated out of criteria for maintenance or repair. Outage periods will be minimized to the extent practicable.

2. Only one of the two fish facilities may be out of service at a time unless specially coordinated. The other facility must be operated at full passage season criteria unless specially coordinated with the fishery agencies and tribes through the Corps' Fish Passage O&M Coordination Team. However, operation of unit 2 may be substituted for unit 1 without special coordination.

3. Pull picket leads at counting stations and have crowders adjusted such that the counting slots are fully open at the end of the counting season (this will be done shortly after adult fish counting ends).

4. Maximum of 0.5' head on attraction water intakes and trashracks at all ladder exits. Debris shall be removed when significant amounts accumulate.

5. Inspect the facilities once per day.

3. Fish Facilities Maintenance.

3.1. General.

3.1.1. Scheduled Maintenance.

3.1.1.1. Staff gauges will be installed, cleaned, and/or repaired as required.

3.1.1.2. A zebra mussel monitoring program will continue. These organisms have become a serious problem elsewhere in the country and are expected to eventually be introduced into the Columbia.

3.1.1.3. Scheduled fishway maintenance, to the extent practicable, will be conducted during periods when passage has been documented to be at its lowest during the regular scheduled workday, to minimize impacts to migrating salmonids.

3.2. Juvenile Fish Passage Facilities.

3.2.1. Scheduled Maintenance.

3.2.1.1. Submersible Traveling Screens. The STS system may receive preventive maintenance or repair anytime during the year including the winter maintenance period when all STSs may be removed from the intakes. Whenever a generator malfunctions or is scheduled for maintenance, the three STSs in that turbine may be maintained, repaired, or exchanged for other STSs needing maintenance or repair. About one third of the STSs at John Day are scheduled for complete overhaul each year resulting in a three year maintenance cycle unless future developments indicate that a longer life expectancy is possible.

3.2.1.2. Juvenile Bypass System. The John Day juvenile bypass facilities may receive preventive maintenance at all times of the year. During the juvenile fish passage season this will normally be above water work, such as maintenance of automatic systems, air lines, electrical systems, and monitoring equipment. During the winter maintenance period the system is dewatered downstream of the gatewell orifices. The system is then visually inspected in all accessible areas for damaged equipment and areas that may cause problems to the juvenile fish. Any problems identified are repaired if the project is able. In extreme cases, the work will be contracted as soon as possible or repaired during the next winter maintenance period. Modifications and general maintenance to the channel are also completed at this time.

Main units one through five will be raked every two weeks between 1 April and 1 July. Units six through ten or units eleven through sixteen will be alternately raked with units one through five from 1 April to 1 July. If descaling is at least 5% higher in airlift sampled fish than in dip net sampled fish, arrangements will be made to remove the airlift for inspection and repair. The STS and VBS will be video inspected and if excessive debris is found (as compared to other slots) the screens will be cleaned, dewatering the gatewell if necessary. NMFS will inspect the airlift sampler at least weekly, and more frequently if sudden increases in descaling are noted. Debris accumulations in the forebay of 500 square feet or more will be removed within 48 hours. Efforts should continue until the debris load has been completely removed. If debris loads are obvious in the forebay, trash will be raked in front of the affected units weekly until the debris load has been removed. Additional raking will occur whenever trash accumulations are suspected because of increased differential (1.5') across the trash racks, or as determined by the project biologist in reference to indicators such as increased juvenile fish descaling at the dam or increased accumulations of tumbleweeds in the forebay. The gatewell orifices must be closed during the raking process.

3.2.1.3. Turbines and Spillway. The maintenance and routine repair of project turbines and spillways is a regular and recurring process which requires that units be shut down for up to two months (see 5. Dewatering Plans.). The maintenance schedules for these turbines and spillways will be coordinated through the Corps' Fish Passage O&M Coordination Team. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the area of fishway entrances, to keep predator fish from accumulating in the area of juvenile release sites and to move juveniles downstream away from the project. The maintenance schedules for these turbines and spillways will reflect equal weighting given to fish, power, and water management and will be coordinated with the appropriate fisheries agencies.

Some types of maintenance on turbines will result in the requirement to test operate the turbines throughout it's full range of capability before returning the turbine to normal service.

3.2.2. Unscheduled Maintenance.

3.2.2.1. Submersible Traveling Screens. If an STS or VBS is found to be damaged or inoperative in an operating unit, the unit will be regarded as an unscreened unit. The screen will be repaired or replaced before returning the unit to normal service. Between 16 April and 31 August, and the six days following a juvenile fish release in the John Day pool or as determined by the project biologist based on juvenile salmon passage by John Day Dam, a crane crew will be taken off lower priority work or will work overtime to remove and replace (if spare available) a damaged or malfunctioning STS or VBS from any unit needed or likely to be needed for power within the next 48 hours. Crews will work overtime or on weekends as required.

3.2.2.2. Juvenile Bypass System.

a. John Day's juvenile bypass system is controlled by automatic systems. If the automatic system fails, it can usually be operated manually. This allows the facility to operate according to criteria while repair of the automatic system is completed. If the orifices become plugged with debris they are mechanically cleaned.

b. Inspect all STS gatewells daily. The project will clean before gatewell water surface becomes one half covered with debris. If due to the volume of debris, it is not possible to keep the gatewell surfaces at least half clear, they will be cleaned at least daily. Turbines with a gatewell fully covered with debris will not be operated except on a last on/first off basis, if required to be in compliance with other coordinated fishery measures. The gatewell orifices must be closed during the debarking process.

CBFWA recommends that the gatewells be cleaned before they become half covered with debris.

c. If the bypass system fails in the powerhouse conduit, tainter gate, or transportation outfall making the system unsafe for fish, the decision to dewater for repairs will be made in coordination with the agencies on the Fish Passage O&M Coordination Team. During this emergency operating mode, power generation will be minimized to the extent practicable. If this operating mode is expected to last longer than four days, then all units required for generation will be sequentially shut down, fish salvaged from the gatewell, the STS removed, and the unit restarted. The orifice gates will be closed, then opened once each day to float any debris accumulating around the orifice.

d. During fishway inspection activities, VBSs may be found to be plugged with debris or damaged. In these cases, the associated unit will be regarded as if unscreened and repairs will be made before returning the unit to normal service.

3.2.2.3. Turbines and Spillways.

a. If a spill gate becomes inoperable, the operators will immediately notify the Operations supervisor and project biologist to determine the best pattern to follow until repairs can be made.

b. Unit 2 will replace unit 1 for adult attraction, should unit 1 become inoperative.

3.3. Adult Passage Facilities.

3.3.1. Scheduled Maintenance.

3.3.1.1. Fishway Auxiliary Water Systems. The John Day Dam has pump style auxiliary water systems. Preventive maintenance and normal repair are carried out throughout the year. Trashracks for the AWS intakes will be raked when drawdown exceeds criteria. When practicable, rake trashracks during the time of day when fish passage is least affected.

During the annual navigation lock maintenance outage, normally in March, the North Ladder auxiliary water is shut off for about half a day. This is required to allow divers to clean off the navigation lock discharge sill so that a bulkhead can be placed.

3.3.1.2. Powerhouse and Spillway Fish Collection Systems. Preventive maintenance and repair occurs throughout the year. During the adult fish passage season this maintenance will not involve any operations which will cause a failure to comply with the adult fishway criteria unless specially coordinated with the fishery agencies and tribes through the Corps' Fish Passage O&M Coordination Team. Inspection of those parts of the adult collection channel systems which require dewatering such as diffusion gratings, picket leads, and entrance gates will be scheduled at least once per year during the winter maintenance season while the system is dewatered, with one additional inspection during the fish passage season, unless a channel must be dewatered for fishway modifications or to correct observed problems (see 5. Dewatering Plans.). Inspection by a diver or underwater video system may be used for the underwater inspections.

This scheduled inspection and any associated maintenance will occur during the winter maintenance period. Any non-routine maintenance and fishway modifications will be handled on a case by case basis.

The project biologist or alternate Corps fisheries personnel will attend all dewatering activities potentially involving fish, as well as inspections to provide fishery input (see 5. Dewatering Plans.).

3.3.1.3. Adult Fish Ladders and Counting Stations. The adult fish ladders will be dewatered once each year (unless specially coordinated) during the winter maintenance period. During this time the ladders are inspected for blocked orifices, projections into the fishway that may injure fish, stability of the weirs, damaged picket leads, exit gate problems, loose diffusion gratings, unreadable or damaged staff gauges, defective diffusion valves, and malfunctioning operating equipment at the counting stations. Potential problems identified throughout the passage year that do not impact fish passage, as well as those identified during the dewatered period, are then repaired. Trashracks at the ladder exits will be raked when criteria is exceeded. When practicable, rake trashracks during the time of day when fish passage is least affected. Fish count station windows, light panels, and crowder panels will be cleaned as needed to achieve accurate counts, and when practicable, during the time of day when fish passage is least affected.

The netting installed on the ladders to prevent fish leaping will be inspected weekly and maintained when necessary. Summaries of inspections will be included in the weekly activity report.

3.3.2. Unscheduled maintenance.

3.3.2.1. Fishway Auxiliary Water Systems. The fishway auxiliary water systems are operated mostly automatically. If the automatic system fails, the system will be operated manually by project personnel. This will allow the fish facility to operate according to criteria while the automatic system is repaired. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure that criteria are being met.

a. South Ladder. If one of the three auxiliary water turbines fails, assuming all three turbines are being used to meet criteria, bulkheads will be installed in the failed turbine discharge conduit and the output of the two remaining turbines will be increased to bring the fishway into agreement with the adult fishway criteria.

If a second turbine unit fails, bulkheads will be installed in the second failed turbine intake conduit, and the adult fish facility will be operated as follows until a fishway head of 1.0 foot is achieved.

1. Raise the north powerhouse entrances (NE-1, NE-2) in 1.0 foot increments to 6.0 feet of total depth below the tailwater surface.

2. Close NE-1.

3. Raise the south powerhouse entrance weir (SE-1) in 1.0 foot increments to 6.0 feet of depth below the tailwater surface.

4. Close the center five floating gate submerged orifice entrances starting at the north end (17, 15, 12, 9, 6).

5. If the above criteria are still not achieved, then leave in this configuration until more auxiliary water becomes available. Then reverse the above procedure.

If all three turbine units fail, bulkheads will be installed in the failed turbine discharge conduits and the adult fish facility will be operated as follows until repairs can be made.

6. SE-1 will be open with the weir crest 6.0 feet below the tailwater surface.

7. Cross channel bulkheads will be placed in the powerhouse collection channel between units 2 and 3.

8. The floating orifice gate in front of unit 2 will be closed, leaving the floating orifice gate in front of unit 1 open.

b. North Ladder. This system can operate according to the adult fishway criteria under most conditions by using fewer than the six auxiliary water pumps. If one pump fails, one of the standby pumps will be started. This routine will be followed until the available pumps can no longer meet the adult fishway criteria. If this occurs, then EW-2 will be raised in 1.0 foot increments until a fishway head of 1.0 foot is met or until the weir crest reaches a depth of 6.0 feet below the tailwater surface. If this fishway criterion is still not met, EW-1 will be raised in 1.0 foot increments until that criterion is met or the weir crest reaches a depth of 6.0 feet below the tailwater surface. If the criterion is still not achieved, close EW-2 and the EW-1 weir will be maintained at the 8.0 foot level. If head of 1.0 is not met, then raise EW-1 in 1.0 foot increments until the weir crest reaches a depth of 6.0 feet below tailwater surface. Maintain in this condition until repairs reach a stage which allows more water to be added to the system. The weirs will then be opened in the reverse order in which they were closed.

3.3.2.2. Powerhouse and Spillway Fish Collection Systems. The John Day Dam contains several types of fishway entrances. In most cases, if failures occur, the entrance can and will be operated manually by project personnel until repairs are made. When this operation becomes necessary, project personnel will increase the surveillance of the adult system to ensure criteria are being met. In those cases in which the failure will not allow the entrance to be operated manually, the gate will be maintained, to the extent possible, in an operational position. If this is not possible, the entrance will be repaired expediently, and the entrance will be returned to manual or automatic control at the earliest possible date.

3.3.2.3. Adult Fish Ladders and Counting Stations. The structures of the ladders include picket leads, counting stations, fishway exits, and overflow weirs with orifices. Pickets with excessive spacing (greater than 1"), erosion of concrete around the picket leads, or missing pickets can allow fish into areas where escape is not possible. In some instances of picket lead failure, there are spare picket leads and spare installation slots. In these cases, the spare leads are installed and the damaged leads are removed and repaired. In the remaining instances of picket lead failure or concrete erosion, the timing and method of repair will depend upon the severity of the problem. The decision of whether or not to dewater the fishway and repair any problem will be made in coordination with the Fish Passage O&M Coordination Team.

4. Turbine Unit Operation and Maintenance.

4.1. The project's turbine unit maintenance schedules will be reviewed by project and district biologists for fishery impacts.

4.2. Guidelines for operation of the turbine units within 1% peak efficiency at various head ranges are shown in John Day Dam Peak Turbine Efficiency Ranges (p. JDA-32).

4.3. To the extent technically feasible, turbines will be operated within +/- 1% of peak turbine efficiency (appendix C), unless operation outside of that range is necessary to meet load requirements of the BPA administrator, whose load requests will be consistent with BPA's System Load Shaping Guidelines, or to comply with other coordinated fishery measures. BPA's System Load Shaping Guidelines (appendix C) apply between 15 March and 31 October. However, during the rest of the year, the project will continue to operate units within the peak turbine efficiency range, except as specifically requested by BPA to do otherwise as power requirements demand.

CBFWA recommends operation of all units within 1% of peak turbine efficiency unless otherwise agreed. (These comments apply to item 4.4. also.)

4.4. Juvenile fish passage decreases through units from South to the North, making inefficient operation of unit 16 least likely to impact fish. Based on this, if it is necessary to select turbines to operate outside the peak efficiency range, they will be selected in sequence from North to South. However, allowance will also be given to special project requirements for stable voltage control which require load distribution between transformer banks.

Turbine Units With Standard-Length Submersible Traveling Screens Installed:

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	75	12,168	137	22,317
86	76	12,168	140	22,441
87	76	12,010	141	22,331
88	77	12,009	142	22,238
89	78	12,006	144	22,151
90	79	12,003	145	22,067
91	79	11,872	146	21,982
92	80	11,874	149	22,106
93	81	11,878	150	22,023
94	82	11,887	151	21,943
95	83	11,897	152	21,866
96	83	11,790	154	21,792
97	84	11,803	155	21,724
98	85	11,813	155	21,478
99	86	11,814	155	21,237
100	86	11,713	155	21,024
101	87	11,717	155	20,816
102	88	11,720	155	20,588
103	89	11,723	155	20,365
104	89	11,628	155	20,146
105	90	11,733	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information for John Day Dam. This table is based on data from Little Goose Dam.

Turbine Units With Extended-Length Submersible Bar Screens Installed:

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	69	11,204	128	20,769
86	70	11,256	130	20,866
87	72	11,308	133	20,963
88	73	11,360	135	21,058
89	74	11,424	137	21,177
90	75	11,462	140	21,247
91	77	11,525	142	21,364
92	78	11,575	144	21,457
93	79	11,611	147	21,523
94	80	11,673	149	21,638
95	82	11,708	151	21,703
96	83	11,742	154	21,767
97	84	11,803	155	21,724
98	86	11,850	155	21,478
99	87	11,897	155	21,237
100	88	11,957	155	21,024
101	89	12,017	155	20,816
102	91	12,062	155	20,588
103	92	12,107	155	20,365
104	93	12,152	155	20,146
105	95	12,210	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information for John Day Dam. This table is based on data from Little Goose Dam.

Turbine Units 1-3 Without Screens:

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	75	12,168	137	22,317
86	76	12,168	140	22,441
87	76	12,010	141	22,331
88	77	12,009	142	22,238
89	78	12,006	144	22,151
90	79	12,003	145	22,067
91	79	11,872	146	21,982
92	80	11,874	149	22,106
93	81	11,878	150	22,023
94	82	11,887	151	21,943
95	83	11,897	152	21,866
96	83	11,790	154	21,792
97	84	11,803	155	21,724
98	85	11,813	155	21,478
99	86	11,814	155	21,237
100	86	11,713	155	21,024
101	87	11,717	155	20,816
102	88	11,720	155	20,588
103	89	11,723	155	20,365
104	89	11,628	155	20,146
105	90	11,733	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information for John Day Dam. This table is based on data from Little Goose Dam.

5. Dewatering Plans.

5.1. Guidelines for Dewatering and Fish Handling Plans (appendix G) have been developed and are followed for project facilities dewaterings. These plans include consideration for fish safety and are consistent with the following general guidance. The appropriate plans are reviewed by participants before each salvage operation.

5.2. The project fish biologist and/or alternate Corps fisheries personnel will attend all project activities involving fish handling.

5.3. The fisheries agencies and tribes will be invited to assist in any dewatering, and at a minimum, will be represented at all ladder dewaterings by the WDFW fish counting program supervisor or an alternate.

5.4. Adult Fish Ladders.

5.4.1. Scheduled Maintenance.

5.4.1.1. When possible, operate ladder to be dewatered at reduced flow for at least 24 hours, but not more than 96 hours prior to dewatering. Reduced flow is defined as less than criterion operation, but more than orifice flow.

5.4.1.2. Discontinue all fishway auxiliary water supply at least 24 hours, but no more than 96 hours prior to dewatering.

5.4.1.3. The project biologist will assure that fish rescue equipment is available, and will coordinate to ensure adequate numbers of personnel will be available to move fish out of the dewatered ladder.

5.4.1.4. Project personnel will install head gates to shut down ladder flow. Where possible, a flow of 1-2 inches will be maintained in the ladder until fish are rescued.

5.4.1.5. The project biologist or alternate Corps fisheries personnel will oversee fish rescue when the ladders are dewatered. The project biologist will invite fishery agency and/or tribal biologists' participation in the dewatering. Rescue personnel will walk the inside of the ladder from the head gates down to tailwater salvaging all fish either by moving fish to tailwater within the ladder flow, or capturing and placing the fish in a large water filled tank, which is then transported to the forebay or tailwater, depending on the fish' life stage (adults to forebay, juveniles to tailrace), for release.

5.4.2. Unscheduled Maintenance.

5.4.2.1. When possible, discontinue auxiliary water and operate ladder at reduced flow as long as possible (prefer 3-24 hours) prior to dewatering.

5.4.2.2. Follow steps 5.4.1.3. through 5.4.1.5. above.

5.5. Powerhouse Fish Collection System.

5.5.1. Scheduled Maintenance.

5.5.1.1. During the pumping or draining operation to dewater a portion or all of the collection channel, the water level will not be allowed to drop to a level which strands fish. Adequate inspections will be conducted to ensure that stranding does not occur.

5.5.1.2. The project biologist will assure that rescue equipment is available if needed.

5.5.1.3. The project biologist or alternate Corps fisheries personnel will provide technical guidance on fish safety and will assist directly in rescue operations.

5.6. Juvenile Bypass System.

5.6.1. Scheduled Maintenance.

5.6.1.1. It is normal practice, when draining the juvenile bypass channel, to flush the channel with only the bypass orifices in bay 16 open. The associated gatewells will be dipped in advance to minimize the number of fish contained in this flushing water.

5.7. Turbines.

5.7.1. Remove juvenile fish from the gatewell(s) which will be drained. This is done by use of a special dipping basket. Typically, one of the three gatewells is drained to allow ventilation into the draft tube. Immediately before setting the headgates, spin the unit to move fish out of the draft tube.

5.7.2. When possible, place head gates and tail logs immediately after the turbine unit is shut down if the draft tube is to be dewatered.

5.7.3. If the turbine unit draft tube is to be dewatered and the turbine unit has been idle for any length of time, it will be operated when possible, at "speed/no load" and stop logs will then be placed immediately.

5.7.4. Water levels in the draft tube will not be allowed to drop to a level which strands fish. Adequate inspections will be conducted to ensure that stranding does not occur.

5.7.5. Fish rescue personnel will inspect dewatered turbine draft tubes and intakes as soon as the water levels reach a depth permitting visual inspection and the hatch cover is opened. The project biologist or alternate Corps fisheries personnel will provide technical guidance on fish safety and will directly participate in fish salvage.

5.7.6. The project biologist will assure that rescue equipment is available if needed.

5.7.7. If the turbine unit is planned to be partially dewatered for less than 4 days and low numbers of fish are trapped, then removal of fish from draft tubes will not be necessary as long as an adequate "safety pool" is maintained. Adequate inspections will need to be conducted to ensure that the safety pool is maintained and fish are in good condition.

6. Endnotes.

[1] Hydroacoustic Monitoring of Downstream Migrant Juvenile Salmonids at John Day Dam in 1983. R. Magne et.al., US COE research Report. 35 pp. plus appendices. (1987)

[2] Hydroacoustic Monitoring of Downstream Migrant Juvenile Salmonids at John Day Dam 1984-85. R. Magne et. al. , US COE Research Report. 29 pp. plus appendices. (1987)

[3] Hydroacoustic Evaluation of Juvenile Salmonid Fish Passage at John Day Dam in Summer 1986. Sue Kuehl, BioSonics, Inc. Final Report. Prepared for US COE under Contract No. DACW57-86-C-0088. 61 pp. plus appendices. (1987)

[4] Hydroacoustic Evaluation of the Spill Program for Fish Passage at John Day Dam in 1987. L. Johnson et. al., Associated Fisheries Biologists, Inc. Final Report prepared for US COE under Contract No. DACW57-87-C-0077. 71 pp. plus appendices. (1987)

SECTION 5

McNARY DAM

McNary Dam

1. Fish Passage Information.

The locations of fish passage facilities are shown on the following general site plan for McNary Lock and Dam (Figure 9). Dates of project operations for fishery purposes and special operations are listed in Table 2.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The juvenile facilities at McNary Dam consist of extended-length submersible bar screens (ESBS) with flow vanes, gatewell orifices, a concrete collection channel with emergency bypass outlets, primary and secondary dewatering structures, and a pipeline/corrugated metal flume for transporting juvenile fish to the transportation facilities or bypassing them back to the river. Juvenile transportation facilities at McNary include: a separator to sort juvenile fish by size and to separate them from adult fish; a flume system for distributing fish among the raceways; covered raceways for holding fish; sampling facilities; an office and sampling building with fish marking facilities; barge and truck loading facilities; and PIT tag detection and deflection systems. In 1997, it is anticipated that all turbine units will be equipped with new ESBSs by April 1.

1.1.2. Juvenile Migration Timing. Juvenile migration timing at McNary Dam is indicated in Table 1. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities which may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

Table 1. Juvenile migration timing at McNary Dam based on juvenile fish collection numbers.

	% Collection	1992	1993	1994	1995	1996
Ylg Chin						
	10%	4/13	4/30	5/2	4/24	4/23
	90%	5/26	5/31	6/3	5/28	5/26
Subylg Chin						
	10%	6/17	6/28	6/24	6/22	6/20
	90%	7/13	8/2	7/14	7/21	8/14
Hatch Steelhead						
	10%	5/2	4/30	5/1	4/29	4/25
	90%	6/17	5/25	6/21	5/24	5/24
Wild Steelhead						
	10%	4/21	4/29	4/28	4/24	4/23
	90%	5/25	5/27	5/31	5/24	5/24
Sockeye						
	10%	4/29	5/8	5/5	5/2	5/1
	90%	5/23	5/28	5/29	5/25	5/26

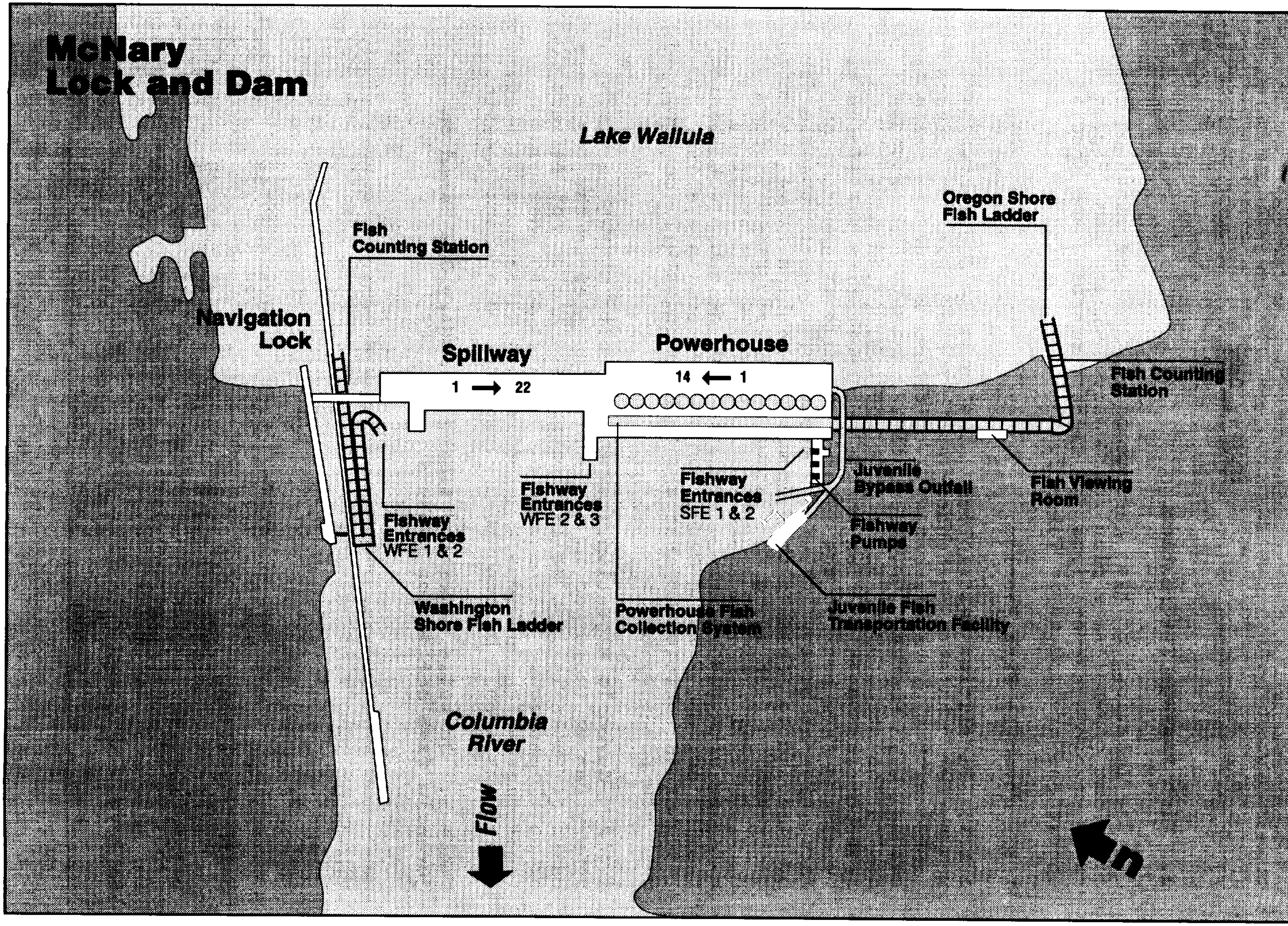
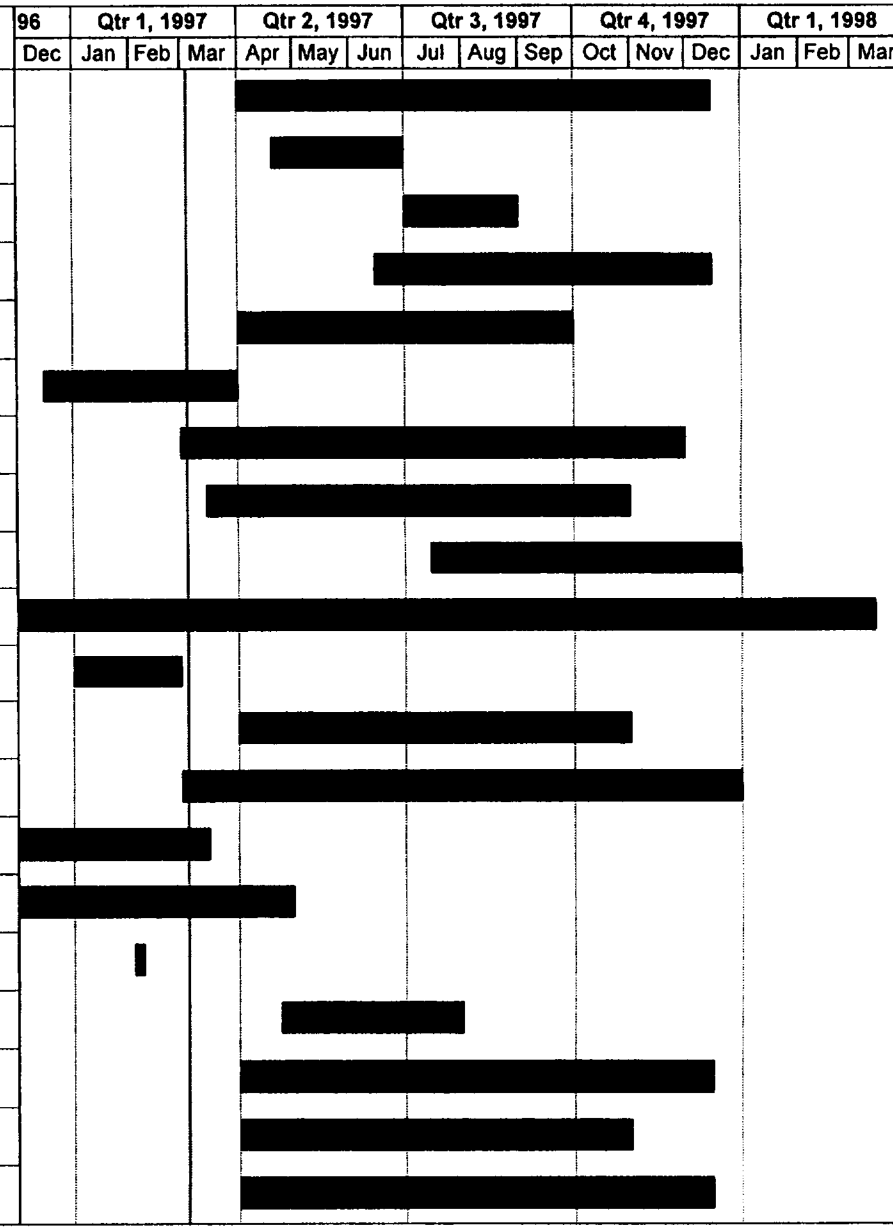


Figure 9 McNary Lock and Dam General Site Plan

Table 2. Dates of project operations for fishery purposes at McNary Dam, 1997.

ID	Name	Start	Finish	Notes
1	Juvenile Fish Passage Period	4/1/97	12/15/97	end date may vary with weather
2	Spill Spring	4/20/97	6/30/97	50% 1800 to 0600
3	Spill Summer	7/1/97	8/31/97	no spill
4	Juvenile Fish Transportation	6/15/97	12/15/97	actual dates may vary
5	Dissolved Gas Monitoring	4/1/97	9/30/97	Forebay and tailrace stations
6	ByPass Facility Maintenance	12/16/96	3/31/97	
7	Turbine Operation for Adult/Junvenile Fish	3/1/97	11/30/97	Unit priorities may vary during this time
8	Turbine 1% Operation	3/15/97	10/31/97	soft constraint 11/1 to 3/14
9	Turbine Maintenance Period	7/15/97	12/31/97	timing varies with unit priority
10	Adult Passage Period	12/1/96	3/14/98	Critical period 3/1 - 12/31
11	Adult Facility Maintenance Period	1/1/97	2/28/97	
12	Adult Fish Counting	4/1/97	10/31/97	0400-2000 PST
13	Weekly Reporting	3/1/97	12/31/97	Fri-Thurs: sent by noon following Mon
14	North Shore Fish Ladder	12/1/96	3/15/97	See App. A for additional details
15	Installation of Bypass Screens	12/1/96	4/30/97	See App. A for additional details
16	Spill Test	2/3/97	2/7/97	See App. A for additional details
17	VBS Evaluation	4/24/97	7/31/97	See App. A for additional details
18	Gatewell Debris testing	4/1/97	12/15/97	See App. A for additional details
19	Adult Fish Passage Evaluation	4/1/97	10/31/97	See App. A for additional details
20	Prototype PIT Tag Detector	4/1/97	12/15/97	See App. A for additional details



1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at McNary consist of separate north and south shore facilities. The north shore facilities are made up of a fish ladder with counting station, a small collection system, and a gravity-flow auxiliary water supply system. The gravity-flow auxiliary water supply system has a generating turbine installed on it and operated by North Wasco County PUD. The turbine will be operational in 1997. The north shore collection system has three downstream entrances and a side entrance into the spillway basin. Two of the downstream entrances are used during normal operation. The gravity-flow auxiliary water supply system takes water from the forebay through 2 conduits, passes the water through a turbine unit or alternatively through a juvenile bypass/energy dissipater, and distributes the water through a diffuser system at the bottom of the ladder and in the transportation channel. The south shore facilities are comprised of a fish ladder with counting station, two south shore entrances, a powerhouse collection system, and gravity and pumped auxiliary water supply systems. The powerhouse collection system contains three downstream and one side entrance into the spillway basin at the north end of the powerhouse, twelve floating orifices located across the powerhouse, and a common transportation channel for all of the entrances. At the north end of the powerhouse, two of the downstream entrances are used during normal operation with the other downstream and side entrances closed. The gravity-flow auxiliary water is provided by one conduit from the forebay and supplies the diffusers at the bottom of the ladder at tailwater level. The pumped auxiliary water is supplied by three electric pumps with variable-pitched blades. Two pumps are capable of providing the required flow when the third pump is bulkheaded to prevent water from flowing back through the pump to the river. The electric pumps supply the auxiliary water for the diffusers at the entrances and in the transportation channel. Excess water from the primary dewatering structure in the juvenile fish collection channel is routed to the adult collection system at the north end of the powerhouse.

1.2.2. Adult Migration Timing. Upstream migrants are present at McNary Dam year round. Maintenance of upstream passage facilities is scheduled for January through February to minimize impacts on upstream migrants. Table 3 shows primary passage periods by species and the earliest and latest dates of peak passage on record, from fish count data compiled by the Corps of Engineers. Adult fish are normally counted 16-hours per day (0400 through 2000 Pacific Standard Time) from April 1 through October 31.

Table 3. Adult migration timing from fish counts, 1954-1996.

Species	Count Period	Earliest Recorded Date Peak Passage	Latest Recorded Date Peak Passage
Spring chinook	4/1-6/8	4/23	5/26
Summer chinook	6/9-8/8	6/17	7/26
Fall chinook	8/9-10/31	9/10	9/25
Steelhead	4/1-10/31	7/9	10/13
Coho	4/1-10/31	9/5	10/11
Sockeye	4/1-10/31	6/23	7/16

2. Project Operation.

2.1. Spill Management. Spill at McNary is the result of river flow exceeding powerhouse capacity or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at McNary shall be distributed in accordance with the adult fish passage spill pattern included at the end of this section in Table 5. Special spills for juvenile fish passage may be provided as detailed in Appendix A (Special Project Operations and Research).

2.2. Dissolved Gas Management and Control. Dissolved gasses at McNary are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. Total dissolved gas monitoring in the McNary forebay is at two locations: at the navigation lock on the north shore to monitor the mid-Columbia arm of the McNary pool; and on the south end of the powerhouse to monitor Snake River inflow. The McNary north and south shore stations have been automated wherein data are transmitted via satellite. Total dissolved gas levels will be reported every four hours from April 1 through September 30. Total dissolved gas levels will also be monitored in the McNary tailrace. Related data collected at the same time for McNary Project will be spill volume and total project flow. Implementation of requests for spill at McNary will be based in part upon dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migrant monitoring data. Requests for spill will be coordinated through the Technical Management Team.

2.3. Operating Criteria

2.3.1. Juvenile Fish Passage Facilities: April 1 through December 15 operate according to criteria listed below and in Appendix B (Corps Juvenile Fish Transportation Program Operating Criteria) for the bypassing, collection, and transportation of juvenile salmonids. The transportation program may be revised in accordance with the ESA Section 10 permit and NMFS's biological opinion. In late November and December adverse weather may cause ice to form in parts of the juvenile bypass system. If this happens, the McNary Project Manager will make the decision on when the juvenile bypass system must be unwatered to protect the integrity of the system or for personnel safety. Bad road conditions between McNary Dam and Bonneville Dam may also halt the juvenile fish transportation program prior to its scheduled completion date. National Marine Fisheries Service will be consulted prior to the unwatering of the bypass system.

2.3.1.1. Winter Maintenance Period (December 16 through March 31).

a. Forebay Area and Intakes.

1. Remove debris from forebay and trash racks.

2. Rake trash racks.

3. Remove debris from gatewell slots.

4. Measure and log drawdown in gatewell slots.

b. Extended Length Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

1. Maintenance completed on all ESBSs.

2. Inspect ESBSs for good running order and operate debris cleaner one trial run (dogged off at deck level).

3. Inspect flow vanes to make sure they are in good condition and all surfaces are smooth. Repair as needed.

4. Inspect all VBSs at least once per year.

c. Collection Channel.

1. Orifice lights operational.

2. Orifices clean and operational.

3. Orifice valves operational.

4. Orifice air backflush system operational.

d. Dewatering Structure and Flume.

1. Inclined and side dewatering screens clean and in good condition with no gaps between screen panels, no damaged panels, and no missing silicone.

2. Cleaning brush systems maintained and operational.

3. All valves in good operating order.

4. Flume and pipe smooth with no rough edges.

e. Transportation Facilities.

1. Flume switch gate maintained and operational.

2. Flume smooth with no rough edges.

3. Perforated plate and bar screen edges smooth with no rough edges.

4. Check wet separator and fish distribution system for operation as designed.

5. Brushes on crowders in good order.

6. Crowders operate properly.

7. All valves, slide gates, and switch gates in good operating order.

8. Retainer screens in place with no holes or sharp wires protruding.

9. Barge and truck loading pipes free of debris, cracks, or blockages.

10. Barge loading boom maintained and tested.

11. All sampling equipment maintained and operable.

f. Powerhouse Tailrace Area. Bird wires in place and in good repair.

g. Fish Transport Trailers.

1. All systems maintained, including refrigeration system, and operating properly.

2. No leaks around air stone fittings.

3. Plugs in end of air stones.

4. Turn air stones on lathe if necessary to allow free air passage through stones.

5. Each trailer carries two 5-inch hoses and necessary 5-inch camlock caps.

6. All valves operating properly.

7. Overall condition of trailer in good shape including hatch covers, release gates, and oxygen manifold system.

h. Maintenance Records. Record all maintenance and inspections.

2.3.1.2. Fish Passage Period (April 1 through December 15).

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Inspect gatewell slots daily for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell at least half clear, they should be cleaned at least once daily. If flows through an orifice or fish conditions give indications that an orifice may be partially obstructed with debris, the orifice will be closed and backflushed to remove the obstruction. If the obstruction can not be removed, the orifice shall be closed and the alternate orifice for that gatewell slot shall be operated. If both orifices become obstructed or plugged with debris, the turbine unit will not be operated until the gatewell and orifices are cleared of debris.

3. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot removed within 24 hours, the gatewell orifices shall be closed and the turbine unit shut down until the material has been removed and any problems corrected. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Orifices shall not be closed for longer than 48 hours.

4. Remove debris from forebay and trashracks as required to minimize impacts on fish condition. Additional raking may be required when heavy debris loads are present in the river. Fish quality will also be an indicator of debris buildup on the trash racks. Project biologist shall determine when additional trash raking is required

5. Coordinate cleaning efforts with personnel operating juvenile collection facilities.

6. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering bulkhead slot.

b. Extended Length Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

1. Operate ESBSs with flow vanes attached to screen.

2. Operate ESBSs with debris cleaners in automatic mode. Set cleaning frequency as required to maintain good fish condition, with initial settings of every 15 minutes. Increase cleaning frequency if needed to maintain clean screens.

3. Inspect ESBSs in at least 3 operating turbine units per week.

4. Conduct additional ESBS inspections if fish condition warrants it.

5. If an ESBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of ESBSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged ESBS, or VBS. Turbine units shall not operate for more than 10 hours with ESBSs in place and orifices closed.

6. Make formal determination at end of season as to adequacy of bar screen panels and debris cleaner brushes and replace components as necessary.

7. Measure head differentials across VBSs daily during times of debris. Clean VBS when head differentials reach 1.5 feet. When a head differential of 1.5 feet is reached, the respective turbine unit should be operated at a reduced generation loading if the VBSs can not be cleaned within 8 hours, to minimize loading on the VBS and potential fish impingement.

8. Inspect at least 4 VBSs at random across the powerhouse between the spring and summer migration periods. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

9. Inspect all vertical barrier screens at least once per year. Repair as needed.

c. Collection Gallery.

1. Operate at least one orifice per gate slot (preferably the south orifice). If orifices must be closed to repair any part of the facility, do not close orifices in operating turbine units with ESBSs in place for longer than 10 hours. During periods of high fish numbers or high debris, this time period may be less. Monitor fish condition in gatewells hourly during orifice closure.

2. Orifices clean and operating.

3. Orifice lights operating on open orifices.

4. Orifice jets hitting no closer than 3 feet from wall (bypass gallery full).

5. Orifice valve either full open or closed.

6. Backflush orifices at least once per day. During periods of high debris, orifices should be inspected and backflushed several times per day, as determined by the project biologist, to keep orifices clean.

d. Dewatering Structure.

1. No gaps between panels or missing silicone in side and inclined screens.

2. Trash sweeps operating correctly.

3. The project biologist shall determine the frequency of operation of the trash sweeps. The sweeps should operate at a frequency to maintain a clean screen given present debris loads. Frequency of operation may vary from as low as once every 15 minutes to once every 2 or more hours.

4. The dewatering structure shall be dewatered twice during the season, during low fish passage periods in June and September, for inspection and cleaning of the dewatering screens.

e. Transportation Facilities.

1. No holes or gaps between screen panels. Silicone in good condition.

2. Crowder screen brushes in good operating condition.

3. Retainer screens in raceway clean with no holes or protruding wires.

4. Operate wet separator and fish distribution system as designed.

5. Truck and barge loading facilities in good operating condition.

f. Facility Inspections. Inspect all facilities according to fish facilities monitoring plan. Record all inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities according to the criteria listed below.

2.3.2.1. Winter Maintenance Period (January 1 through March 1).

a. Inspect all staff gauges and water level indicators: repair and/or clean where necessary.

b. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Inspect all diffuser gratings and chambers either visually or by video according to CENPW-OP-TF approved inspection program. Repair deficiencies.

c. Inspect for, and, when necessary, clear debris in the ladder exits.

d. Calibrate all mechanical water level sensing devices, as necessary, for proper facilities operations.

e. Inspect all spillgates and ensure that they are operable.

2.3.2.2. Fish Passage Period (March 1 through December 31).

a. Fishway Ladders. Water depth over weirs: 1.0 to 1.3 feet

b. Head on all Entrances. Head range: 1.0 to 2.0 feet

c. Collection Channel Transportation Velocity. 1.5 to 4 feet per second

d. North Shore Entrances (WFE 1 & 2).

1. Operate 2 downstream gates

2. Weir depth: 8.0 feet or greater below tailwater.

e. North Powerhouse Entrances (NFE 2 & 3).

1. Operate 2 downstream gates.

2. Weir depth: 9.0 feet or greater below tailwater.

f. Powerhouse Collection System Floating Orifices.

Operate 12 floating orifices (O.G. numbers 1, 3, 4, 8, 14, 21, 26, 32, 37, 41, 43, and 44).

g. South Shore Entrances (SFE 1 & 2).

1. Operate 2 entrances.

2. Weir depth: 9.0 feet or greater below tailwater.

h. Head on Trashracks.

1. Maximum head of 0.5 feet on ladder exits

2. Maximum head on picketed leads shall be 0.5 feet. Normal head differential on clean leads is 0.3 feet.

i. Staff Gauges and Water Level Indicators.

Shall be readable at all water levels encountered during the fish passage period.

j. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day.

2. Project biologists shall inspect facilities three times per week. Inspect all facilities according to fish facilities monitoring program.

3. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration. This may be done as part of routine fishway inspections.

4. Inspect fishways daily for foreign substances, (particularly oil). If substances are found, corrective actions should be undertaken immediately.

5. Record all inspections.

2.3.3. Facility monitoring and reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, from March 1 through December 31, summarizing project operations. The weekly reports should provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; ESBS and VBS inspections; and any unusual activities which occurred at the project which may effect fish passage. The weekly reports shall cover a Friday through Thursday time period and shall be sent to CENPW-OP-TF by noon the following Monday via electronic mail. Project biologist shall prepare a draft annual report by February 10 and a final report by March 15 summarizing the operation of the project fish passage facilities for the previous year. Project biologist inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENPW-OP-TF on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance.

Project biologists should be present to provide technical guidance at all project activities which may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering and fish handling plans. Dewatering and fish handling plans shall be reviewed to ensure that they comply with Appendix G, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities which require them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 to March 31. During the fish passage season, parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

3.1.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and/or survival. Maintenance of facilities such as fish screens, which sometimes break down during the fish passage season, will be carried out as described below. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA (through the FPC) and NMFS on a case-by-case basis by CENPW-OP-TF. CENPW-OP-TF will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-TF when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-TF includes:

a. Description of the problem.

b. Type of outage required.

c. Impact on facility operation.

d. Length of time for repairs.

e. Expected impacts on fish passage.

3.1.2.1. Extended-length bar screens. Screens are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged it will be removed and either replaced with a spare ESBS or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning ESBS or VBS, or without a full compliment of ESBSs, flow vanes, and VBSs. If a screen fails on a weekend or at night when maintenance crews are not available, the respective turbine unit will be shut down and generation switched to another, fully screened unit. If all screened turbine units are in service, water may be spilled until the affected screen can be removed and repaired or replaced.

3.1.2.2. Vertical barrier screen cleaning. STSs and ESBSs deflect fish and water up the gatewell slots as part of the fish collection process. Each gatewell has a VBS located vertically between the bulkhead slot and the operating gate slot. The VBSs keep guided juvenile and adult fish from passing through the bulkhead slot into the operating gate slot where the fish can pass back into the turbine intake. The VBSs are designed to distribute the flow evenly through the screens to minimize fish impingement and descaling. The water surface elevations in the gatewells are routinely measured to determine head differential across the VBSs caused by debris plugging the VBSs. VBSs are to be pulled and cleaned when head differentials reach 1.5 feet. Prior to pulling a VBS for cleaning, the turbine unit loading will be lowered to the lower end of the 1% peak efficiency range and the gatewell dipped with a gatewell basket to remove all fish present in the gatewell. Immediately after dipping, the VBS shall be raised and impinged debris hosed off. The turbine unit shall remain operating at the lower end of the 1% peak efficiency range while the VBS is being cleaned so gatewell flow will carry the debris into the operating gatewell, where it will pass through the turbine unit. Immediately after cleaning the VBS, the VBS shall be lowered to the normal operating position to prevent fish passage from the bulkhead slot into the operating gate slot. VBSs shall not be raised longer than 30 minutes with the turbine unit running. If VBSs can not be cleaned within one work day of the head differential reaching 1.5 feet, the turbine unit loading will be lowered to the lower end of the 1% peak efficiency range until the VBS can be cleaned. If the cleaning frequency of VBSs exceeds project personnel's cleaning capability of approximately 10 VBSs per day, 7 days per week, project personnel will notify CENPW-OP-TF. CENPW-OP-TF will coordinate with NMFS regarding an exemption to dipping gatewells prior to cleaning VBSs. An exemption to dipping gatewells prior to cleaning VBSs will be based on fish numbers and total dissolved gas levels. If a VBS is found to be damaged during an inspection or cleaning, the VBS panel will be repaired or replaced with a spare panel. The turbine unit will not be operated with a known damaged VBS.

3.1.2.3. Gatewell Orifices. Each gatewell has two orifices with valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell (normally the south orifice) is operated. If an orifice becomes blocked with debris or is damaged, it will be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, the turbine unit will be taken out of service until repairs can be made. If there is a major failure with the bypass system which prevents the gatewell orifices from operating, traveling screens and bar screens will remain in operation. Turbine units with bar screens in place shall not be operated with blocked or closed orifices for longer than 10 hours. During any orifice closure, gatewells shall be monitored by project personnel for signs of fish problems or mortality. If repairs are expected to take longer than two days, a salvage program will be initiated to dip the juveniles from the gatewells with a gatewell basket until repairs are made and the system watered up again or orifices opened. Juvenile fish shall not remain in gatewells longer than 48 hours. During periods of high fish passage, it may be necessary to cease operation of turbine units with ESBSs in place and with closed orifices in less than 10 hours, depending on fish numbers and condition. Spill may occur to provide an alternate avenue for fish passage during facility outages.

3.1.2.4. Dewatering Structure. The dewatering structure acts as a transition from the collection channel to the bypass pipe/flume. An inclined screen and a side dewatering screen allow excess water to be bled off, with all fish and remaining water transitioning into the bypass pipe. The excess water is discharged into the adult fish facility auxiliary water supply system and is used as the water supply for the transportation facilities. The dewatering structure contains trash sweeps for cleaning the dewatering screens of impinged debris. If a trash sweep breaks and interferes with juvenile fish passage through the structure or if a screen is damaged, an emergency bypass system in the collection channel may be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be unwatered and stoplogs inserted at the upstream end of the inclined screen. The emergency bypass is then opened and the bypass system operated with one orifice per gatewell open. Spill may also be required to bypass juvenile fish while in emergency bypass operations. Prior to any emergency dewatering of the collection channel, CENPW-OP-TF will be notified. CENPW-OP-TF will be responsible for notifying NMFS and FPC of the action and coordinating changes in spill or other project operations.

3.1.2.5. Bypass Pipe/Flume. The bypass pipe/corrugated metal flume transports juveniles to either the transportation facilities or to the river below the project. If there is a problem with the flume which interferes with its operation, the emergency bypass system in the collection system can be opened and all of the fish in the bypass system diverted into the ice and trash sluiceway and passed to the river through the north powerhouse ice and trash sluiceway exit.

3.1.2.6. Transportation Facilities. The transportation facilities can be operated to either collect and hold juveniles for the transportation program or to separate fish by species (based on fish size), enumerate the fish through the sampling system, and bypass part or all of the fish back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the switch gate in the bypass flume will be used to bypass fish directly to the river until repairs can be made.

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not effect fish passage may be conducted during the rest of the year. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage at the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to the normal operating criteria, unless otherwise coordinated with the fishery agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance which will significantly affect the operation of a facility will be coordinated with the CBFWA (through the FPC) and NMFS. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project so there will be less impact of it being unwatered or taken out of service. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladders and Counting Stations. The fish ladders contain tilting weirs, fixed weirs, counting stations with picketed leads, and fish exits with trash racks. If any part of the fish ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, tilting weir mechanisms, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to unwater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

3.2.2.2. North Shore Auxiliary Water Supply System. During normal operation, conduits 1 and 4 are operated along with entrance weirs WFE2 and WFE3. Conduit #4 feeds diffusers 1 through 4 and conduit #1 feeds diffusers 5 through 12. Each diffuser has two or more rotovalves which control the amount of water going into a diffuser. If a rotovalve fails, the closest rotovalve that is closed will be opened to provide the required flow. If more rotovalves fail than there are closed valves and it is not possible to operate the entrances within criteria, WFE2 weir crest will be raised at one-foot increments to maintain the required 1.0 to 2.0 head differential. If this is not possible by the time the weir reaches 4 feet below tailwater, the entrance will be closed. If one conduit fails, WFE2 will be closed and WFE3 will be operated as deep as possible to maintain the 1.0 to 2.0 feet head differential. If it is not possible to maintain the head differential at a depth of 6 feet or greater, the weir will be maintained at 6 feet regardless of the head. If both conduits fail, WFE2 will be closed and WFE3 operated at a depth of 6 feet until repairs can be made.

3.2.2.3. South Shore Auxiliary Water Supply System. The south shore auxiliary water is made up of a combination of gravity flow from the forebay and pumped water from the tailrace. The gravity flow supplies the diffusers above weir 253 (diffusers 7 through 14) and the pumps supply the diffusers below weir 253 (diffusers 1 through 7 and the main unit diffusers). Diffuser 7 is where both systems meet and is supplied by either gravity flow or pumped flow. The gravity flow diffusers are regulated by rotovalves and the pumped flow diffusers by sluice gates. If a rotovalve fails, the nearest closed rotovalve will be opened to supply the flow. If more rotovalves fail than there are closed valves the sluice gates in diffusers 3 through 7 will be opened more to provide the required transportation flows. If any sluice gates fail, the sluice gates nearest it will be opened further to make up the water. If one pump fails, the other two pumps will be operated to maintain the facilities within criteria. If two pumps fail, SFE2 and NFE3 will be closed and SFE1 and NFE2 will be operated as deep as possible to maintain the 1.0 to 2.0-foot head differential. If all three pumps fail, the powerhouse transportation channel will be bulkheaded off at the junction pool and SFE1 and SFE2 operated a deep as possible and to maintain the 1.0 to 2.0-foot head differential. If a depth of 6 feet on both gates cannot be maintained, SFE2 will be closed. If the gravity flow and pumped auxiliary water supply systems both fail, the powerhouse transportation channel will be bulkheaded off at the junction pool, SFE2 closed, and SFE1 operated at 6 feet below tailwater until repairs can be made.

3.2.2.4. Fishway Entrances. The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction the weirs can usually be operated manually by project personnel and kept within criteria. If there is a further failure which prevents the entrance from being operated manually, the entrance may be lowered down and left in an operating position or an alternate entrance opened until repairs can be made. If a floating orifice fails, it will be pulled out of the water and replaced with a spare floating orifice.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units will be operated to enhance adult and juvenile fish passage from March 1 through November 30. During this time period, turbine units will be operated (as needed to meet generation requirements) in the following order: 1, 2, 3 through 10 (in any order), and then 11 through 14 (in any order) when units are available for operation. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. If the project is bypassing juvenile fish back to the river through the juvenile release pipe, turbine units 1 through 4 shall be operated first (if available for operation) to provide flows at the outfall. During the summer, turbine operating priority should change to north powerhouse loading if warm water temperatures result in increased juvenile fish mortality or if project temperature monitoring indicates a temperature gradient exists across the powerhouse. Under north powerhouse loading, turbine units shall be loaded consecutively from unit 14 back through unit 8. Starting and stopping of units should be avoided if possible. If more generation is required, additional units will be operated in consecutive order from the north to south end of the powerhouse.

Turbine units will be operated within 1% of best efficiency from March 15 through October 31 (or as specified in BPA's load shaping guidelines) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA Administrator whose load requests will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines (Appendix C); or 2) be in compliance with other coordinated fishery measures. Project personnel shall record when turbine units are operated outside the 1% best efficiency range and shall provide the information to BPA on a weekly basis according to the load shaping guidelines. Between November 1 and March 15, turbine units will continue to be operated within the 1% best efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within 1% of best efficiency at various head ranges are listed in Table 4.

The CBFWA recommends that turbine units be operated within 1% of best efficiency unless otherwise agreed.

4.2. Turbine Unit Maintenance. The project's turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fishery impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance which may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late December time frame. The maintenance of priority units for adult passage is normally conducted in mid-August or November and December, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent peak efficiency. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish.

Table 4. Turbine unit operating range with extended-length submersible bar screens for 1% best efficiency, McNary Dam.

Head	Lower Generator Limits		Upper Generator Limits	
(Feet)	(MW)	(CFS)	(MW)	(CFS)
67	38	8,019	59	12,484
68	38	7,999	60	12,399
69	39	7,980	62	12,314
70	39	7,960	63	12,229
71	40	7,940	64	12,144
72	41	7,916	65	12,287
73	41	7,893	67	12,430
74	41	7,869	68	12,574
75	42	7,846	69	12,717
76	42	7,822	71	12,860
77	43	7,731	72	12,939
78	44	7,640	73	13,018
79	44	7,549	74	13,096
80	45	7,458	75	13,175
81	45	7,548	77	13,250
82	46	7,639	79	13,326
83	46	7,729	81	13,401

Turbine unit operating range for 1% best efficiency, McNary Dam.

Table being developed

NOTE: The turbine efficiency tables are being revised to reflect new information regarding extended-length submersible bar screens and the without-screen condition. This table contains the best information currently available.

Turbine units at McNary Dam are to be operated with raised operating gates to improve fish passage conditions when ESBSs are installed. To facilitate annual maintenance, operating gates are used to unwater the turbine units. To minimize turbine outage periods to the actual time required for maintenance, operating gates may be lowered to the standard operating position and connected to hydraulic cylinders on the afternoon of the last regular work day (normally Thursday) prior to the start of the maintenance. With the operating gate in the standard operating position, turbine units may be operated until 0700 hours of the next regular work day (normally Monday) with generation loads restricted to 60 MWs or less. On the completion of maintenance, the turbine unit can be operated with the operating gates in the stored position at 60 MWs or less until the 0700 hours of the first regular work day after the maintenance is completed. If turbine maintenance or the raising of the operating gates to the raised operating position is delayed after the time periods stated above, the turbine unit shall be immediately taken out of service until the work can be accomplished. Operation of turbine units with operating gates in the standard operating position shall be restricted to the August 1 through December 15 time period, and shall not begin until juvenile fish collection numbers drop to less than 10,000 fish per day. No more than 2 turbine units at a time shall be operated with operating gates in the standard operating position and the turbine units will be operated on last on, first off operating priority.

Table 5. McNary Dam spill pattern for adult fish passage.

Discharges in KCFS at Forebay Elevation 339

KCFS Spill	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total Stops
1.4	1																					1
4.2	1	1																			1	3
7.6	1	1	1																	1	1	5
11.6	1	1	1	1															1	1	1	7
13.8	1	2	1	1															1	1	2	9
17.8	1	2	1	1	1													1	1	1	2	11
21.8	1	2	1	1	1	1											1	1	1	1	2	13
25.8	1	2	1	1	1	1	1									1	1	1	1	1	2	15
29.8	1	2	1	1	1	1	1	1							1	1	1	1	1	1	2	17
33.8	1	2	1	1	1	1	1	1	1					1	1	1	1	1	1	1	2	19
34.9	2	2	1	1	1	1	1	1	1					1	1	1	1	1	1	1	2	20
38.9	2	2	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	2	22
42.9	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	24
46.5	2	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	2	26
51.9	2	2	1	1	1	1	1	2	1	1	1	2	2	1	2	1	1	1	1	1	2	28
55.5	2	2	1	1	1	2	1	2	1	1	1	2	2	1	2	1	2	1	1	1	2	30
57.7	2	3	1	1	1	2	1	2	1	1	1	2	2	1	2	1	2	1	1	1	3	32
61.3	2	3	1	2	1	2	1	2	1	1	1	2	2	1	2	1	2	1	2	1	3	34
64.9	2	3	1	2	1	2	1	2	1	2	2	2	2	1	2	1	2	1	2	1	3	36
66.7	2	3	1	2	1	2	1	2	2	2	2	2	2	2	2	1	2	1	2	1	3	38
68.8	3	3	1	2	1	2	1	2	2	2	2	2	2	2	2	1	2	1	2	1	3	39
71.4	3	3	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	3	41
73.6	3	4	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	4	43
76.8	3	4	1	2	1	2	2	2	2	2	2	3	3	2	2	2	2	1	2	1	4	45
80.3	3	4	2	2	1	2	2	2	2	2	2	3	3	3	2	2	2	1	2	1	4	47
83.4	3	4	2	2	1	2	2	2	2	3	3	3	3	3	2	2	2	1	2	1	4	49
87.0	3	4	2	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2	2	1	4	51
90.2	3	4	2	2	2	2	2	3	2	3	3	3	3	3	2	2	3	2	2	1	4	53
93.4	3	4	2	2	2	2	2	3	3	3	3	3	3	3	3	2	3	2	2	1	4	55
96.6	3	4	2	2	2	3	2	3	3	3	3	3	3	3	3	3	3	2	2	1	4	57
99.9	3	4	2	2	2	3	3	3	3	3	3	3	3	3	4	3	3	2	2	1	4	59
102.1	3	5	2	2	2	3	3	3	3	3	3	3	3	3	4	3	3	2	2	2	4	61
105.4	3	5	2	2	3	3	3	3	3	3	4	3	3	3	4	3	3	2	2	2	4	63
108.2	4	5	2	2	3	3	3	3	3	3	4	3	3	4	4	3	3	2	2	2	4	65
109.8	4	5	2	2	3	3	3	3	3	3	4	3	3	4	4	3	3	3	2	2	4	66

_ Means open this gate first.

Table 5 (Continued). McNary Dam Spill Pattern for Adult Fish Passage.

KCFS Spill	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total Stops
112.6	4	5	2	2	3	3	3	3	3	4	4	3	3	4	4	3	3	3	2	2	5	68
114.2	4	5	2	2	3	3	3	3	3	4	4	3	3	4	4	3	3	3	3	2	5	69
117.6	4	5	2	2	3	3	3	3	4	4	4	3	3	4	4	4	3	3	3	2	5	71
121.0	4	5	2	2	3	3	3	3	4	4	4	3	4	4	4	4	4	3	3	2	5	73
123.1	4	5	2	2	3	3	3	3	4	4	4	3	4	4	4	4	4	3	3	3	6	75
126.5	4	5	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4	3	4	3	6	77
129.2	5	5	2	3	3	3	3	3	4	4	4	4	4	4	4	4	4	3	4	3	6	79
130.9	5	5	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	3	4	3	6	80
133.0	5	6	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	3	4	4	6	82
136.3	5	6	3	3	3	4	3	4	4	4	4	4	4	4	4	4	4	3	4	4	6	84
139.0	6	6	3	4	3	4	3	4	4	4	4	4	4	4	4	4	4	3	4	4	6	86
142.2	6	6	3	4	3	4	3	4	4	4	5	4	5	4	4	4	4	3	4	4	6	88
144.4	6	7	3	4	3	4	3	4	4	4	5	4	5	4	4	4	4	3	4	4	7	90
147.7	6	7	3	4	3	4	4	4	4	4	5	4	5	5	4	4	4	3	4	4	7	92
148.8	7	7	3	4	3	4	4	4	4	4	5	4	5	5	4	4	4	3	4	4	7	93
152.0	7	7	3	4	3	4	4	5	4	4	5	4	5	5	5	4	4	3	4	4	7	95
155.2	7	7	3	4	3	4	4	5	4	5	5	5	5	5	5	4	4	3	4	4	7	97
158.6	7	7	4	4	3	4	4	5	4	5	5	5	5	5	5	4	4	4	4	4	7	99
161.3	7	8	4	4	3	4	4	5	4	5	5	5	6	5	5	4	4	4	4	4	7	101
164.5	7	8	4	4	3	4	4	5	5	5	5	5	6	5	5	4	5	4	4	4	7	103
167.9	7	8	4	4	4	4	4	5	5	5	6	5	6	5	5	4	5	4	4	4	7	105
171.2	7	8	4	4	4	5	4	5	5	5	6	6	6	5	5	4	5	4	4	4	7	108
173.9	8	8	4	4	4	5	4	5	5	6	6	6	6	5	5	4	5	4	4	4	7	109
177.3	8	8	4	4	4	5	4	5	6	6	6	6	6	6	5	4	5	4	4	4	7	111
179.9	8	8	4	4	4	5	4	5	6	6	6	7	6	6	5	4	5	4	4	4	8	113
183.1	8	8	4	4	4	5	4	5	6	6	7	7	7	6	5	4	5	4	4	4	8	115
186.3	8	8	4	4	4	5	5	5	6	6	7	7	7	6	5	5	5	4	4	4	8	117
189.6	8	8	4	4	4	5	5	5	6	7	7	7	7	6	6	5	5	4	4	4	8	119
192.2	8	9	4	4	4	5	5	6	6	7	7	7	7	6	6	5	5	4	4	4	8	121
195.4	8	9	4	4	4	5	5	6	7	7	7	8	7	6	6	5	5	4	4	4	8	123
198.6	8	9	4	5	4	5	5	6	7	7	7	8	7	6	6	5	5	4	5	4	8	125
198.5	9	9	4	5	4	5	5	6	7	7	7	8	7	6	6	5	5	4	5	4	8	126
222.4	9	10	4	5	5	6	5	6	7	8	8	9	9	9	7	6	5	5	5	4	9	141
247.6	10	11	5	6	5	6	6	6	7	8	9	10	10	10	9	8	6	5	6	5	10	158

SECTION 6

ICE HARBOR DAM

Ice Harbor Dam

1. Fish Passage Information.

The locations of fish passage facilities are shown on the following general site plan for Ice Harbor Lock and Dam (Figure 10). Dates of project operations for fishery purposes and special operations are listed in Table 1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The juvenile fish passage facilities at Ice Harbor consist of standard length STSs, vertical barrier screens, 12-inch orifices, collection channel and dewatering structure, sampling facilities, and transportation flume/pipe to the tailrace below the project.

1.1.2. Juvenile Migration Timing. Juvenile passage timing at Ice Harbor Dam corresponds closely with juvenile passage at Lower Monumental Dam. Maintenance of juvenile fish passage facilities is scheduled during the winter maintenance periods detailed in the facility operating criteria and project maintenance sections.

1.2. Adult fish Passage.

1.2.2. Facilities Description. The adult fish passage facilities at Ice Harbor are made up of separate north and south shore facilities. The north shore facilities include a fish ladder with counting station, a small collection system, and a pumped auxiliary water supply system. The collection system includes two downstream entrances and one side entrance into the spillway basin. In normal operation one downstream entrance is used and the other two entrances are closed. The auxiliary water is supplied by three electric pumps with all three pumps normally operated. The south shore facilities are comprised of a fish ladder with counting station, two south shore entrances, a powerhouse collection system, and a pumped auxiliary water supply system. The powerhouse collection system includes two downstream entrances and one side entrance into the spillway basin at the north end of the powerhouse, twelve floating orifices, and a common transportation channel. One of the downstream north powerhouse entrances and seven of the floating orifices are used during normal operation. At the south shore entrances, one entrance is normally used. The auxiliary water is supplied by eight electric pumps of which from six to eight are normally used to provide the required flows. The excess water from the juvenile fish passage facilities is routed into the fish pump discharge chamber to provide additional attraction flow.

1.2.2. Adult Migration Timing. Migrants are present at Ice Harbor year around. The maintenance of adult passage facilities is scheduled for the period of January through February to minimize impact on adult migrants. Table 2 shows primary passage

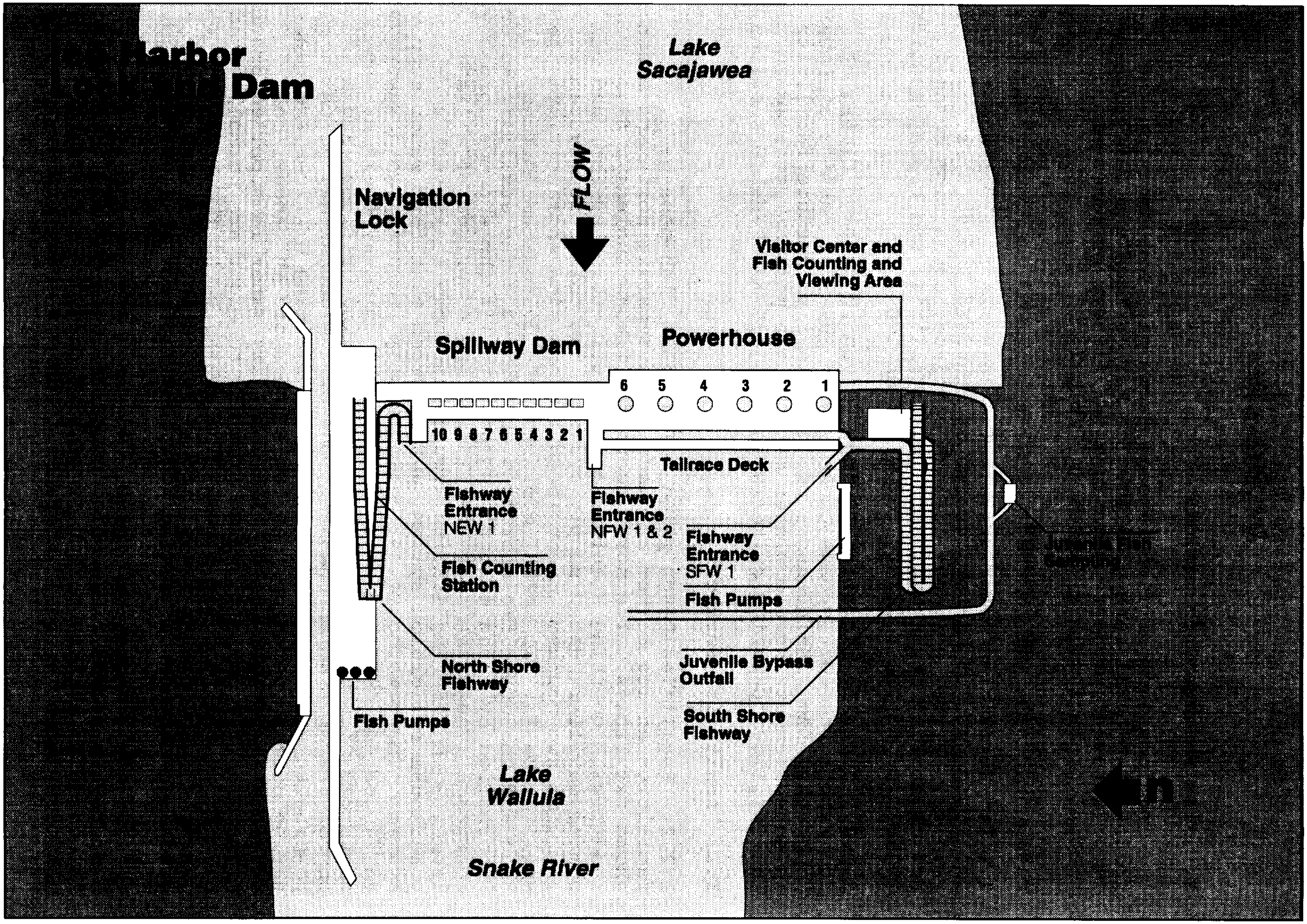
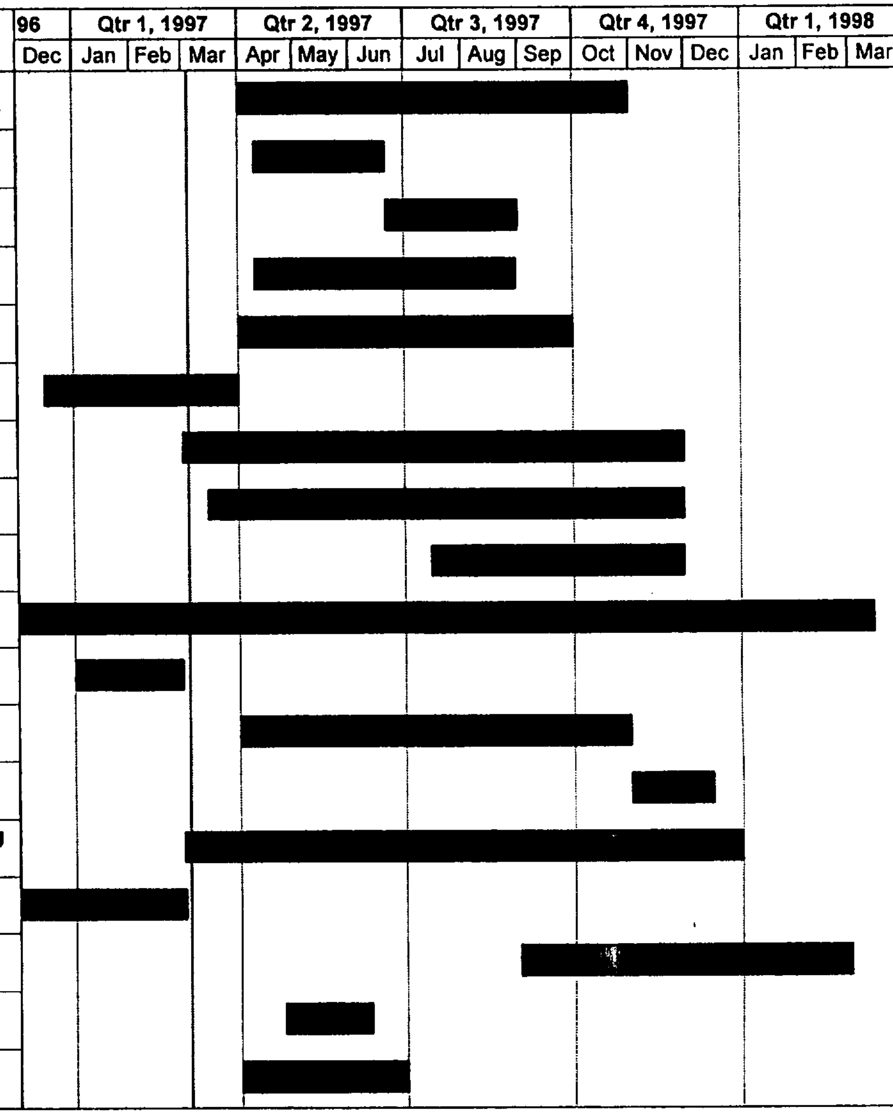


Figure 10 Ice Harbor Lock and Dam General Site Plan

Table 1. Dates of project operations for fishery purposes at Ice Harbor Dam, 1997.

ID	Name	Start	Finish	Notes
1	Juvenile Fish Passage Period	4/1/97	10/31/97	11/1 - 12/15 operate facilities for adult fallback protection
2	Spill Spring	4/10/97	6/20/97	27% for 24 hours
3	Spill Summer	6/21/97	8/31/97	70% for 24 hours
4	MOP Operation	4/10/97	8/30/97	end date not fixed
5	Dissolved Gas Monitoring	4/1/97	9/30/97	Forebay and tailrace stations
6	Bypass Facility Maintenance	12/16/96	3/31/97	
7	Turbine Operation for Adult/Junvenile Fish	3/1/97	11/30/97	Unit priorites vary during this time
8	Turbine 1% operation	3/15/97	11/30/97	soft constraint 12/1 to 3/14
9	Turbine Maintenance Period	7/15/97	11/30/97	priority units (1,2,3) mid_August
10	Adult Passage Period	12/1/96	3/14/98	do per McNary
11	Adult Facility Maintenance	1/1/97	2/28/97	
12	Adult Fish Counting video 2000 - 0400	4/1/97	10/31/97	0400-2000 PST video count 2000-0400
13	Adult Fish Counting video 2400	11/1/97	12/15/97	video count 24 hours
14	Weekly Reporting	3/1/97	12/31/97	Fri-Thurs: sent by noon the following Mon
15	Spill way Deflector Constrution	12/1/96	3/1/97	See App. A for addition details
16	Spill way Deflector Constrution	9/1/97	3/1/98	See App. A for addition details
17	Radio Tagging Study	4/25/97	6/11/97	See App. A for addition details
18	Adult Passage Study	4/1/97	6/30/97	See App. A for addition details



periods for each species and shows earliest and latest date of peak passage on record from fish count data compiled by the Corps of Engineers. Adult fish are counted from April 1 through December 15. From April 1 through October 31, adult fish are counted 24-hours per day. Fish are visually counted by fish counters 16-hours per day (from 0400 to 2000 hours Pacific Standard Time) with nighttime passage from 2000 to 0400 hours videotaped with later interrogation by fish counters. From November 1 through December 15, fish passage is videotaped 24-hours per day with later interrogation by fish counters.

Table 2. Adult migration timing at Ice Harbor Dam from 1962-1996 fish counts.

Species	Counting Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/11	4/24	5/26
Summer Chinook	6/12 - 8/11	6/12	7/23
Fall Chinook	8/12- 12/15	9/07	9/30
Steelhead	4/1 - 12/15	9/15	10/12
Sockeye	4/1 - 12/15	7/01	9/22

2. Project Operation.

2.1. Spill Management. Spill at Ice Harbor is the result of river flow exceeding powerhouse capacity or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at Ice Harbor will be distributed in accordance with the adult spill pattern listed in Table 3. Special spills for juvenile fish passage may be provided as detailed in Appendix A (Special Project Operations and Research).

2.2. Dissolved Gas Management and Control. Dissolved gasses at Ice Harbor are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. Total dissolved gas will be monitored in the Ice Harbor forebay. Total dissolved gas data will be collected every hour and reported every four hours from April 1 through September 30. Total dissolved gas will also be monitored hourly at several locations downstream of Ice Harbor Dam from April 1 through September 30. Related data collected at the same time will be spill volume and total project flow. Implementation of requests for spill will be based in part upon dissolved gas monitoring data along with juvenile migration data. Requests for spill will be coordinated through the Technical Management Team.

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through October 31 for juvenile fish passage and from November 1 through December 15 for protecting adult fallbacks. Operate the facilities according to the following criteria:

2.3.1.1. Winter Maintenance Period (December 16 through March 31).

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trash racks.

3. Measure drawdown in gatewell slots.

b. Submersible Traveling Screens (STS) and Vertical Barrier Screens (VBS).

1. Inspect STSs for good running order and operate one trial run (dogged off on deck).

2. Log trial Run.

3. Inspect all VBSs at least once per year. Repair as needed.

c. Collection Gallery.

1. Water-up valve operational.

2. Orifice lights operational.

3. Orifices clean and operational.

d. Dewatering Structure and Flume.

1. Inclined screen clean and in good condition with no gaps between screen panels, damaged panels, or missing silicone.

2. Screen cleaning system maintained and operational.

3. Overflow weirs maintained and tested.

4. All valves in good operating order.

5. Flume smooth with no rough edges.

e. Sampling Facilities.

1. Flume dewatering structure maintained and in good operating condition. No holes or gaps between dewatering screen panels.

2. Flume drop gate maintained and in good operating condition.

3. Check wet separator and fish distribution system for operation as designed.

4. All dewatering screens in separator and flume in good condition with no holes or gaps between panels, or sharp edges.

5. Valves and switch gate in good operating order.

6. All sampling equipment maintained and operable.

f. Powerhouse Tailrace Area. Inspect bird wires and repair as needed.

2.3.1.2. Fish Passage Period (April 1 through December 15).

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Remove debris from trashracks as required to maintain less than one foot of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river.

3. Inspect gatewell slots daily for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell surfaces at least half clear, they should be cleaned at least once daily. If flows through an orifice give indications that an orifice may be partially obstructed with debris, the orifice will be closed and backflushed to remove the obstruction. If the obstruction can not be removed, the orifice shall be closed and the alternate orifice for that gatewell slot shall be operated. If both orifices become obstructed or plugged with debris, the turbine unit shall not be operated until the gatewell and orifices are cleared of debris.

4. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot be removed within 24 hours, the gatewell orifices shall be closed and the turbine unit shut done until the material has been removed and any problems corrected. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Orifices shall not be closed for longer than 48 hours.

5. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering bulkhead slot.

b. Submersible Traveling Screens (STS) and Vertical Barrier Screens (VBS).

1. Operate STSs in cycling mode when weekly average fork length of subyearling chinook or sockeye is greater than 120 mm at Lower Monumental collection facility.

2. Operate STSs in continuous operational mode when weekly average fork length of subyearling chinook or sockeye is less than 120 mm at Lower Monumental collection facility, or if there is other evidence that smaller juvenile fish are present at the project.

3. Inspect each STS once per month.

4. Record STS amp readings daily.

5. If an STS or VBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of STSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged STS or VBS.

6. Up to one-half of the STSs may be removed after October 1 for annual maintenance provided there is no operation of units without screens.

7. Make formal determination at end of season as to adequacy of STS screen mesh and replacement if necessary.

8. Inspect at least 2 VBSs at random across the powerhouse between the spring and summer migration periods. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

c. Collection Gallery Checks.

1. Orifices clean and operating. Operate at least one 12-inch orifice per slot (preferably the north orifice). If the project is operating at MOP, additional orifices may be operated to maintain full collection channel.

2. Orifice lights operational and operating on open orifices.

3. Orifice jets hitting no closer than 3 feet from wall (bypass channel full).

4. Backflush orifices at least once per day and more frequently if required. During periods of high debris, orifices should be inspected and backflushed several times per day, as determined by the project biologist, to keep orifices clean.

5. Water-up valve operational.

d. Dewatering Structure.

1. Trash sweep operating correctly. Set frequency of sweep as necessary to maintain a clean screen, with a minimum of at least once per hour.

2. Clean trapezoidal section as required to maintain in clean condition. Clean at least once per day.

3. Overflow weirs operating correctly.

4. No gaps between screen panels in inclined screen.

e. Sampling Facilities.

1. No holes in screens.

2. Operate wet separator and fish distribution system as designed. Sample fish twice per week during the main juvenile bypass season to monitor juvenile fish descaling and other fish condition parameters. Provide information in project weekly report.

3. Crowder screen brushes in good operating condition. No holes or sharp edges in crowder screen.

4. Operate preanesthetic system as designed.

f. Inspection and Record Keeping.

Inspect all facilities according to fish facilities monitoring plan. Record all maintenance and inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities according to the following criteria.

2.3.2.1. Winter Maintenance Period (January 1 through March 1).

a. Inspect all staff gauges and water level indicators. Repair and/or clean where necessary.

b. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Inspect all diffuser gratings and chambers either visually or by video according to CENPW-OP-TF approved inspection program. Repair deficiencies.

c. Inspect for and, when necessary, clear debris in the ladder exits.

d. Calibrate all mechanical water level sensing devices, as necessary, for proper facilities operations.

e. Inspect all spillgates and ensure that they are operable.

2.3.2.2. Fish Passage Period (March 1 through December 31).

a. Fishway Ladders. Water depth over weirs: 1.0 to 1.3 feet

b. Head On All Entrances. Head range: 1.0 to 2.0 feet

c. North Shore Entrance (NEW 1). Elevation of top of gate when on sill = 332.25.

1. Operate downstream gate closest to shore.

2. Weir depth: 8 feet or greater below tailwater. At tailwaters less than elevation 340.25, weirs should be on sill.

[**Note:** At low river flow and tailwater, some of the diffusers are above tailwater and project may only be able to maintain a 6 foot weir depth.]

CBFWA recommends a weir depth of 8 feet or greater at all times.

d. North Powerhouse Entrance (NFE 1 & 2). Elevation of top of gate when on sill = 332.25.

1. Operate 1 downstream gate.

2. Weir depth: 8 feet or greater below tailwater. At tailwaters less than elevation 340.25, weirs should be on sill.

[**Note:** At low tailwater, weirs will bottom out and will be less than 8 feet below tailwater.]

e. Powerhouse Collection System. Operate 7 floating orifices (O.G. numbers 1, 2, 4, 6, 8, 10, and 12).

f. South Shore Entrance (SFE-1). Elevation of top of gate when on sill = 332.25.

1. Operate entrance closest to powerhouse.

2. Weir depth: 8 feet or greater below tailwater. At tailwaters less than elevation 340.25, weirs should be on sill.

[**Note:** At low tailwater, weirs will bottom out and will be less than 8 feet below tailwater.]

g. Channel Transportation Velocity. 1.5 to 4 feet per second.

h. Head on Trashracks.

1. Maximum head of 0.5 feet on ladder exits.

2. Maximum head on picketed leads shall be 0.3 feet.

i. Staff Gauges and Water Level Indicators. Shall be readable at all water levels encountered during fish passage period.

j. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day. Maintain computerized fishway control system record keeping system.

2. Project biologists shall inspect facilities three times per week. Inspect all facilities according to fish facilities monitoring program.

3. Project personnel shall check computerized fishway control system twice per month to ensure that it is kept within calibrations.

4. Inspect fishways daily for foreign substances, (particularly oil). If substances are found, corrective actions should be undertaken immediately.

5. Record all inspections.

2.3.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, from March 1 through December 31, summarizing project operations. The weekly reports should provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any unusual activities which occurred at the project which may effect fish passage. The weekly reports shall cover a Friday through Thursday time period and shall be sent to CENPW-OP-TF by noon the following Monday via electronic mail. Project biologist shall prepare a draft annual report by February 10 and a final report by March 15 summarizing the operation of the project fish passage facilities for the previous year. Project biologist inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENPW-OP-TF on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance.

Project biologists should be present to provide technical guidance at all project activities which may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering plans. Dewatering and fish handling plans shall be reviewed to ensure that they comply with Appendix G, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the non-fish passage season from December 16 to March 31. Long-term maintenance or modifications to the facilities which require them to be out of service are done during this period. During the fish passage season, the facilities are inspected on a daily basis to insure that they are operating correctly.

3.1.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and survival. Unscheduled maintenance of facilities such as submersible traveling screens, which sometimes break down during the fish passage season, will be carried out according to procedures described below. In these cases, repairs will be made as prescribed and CENPW-OP-TF notified for further coordination. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA (through the FPC) and NMFS on a case-by-case basis by CENPW-OP-TF. CENPW-OP-TF will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-TF when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-TF includes:

a. Description of the problem.

b. Type of outage required.

c. Impact on facility operation.

d. Length of time for repairs.

e. Expected impacts on fish passage.

3.1.2.1. Submersible Traveling Screens (STS). STSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If an STS is found to be damaged it will be removed and either replaced with the spare STS or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning STS or without a full compliment of STSs. If an STS fails on a weekend or at night when maintenance crews are not available, the respective turbine unit will be shut down and generation switched to another, fully screened unit. If all screened turbine units are in service, water may be spilled until the affected STS can be removed and repaired or replaced.

3.1.2.2. Gatewell Orifices. Each gatewell has two 12-inch orifices with air operated valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell is operated. To minimize blockage from debris, orifices are cycled and backflushed at least once per day, and more frequently if required by heavy debris loads. If an air-valve fails or is blocked with debris, the valve should be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, the turbine unit will be taken out of service until repairs can be made. If repairs are to take longer than 48 hours, juvenile fish will be dipped from the gatewell with a gatewell dip basket in accordance with the project dewatering and fish handling plan.

3.1.2.3. Dewatering Structure. The dewatering structure acts as a transition from the collection channel to the corrugated metal flume. An inclined screen allows excess water to be bled off, with all fish and remaining water transitioning into the corrugated metal flume. The excess water is discharged into the adult fish facility auxiliary water supply system and is also used as the water supply for the sampling facilities. The dewatering structure contains a trash sweep for cleaning the rectangular portion of the inclined screen, and an air blowback system for cleaning the transition (trapezoidal) section of the screen. If the trash sweep breaks and interferes with juvenile fish passage through the structure or if the inclined screen or other component of the structure is damaged, the orifices may need be closed and the collection channel dewatered to allow repairs to be made. If the orifices are closed and the collection channel unwatered, the traveling screens will remain in operation. Fish will be allowed to accumulate in the gatewells for up to 2 days. If repairs are expected to take longer than 2 days, a salvage program will be initiated to remove fish from gatewells, with a gatewell dip basket, until repairs can be made and the system watered up again. While the collection channel is out of service, project personnel shall monitor gatewells for signs of fish problems or mortality. Spill may be provided as an alternative avenue for fish passage during the collection channel outage.

3.1.2.4. Bypass Flume/Pipe. The bypass flume/pipe transports fish to the sampling facilities and to the tailrace below the project. If there is a problem with the flume/pipe which requires it to be unwatered, procedures will be taken similar to under 3) above.

3.1.2.5. Sampling Facilities. Under normal operation, juvenile fish are routed around the sampling facilities, except when sampling is being conducted. If there is a problem with the sampling facilities when it is in operation, the drop gate will be lowered to keep all juvenile fish in the bypass flume/pipe to bypass them directly to the river below the project. All fish in the sampling facility will then be released back to the river prior to sampling if there are any problems with holding them in the sample tank until they can be sampled.

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not have a significant affect on fish passage may be conducted during the rest of the year. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage past the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal criteria, unless otherwise coordinated with the fishery agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance which will significantly effect the operation of a facility will be coordinated with the CBFWA and NMFS. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental affects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions and may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladders and Counting Stations. The fish ladders contain fixed weirs, counting stations with picketed leads, and fish exits with trash racks. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to unwater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

3.2.2.2. North Shore Auxiliary Water Supply System. The north shore facilities contain three electric pumps which provide auxiliary water to the diffusers at the bottom of the ladder and at the entrances. During normal operation two or three pumps are required, depending on the tailwater elevation, to provide the necessary auxiliary water. If a pump fails during a two-pump operation, the pump on standby will be operated to provide the necessary flows. If a pump fails during a three-pump operation, NEW1 will be raised until the required 1.0 to 2.0-foot head differential is achieved. If this cannot be met by the time the weir reaches 6 feet below tailwater, the gate will remain at that level regardless of the head. If two or all three pumps fail, the weir will be maintained at a level of 6 feet below tailwater until repairs are made.

3.2.2.3. South Shore Auxiliary Water Supply System. The south shore auxiliary water is supplied by eight electric pumps and the excess water from the juvenile fish passage facilities. Fluctuating tailwater levels require from six to eight pumps to be operated to provide the auxiliary water. If one pump fails, a standby pump will be started to keep the fishway within criteria. If more pumps fail, this procedure will continue until all the standby pumps are in operation. If criteria cannot be met, the floating orifices should be closed in the following order: OG-12, OG-10, OG-8, and OG-6. If the required head differential of 1.0 to 2.0 feet cannot be reached when the floating orifices are closed, SSE 1 and NFE 2 will be closed equally at one-foot intervals until it is reached or until the weirs are 5 feet below tailwater. Then the remaining floating orifices should be closed in the following order: OG-4, OG-1, and OG-2. If there is still not enough auxiliary water to maintain the head differential on the two main entrances, NFE 2 will be closed, the transportation channel bulkheaded off at the junction pool, and SSE 1 operated as deep as possible to maintain the head differential. If it cannot be maintained at a depth of 6 feet or greater, the weir will remain at 6 feet regardless of the head.

3.2.2.4. Fishway Entrances. The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction, the weirs can usually be operated manually by project personnel and kept within criteria. If there is a further failure which prevents the entrance from being operated manually, an alternate entrance will be opened until repairs can be made. If a floating orifice fails, it will be pulled out of the water and the entrance bulkheaded off until the floating orifice is repaired.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units will be operated to enhance adult and juvenile fish passage from March 1 through November 30. During these dates, turbine units will be operated (as needed to meet generation requirements) in the following order: 1, 2, 3, and then 4 through 6 (in any order) when units are available for operation. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. Units 3 and 4 should remain in operation as much as possible to maintain positive downstream flows at the juvenile bypass outfall. If a turbine unit is taken out of service for maintenance or repair, the next unit in the priority list shall be operated.

Turbine units will be operated within 1% of best efficiency from March 15 through November 30 (or as specified in BPA's load shaping guidelines) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines (Appendix C); or 2) be in compliance with other coordinated fishery measures. Project personnel shall record when turbine units are operated outside the 1% best efficiency range and shall provide the information to BPA on a weekly basis according to the load shaping guidelines. Between December 1 and March 15, turbine units will continue to be operated within the 1% best efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within 1% of best efficiency at various head ranges are shown on pages IHR-14 through IHR-16.

The CBFWA recommends that turbine units be operated within 1% of best efficiency unless otherwise agreed.

Turbine Units 1-3. The following 1% best efficiency ranges were calculated using results from 1994 index testing of turbine unit 3. Maximum generation of units 1 through 3 at 115% overload is 103 MW.

With Standard Length Submersible Traveling Screens Installed.

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	50	7,801	74	11,708
86	50	7,838	76	11,763
87	51	7,874	77	11,818
88	52	7,919	78	11,886
89	53	7,955	80	11,939
90	54	8,000	81	12,006
91	55	8,044	82	12,073
92	56	8,079	84	12,125
93	57	8,123	85	12,191
94	58	8,166	86	12,256
95	59	8,210	88	12,321
96	59	8,253	89	12,386
97	60	8,286	91	12,436
98	61	8,329	92	12,500
99	62	8,371	93	12,564
100	63	8,414	95	12,627
101	64	8,455	96	12,690
102	65	8,497	98	12,753
103	66	8,548	99	12,830
104	67	8,590	101	12,892
105	68	8,631	102	12,954

NOTE: The turbine efficiency tables are being revised to reflect new information. These tables contain the best information currently available.

Turbine Units 1-3 Without Screens Installed:

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	50	7,897	85	13,448
86	51	7,934	87	13,512
87	52	7,971	88	13,575
88	53	8,017	90	13,653
89	54	8,053	92	13,714
90	55	8,098	93	13,791
91	56	8,143	95	13,868
92	56	8,178	96	13,928
93	57	8,223	98	14,003
94	58	8,267	99	14,079
95	59	8,311	101	14,153
96	60	8,354	103	14,228
97	61	8,388	104	14,285
98	62	8,431	106	14,359
99	63	8,474	107	14,432
100	64	8,517	109	14,505
101	65	8,559	111	14,577
102	66	8,602	112	14,649
103	67	8,653	114	13,737
104	68	8,695	116	14,808
105	69	8,737	117	14,879

Turbine Units 4-6: The following 1% best efficiency ranges were calculated using results from January 1994 index testing on unit 6 and are with submersible traveling screens installed in operating units. **If screens are not installed, upper generator limits are 10 MWs lower.** Maximum generation of units 4 through 6 at 115% overload is 127 MW.

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	58	9,174	122	19,234
86	59	9,222	123	19,194
87	60	9,157	124	18,925
88	60	9,132	125	19,037
89	61	9,121	126	18,900
90	62	9,167	128	18,866
91	63	9,155	129	18,717
92	64	9,258	130	18,805
93	64	9,128	131	18,712
94	65	9,172	132	18,683
95	66	9,151	134	18,524
96	67	9,189	135	18,488
97	67	9,058	136	18,386
98	68	9,225	137	18,613
99	69	9,201	138	18,455
100	70	9,248	140	18,443
101	70	9,167	141	18,439
102	71	9,207	142	18,414
103	72	9,191	143	18,280
104	73	9,241	144	18,280
105	73	9,166	146	18,282

4.2 Turbine Unit Outages During High River Flow Periods. During high spring flows, turbine unit outages for inspecting fish screens, repairing research equipment such as hydroacoustic or radio telemetry equipment, and other fishery items may cause increased spill at a project in order to maintain reservoirs levels within operating levels. This may result in total dissolved gas levels exceeding standards. It is important that this work be conducted when scheduled to ensure that facilities are working correctly and not injuring migrating fish, and that important fish research data is collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Ice Harbor Dam, this special operation shall take place when river flows are above 100 kcfs or when increasing spill levels will result in total dissolved gas levels exceeding standards. The activities covered under these operations will be coordinated with and approved by the Technical Management Team whenever possible.

For scheduled inspection or repair of research equipment, reservoirs shall be drafted to the bottom of MOP and allowed to fill to 1 foot above the MOP operating range as the work is accomplished. After the work, reservoirs will be slowly drafted back to the MOP operating range. When inspection or repair work can be scheduled ahead of time, the following process will be followed:

a. Project personnel shall schedule turbine unit outages through the approved turbine outage scheduling procedure by noon of the Tuesday of the week prior to the outage.

b. Project personnel shall also contact CENPW-OP-TF and CENPD-ET-WM (Reservoir Control Center) by the same time period and inform them of the intended work.

c. CENPD-ET-WM will coordinate the work activities with regional parties at the Technical Management Team meeting on the following Wednesday.

d. After coordination with the TMT, CENPD-ET-WM shall issue a teletype through the CBTT issuing instructions to project and BPA personnel for the scheduled work.

e. Spill will be increased by one spillbay stop setting (about 1.7 kcfs) above passing inflow to slowly lower the level of Ice Harbor pool to the bottom of the MOP range prior to the scheduled work taking place.

f. When the work takes place, additional spill will not be provided and the reservoir will be allowed to refill until the reservoir is 1 foot above the normal MOP range (a 2 foot pondage from where the pool was when the work started). At this point, screen inspections shall be stopped. (At Snake River projects, this should allow about one normal work day for the scheduled work.)

g. At the conclusion of the work, the reservoir shall be drafted back down to the MOP range utilizing a one spillbay stop increase in spill above passing inflow.

h. If work, such as screen inspections, is not finished, project personnel shall schedule another turbine unit outage for a date where it can be implemented again.

If the work that needs to be done is of an emergency type nature that does not normally require the turbine unit to be taken out of service (such as a failed hydroacoustic transducer versus a failed fish screen), and can not wait for the above process to be implemented, project personnel shall notify CENPW-OP-TF and CENP-ET-WM to get approval to do the work. If approval to do the work is given, the turbine unit shall be taken out of service and the reservoir level allowed to increase until it reaches 1 foot above the MOP operating range. At this point, the turbine unit must be returned to service and the reservoir will be drafted back to the MOP range using one spillbay stop setting above passing inflows.

4.3. Turbine Unit Maintenance. The project's turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fishery impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance which may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted in mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent peak efficiency. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish.

Table 3. Ice Harbor Dam 1997 spill pattern with deflectors in 4 spillbays and spillbays 3 and 8 closed.

SPILLBAY 1	2	3	4	5	6	7	8	9	10	TOTAL STOPS	TOTAL SPILL (KCFS)
1										1	1.7
1									1	2	3.5
1	1								1	3	5.2
1	1							1	1	4	6.9
1	1				1			1	1	5	8.7
1	1			1	1			1	1	6	10.4
1	1		1	1	1			1	1	7	12.1
1	1		1	1	1	1		1	1	8	13.8
1	1		1	1	1	1		2	1	9	15.6
1	2		1	1	1	1		2	1	10	17.3
1	2		1	2	1	1		2	1	11	19.0
1	2		1	2	2	1		2	1	12	20.7
1	2		1	2	2	1		3	1	13	22.4
1	3		1	2	2	1		3	1	14	24.1
1	3		2	2	2	1		3	1	15	25.8
1	3		2	2	2	2		3	1	16	27.6
1	3		2	2	2	2		4	1	17	29.3
1	4		2	2	2	2		4	1	18	31.0
1	4		2	3	2	2		4	1	19	32.7
1	4		2	3	3	2		4	1	20	34.4
1	4		3	3	3	2		4	1	21	36.1
1	4		3	3	3	3		4	1	22	37.8
1	4		3	3	3	3		5	1	23	39.4
1	5		3	3	3	3		5	1	24	41.1
1	5		3	3	3	3		5	2	25	42.8
2	5		3	3	3	3		5	2	26	44.6
2	5		3	3	3	3		6	2	27	46.2
2	6		3	3	3	3		6	2	28	47.9
2	6		3	4	3	3		6	2	29	49.6
2	6		3	4	4	3		6	2	30	51.3
2	6		4	4	4	3		6	2	31	53.0
2	6		4	4	4	4		6	2	32	54.7
2	6		4	4	4	4		7	2	33	56.3
2	7		4	4	4	4		7	2	34	57.9
2	7		4	4	4	4		7	3	35	59.6

Table 3. Ice Harbor Dam 1997 spill pattern (Continued).

SPILLBAY 1	2	3	4	5	6	7	8	9	10	TOTAL STOPS	TOTAL SPILL (KCFS)
3	7		4	4	4	4		7	3	36	61.3
3	7		4	4	5	4		7	3	37	63.0
3	7		4	5	5	4		7	3	38	64.7
3	7		5	5	5	4		7	3	39	66.3
3	7		5	5	5	5		7	3	40	68.0
3	7		5	5	5	5		8	3	41	69.7
3	8		5	5	5	5		8	3	42	71.4
3	8		5	5	6	5		8	3	43	73.1
3	8		5	6	6	5		8	3	44	74.8
3	8		5	6	6	6		8	3	45	76.4
3	8		6	6	6	6		8	3	46	78.1
3	8		6	6	6	6		9	3	47	79.7
3	9		6	6	6	6		9	3	48	81.3
3	9		6	6	6	6		9	4	49	83.0
4	9		6	6	6	6		9	4	50	84.7
4	9		6	6	7	6		9	4	51	86.3
4	9		6	7	7	6		9	4	52	87.9
4	9		6	7	7	7		9	4	53	89.5
4	9		7	7	7	7		9	4	54	91.1
4	9		7	7	8	7		9	4	55	92.8
4	9		7	8	8	7		9	4	56	94.5
4	9		7	8	8	8		9	4	57	96.2
4	9		8	8	8	8		9	4	58	97.9
4	9		8	8	8	8		10	4	59	99.5
4	10		8	8	8	8		10	4	60	101.1
4	10		8	8	9	8		10	4	61	102.7
4	10		8	9	9	8		10	4	62	104.3
4	10		8	9	9	9		10	4	63	105.9
4	10		9	9	9	9		10	4	64	107.5
4	10		9	9	9	9		11	4	65	109.2
4	11		9	9	9	9		11	4	66	110.9
4	11		9	9	10	9		11	4	67	112.5
4	11		9	10	10	9		11	4	68	114.1
4	11		9	10	10	10		11	4	69	115.7
4	11		10	10	10	10		11	4	70	117.3

Table 3. Ice Harbor Dam 1997 spill pattern (Continued).

SPILLBAY 1	2	3	4	5	6	7	8	9	10	TOTAL STOPS	TOTAL SPILL (KCFS)
4	11		10	10	10	10		11	4	70	117.3
4	11		10	10	10	10		12	4	71	118.9
4	12		10	10	10	10		12	4	72	120.5
5	12		10	10	10	10		12	5	74	123.9
5	12		10	10	11	10		12	5	75	125.6
5	12		10	11	11	10		12	5	76	127.3
5	12		10	11	11	11		12	5	77	129.0
5	12		11	11	11	11		12	5	78	130.7
5	12		11	11	12	11		12	5	79	132.3
5	12		11	12	12	11		12	5	80	133.9
5	12		11	12	12	12		12	5	81	135.5
5	12		12	12	12	12		12	5	82	137.1
5	12		12	12	12	12		12	5	82	137.1
6	12		12	12	12	12		12	6	84	140.4
6	12		12	12	12	12		13	6	85	142.0
6	13		12	12	12	12		13	6	86	143.6
6	13		12	12	12	12		13	7	87	145.2
7	13		12	12	12	12		13	7	88	146.8
7	13		12	12	13	12		13	7	89	148.4
7	13		12	13	13	12		13	7	90	150.0
7	13		12	13	13	13		13	7	91	151.6
7	13		13	13	13	13		13	7	92	153.2
7	13		13	13	13	13		13	8	93	154.9
8	13		13	13	13	13		13	8	94	156.6
8	13		13	13	13	13		14	8	95	158.2
8	14		13	13	13	13		14	8	96	159.8
8	14		13	13	13	13		14	9	97	161.4
9	14		13	13	13	13		14	9	98	163.0
9	14		13	13	13	13		14	10	99	164.6
10	14		13	13	13	13		14	10	100	166.2
10	14		13	13	14	13		14	10	101	167.8
10	14		13	14	14	13		14	10	102	169.4
10	14		13	14	14	14		14	10	103	171.0
10	14		14	14	14	14		14	10	104	172.6
10	14		14	14	14	14		14	11	105	174.3

Table 3. Ice Harbor Dam 1997 spill pattern (Continued).

SPILLBAY 1	2	3	4	5	6	7	8	9	10	TOTAL STOPS	TOTAL SPILL (KCFS)
11	14		14	14	14	14		14	11	106	176.0
11	14		14	14	14	14		14	12	107	177.6
12	14		14	14	14	14		14	12	108	179.2
12	14		14	14	14	14		14	13	109	180.8
13	14		14	14	14	14		14	13	110	182.4
13	14		14	14	14	14		15	13	111	184.2
13	15		14	14	14	14		15	13	112	186.0
13	15		14	14	14	14		15	14	113	187.6
14	15		14	14	14	14		15	14	114	189.2
14	15		14	14	15	14		15	14	115	191.0
14	15		14	15	15	14		15	14	116	192.8
14	15		14	15	15	15		15	14	117	194.6
14	15		15	15	15	15		15	14	118	196.4
14	15		15	15	15	15		15	15	119	198.2
15	15		15	15	15	15		15	15	120	200.0

SECTION 7

LOWER MONUMENTAL DAM

Lower Monumental Dam

1. Fish Passage Information.

The locations of fish passage facilities are shown on the following general site plan for Lower Monumental Lock and Dam (Figure 11). Dates of project operations for fishery purposes and special operations are listed in Table 2.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. Lower Monumental's juvenile facilities consist of standard length STSs, vertical barrier screens, 12-inch orifices, collection gallery, dewatering structure, and bypass flume to the tailrace below the project. Transportation facilities consist of a separator to sort juvenile fish by size and to separate them from adult fish, sampling facilities, raceways, office and sampling building, truck and barge loading facilities, and PIT tag detection and deflector systems.

1.1.2. Juvenile Migration Timing. Juvenile migration timing at Lower Monumental Dam is indicated in Table 1. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities which may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

Table 1. Juvenile migration timing at Lower Monumental Dam based on juvenile fish collection numbers.

	% Collection	1993	1994	1995	1996
Ylg Hatch Chin					
	10%	5/5	4/27	5/2	4/16
	90%	5/30	5/19	5/21	5/25
Ylg Wild Chin					
	10%	5/5	4/26	4/26	4/22
	90%	5/30	5/24	6/8	5/28
Subylg Chinook					
	10%	6/23	5/17	7/10	6/7
	90%	9/5	9/19	9/1	8/11
Hatch Steelhead					
	10%	5/6	5/3	5/7	4/25
	90%	5/22	6/22	5/26	5/23
Wild Steelhead					
	10%	5/7	4/27	5/5	4/17
	90%	5/23	5/29	5/22	5/22

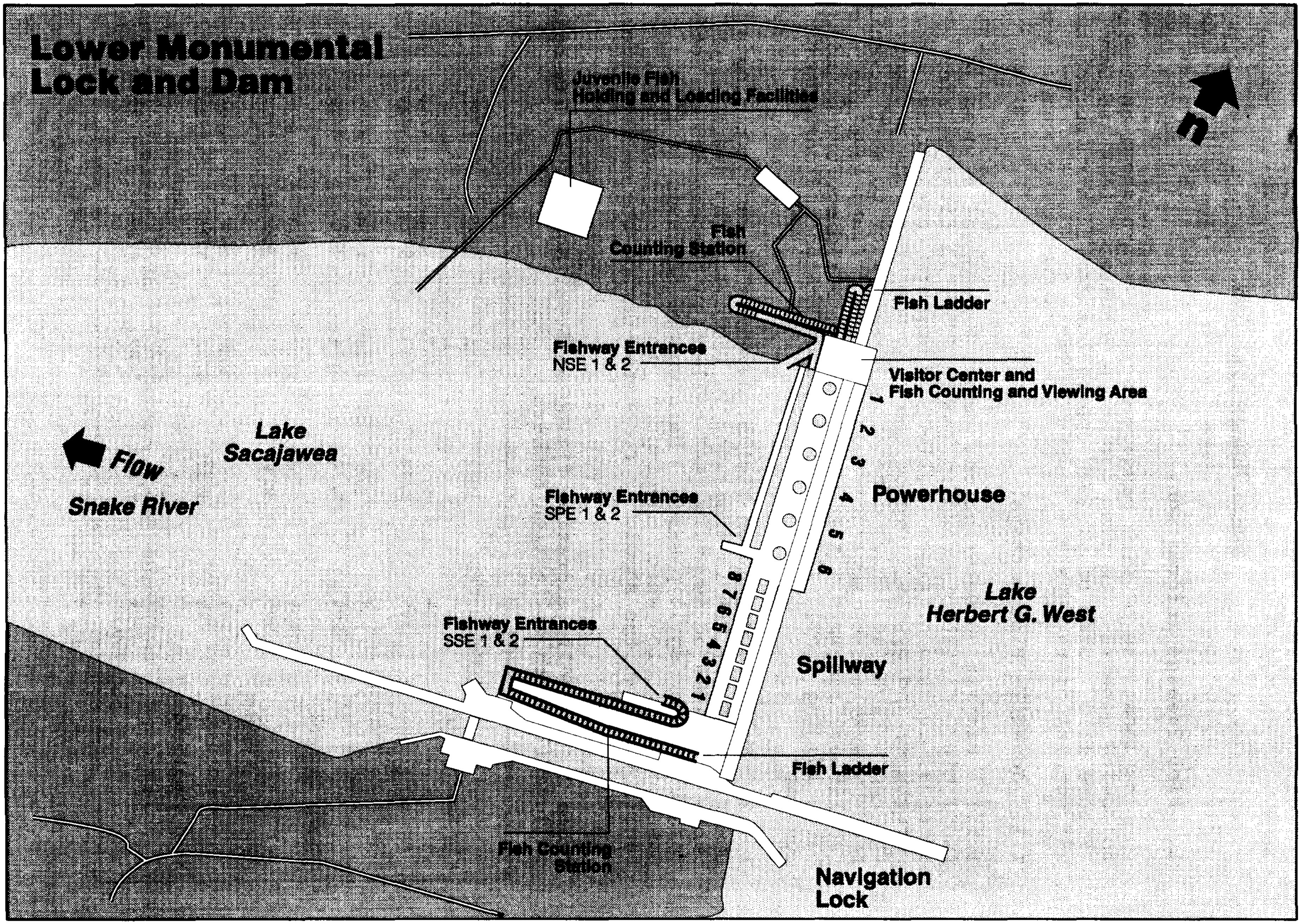
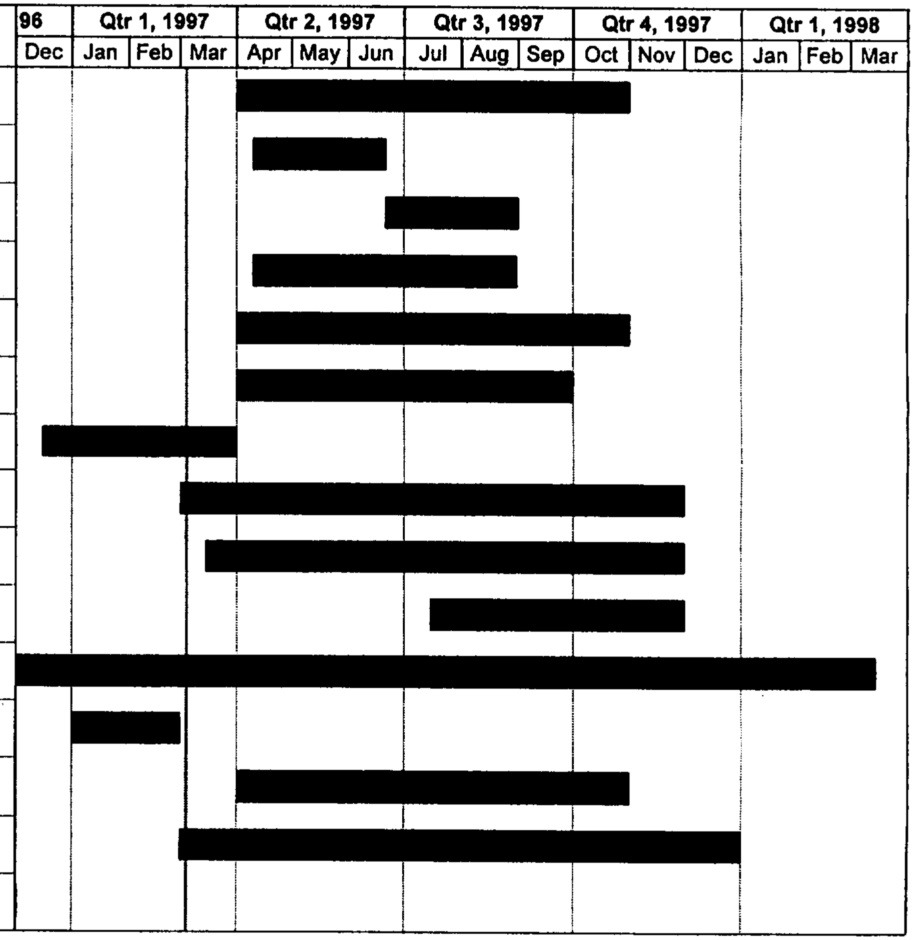


Figure 11 Lower Monumental Lock and Dam General Site Plan

Table 2. Dates of project operations for fishery purposes at Lower Monumental Dam, 1997.

ID	Name	Start	Finish	Notes
1	Junvenile Fish Passage Period	4/1/97	10/31/97	11/1 - 12/15 operate facilities for adult fallback protection
2	Spill Spring	4/10/97	6/20/97	81% 1800 to 0600 (no spill if flows below 85 kcfs)
3	Summer Spill	6/21/97	8/31/97	no spill
4	MOP Operation	4/10/97	8/30/97	end date not fixed
5	Junvenile Fish Transportation	4/1/97	10/31/97	actual dates may vary
6	Dissolved Gas Monitoring	4/1/97	9/30/97	Forebay and tailrace stations
7	Bypass Facility Maintenance	12/16/96	3/31/97	
8	Turbine Operation for Juvenile Fish	3/1/97	11/30/97	Unit priorities vary during this time
9	Turbine 1% Operation	3/15/97	11/30/97	soft constaint 12/1 - 3/14
10	Turbine Maintenance Period	7/15/97	11/30/97	priority units 1 by 1 Sept
11	Adult Passage Period	12/1/96	3/14/98	do per McNary
12	Adult Facility Maintenance	1/1/97	2/28/97	
13	Adult Fish Counting	4/1/97	10/31/97	0400-2000 PST (Video)
14	Weekly reporting	3/1/97	12/31/97	Fri-Thurs: sent by noon following Mon
15	Adult Fish Passage/Spill evaluation	12/1/96	12/2/96	See App. A for additional details NO Dates !!!!



1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at Lower Monumental are comprised of north and south shore fish ladders and collection systems with a common auxiliary water supply. The north shore fish ladder connects to two north shore entrances and the powerhouse collection system. The powerhouse collection system has two downstream entrances and one side entrance into the spillway basin at the south end of the powerhouse, ten floating orifices, and a common transportation channel. The two north shore entrances, two downstream south powerhouse entrances, and five of the floating orifices are used during normal operation. The south shore fish ladder has two downstream entrances and a side entrance into the spillway basin. The two downstream entrances are used during normal operation. The auxiliary water is supplied by three turbine-driven pumps located in the powerhouse on the north side of the river. The water is pumped into a supply conduit which travels under the powerhouse collection channel, distributing water to the powerhouse diffusers, and under the spillway to the diffusers in the south shore collection system. Excess water from the juvenile fish bypass system (approximately 200-240 cfs) is added to the auxiliary water supply system for the powerhouse collection system.

1.2.2. Adult Migration Timing. Upstream migrants are present at Lower Monumental dam all year. Maintenance of adult fish facilities is scheduled in January and February to minimize impacts to adult migrants. Facilities are usually shut down one shore at a time for maintenance to minimize impacts on adult fish passage. Table 3 shows the primary passage periods by species and shows the latest and earliest recorded dates of peak passage from fish count records complied by the Corps. Adult fish are normally counted 16-hours per day (0400 to 2000 Pacific Standard Time) from April 1 through October 31. Adult fish passage is video taped with later interrogation and counting done by fish counters.

Table 3. Adult migration timing at Lower Monumental Dam from 1969-1996.

Species	Counting Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/13	4/20	5/27
Summer Chinook	6/14 - 8/13	6/14	7/12
Fall Chinook	8/14 -10/31	9/13	9/30
Steelhead	4/1 - 10/31	9/15	10/13
Sockeye	4/1 - 10/31	6/24	7/25

2. Project Operation.

2.1. Spill Management. Spill at Lower Monumental is the result of river flow exceeding powerhouse capacity, insufficient generation loads to pass the river flow, or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Daytime spill at Lower Monumental (from 0600 to 1800 hours) will be distributed across the spillway in accordance with the spill pattern in Table 4. Nighttime spills (from 1800 to 0600 hours) will be distributed in accordance with the spill pattern listed in Table 5 to minimize dissolved gas levels. Special spills for juvenile fish passage will be provided as detailed in Appendix A (Special Project Operations and Research).

2.2. Dissolved Gas Management and Control. Dissolved gasses at Lower Monumental are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. Dissolved gas is monitored in the forebay at Lower Monumental Dam from April 1 through September 30. Data will be collected hourly and transmitted via satellite every 4 hours. Total dissolved gas information will also be monitored hourly in the Lower Monumental tailrace from April 1 through September 30. Implementation of spill management requests will be based upon total dissolved gas monitoring and juvenile migration data. Requests for spill will be coordinated through the Technical Management Team.

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through October 31 for juvenile fish bypass, collection and transportation and from November 1 through December 15 for bypassing adult fallbacks. Operate the juvenile facilities according to the criteria listed below and in Appendix B (Corps' Juvenile Fish Transportation Program Operating Criteria) for the bypassing, collection, and transportation of juvenile salmonids.

2.3.1.1. Winter Maintenance Period (December 16 through March 31).

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trash racks.

3. Measure drawdown in gatewell slots.

b. Submersible Traveling Screens (STS) and Vertical Barrier Screens (VBS).

1. Inspect STSs for good running order and operate on one trial run (dogged off on deck).

2. Log trial run.

3. Inspect all VBSs at least once per year. Repair as needed.

c. Collection Gallery.

1. Water-up valve operational.

2. Orifice lights operational.

3. Orifices clean and operational.

d. Dewatering Structure and Flume.

1. Inclined screen clean and in good condition with no gaps between screen panels, damaged panels, or missing silicone.

2. Cleaning brush system maintained and operational.

3. Overflow weirs maintained and tested.

4. All valves in good operating order.

5. Flume smooth with no rough edges.

e. Transportation Facilities.

1. Flume switch gate maintained and operational.

2. Flume smooth with no rough edges.

3. Perforated plate edges smooth with no rough edges.

4. Check wet separator and fish distribution system for operation as designed.

5. Brushes and screens on crowders in good order.

6. Crowders maintained, tested, and operate properly.

7. All valves, slide gates, and switch gates maintained and in good operating order.

8. Retainer screens in place with no holes or gaps in screens or sharp wires protruding.

9. Barge and truck loading pipes free of debris, cracks, or blockages.

10. Barge loading boom maintained and tested.

11. All sampling equipment maintained and operable.

f. Powerhouse Tailrace Area. Inspect bird wires and repair as needed.

g. Maintenance Records. Record all maintenance and inspections.

2.3.1.2. Fish Passage Period (April 1 through December 15).

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Inspect gatewell slots daily (preferably early in day shift) for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell surfaces at least half clear, they should be cleaned at least once daily. If flows through an orifice or fish conditions give indications that an orifice may be partially obstructed with debris, the orifice will be closed and backflushed to remove the obstruction. If the obstruction can not be removed, the orifice shall be closed and the alternate orifice for that gatewell slot shall be operated. If both orifices become obstructed or plugged with debris, the turbine unit will not be operated until the gatewell and orifices are cleared of debris.

3. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot be removed within 24 hours, the gatewell orifices shall be closed and the turbine unit shut down until the material has been removed and any problems corrected. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Orifices shall not be closed for longer then 48 hours.

4. Log drawdown differentials at least once a week.

5. Remove debris from forebay and trashracks as required to maintain less than one foot of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river.

6. Coordinate cleaning effort with personnel operating juvenile collection facilities.

7. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering bulkhead slot.

b. Submersible Traveling Screens (STS) and Vertical Barrier Screens (VBS).

1. Operate STSs in cycling mode when average fork length of subyearling or sockeye is greater than 120 mm.

2. Operate STSs in continuous operational mode when average fork length of subyearling chinook or sockeye is less than 120 mm or if fish condition deteriorates.

3. Inspect each STS once per month.

4. Record STS amp readings daily.

5. If an STS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of STSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged STS.

6. Half of the STSs may be pulled after October 1 for maintenance as long as unscreened turbine units are not operated.

7. Make formal determination at end of season as to adequacy of STS mesh and replacement if necessary.

8. Inspect at least 2 VBSs at random across the powerhouse between the spring and summer migration periods. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

c. Collection Gallery Checks.

1. Orifices clean and operating.

2. Orifice lights operational and operating on open orifices.

3. Orifice jets hitting no closer than 3 feet from wall (bypass gallery full).

4. Operate at least one 12-inch orifice per slot (preferably the north orifice). If the project is operating at MOP, additional orifices may be operated to maintain a full collection channel.

5. Backflush orifices at least once per day, and more frequently if required. During periods of high debris, orifices should be inspected and backflushed several times per day, as determined by the project biologist, to keep orifices clean.

6. Water-up valve operational.

d. Dewatering Structure.

1. Trash sweep operating correctly.

2. Hand clean trapezoidal section as often as required to maintain in clean condition.

3. Overflow weirs operating correctly.

4. No holes in inclined screen.

e. Transportation Facilities.

1. No holes in screens.

2. Crowder screen brushes in good operating condition.

3. Retainer screens in raceway clean with no holes or protruding wires.

4. Operate wet separator and fish distribution system as designed.

5. Truck and barge loading facilities in good operating condition.

f. Inspection and Record Keeping.

1. Inspect fish facilities once each shift. Inspect all facilities according to fish facilities monitoring program.

2 Record all maintenance and inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities according to the following criteria:

2.3.2.1. Winter Maintenance Period (January 1 through March 1).

a. Inspect all staff gauges and water level indicators, repair and/or clean where necessary.

b. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Inspect all diffuser gratings and chambers either visually or by video according to CENPW-OP-T approved inspection program. Repair deficiencies.

c. Inspect for, and, when necessary, clear debris in the ladder exits.

d. Calibrate all mechanical water level sensing devices, as necessary, for proper facilities operations.

e. Inspect all spillgates and ensure that they are operable.

2.3.2.2. Fish Passage Period (March 1 through December 31):.

Note: Ice Harbor pool may be operated at minimum operating pool (MOP), between elevations 437 and 438, as part of the Corps' efforts for improving migration conditions for juvenile salmonids. This will result in some of the adult fishway entrances at Lower Monumental bottoming out on their sills prior to reaching criteria depths. Continuous operation at MOP may also result in increased pumping head on the auxiliary water supply pumps, decreasing the amount of water supplied by the pumps.

a. Fishway Ladders. Water depth over weirs: 1.0 to 1.3 feet

b. Head on all Entrances. Head range: 1.0 to 2.0 feet

c. North Shore Entrances (NSE 1 & 2). Elevation of top of gate when on sill = 429.0.

1. Operate both gates.

2. Weir depth: 8 feet or greater below tailwater.

d. Powerhouse Collection System. Operate 5 floating orifices (O.G numbers 1, 3, 5, 7, 9).

e. South Powerhouse Entrances (SPE 1 & 2). Elevation of top of gate when on sill = 432.0.

1. Operate both downstream gates.

2. Weir depth: 8 feet or greater below tailwater. At tailwaters below elevation 440.0, weirs should be on sill.

f. South Shore Entrances (SSE 1 & 2). Elevation of top of gate when on sill = 431.0.

1. Operate both downstream gates.

2. Weir depth: SSE 1 operate 8 feet or greater below tailwater. SSE 2 raise 6 feet above sill. At tailwaters below elevation 439.0, SSE 1 weir should be on sill.

g. Transportation Velocity:. 1.5 to 4 feet per second.

h. Head on Trashracks.

1. Maximum head of 0.5 feet on ladder exits.

2. Maximum head on south shore picketed leads shall be 0.3 feet. Maximum head on north shore picketed leads shall be 0.4 feet.

i. Staff Gauges and Water Level Indicators. Gauges shall be readable at all water levels encountered during fish passage period.

j. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day.

2. Project biologist shall inspect facilities three times per week. Inspect all facilities according to fish facilities monitoring program.

3. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration.

4. Inspect fishways daily for foreign substances (particularly oil). If substances are found, corrective actions should be undertaken immediately.

5. Record all inspections.

2.3.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, from March 1 through December 31, summarizing project operations. The weekly reports should provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; STS and VBS inspections; and any unusual activities which occurred at the project which may effect fish passage. The weekly reports shall cover a Friday through Thursday time period and shall be sent to CENPW-OP-T by noon the following Monday via electronic mail. Project biologist shall prepare a draft annual report by February 15 and a final report by March 15 summarizing the operation of the project fish passage facilities for the previous year. Project biologist inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENPW-OP-TF on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance.

Project biologist should be present to provide technical guidance at all project activities which may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering plans. Dewatering and fish handling plans shall be reviewed to ensure that they comply with Appendix G, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modifications to the facilities which require them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 through March 31. During the fish passage season, parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

3.1.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and/or survival. Unscheduled maintenance of facilities such as submersible traveling screens, which sometimes break down during the fish passage season, will be carried out according to procedures described below. In these cases, repairs will be made as prescribed and CENPW-OP-T notified for further coordination. Unscheduled maintenance which will have a significant effect on fish passage will be coordinated with the CBFWA and NMFS on a case-by-case basis by CENPW-OP-T. CENPW-OP-T will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-T when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-T includes:

a. Description of the problem.

b. Type of outage required.

c. Impact on facility operation.

d. Length of time for repairs.

e. Expected impacts on fish passage.

3.1.2.1. Traveling Screens. Traveling screens are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged it will be removed and either replaced with the spare STS or repaired and returned to service. A turbine unit shall not be operated with a known damaged or nonfunctioning STS or without a full compliment of STSs. If an STS fails on a weekend or at night when maintenance crews are not available, the respective turbine unit will be shut down and generation switched to another, fully screened unit. If all screened turbine units are in service, water may be spilled until the affected STS can be removed and repaired or replaced.

3.1.2.2. Gatewell Orifices. Each gatewell has two 12-inch orifices with air operated valves to allow fish to exit the gatewell. Under normal operation, one orifice per gatewell is operated. To minimize blockage from debris, orifices are cycled and backflushed at least once per day, and more frequently if required by heavy debris loads. If an air-valve fails, the valve should be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, the turbine unit will be taken out of service until repairs can be made. If repairs are to take longer than 48 hours, juvenile fish will be dipped from the gatewell with a gatewell dip basket. During any closure event of orifices in an operating turbine unit, gatewells will be checked hourly. During times of high fish passage or if there is evidence of any difficulty in holding fish in gatewells, fish are to be dipped from the gatewells at a more frequent interval.

3.1.2.3. **Dewatering Structure.** The dewatering structure acts as a transition from the collection channel to the corrugated metal flume. An inclined screen allows excess water to be bled off, with all fish and remaining water transitioning into the corrugated metal flume. The excess water is discharged into the adult fish facility auxiliary water supply system and used as the water supply for the transportation facilities. The dewatering structure contains a trash sweep for cleaning the inclined screen of impinged debris. If the trash sweep breaks and interferes with juvenile fish passage through the structure or if the inclined screen is damaged, an emergency bypass system at the upstream end of the dewatering structure will be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be unwatered and stoplogs inserted at the upstream end of the inclined screen. The emergency bypass is then opened and the bypass system operated with 6 gatewell orifices open. Orifices will then need to be routinely rotated in order to let juveniles emigrate from all of the gatewells. While the facilities are in emergency bypass operation, project personnel shall monitor gatewells for signs of fish problems or mortality. Spill may be provided as an alternative avenue for fish passage during a collection channel outage.

3.1.2.4. **Bypass Flume.** The corrugated metal flume transports juveniles to either the transportation facilities or to the river below the project. If there is a problem with the flume which interferes with its operation, the emergency bypass system at the upper end of the flume can be opened and all of the fish in the bypass system diverted to the river below the project through the emergency bypass pipe while repairs are made.

3.1.2.5. **Transportation Facilities.** The transportation facilities can be operated to either collect and hold juveniles for the transportation program or to bypass them back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the fish will be bypassed around the transportation facilities.

3.2. Adult fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not have a significant affect on fish passage may be conducted during the rest of the year. Fishway auxiliary water supply pumps require monthly, semi-annual, and annual maintenance. Monthly maintenance requires a one-day outage per pump, semi-annual maintenance requires a two-day outage per pump in July, and annual maintenance requires a two-week outage per pump during the winter maintenance period. Maintenance is normally conducted on one fish ladder at a time during the winter to provide some fish passage at the project at all times. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fishery agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance which will significantly affect the operation of a facility will be coordinated with the CBFWA and NMFS. Coordination procedures for unscheduled maintenance of adult facilities are the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental affects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions and may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladders and Counting Stations. The fish ladders contain fixed weirs, counting stations with picketed leads, and fish exits with trash racks. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision on whether to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

3.2.2.2. Auxiliary Water Supply System. The auxiliary water for the fish ladders and the collection systems is supplied by three turbine-driven pumps on the north shore with all three pumps being required for normal operation. If one, two, or all three pumps fail, the fishway will be adjusted in the following manner until repairs can be made: SPE 2 and SSE 2 will be closed and SPE 1 raised to provide the required 1.0 to 2.0 foot head differential in the system. If the desired head differential cannot be reached by the time SPE 1 reaches 5 feet below tailwater, the floating orifices should be closed starting at OG-9 and working north across the powerhouse. If the head differential still cannot be maintained when all the floating orifices are closed, SPE 1 should be closed, the collection channel bulkheaded off at the junction pool, and NSE 1 and 2 and SSE 1 operated as deep as possible to maintain the head. If it cannot be maintained at a depth greater than 6 feet, the weirs should be maintained at 6 feet regardless of the head differential.

3.2.2.3. Fishway Entrances. The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater fluctuations. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually, the weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made. If a floating orifice is damaged, it will be pulled out of the water and the entrance bulkheaded off until it is repaired.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units at Lower Monumental will be operated to enhance adult fish passage from March 1 through November 30. During this time period, turbine units will be operated (as needed to meet generation requirements) in the following order: 1, 2, 3, and then 4 through 6 (in any order) when units are available for operation. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. To minimize mortality to juvenile fish passing through the turbine units from April 1 through October 31 (or as long as there is sufficient river flow and/or generation requests to operate turbine units 4, 5, and 6 within 1 percent of peak efficiency), operating priority during nighttime hours from 2000 to 0400 hours shall be units 4, 5, and 6 (in any order), and then units 1, 2 and 3 as needed. If the project is spilling for juvenile fish passage nightly with no daytime spill, unit priorities shall change at 1800 and 0600 hours, when spill is started and ended, to minimize starting and stopping of turbine units. If the project is bypassing fish back to the river, nighttime turbine unit operation shall be units 1 and then 4, 5, and 6 (in any order), and then 2, and 3. If a turbine unit is taken out of service for maintenance or repair, the next unit in the priority list shall be operated.

Turbine units will be operated within 1% of best efficiency from March 15 through November 30 (or as specified in BPA's load shaping guidelines) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA administrator whose load requests will be made in accordance with

BPA's policy, statutory requirements and load shaping guidelines (Appendix C); or 2) be in compliance with other coordinated fishery measures. Project personnel shall record when turbine units are operated outside the 1% best efficiency range and shall provide the information to BPA on a weekly basis according to the load shaping guidelines. Between December 1 and March 15, turbine units will continue to be operated within the 1% best efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within 1% of best efficiency at various head ranges are listed below. The following 1% best efficiency ranges were calculated using results from 1994 index testing of turbine unit 3 at Little Goose Dam. Maximum generation of turbine units at 115% overload is 155 MW.

The CBFWA recommends that turbine units be operated within 1% of best efficiency unless otherwise agreed.

4.2 Turbine Unit Outages During High River Flow Periods. During high spring flows, turbine unit outages for inspecting fish screens, repairing research equipment such as hydroacoustic or radio telemetry equipment, and other fishery items may cause increased spill at a project in order to maintain reservoirs levels within operating levels. This may result in total dissolved gas levels exceeding standards. It is important that this work be conducted when scheduled to ensure that facilities are working correctly and not injuring migrating fish, and that important fish research data is collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Lower Monumental, this special operation shall take place when river flows are above 120 kcfs or when increasing spill levels will result in total dissolved gas levels exceeding standards. The activities covered under these operations will be coordinated with and approved by the Technical Management Team whenever possible.

For scheduled inspection or repair of research equipment, reservoirs shall be drafted to the bottom of MOP and allowed to fill to 1 foot above the MOP operating range as the work is accomplished. After the work, reservoirs will be slowly drafted back to the MOP operating range. When inspection or repair work can be scheduled ahead of time, the following process will be followed:

a. Project personnel shall schedule turbine unit outages

through the approved turbine outage scheduling procedure by noon of the Tuesday of the week prior to the outage.

Turbine Units 1-3 With Standard Length Submersible Traveling Screens Installed.

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	80	12,966	137	22,317
86	81	12,966	140	22,441
87	81	12,797	141	22,331
88	82	12,796	142	22,239
89	83	12,793	144	22,151
90	84	12,790	145	22,067
91	84	12,651	146	21,982
92	85	12,653	149	22,106
93	87	12,657	150	22,023
94	88	12,666	151	21,943
95	89	12,677	152	21,866
96	89	12,563	154	21,793
97	90	12,577	155	21,724
98	91	12,588	155	21,478
99	92	12,589	155	21,237
100	92	12,481	155	21,024
101	93	12,486	155	20,816
102	94	12,489	155	20,588
103	95	12,492	155	20,365
104	95	12,390	155	20,146
105	96	12,502	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best information currently available.

Turbine Units 1-3 Without Screens.

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	75	12,168	137	22,317
86	76	12,168	140	22,441
87	76	12,010	141	22,331
88	77	12,009	142	22,238
89	78	12,006	144	22,151
90	79	12,003	145	22,067
91	79	11,872	146	21,982
92	80	11,874	149	22,106
93	81	11,878	150	22,023
94	82	11,887	151	21,943
95	83	11,897	152	21,866
96	83	11,790	154	21,792
97	84	11,803	155	21,724
98	85	11,813	155	21,478
99	86	11,814	155	21,237
100	86	11,713	155	21,024
101	87	11,717	155	20,816
102	88	11,720	155	20,588
103	89	11,723	155	20,365
104	89	11,628	155	20,146
105	90	11,733	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information. This table is based on data from Little Goose Dam.

<u>Turbine Units 4-6</u> With Standard Length Submersible Traveling Screens Installed.

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	86	13,525	120	18,945
86	87	13,516	122	19,014
87	88	13,509	124	19,080
88	89	13,502	126	19,142
89	90	13,495	128	19,200
90	91	13,487	130	19,255
91	92	13,480	132	19,310
92	93	13,477	134	19,364
93	94	13,475	135	19,255
94	95	13,472	137	19,305
95	96	13,469	138	19,203
96	98	13,559	139	19,264
97	99	13,554	140	19,180
98	100	13,547	141	19,102
99	102	13,632	142	19,027
100	104	13,720	143	18,956
101	106	13,808	143	18,746
102	107	13,801	143	18,542
103	108	13,796	143	18,342
104	109	13,791	145	18,418
105	110	13,785	147	18,434

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best information currently available.

Turbine Units 4-6 Without Screens.

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits MW)	Upper Generator Limits (CFS)
85	98	15,421	126	19,896
86	99	15,410	128	19,968
87	100	15,402	131	20,037
88	102	15,394	133	20,103
89	103	15,386	135	20,164
90	104	15,377	137	20,221
91	105	15,370	139	20,279
92	106	15,366	141	20,336
93	107	15,364	142	20,221
94	108	15,361	144	20,273
95	110	15,357	145	20,167
96	112	15,460	147	20,231
97	113	15,454	148	20,142
98	114	15,446	149	20,060
99	116	15,543	150	19,982
100	119	15,643	151	19,907
101	121	15,744	151	19,686
102	122	15,736	151	19,472
103	123	15,730	151	19,262
104	124	15,724	153	19,343
105	126	15,717	155	19,359

NOTE: The turbine efficiency tables are being revised to reflect new information. This table is based on data from Little Goose Dam.

b. Project personnel shall also contact CENPW-OP-TF and CENPD-ET-WM (Reservoir Control Center) by the same time period and inform them of the intended work.

c. CENPD-ET-WM will coordinate the work activities with regional parties at the Technical Management Team meeting on the following Wednesday.

d. After coordination with the TMT CENPD-ET-WM shall issue a teletype through the CBTT issuing instructions to project and BPA personnel for the scheduled work.

e. Spill will be increased by one spillbay stop setting (about 1.7 kcfs) above passing inflow to slowly lower the level of Lower Monumental pool to the bottom of the MOP range prior to the scheduled work taking place.

f. When the work takes place, additional spill will not be provided and the reservoir will be allowed to refill until the reservoir is 1 foot above the normal MOP range (a 2 foot pondage from where the pool was when the work started). At this point, screen inspections shall stop. (At Snake River projects, this should allow about one normal work day for the scheduled work.)

g. At the conclusion of the work, the reservoir shall be drafted back down to the MOP range utilizing a one spillbay stop increase in spill above passing inflow.

h. If work, such as screen inspections, is not finished, project personnel shall schedule another turbine unit outage for a date where it can be implemented again.

If the work that needs to be done is of an emergency type nature that does not normally require the turbine unit to be taken out of service (such as a failed hydroacoustic transducer versus a failed fish screen), and can not wait for the above process to be implemented, project personnel shall notify CENPW-OP-TF and CENP-ET-WM to get approval to do the work. If approval to do the work is given, the turbine unit shall be taken out of service and the reservoir level allowed to increase until it reaches 1 foot above the MOP operating range. At this point, the turbine unit must be returned to service and the reservoir will be drafted back to the MOP range using one spillbay stop setting above passing inflows.

4.3. Turbine Unit Maintenance. The project's turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fishery impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance which may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted in mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent peak efficiency. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish. Transformers are Doble tested every 3 years. Testing may need to be more frequent if there is a known problem with a transformer. These tests normally take 2 to 3 work days. To conduct the testing, the distribution lines have to be disconnected from the transformers and normal generation stopped. One turbine unit will operate in a speed-no-load condition to provide project power and operation of fish passage facilities. Spill may be provided to meet minimum required project discharges during the testing hours. The Doble tests are normally scheduled for the August time period to minimize impacts on adult and juvenile fish passage.

Table 4. Lower Monumental Dam daytime spillway pattern for adult fish passage.

Gate Number								Total Stops	Total KCFS
1	2	3	4	5	6	7	8		
1								1	1.1
1							1	2	2.2
1	1						1	3	3.3
1	1					1	1	4	4.4
2	1					1	1	5	6.1
2	1					1	2	6	7.8
2	1	1				1	2	7	8.9
2	1	1			1	1	2	8	10.0
2	1	1	1		1	1	2	9	11.1
2	1	1	1	1	1	1	2	10	12.2
2	1	2	1	1	1	1	2	11	13.9
2	1	2	1	1	2	1	2	12	15.6
2	1	2	2	1	2	1	2	13	17.3
2	1	2	2	2	2	1	2	14	19.0
3	1	2	2	2	2	1	2	15	20.8
3	2	2	2	2	2	1	2	16	22.5
3	2	2	2	2	2	1	3	17	24.3
3	2	2	2	2	2	2	3	18	26.0
4	2	2	2	2	2	2	3	19	27.7
4	2	2	2	3	2	2	3	20	29.5
4	2	2	2	3	2	2	4	21	31.2
4	2	2	2	3	2	3	4	22	33.0
4	2	3	2	3	2	3	4	23	34.8
4	3	3	2	3	2	3	4	24	36.6
4	3	3	3	3	2	3	4	25	38.4
4	3	3	3	3	3	3	4	26	40.2
4	3	3	4	3	3	3	4	27	41.9
4	3	3	4	4	3	3	4	28	43.6
5	3	3	4	4	3	3	4	29	45.3
5	4	3	4	4	3	3	4	30	47.0
5	4	3	4	4	3	3	5	31	48.7
5	4	3	4	4	3	4	5	32	50.4
5	4	4	4	4	3	4	5	33	52.1
5	4	4	4	4	4	4	5	34	53.8
5	4	4	5	4	4	4	5	35	55.5
5	4	4	5	4	5	4	5	36	57.2
6	4	4	5	4	5	4	5	37	58.9
6	5	4	5	4	5	4	5	38	60.6
6	5	4	5	4	5	4	6	39	62.3
6	5	4	5	4	5	5	6	40	64.0
6	5	5	5	4	5	5	6	41	65.7
6	5	5	5	5	5	5	6	42	67.4
6	5	5	6	5	5	5	6	43	69.1
6	5	5	6	5	6	5	6	44	70.8
7	5	5	6	5	6	5	6	45	72.5

Table 5. Lower Monumental Dam daytime spillway pattern for adult fish passage (Continued).

Gate Number								Total Stops	Total Kcfs
1	2	3	4	5	6	7	8		
7	6	5	6	5	6	5	6	46	74.2
7	6	5	6	5	6	5	7	47	75.9
7	6	5	6	5	6	6	7	48	77.6
7	6	6	6	5	6	6	7	49	79.3
7	6	6	6	6	6	6	7	50	81.0
7	6	6	7	6	6	6	7	51	82.7
7	6	6	7	6	7	6	7	52	84.4
8	6	6	7	6	7	6	7	53	86.3
8	7	6	7	6	7	6	7	54	88.0
8	7	6	7	6	7	6	8	55	89.9
8	7	6	7	6	7	7	8	56	91.6
8	7	7	7	6	7	7	8	57	93.3
8	7	7	7	7	7	7	8	58	95.0
8	7	7	8	7	7	7	8	59	96.9
8	7	7	8	7	8	7	8	60	98.8
9	7	7	8	7	8	7	8	61	100.4
9	8	7	8	7	8	7	8	62	102.3
9	8	7	8	7	8	7	9	63	103.9
9	8	7	8	7	8	8	9	64	105.8
9	8	8	8	7	8	8	9	65	107.7
9	8	8	8	8	8	8	9	66	109.6
9	8	8	9	8	8	8	9	67	111.2
9	8	8	9	8	9	8	9	68	112.8
10	8	8	9	8	9	8	9	69	114.6
10	9	8	9	8	9	8	9	70	116.2
10	9	8	9	8	9	8	10	71	118.0
10	9	8	9	8	9	9	10	72	119.6
10	9	9	9	8	9	9	10	73	121.2
10	9	9	9	9	9	9	10	74	122.8
10	9	9	10	9	9	9	10	75	124.6
10	9	9	10	9	10	9	10	76	126.4
11	9	9	10	9	10	9	10	77	128.1
11	10	9	10	9	10	9	10	78	129.9
11	10	9	10	9	10	9	11	79	131.6
11	10	9	10	9	10	10	11	80	133.4
11	10	10	10	9	10	10	11	81	135.2
11	10	10	10	10	10	10	11	82	137.0
11	10	10	11	10	10	10	11	83	138.7
11	10	10	11	10	11	10	11	84	140.4
12	10	10	11	10	11	10	11	85	142.2
12	11	10	11	10	11	10	11	86	143.9
12	11	10	11	10	11	10	12	87	145.7
12	11	10	11	10	11	11	12	88	147.4
12	11	11	11	10	11	11	12	89	149.1
12	11	11	11	11	11	11	12	90	150.8

Table 5. Lower Monumental Dam nighttime spill pattern for minimizing dissolved gas levels.

SPILLBAY								TOTAL STOPS	TOTAL SPILL
1	2	3	4	5	6	7	8		
	1							1	1.10
	1	1						2	2.20
	1	1	1					3	3.30
	1	1	1	1				4	4.40
	1	1	1	1	1			5	5.50
	1	1	1	1	1	1		6	6.60
	2	1	1	1	1	1		7	8.30
	2	2	1	1	1	1		8	10.00
	2	2	2	1	1	1		9	11.70
	2	2	2	2	1	1		10	13.40
	2	2	2	2	2	1		11	15.10
	2	2	2	2	2	2		12	16.80
	3	2	2	2	2	2		13	18.60
	3	3	2	2	2	2		14	20.40
	3	3	3	2	2	2		15	22.20
	3	3	3	3	2	2		16	24.00
	3	3	3	3	3	2		17	25.80
	3	3	3	3	3	3		18	27.60
	4	3	3	3	3	3		19	29.20
	4	4	3	3	3	3		20	30.80
	4	4	4	3	3	3		21	32.40
	4	4	4	4	3	3		22	34.00
	4	4	4	4	4	3		23	35.60
	4	4	4	4	4	4		24	37.20
	5	4	4	4	4	4		25	38.90
	5	5	4	4	4	4		26	40.60
	5	5	5	4	4	4		27	42.30
	5	5	5	5	4	4		28	44.00
	5	5	5	5	5	4		29	45.70
	5	5	5	5	5	5		30	47.40
	6	5	5	5	5	5		31	49.10
	6	6	5	5	5	5		32	50.80
	6	6	6	5	5	5		33	52.50
	6	6	6	6	5	5		34	54.20
	6	6	6	6	6	5		35	55.90

Table 5. Lower Monumental Dam nighttime spill pattern for minimizing dissolved gas levels (Continued).

SPILLBAY									
1	2	3	4	5	6	7	8	TOTAL STOPS	TOTAL SPILL
	6	6	6	6	6	6		36	57.60
	7	6	6	6	6	6		37	59.30
	7	7	6	6	6	6		38	61.00
	7	7	7	6	6	6		39	62.70
	7	7	7	7	6	6		40	64.40
	7	7	7	7	7	6		41	66.10
	7	7	7	7	7	7		42	67.80
	8	7	7	7	7	7		43	69.60
	8	8	7	7	7	7		44	71.40
	8	8	8	7	7	7		45	73.20
	8	8	8	8	7	7		46	75.00
	8	8	8	8	8	7		47	76.80
	8	8	8	8	8	8		48	78.60
	9	8	8	8	8	8		49	80.30
	9	9	8	8	8	8		50	82.00
	9	9	9	8	8	8		51	83.70
	9	9	9	9	8	8		52	85.40
	9	9	9	9	9	8		53	87.10
	9	9	9	9	9	9		54	88.80
	10	9	9	9	9	9		55	90.50
	10	10	9	9	9	9		56	92.20
	10	10	10	9	9	9		57	93.90
	10	10	10	10	9	9		58	95.60
	10	10	10	10	10	9		59	97.30
	10	10	10	10	10	10		60	99.00
	11	10	10	10	10	10		61	100.70
	11	11	10	10	10	10		62	102.40
	11	11	11	10	10	10		63	104.10
	11	11	11	11	10	10		64	105.80
	11	11	11	11	11	10		65	107.50
	11	11	11	11	11	11		66	109.20
	12	11	11	11	11	11		67	111.00
	12	12	11	11	11	11		68	112.80
	12	12	12	11	11	11		69	114.60
	12	12	12	12	11	11		70	116.40

Table 5. Lower Monumental Dam nighttime spill pattern for minimizing dissolved gas levels (Continued).

SPILLBAY									
1	2	3	4	5	6	7	8	TOTAL STOPS	TOTAL SPILL
	12	12	12	12	12	11		71	118.20
	12	12	12	12	12	12		72	120.00
	13	12	12	12	12	12		73	121.70
	13	13	12	12	12	12		74	123.40
	13	13	13	12	12	12		75	125.10
	13	13	13	13	12	12		76	126.80
	13	13	13	13	13	12		77	128.50
	13	13	13	13	13	13		78	130.20
	14	13	13	13	13	13		79	131.90
	14	14	13	13	13	13		80	133.60
	14	14	14	13	13	13		81	135.30
	14	14	14	14	13	13		82	137.00
	14	14	14	14	14	13		83	138.70
	14	14	14	14	14	14		84	140.40
	15	14	14	14	14	14		85	142.20
	15	15	14	14	14	14		86	144.00
	15	15	15	14	14	14		87	145.80
	15	15	15	15	14	14		88	147.60
	15	15	15	15	15	14		89	149.40
	15	15	15	15	15	15		90	151.20
	16	15	15	15	15	15		91	152.90
	16	16	15	15	15	15		92	154.60
	16	16	16	15	15	15		93	156.30
	16	16	16	16	15	15		94	158.00
	16	16	16	16	16	15		95	159.70
	16	16	16	16	16	16		96	161.40

SECTION 8

LITTLE GOOSE DAM

Little Goose Dam

1. Fish Passage Information.

The locations of fish passage facilities are shown in the following general site plan of Little Goose Lock and Dam (Figure 12). Dates of project operations for fishery purposes and special operations are listed in Table 2.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. Little Goose's juvenile facilities consist of a bypass system and juvenile transportation facilities. The bypass system contains extended length submersible bar screens with flow vanes, vertical barrier screens, 12-inch gatewell orifices, a bypass channel running the length of the powerhouse, a metal flume mounted on the face of the dam and the upper end of the fish ladder, a dewatering structure to eliminate excess water, two emergency bypass systems, and a corrugated metal flume to transport the fish to either the transportation facilities or to the river. The transportation facilities include a separator structure, raceways for holding fish, a distribution system for distributing the fish among the raceways, a sampling and marking building, truck and barge loading facilities, and PIT tag detection and deflection systems.

1.1.2. Juvenile Migration Timing. Juvenile migration timing at Little Goose Dam is indicated in Table 1. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities which may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

Table 1. Juvenile migration timing at Little Goose Dam based on juvenile fish collection numbers.

	%Collection	1992	1993	1994	1995	1996
Ylg Hatch Chin						
	10%		5/2	4/29	5/1	4/27
	90%		5/18	5/21	5/24	5/25
Ylg Wild Chin						
	10%	4/22	5/1	4/26	4/22	4/21
	90%	5/20	5/31	5/28	6/12	5/22
Subylg Chin						
	10%	6/4	6/25	5/22	7/13	6/25
	90%	7/31	8/28	9/2	8/30	8/13
Hatch Steelhead						
	10%	5/5	5/3	5/3	5/6	4/23
	90%	7/5	5/24	6/1	5/26	5/21
Wild Steelhead						
	10%	4/23	4/29	4/27	5/1	4/14
	90%	5/31	5/23	5/25	5/25	5/21

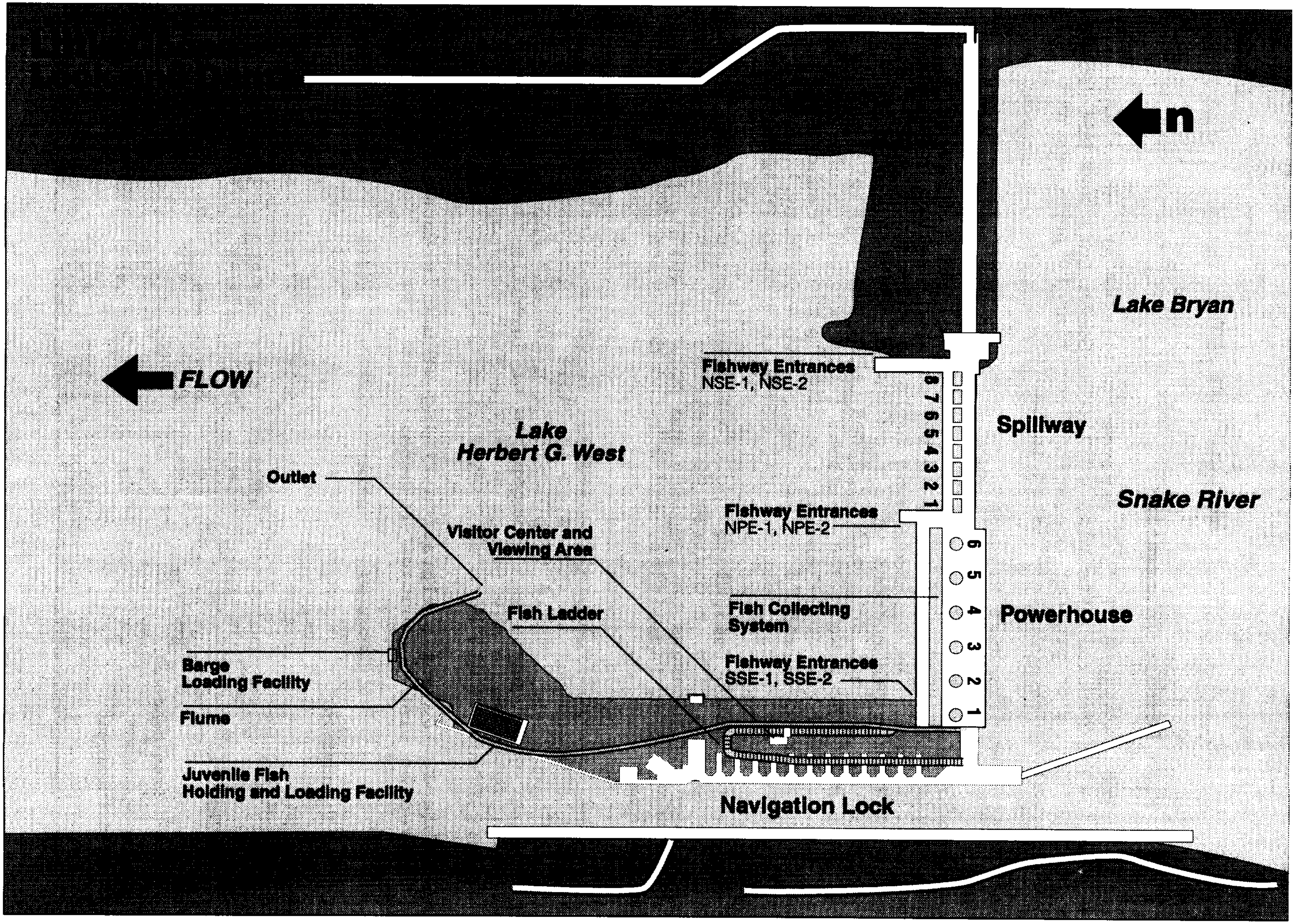
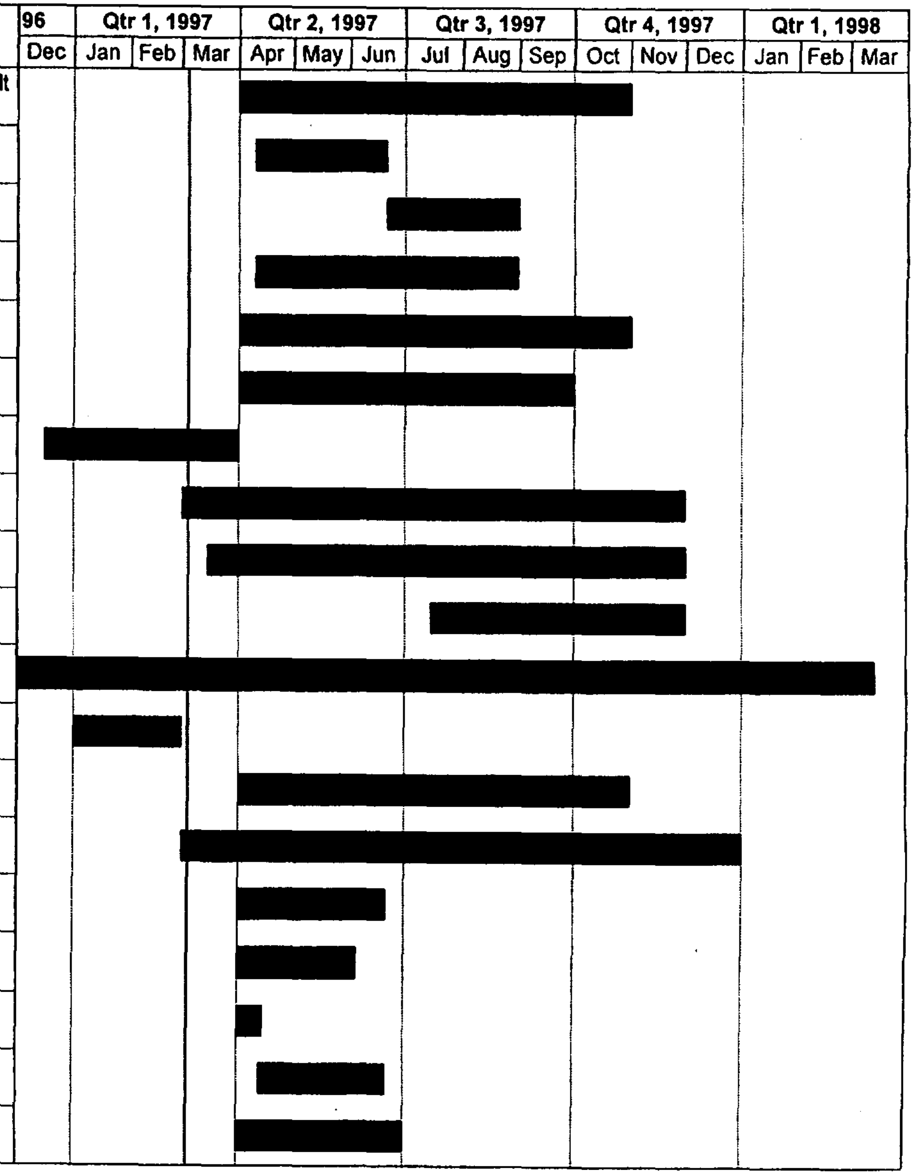


Fig e 12 Little Goose Lock and Dam General Site Plan

Revised March 1, 1997

Table 2. Dates of Project Operations for Fishery Purposes at Little Goose Dam, 1997.

ID	Name	Start	Finish	Notes
1	Juvenile Fish Passage Period	4/1/97	10/31/97	11/1 - 12/15 operate facilites for adult fallback protection
2	Spill Spring	4/10/97	6/20/97	80% 1800 to 0600 (no spill if flows below 85 kcfs)
3	Spill Summer	6/21/97	8/31/97	no spill
4	MOP Operation	4/10/97	8/30/97	end date not fixed
5	Junvenile Fish Transportation	4/1/97	10/31/97	actual dates may vary
6	Dissolved Gas Monitoring	4/1/97	10/1/97	Forebay and tailrace stations
7	Bypass Facility Maintenance	12/16/96	3/31/97	
8	Turbine Operation for Adult/Juvenile Fish	3/1/97	11/30/97	Unit priorities vary during this time
9	Turbine 1%operation	3/15/97	11/30/97	soft constraint 12/1 to 3/14
10	Turbine Maintenance Period	7/15/97	11/30/97	priority unit 1 by Sept 1
11	Adult Passage Period	12/1/96	3/14/98	do per McNary
12	Adult Facility Maintence	1/1/97	2/28/97	
13	Adult Fish Counting	4/1/97	10/31/97	0400-2000 PST (video)
14	Weekly Reporting	3/1/97	12/31/97	Fri-Thur: sent by noon following Mon
15	Spill Test	4/1/97	6/20/97	See App. A for additional details
16	Pit Tag Study	4/1/97	6/4/97	See App. A for additional details
17	Spillway Survival Study	4/1/97	4/14/97	See App. A for additional details
18	Hydroacoustic Evaluation	4/13/97	6/20/97	See App. A for additional details
19	Adult passage Study	4/1/97	6/30/97	See App. A for additional details



1.2. Adult Fish Passage.

1.2.1. Facilities Description. The adult fish passage facilities at Little Goose are comprised of one fish ladder on the south shore, two south shore entrances, a powerhouse collection system, north shore entrances with a transportation channel underneath the spillway to the powerhouse collection system, and auxiliary water supply system. The powerhouse collection system is comprised of four floating orifices, two downstream entrances and one side entrance into the spillway basin on the north end of the powerhouse, and a common transportation channel. The four floating orifices and the two downstream entrances at the north end of the collection system are normally used. The north shore entrances are made up of two downstream facing entrances and a side entrance into the spillway basin with the two downstream entrances normally used. The auxiliary water is supplied by three turbine-driven pumps that pump water from the tailrace into the distribution system for the diffusers. Additional water is supplied to the auxiliary water supply system from the juvenile fish passage facilities primary dewatering structure.

1.2.2. Adult Migration Timing. Upstream migrants are present at the project year around. Maintenance of upstream passage facilities is scheduled for January through February to minimize the impact on upstream migrants. Table 3 lists primary passage periods by species and shows the earliest and latest dates of peak passage which have been recorded from compilation of fish counts by the Corps. Adult fish are normally counted 16 hours per day (0400 to 2000 Pacific Standard Time) from April 1 through October 31. Adult fish passage is videotaped with later interrogation by fish counters.

Table 3. Adult migration timing at Little Goose Dam from 1969-1996.

Species	Counting Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/15	4/20	5/27
Summer Chinook	6/16 - 8/15	6/14	7/12
Fall Chinook	8/16 - 10/31	9/14	9/30
Steelhead	4/1 - 10/31	9/15	10/14
Sockeye	6/15 - 10/31	6/24	7/25

2. Project Operations.

2.1. Spill Management. Spill at Little Goose is the result of river flow exceeding powerhouse capacity or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Daytime spill at Little Goose (from 0600 to 1800 hours) shall be distributed in accordance with the adult fish passage spill pattern listed on

Table 4. Nighttime spills (from 1800 to 0600 hours) will be distributed in accordance with the spill pattern listed in Table 5 to minimize dissolved gas levels. Special spills for juvenile fish passage will be provided as detailed in Appendix A (Special Project Operations and Research).

2.2. Dissolved Gas Management and Control. Dissolved gasses at Little Goose are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. Total dissolved gas will be monitored hourly in the Little Goose forebay and reported every 4 to 6 hours from April 1 through September 30. Total dissolved gas will also be monitored hourly in the Little Goose tailwaters from April 1 through September 30. Related data reported at the same time will be spill volume, and total project flow. Implementation of spill management requests will be based in part upon dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Requests for spill will be coordinated through the Technical Management Team.

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through 31 for juvenile fish bypass, collection, and transportation and from November 1 through December 15 for bypassing adult fallbacks. Operate according to the criteria listed below and in Appendix B (Corps' Juvenile Fish Transportation Program Operating Criteria) for the bypassing, collection, and transportation of juvenile salmonids. The transportation program may be revised in accordance with the ESA Section 10 permit and NMFS's biological opinion.

2.3.1.1. Winter Maintenance Period (December 16 through March 31).

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trashracks.

3. Measure drawdown in gatewell slots.

b. Extended-length Submersible Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

1. Maintenance completed on all ESBSs.

2. Inspect ESBSs for good running order and operate debris cleaner on one trial run (dogged off on deck).

3. Log results of trial run.

4. Inspect VBSs at least once per year. Repair as needed.

5. Inspect flow vanes to make sure they are in good condition and all surfaces smooth. Repair as needed.

c. Collection Gallery.

1. Makeup water gate operational.

2. Orifice lights operational.

3. Orifices clean and operational.

d. Dewatering Structure.

1. Inclined screen clean and in good condition with no gaps between screen panels, damaged panels, or missing silicone.

2. Cleaning brush system maintained and operational.

3. Overflow weirs maintained and tested.

e. Transportation Facilities.

1. Flume switch gate maintained and operational.

2. Flume smooth with no rough edges.

3. Perforated plate smooth with no rough edges.

4. Check wet separator and fish distribution system for operation as designed.

5. Brushes on crowders in good order.

6. Crowders operate properly.

7. All valves, slide gates, and switch gates in good operating order.

8. Retainer screens in place with no holes or sharp wires protruding.

9. Barge and truck loading pipes free of debris, cracks, or blockages.

10. Barge loading boom maintained and tested.

11. All sampling equipment maintained and

operable.

f. Maintenance Records. Record all maintenance and inspections.

g. Powerhouse Tailrace Area. Inspect bird wires and replace as needed.

2.3.1.2. Fish Passage Period (April 1 through December 15):

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Inspect gatewell slots daily for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell at least half clear, they should be cleaned at least once daily. If flows through an orifice or fish conditions give indications that an orifice may be partially obstructed with debris, the orifice will be close and backflushed to remove the obstruction. If the obstruction can not be removed, the orifice shall be closed and the alternate orifice for that gatewell slot shall be operated. If both orifices become obstructed or plugged with debris the turbine unit will not be operated until the gatewell and orifices are cleared of debris.

3. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot removed within 24 hours, the gatewell orifices shall be closed and the turbine unit shut down until the material has been removed and any problems corrected. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Orifices shall not be closed for longer than 48 hours.

4. Log drawdown differentials in bulkhead and operating gate slots at least once a week from April 1 through June 30 and biweekly from July 1 through October 31.

5. Remove debris from forebay and trashracks as required to maintain less than one foot of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river.

6. Coordinate cleaning effort with personnel operating juvenile collection facilities.

7. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering a bulkhead slot.

b. Extended-length Submersible Bar Screens (ESBS) and Vertical Barrier Screens (VBS).

1. Operate ESBSs with flow vanes attached to screen.

2. Operate ESBSs with debris cleaners in automatic mode. Set cleaning frequency as required to maintain clean screens and good fish condition. Change cleaning frequency as needed.

3. Inspect each ESBS once per month.

4. If an ESBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of ESBSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged ESBS, except as noted.

5. One-half of the ESBSs may be pulled after October 1 for maintenance as long as unscreened turbine units are not operated.

6. Make formal determination at end of season as to adequacy of bar screen panels and debris cleaner brushes and replace components as necessary.

7. Measure head differentials across VBSs twice per week from April 1 through June 15 (more frequently if required) and weekly for the remainder of the operating season. Clean VBS when head differentials reach 1.5 feet. When a head differential of 1.5 feet is reached, the respective turbine unit should be operated at a reduced loading, not more than 110 MW, to minimize loading on the VBS and potential fish impingement until the VBS can be cleaned. Clean VBSs as soon as possible after a 1.5 head differential is reached.

8. Inspect at least 2 VBSs at random across the powerhouse between the spring and summer migration periods. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

c. Collection Gallery Checks.

1. Orifices clean and operating.

2. Orifice lights operating on operating orifices.

3. Orifice jets not within three feet of back wall (bypass gallery full).

4. Operate at least one 12-inch orifice per gatewell slot (preferably the north orifice). If the project is operating at MOP, additional orifices may be operated to maintain a full collection gallery. If orifices must be closed to repair any part of the facility, do not close orifices in operating turbine units with ESBSs in place for longer than 5 hours. Monitor fish conditions in gatewells hourly during orifice closure period.

5. Backflush orifices at least once per day, and more frequently if required. During periods of high debris, orifices should be inspected and backflushed several times per day, as determined by the project biologist, to keep orifices clean.

6. Makeup water gate operational.

d. Dewatering Structure.

1. Trash sweep operating correctly.

2. Overflow weirs operating correctly.

3. Hand clean trapezoidal section as often as required to maintain in clean condition.

4. No gaps between screen panels or damaged panels in inclined screen.

e. Transportation Facilities.

1. No holes in screens.

2. Crowder screen brushes in good operating condition.

3. Retainer screens in raceways clean with no holes or protruding wires.

4. Operate wet separator and fish distribution system as designed.

5. Truck and barge loading facilities in good operating condition.

g. Inspection and Record Keeping.

1. Inspect fish facilities once each shift. Inspect all facilities according to fish facilities monitoring program.

2. Record all maintenance and inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities according to the following criteria:

2.3.2.1. Winter Maintenance Period (January 1 through March 1).

a. Inspect all staff gauges and water level indicators, repair and/or clean where necessary.
b. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder. Inspect all diffuser gratings and chambers either visually or by video according to CENPW-OP-T approved inspection program. Repair deficiencies.

c. Inspect for and, when necessary, clear debris in the ladder exits.

d. Calibrate all mechanical and electronic water level sensing devices, as necessary, for proper facility operations.

e. Inspect all spill gates and ensure that they are operable.

2.3.2.2. Fish Passage Period (March 1 through December 31).

Note: Lower Monumental pool may be operated at minimum operating pool (MOP), between elevations 537 and 538, as part of the Corps' efforts to improve migration conditions for juvenile salmonids. This may result in some of the adult fishway entrances at Little Goose bottoming out on their sills prior to reaching criteria depths. Continuous operation at MOP may also result in increased pumping head on the auxiliary water supply pumps, decreasing the amount of water supplied by the pumps.

a. Fishway Ladder. Water depth over weirs: 1.0 to 1.3 feet

b. Head on all Entrances. Head range: 1.0 to 2.0 feet

c. North Shore Entrances (NSE 1 & 2). (Elevation of top of gates when on sill - 529.0)

1. Operate both downstream gates.

2. Weir depth: 6 feet or greater below tailwater.

d. North Powerhouse Entrances (NPE 1 & 2). (Elevation of top of gates when on sill - 532.0)

1. Operate both downstream gates.

2. Weir Depth: 7 feet or greater below tailwater, tailwater permitting. At tailwater below elevation 539, entrance weirs should be on sill.

CBFWA recommends that weir depths be operated at 8 feet or greater below tailwater at all times.

e. Powerhouse Collection System. Operate 4 floating orifices (numbers 1, 4, 6, and 10).

f. South Shore Entrances (SSE 1 & 2). (Elevation of top of gates when on sill - 529.0)

1. Operate both gates.

2. Weir depth: 8 feet or greater below tailwater.

g. Transportation Velocity. 1.5 to 4 feet per second.

h. Tunnel Lights: Lights in the tunnel section, under the spillway, shall be on during fish passage period.

i. Head on Trashracks.

1. Maximum head of 0.5 feet on ladder exit.

2. Maximum head on picketed leads shall be 0.3 feet.

j. Staff Gauges and Water Level Indicators: Shall be readable at all water levels encountered during fish passage period.

k. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day.

2. Project biologist shall inspect facilities three times per week. Inspect all facilities according to fish facilities monitoring program.

3. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration.

4. Inspect fishways daily for foreign substances (particularly oil). If substances are found, corrective actions should be undertaken immediately.

5. Record all inspections.

2.3.3. Facility Monitoring and Reporting. Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, from March 1 through December 31, summarizing project operations. The weekly reports should provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; ESBS and VBS inspections; and any unusual activities which occurred at the project which may effect fish passage. The weekly reports shall cover a Friday through Thursday time period and shall be sent to CENPW-OP-TF by noon the following Monday via electronic mail. Project biologist shall prepare a draft annual report February 10 and a final report by March 15 summarizing the operation of the project fish passage facilities for the previous year. Project biologist inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENPW-OP-TF on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance.

Project biologists should be present to provide technical guidance at all project activities which may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering plans. Dewatering and fish handling plans shall be reviewed to ensure that they comply with Appendix G, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities which requires them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 to March 31. During the fish passage season, parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

3.1.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and survival. Maintenance of facilities such as ESBSs, which sometimes break down during the fish passage season, will be carried out according to procedures described below. In these cases, repairs will be made as prescribed and CENPW-OP-TF notified for further coordination. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA and NMFS on a case-by-case basis by CENPW-OP-TF. CENPW-OP-TF will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-TF when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-TF includes:

a. Description of the problem.

b. Type of outage required.

c. Impact on facility operation.

d. Length of time for repairs.

e. Expected impacts on fish passage.

3.1.2.1. Extended-length Submersible Bar Screens. ESBSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged or malfunctions at any time it will be removed and either replaced with a spare ESBS or repaired and returned to service. A turbine unit shall not be operated during the juvenile bypass season with a missing, known damaged, or non-operating ESBS (except as detailed below). If an ESBS fails on a weekend or at night when maintenance crews are not available, the respective turbine unit will be shut down and generation switched to another, fully screened unit. If all screened turbine units are in service, water may be spilled until the affected ESBS can be removed and repaired or replaced.

During the spring runoff when river flows are at the level where taking a unit out of service and spilling will exceed the total dissolved gas limits allowed by state standards, project personnel may operate a turbine unit at <u>110 MWs or less</u> with a failed screen cleaner if there is evidence that the ESBS will not plug with debris. This will only happen if an ESBS screen cleaner fails after 1400 hours on a regular work day or any time on a weekend. Project personnel will pull and replace the screen the next morning, weekday or weekend inclusive. If the screen can not be pulled and repaired first thing the next morning, the turbine unit will be removed from service until the screen can be repaired. If there is evidence that fish are being injured under this operation, the turbine unit will be removed from service immediately. This operation will not take place when daily average river flows are less than total powerhouse capacity and the turbine unit will not be operated during power peaking operations where turbine units are being turned on and off.

3.1.2.2. Gatewell Orifices. Each gatewell has two 12-inch orifices with air operated valves to allow fish to exit the gatewell. Under normal operation, at least one orifice per gatewell is operated. To minimize blockage from debris, orifices should be backflushed every day. If an air valve fails, the valve should be closed and the alternate valve for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, the turbine unit will be taken out of service until repairs can be made. If repairs are to take longer than 48 hours, juvenile fish will be dipped from the gatewell with a gatewell dip basket.

3.1.2.3. Dewatering Structure. The dewatering structure acts as a transition from the collection channel to the corrugated metal flume. An inclined screen allows excess water to be bled off, with all fish and remaining water transitioning into the corrugated metal flume. The excess water can be either discharged into the river or added to the adult passage facilities auxiliary water supply system, and is also used as the water supply for the transportation facilities. The dewatering structure contains a trash sweep for cleaning the inclined screen of impinged debris. If the trash sweep breaks and interferes with juvenile fish passage through the structure or if the inclined screen is damaged, an emergency bypass system at the upstream end of the dewatering structure will be used to bypass juveniles while repairs are made. Operation of the emergency bypass system requires the juvenile bypass system to be unwatered and stoplogs inserted at the upper end of the inclined screen. The emergency bypass is then opened and the bypass system operated with 6 gatewell orifices open. Orifices will then need to be routinely rotated to allow juveniles to emigrate from all of the gatewells. During any orifice closure, gatewells shall be monitored hourly by project personnel for signs of fish problems or mortality. Orifices shall not be closed for longer than 5 hours in an operating turbine unit with ESBSs in place. During periods of high fish passage, orifice closure times may need to be less than 5 hours depending on fish numbers and condition. If orifices are closed, gatewells shall be monitored hourly. Spill may be used as an alternative avenue for fish passage during a collection channel outage.

3.1.2.4. Bypass Flume. The corrugated metal flume transports juveniles to either the transportation facilities or to the river below the project. If there is a problem with the flume which interferes with its operation, an emergency bypass system at the upper end of the flume can be opened and all of the fish in the bypass system diverted to the river below the project through a 30-inch pipe while repairs are made.

3.1.2.5. Transportation Facilities. The transportation facilities can be operated to either collect and hold juveniles for the transportation program or to bypass them back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the fish will be bypassed around the transportation facilities.

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not have a significant effect on fish passage may be conducted during the rest of the year. Fishway auxiliary water supply pumps require monthly, semi-annual, and annual maintenance. Monthly maintenance requires a one-day outage per pump, semi-annual maintenance requires a two-day outage per pump in July, and annual maintenance requires a two-week outage per pump during the winter maintenance period. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fishery agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance which will significantly affect the operation of a facility will be coordinated with the CBFWA and NMFS. Coordination procedures for unscheduled maintenance of adult facilities shall be the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental affects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladder and Counting Station. The fish ladder contains fixed weirs, a counting station with picketed leads, and a fish exit with trashrack. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. The decision to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

3.2.2.2. Auxiliary Water Supply System. The auxiliary water for the fish ladder and the powerhouse collection system is supplied by three turbine-driven pumps on the south shore with all three pumps being required for normal operation. If one, two, or all three pumps fail, the fishway will be adjusted down in the following manner to get the best fish passage conditions possible until repairs can be made: First, NSE 2 and NPE 2 should be closed and NPE 1 operated to provide the required 1.0 to 2.0-foot head differential. If the desired head differential cannot be maintained at a depth of 5 feet or greater, then NSE 1 should be raised until a depth of 5 feet below tailwater is reached. If the head differential cannot be maintained at this point, floating orifices OG-6 and OG-4 should be closed and SSE 1 and 2 should be raised at one-foot increments until 6 feet below tailwater is reached. If the head differential still cannot be maintained, the transportation channel to the north shore should be bulkheaded off at the end of the powerhouse collection channel. Next, OG-10 and OG-1 should be closed followed by NPE 1 and the powerhouse collection channel bulkheaded off at the junction pool. SSE 1 and 2 should then be operated as deep as possible to maintain the head, but not shallower than 6 feet regardless of the head.

3.2.2.3. Fishway Entrances. The fishway entrances are made up of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater level. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually, the weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made. If a floating orifice is damaged, it will be pulled out of the water and the entrance bulkheaded off until it is repaired.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation turbine units will be operated to enhance adult and juvenile fish passage from March 1 through November 30. During this time period turbine units will be operated (as needed to meet generation requirements) in the following order: 1, 2, 3, and then 4 through 6 (in any order) when units are available for operation. Unit operating criteria may be coordinated differently to allow for fish research, construction, or project maintenance activities. To minimize mortality to juvenile fish passing through the turbine units from April 1 through October 31 (or as long as there is sufficient river flow and/or generation requests to operate turbine units 4, 5, and 6 within 1 percent of peak efficiency), operating priority during nighttime hours from 2000 to 0400 hours shall be units 4, 5, and 6 (in any order), and then units 1, 2, and 3 as needed. If the project is spilling for juvenile fish passage nightly with no daytime spill, unit priorities shall change at 1800 and 0600 hours, when spill is started and ended, to minimize starting and stopping of turbine units. If the project is bypassing juvenile fish back to the river, nighttime unit operating priority shall be unit 1, then units 4 through 6, and followed by units 2 and 3. If a turbine unit is taken out of service for maintenance or repair, the next unit in the priority list shall be operated.

Turbine units will be operated within 1% of best efficiency from March 15 through November 30 (or as specified in BPA's load shaping guidelines) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA Administrator whose load requests will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines (Appendix C); or 2) be in compliance with other coordinated fishery measures. Project personnel shall record when turbine units are operated outside the 1% best efficiency range and shall provide the information to BPA on a weekly basis according to the load shaping guidelines. Between December 1 and March 14, turbine units will continue to be operated within the 1% best efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within 1% of best efficiency at various head ranges are listed below. The 1% best efficiency ranges were calculated using results from 1994 index testing of turbine units 3 and 5 at Little Goose Dam. Maximum generation of units 1 through 6 at 115% overload is 155 MW.

The CBFWA recommends that turbine units be operated within 1% of best efficiency unless otherwise agreed.

Turbine Units 1-3 With Extended-Length Submersible Bar Screens Installed:

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	69	11,204	128	20,769
86	70	11,256	130	20,866
87	72	11,308	133	20,963
88	73	11,360	135	21,058
89	74	11,424	137	21,177
90	75	11,462	140	21,247
91	77	11,525	142	21,364
92	78	11,575	144	21,457
93	79	11,611	147	21,523
94	80	11,673	149	21,638
95	82	11,708	151	21,703
96	83	11,742	154	21,767
97	84	11,803	155	21,724
98	86	11,850	155	21,478
99	87	11,897	155	21,237
100	88	11,957	155	21,024
101	89	12,017	155	20,816
102	91	12,062	155	20,588
103	92	12,107	155	20,365
104	93	12,152	155	20,146
105	95	12,210	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information regarding extended-length submersible bar screens. This table contains the best information currently available.

Turbine Units 1-3 Without Screens:

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	75	12,168	137	22,317
86	76	12,168	140	22,441
87	76	12,010	141	22,331
88	77	12,009	142	22,238
89	78	12,006	144	22,151
90	79	12,003	145	22,067
91	79	11,872	146	21,982
92	80	11,874	149	22,106
93	81	11,878	150	22,023
94	82	11,887	151	21,943
95	83	11,897	152	21,866
96	83	11,790	154	21,792
97	84	11,803	155	21,724
98	85	11,813	155	21,478
99	86	11,814	155	21,237
100	86	11,713	155	21,024
101	87	11,717	155	20,816
102	88	11,720	155	20,588
103	89	11,723	155	20,365
104	89	11,628	155	20,146
105	90	11,733	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best available information.

Turbine Units 4-6 With Extended-Length Submersible Bar Screens Installed:

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	93	14,630	121	19,069
86	94	14,716	123	19,181
87	96	14,785	125	19,270
88	98	14,869	127	19,380
89	99	14,937	130	19,468
90	101	15,003	132	19,555
91	103	15,069	134	19,641
92	105	15,135	136	19,727
93	106	15,166	138	19,767
94	108	15,247	141	19,873
95	110	15,311	143	19,956
96	111	15,374	145	20,038
97	113	15,454	148	20,142
98	115	15,516	150	20,223
99	117	15,595	152	20,326
100	118	15,673	154	20,428
101	120	15,734	155	20,280
102	122	15,794	155	20,059
103	124	15,871	155	19,864
104	126	15,948	155	19,673
105	127	16,024	155	19,486

NOTE: The turbine efficiency tables are being revised to reflect new information regarding extended-length submersible bar screens. This table contains the best information currently available.

Turbine Units 4-6 Without Screens:

Head Feet	Lower Generator Limits (MW)	(CFS)	Upper Generator Limits MW)	(CFS)
85	98	15,421	126	19,896
86	99	15,410	128	19,968
87	100	15,402	131	20,037
88	102	15,394	133	20,103
89	103	15,386	135	20,164
90	104	15,377	137	20,221
91	105	15,370	139	20,279
92	106	15,366	141	20,336
93	107	15,364	142	20,221
94	108	15,361	144	20,273
95	110	15,357	145	20,167
96	112	15,460	147	20,231
97	113	15,454	148	20,142
98	114	15,446	149	20,060
99	116	15,543	150	19,982
100	119	15,643	151	19,907
101	121	15,744	151	19,686
102	122	15,736	151	19,472
103	123	15,730	151	19,262
104	124	15,724	153	19,343
105	126	15,717	155	19,359

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best available information.

4.2 Turbine Unit Outages During High River Flow Periods. During high spring flows, turbine unit outages for inspecting fish screens, repairing research equipment such as hydroacoustic or radio telemetry equipment, and other fishery items may cause increased spill at a project in order to maintain reservoir levels within operating levels. This may result in total dissolved gas levels exceeding standards. It is important that this work be conducted when scheduled to ensure that facilities are working correctly and not injuring migrating fish, and that important fish research data is collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Little Goose, this special operation shall take place when river flows are above 120 kcfs or when increasing spill levels will result in total dissolved gas levels exceeding standards. The activities covered under these operations will be coordinated with and approved by the Technical Management Team whenever possible.

For scheduled inspection or repair of research equipment, reservoirs shall be drafted to the bottom of MOP and allowed to fill to 1 foot above the MOP operating range as the work is accomplished. After the work, reservoirs will be drafted back to the MOP operating range. When inspection or repair work can be scheduled ahead of time, the following process will be followed:

a. Project personnel shall schedule turbine unit outages through the approved turbine outage scheduling procedure by noon of the Tuesday of the week prior to the outage.

b. Project personnel shall also contact CENPW-OP-TF and CENPD-ET-WM (Reservoir Control Center) by the same time period and inform them of the intended work.

c. CENPD-ET-WM will coordinate the work activities with regional parties of the work at the Technical Management Team meeting on the following Wednesday.

d. After coordination with the TMT CENPD-ET-WM shall issue a teletype through the CBTT issuing instructions to project and BPA personnel for the scheduled work.

e. Spill will be increased by one spillbay stop setting (about 1.7 kcfs) above passing inflow to slowly lower the level of Little Goose pool to the bottom of the MOP range prior to the scheduled work taking place.

f. When the work takes place, additional spill will not be provided and the reservoir will be allowed to refill until the reservoir is 1 foot above the normal MOP range (a 2 foot pondage from where the pool was when the work started). At this point, screen inspections shall stop. (At Snake River projects, this should allow about one normal work day for the scheduled work.)

g. At the conclusion of the work, the reservoir shall be drafted back down to the MOP range utilizing a one spillbay stop increase in spill above passing inflow.

h. If work, such as screen inspections, is not finished, project personnel shall schedule another turbine unit outage for a date where it can be implemented again.

If the work that needs to be done is of an emergency type nature that does not normally require the turbine unit to be taken out of service (such as a failed hydroacoustic transducer versus a failed fish screen), and can not wait for the above process to be implemented, project personnel shall notify CENPW-OP-TF and CENP-ET-WM to get approval to do the work. If approval to do the work is given, the turbine unit shall be taken out of service and the reservoir level allowed to increase until it reaches 1 foot above the MOP operating range. At this point, the turbine unit must be returned to service and the reservoir will be drafted back to the MOP range using one spillbay stop setting above passing inflows.

4.3. Turbine Unit Maintenance. The project's turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fishery impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance which may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted in mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent peak efficiency. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish. Transformers are Doble tested every 3 years. Testing may need to be more frequent if there is a known problem with a transformer. These tests normally take 2 to 3 work days. To conduct the testing, the transmission lines have to be disconnected from the transformers and normal generation stopped. One turbine unit will operate in a speed-no-load condition to provide project power and operation of fish passage facilities. Spill may be provided to meet minimum required project discharges during the testing hours. The Doble tests are normally scheduled for the August time period to minimize impacts on adult and juvenile fish passage.

Table 4. Little Goose Dam daytime spillway pattern for adult fish Passage.

1.9 KCFS Per Stop

BAY 1	BAY 2	BAY 3	BAY 4	BAY 5	BAY 6	BAY 7	BAY 8	STOPS	KCFS
							1	1	1.9
1							1	2	3.8
1						1	1	3	5.7
1	1					1	1	4	7.6
1	1				1	1	1	5	9.5
1	1	1			1	1	1	6	11.4
1	1	1		1	1	1	1	7	13.3
1	1	1	1	1	1	1	1	8	15.2
1	1	1	1	1	2	1	1	9	17.1
1	1	2	1	1	2	1	1	10	19.0
1	1	2	1	2	2	1	1	11	20.9
1	1	2	2	2	2	1	1	12	22.8
2	1	2	2	2	2	1	1	13	24.7
2	2	2	2	2	2	1	1	14	26.6
2	2	2	2	2	2	1	2	15	28.5
2	2	2	2	2	2	2	2	16	30.4
2	2	2	2	2	2	2	3	17	32.3
3	2	2	2	2	2	2	3	18	34.2
3	2	2	3	2	2	2	3	19	36.1
3	2	3	3	2	2	2	3	20	38.0
3	3	3	3	2	2	2	3	21	39.9
3	3	3	3	2	3	2	3	22	41.8
3	3	3	3	2	3	2	4	23	43.7
3	3	3	3	2	3	3	4	24	45.6
3	3	3	3	3	3	3	4	25	47.5
3	3	3	4	3	3	3	4	26	49.4
4	3	3	4	3	3	3	4	27	51.3
4	3	4	4	3	3	3	4	28	53.2
4	4	4	4	3	3	3	4	29	55.1
4	4	4	4	3	3	4	4	30	57.0
5	4	4	4	3	3	4	4	31	58.9
5	5	4	4	3	3	4	4	32	60.8
5	5	4	4	4	3	4	4	33	62.7
5	5	5	4	4	3	4	4	34	64.6
5	5	5	4	4	3	4	5	35	66.5
5	5	5	4	4	4	4	5	36	68.4

Table 4. Little Goose Dam daytime spillway pattern for adult fish Passage (Continued).

BAY 1	BAY 2	BAY 3	BAY 4	BAY 5	BAY 6	BAY 7	BAY 8	STOPS	KCFS
5	5	5	5	4	4	4	5	37	70.3
5	6	5	5	4	4	4	5	38	72.2
5	6	5	5	4	4	4	6	39	74.1
5	6	5	5	4	4	5	6	40	76.0
5	6	5	5	4	5	5	6	41	77.9
6	6	5	5	4	5	5	6	42	79.8
6	6	5	5	5	4	6	6	43	81.7
6	6	5	5	5	5	5	7	44	83.6
6	6	5	5	5	5	6	7	45	85.5
7	6	5	5	5	5	6	7	46	87.4
7	6	5	5	6	5	6	7	47	89.3
7	6	5	6	6	5	6	7	48	91.2
7	6	5	6	6	6	6	7	49	93.1
7	6	6	6	6	6	6	7	50	95.0
7	6	6	6	7	6	6	7	51	96.9
7	6	6	7	7	6	6	7	52	98.8
7	6	6	7	7	7	6	7	53	100.7
7	7	6	7	7	7	6	7	54	102.6
7	7	6	7	7	7	7	7	55	104.5
7	7	7	7	7	7	7	7	56	106.4
8	7	7	7	7	7	7	7	57	108.3
8	7	7	7	7	7	7	8	58	110.2
8	7	7	7	8	7	7	8	59	112.1
8	7	8	7	8	7	7	8	60	114.0
8	7	8	7	8	8	7	8	61	115.9
8	7	8	8	8	8	7	8	62	117.8
8	7	8	8	8	8	8	8	63	119.7
8	8	8	8	8	8	8	8	64	121.6
8	8	8	8	8	8	8	9	65	123.5
9	8	8	8	8	8	8	9	66	125.4
9	8	8	8	9	8	8	9	67	127.3
9	8	9	8	9	8	8	9	68	129.2
9	8	9	8	9	9	8	9	69	131.1
9	8	9	9	9	9	8	9	70	133.0

Table 5. Little Goose Dam nighttime spill pattern for minimizing dissolved gas levels.

BAY 1	BAY 2	BAY 3	BAY 4	BAY 5	BAY 6	BAY 7	BAY 8	STOPS	KCFS
0	1						0	1	1.8
0	1	1					0	2	3.6
0	1	1	1				0	3	5.4
0	1	1	1	1			0	4	7.2
0	1	1	1	1	1		0	5	9.0
0	1	1	1	1	1	1	0	6	10.8
0	2	1	1	1	1	1	0	7	12.6
0	2	2	1	1	1	1	0	8	14.4
0	2	2	2	1	1	1	0	9	16.2
0	2	2	2	2	1	1	0	10	18.0
0	2	2	2	2	2	1	0	11	19.8
0	2	2	2	2	2	2	0	12	21.6
0	3	2	2	2	2	2	0	13	23.4
0	3	3	2	2	2	2	0	14	25.2
0	3	3	3	2	2	2	0	15	27.0
0	3	3	3	3	2	2	0	16	28.8
0	3	3	3	3	3	2	0	17	30.6
0	3	3	3	3	3	3	0	18	32.4
0	4	3	3	3	3	3	0	19	34.2
0	4	4	3	3	3	3	0	20	36.0
0	4	4	4	3	3	3	0	21	37.8
0	4	4	4	4	3	3	0	22	39.6
0	4	4	4	4	4	3	0	23	41.4
0	4	4	4	4	4	4	0	24	43.2
0	5	4	4	4	4	4	0	25	45.0
0	5	5	4	4	4	4	0	26	46.8
0	5	5	5	4	4	4	0	27	48.6
0	5	5	5	5	4	4	0	28	50.4
0	5	5	5	5	5	4	0	29	52.2
0	5	5	5	5	5	5	0	30	54.0
0	6	5	5	5	5	5	0	31	55.8
0	6	6	5	5	5	5	0	32	57.6
0	6	6	6	5	5	5	0	33	59.4
0	6	6	6	6	5	5	0	34	61.2
0	6	6	6	6	6	5	0	35	63.0
0	6	6	6	6	6	6	0	36	64.8
0	7	6	6	6	6	6	0	37	66.6
0	7	7	6	6	6	6	0	38	68.4
0	7	7	7	6	6	6	0	39	70.2

Table 5. Little Goose Dam nighttime spill pattern for minimizing dissolved gas levels (Continued).

BAY 1	BAY 2	BAY 3	BAY 4	BAY 5	BAY 6	BAY 7	BAY 8	STOPS	KCFS
0	7	7	7	7	6	6	0	40	72.0
0	7	7	7	7	7	6	0	41	73.8
0	7	7	7	7	7	7	0	42	75.6
0	8	7	7	7	7	7	0	43	77.4
0	8	8	7	7	7	7	0	44	79.2
0	8	8	8	7	7	7	0	45	81.0
0	8	8	8	8	7	7	0	46	82.8
0	8	8	8	8	8	7	0	47	84.6
0	8	8	8	8	8	8	0	48	86.4
0	9	8	8	8	8	8	0	49	88.2
0	9	9	8	8	8	8	0	50	90.0
0	9	9	9	8	8	8	0	51	91.8
0	9	9	9	9	8	8	0	52	93.6
0	9	9	9	9	9	8	0	53	95.4
0	9	9	9	9	9	9	0	54	97.2
0	10	9	9	9	9	9	0	55	99.0
0	10	10	9	9	9	9	0	56	100.8
0	10	10	10	9	9	9	0	57	102.6
0	10	10	10	10	9	9	0	58	104.4
0	10	10	10	10	9	9	0	58	104.4
0	10	10	10	10	10	9	0	59	106.2
0	10	10	10	10	10	10	0	60	108.0
0	11	10	10	10	10	10	0	61	109.8
0	11	11	10	10	10	10	0	62	111.6
0	11	11	11	10	10	10	0	63	113.4
0	11	11	11	11	10	10	0	64	115.2
0	11	11	11	11	11	10	0	65	117.0
0	11	11	11	11	11	11	0	66	118.8
0	12	11	11	11	11	11	0	67	120.6
0	12	12	11	11	11	11	0	68	122.4
0	12	12	12	11	11	11	0	69	124.2
0	12	12	12	12	11	11	0	70	126.0
0	12	12	12	12	12	11	0	71	127.8
0	12	12	12	12	12	12	0	72	129.6
0	13	12	12	12	12	12	0	73	131.4
0	13	13	12	12	12	12	0	74	133.2
0	13	13	13	12	12	12	0	75	135.0
0	13	13	13	13	12	12	0	76	136.8
0	13	13	13	13	13	12	0	77	138.6

Table 5. Little Goose Dam nighttime spill pattern for minimizing dissolved gas levels (Continued).

BAY 1	BAY 2	BAY 3	BAY 4	BAY 5	BAY 6	BAY 7	BAY 8	STOPS	KCFS
0	13	13	13	13	13	13	0	78	140.4
0	14	13	13	13	13	13	0	79	142.2
0	14	14	13	13	13	13	0	80	144.0
0	14	14	14	13	13	13	0	81	145.8
0	14	14	14	14	13	13	0	82	147.6
0	14	14	14	14	14	13	0	83	149.4
0	14	14	14	14	14	14	0	84	151.2
0	15	14	14	14	14	14	0	85	153.0
0	15	15	14	14	14	14	0	86	154.8
0	15	15	15	14	14	14	0	87	156.6
0	15	15	15	15	14	14	0	88	158.4
0	15	15	15	15	15	14	0	89	160.2
0	15	15	15	15	15	15	0	90	162.0
0	16	15	15	15	15	15	0	91	163.8
0	16	16	15	15	15	15	0	92	165.6
0	16	16	16	15	15	15	0	93	167.4
0	16	16	16	16	15	15	0	94	169.2
0	16	16	16	16	16	15	0	95	171.0
0	16	16	16	16	16	16	0	96	172.8

SECTION 9

LOWER GRANITE DAM

Lower Granite Dam

1. Fish Passage Information.

The locations of fish passage facilities are shown on the following general design drawing of Lower Granite Lock and Dam (Figure 13). Dates for project operations for fishery purposes and special operations are listed in Table 2.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description: Lower Granite's juvenile facilities consist of a bypass system and juvenile transportation facilities. The bypass system contains extended length bar screens with flow vanes, improved modified balanced flow vertical barrier screens, gatewell orifices, a bypass channel running the length of the powerhouse, and a bypass pipe to transport the fish to the transportation facilities or to the river. The transportation facilities include an upwell and separator structure to separate the juveniles and adults from the excess water and adult fish, raceways for holding fish, a distribution system for distributing the fish among the raceways or to the barge or back to the river, a sampling and marking building, truck and barge loading facilities, and PIT tag detection and deflection systems.

1.1.2. Juvenile Fish Migration Timing. Juvenile migration timing at Lower Granite Dam is indicated in Table 1. The dates in the table are based on juvenile fish collection numbers and do not reflect FGE or spill passage. Maintenance of juvenile fish passage facilities which may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

Table 1. Juvenile migration timing at Lower Granite Dam based on juvenile fish collection numbers.

	% Collection	1992	1993	1994	1995	1996
Ylg Hatch Chin						
	10%		4/28	4/25	4/21	4/24
	90%		5/15	5/12	5/15	5/19
Ylg Wild Chin						
	10%	4/17	4/25	4/22	4/15	4/11
	90%	5/16	5/23	5/18	6/3	5/19
Subylg Chin						
	10%	6/6	6/29	7/3	7/8	6/27
	90%	7/17	8/26	8/23	9/21	8/29
Hatch Steelhead						
	10%	4/22	4/29	4/27	4/28	4/24
	90%	5/23	5/19	5/17	5/21	5/19
Wild Steelhead						
	10%	4/22	4/29	4/23	4/24	4/17
	90%	6/21	5/21	5/15	5/23	5/20

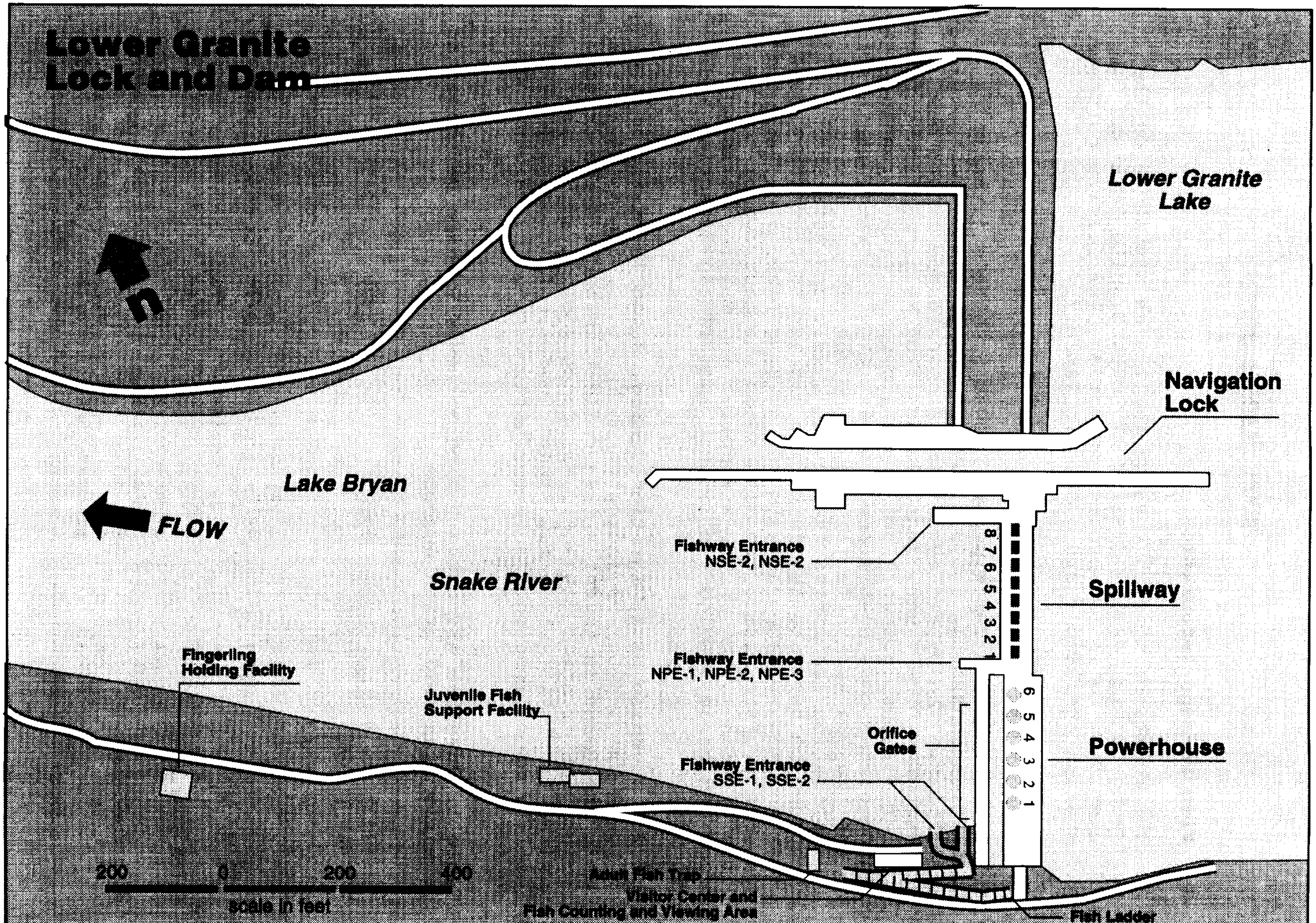
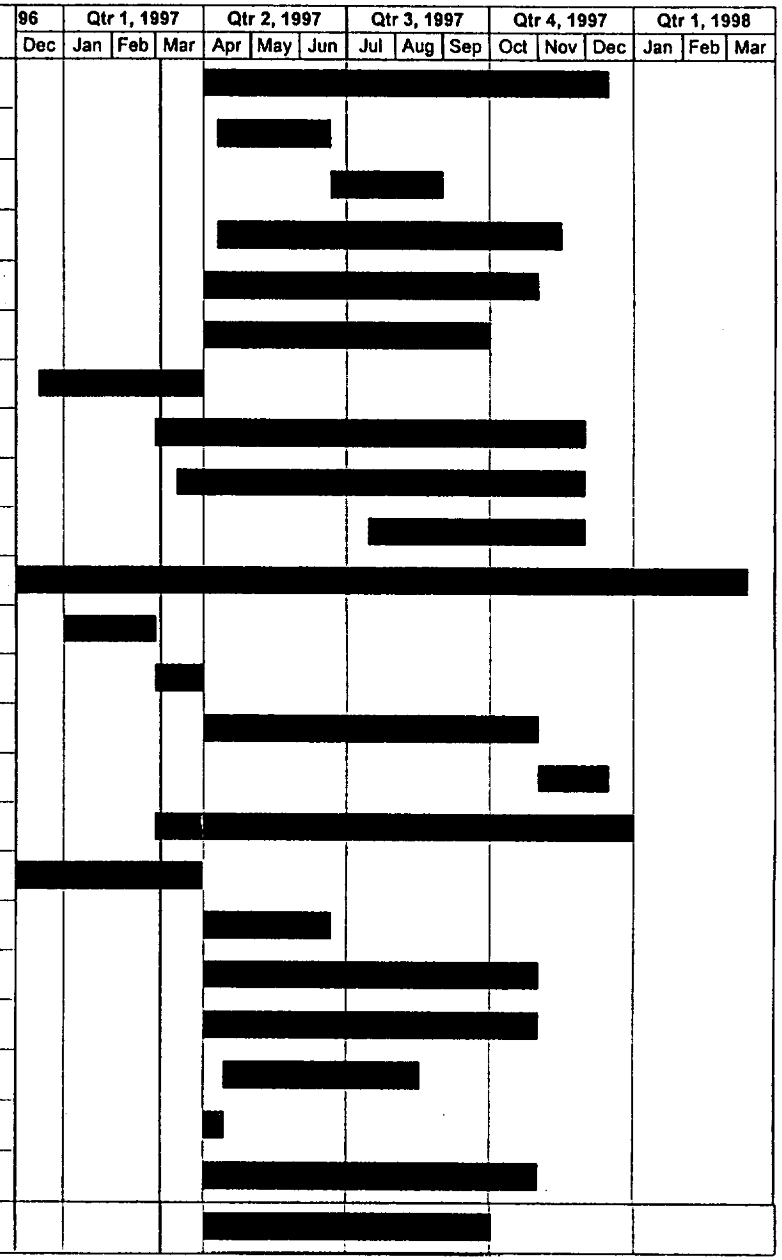


Figure 13 Lower Granite Lock and Dam General Site Plan

Revised March 1, 1997

Table 2. Dates of project operations for fishery purposes at Lower Granite Dam, 1997.

ID	Name	Start	Finish	Notes
1	Juvenile Fish Passage Period	4/1/97	12/15/97	11/1 - 12/15 operate facilities for adult fallback protection
2	Spill Spring	4/10/97	6/20/97	80% 1800 to 0600 (no spill if flows below 85 kcfs)
3	Spill Summer	6/21/97	8/31/97	no spill
4	MOP Operation	4/10/97	11/15/97	end date not fixed
5	Juvenile Fish Transportation	4/1/97	10/31/97	actual dates may vary
6	Dissolved Gas Monitoring	4/1/97	9/30/97	Forebay and tailrace stations
7	Bypass Facility Maintenance	12/16/96	3/31/97	
8	Turbine Operation for Adult/Juvenile Fish	3/1/97	11/30/97	Unit priorities vary during this time
9	Turbine 1% Operation	3/15/97	11/30/97	soft constraint 12/1 to 3/14
10	Turbine Maintenance Period	7/15/97	11/30/97	priority unit 1 by 1 Sep
11	Adult Passage Period	12/1/96	3/14/98	do per McNary
12	Adult Facility Maintenance	1/1/97	2/28/97	
13	Adult Fish Counting 0800-1600 (video)	3/1/97	3/31/97	0800-1600 PST (video)
14	Adult Fish Counting 0400-2000	4/1/97	10/31/97	0400-2000 PST (video 2000-0400)
15	Adult Fish Counting 0600-1600 (video)	11/1/97	12/15/97	0600-1600 PST (video 1600-0600)
16	Weekly Reporting	3/1/97	12/31/97	Fri-Thurs: sent by noon following Mon
17	Surface Bypass Collector Modifications	12/1/96	3/30/97	See App. A for additional details
18	Spill Test	4/1/97	6/20/97	See App. A for additional details
19	Surface BypassCollector Operation	4/1/97	10/31/97	See App. A for additional details
20	Hydroacoustic Evaluation	4/1/97	10/31/97	See App. A for additional details
21	Radio Tagging Study	4/14/97	8/16/97	See App. A for additional details
22	Fish Condition Evaluation	4/1/97	4/13/97	See App. A for additional details
23	Reach Survival Study	4/1/97	10/31/97	See App. A for additional details
24	Adult Passage Study	4/1/97	10/1/97	See App. A for additional details



1.2. Adult Fish Passage.

1.2.1. Facilities Description: The adult fish passage facilities at Lower Granite are made up of one fish ladder on the south shore, two south shore entrances, a powerhouse collection system, north shore entrances with a transportation channel underneath the spillway to the powerhouse collection system, and an auxiliary water supply system. The powerhouse collection system is comprised of ten floating orifices, two downstream entrances and one side entrance into the spillway basin on the north end of the powerhouse, and a common transportation channel. Four of the floating orifices and the two downstream entrances at the north end of the collection system are normally used. The north shore entrances are made up of two downstream entrances and a side entrance into the spillway basin with the two downstream entrances normally used. The auxiliary water is supplied by three electric pumps that pump water from the tailrace to the diffusers with two pumps normally used to provide the required flows.

1.2.2. Adult Migration Timing. Upstream migrants are present at Lower Granite throughout the year. Maintenance of adult facilities is scheduled for the period of January through February to minimize the impact on upstream migrants. Adult fish are normally counted from March 1 through December 15. Fish counters count adult fish by direct observation for 16-hours per day (0400 to 1600 Pacific Standard Time) from April 1 through October 31. Adult fish are counted in March for 8-hours per day (0800 to 1600 Pacific Standard Time) and in November and December for 24-hours per day by video taping of fish passage and later interrogation of the video tapes. Nighttime adult fish passage (2000 to 0400 hours) from April 1 through October is also video taped and interrogated by fish counters for endangered species concerns. Primary passage periods by species and earliest and latest date of peak passage are listed in Table 3.

Table 3. Adult migration timing at Lower Granite Dam from 1975-1996.

Species	Count Period	Earliest Peak	Latest Peak
Spring chinook	3/1 - 6/17	5/3	5/27
Summer chinook	6/18 - 8/17	6/18	7/17
Fall chinook	8/18 - 12/15	9/5	10/6
Steelhead	3/1 - 12/15	9/3	10/16
Sockeye	3/1 - 12/15	7/1	7/19

2. Project Operation.

2.1. Spill Management. Spill at Lower Granite is the result of river flow exceeding powerhouse capacity or the failure of a key component of the juvenile fish passage facility which forces the project to spill to provide juvenile fish passage. Spill at Lower Granite shall be distributed in accordance with the adult fish passage spill pattern included at the end of this section,

Table 4. Special spills for juvenile fish passage may be provided as detailed in Appendix A (Special Project Operations and Research).

2.2. Dissolved Gas Management and Control. Dissolved gasses at Lower Granite are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. Total dissolved gas will be monitored hourly at the Lower Granite forebay automated station and reported every four hours from April 30 through September 30. Total dissolved gas will also be monitored hourly in the Lower Granite tailwater from April 1 through September 30. Related data reported at the same time will be spill volume and total project flow. Implementation of spill management requests will be based in part upon dissolved gas monitoring data and the observed condition of migrant juveniles and adults, along with juvenile migration monitoring data. Requests for spill will be coordinated through the Technical Management Team.

2.3. Operating Criteria.

2.3.1. Juvenile Fish Passage Facilities. Operate from April 1 through October 31 for juvenile fish bypass, collection, and transportation and from November 1 through December 15 for bypassing adult fallbacks. Operate the juvenile facilities according to the criteria listed below and in Appendix B (Corps' Juvenile Fish Transportation Program Operating Criteria) for the bypassing, collection, and transportation of juvenile salmonids. The transportation program may be revised in accordance with the ESA Section 10 permit and NMFS's biological opinion.

2.3.1.1. Winter Maintenance Period (December 16 through March 31).

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trash racks.

b. Extended Length Submersible Bar Screens (ESBS), Flow Vanes, and Vertical Barrier Screens (VBS).

1. Maintenance completed on all ESBSs.

2. Inspect ESBSs for good running order and operate debris cleaner one trial run (dogged off on deck).

3. Log results of trial run.

4. Inspect all VBSs at least once per year.

5. Inspect flow vanes to make sure they are in good condition and all surfaces smooth. Repair as needed.

c. Collection Gallery.

1. Makeup water gates and float control equipment operational.

2. Orifice lights operational.

3. Orifices clean and operational.

d. Transportation Facilities.

1. 42-inch and 72-inch sluice gates operational.

2. Inclined screens clean and in repair with no holes.

3. Perforated plate edges smooth with no rough edges.

4. Check wet separator and fish distribution system for correct operation.

5. Brushes on crowder screens in good order.

6. Crowder operates properly.

7. All valves, slide gates, and switch gates in and around separator and raceways in good operating order.

8. Retainer screens in place with no holes or sharp wires protruding.

9. Barge and truck loading pipes free of debris, cracks, or blockages.

10. Barge loading boom maintained and tested.

11. All sampling facilities maintained and operable.

e. Barges.

1. All pumps in good working order.

2. Dump gates operational.

3. No rough edges or support beams protruding into compartments.

4. No brass or galvanized fittings in circulation lines.

5. All loading hoses properly installed so fish will not hit sides of compartments or support beams when loading.

6. Loading hoses in good shape with rubber gaskets in camlock fittings.

7. Inside edges of camlock joints should be beveled to avoid sharp edges.

8. Warning systems tested and operational.

9. Provide net and/or deck covers.

f. Maintenance Records. Record all maintenance and inspections.

g. Powerhouse Tailrace Area. Inspect bird wires and replace as needed.

2.3.1.2. Fish Passage Period (April 1 through December 15):

a. Forebay Area and Intakes.

1. Remove debris from forebay.

2. Inspect gatewell slots daily for debris, fish buildup, and contaminating substances (particularly oil). Clean gatewells before they become half covered with debris. If, due to the volume of the debris, it is not possible to keep the gatewell at least half clear, they should be cleaned at least once daily. If flows through an orifice or fish conditions give indications that an orifice may be partially obstructed with debris, the orifice will be close and backflushed to remove the obstruction. If the obstruction can not be removed, the orifice shall be closed and the alternate orifice for that gatewell slot shall be operated. If both orifices become obstructed or plugged with debris, the turbine unit will not be operated until the gatewell and orifices are cleared of debris.

3. If a visible accumulation of contaminating substances (such as oil) is detected in a gatewell and it cannot removed within 24 hours, the gatewell orifices shall be closed and the turbine unit shut down until the material has been removed and any problems corrected. Action should be taken as soon as possible to remove the oil from the gatewell so the orifice can be reopened to allow the fish to exit the gatewell. Orifices shall not be closed for longer than 48 hours.

4. Log drawdown differentials at least once per week.

5. Remove debris from forebay and trashracks as required to maintain less than one foot of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river.

6. Coordinate cleaning effort with personnel operating juvenile collection facilities.

7. Dip bulkhead gatewell slots to remove fish prior to installing bulkhead for unwatering bulkhead slot.

b. Extended-length Submersible Bar Screens (ESBS) and Vertical Barrier Screens (VBS).

1. Operate ESBSs with flow vanes attached to screen.

2. Operate ESBSs with debris cleaners in automatic mode. Set cleaning frequency as required to maintain clean screens and good fish condition. Change cleaning frequency as needed.

3. Inspect each ESBS once per month.

4. If an ESBS is damaged or fails during the juvenile fish passage season, follow procedures detailed under unscheduled maintenance of ESBSs. In no case should a turbine unit be operated with a missing or a known non-operating or damaged ESBS, except as noted.

5. One-half of the ESBSs may be pulled after October 1 for maintenance as long as unscreened turbine units are not operated.

6. Make formal determination at end of season as to adequacy of bar screen panels and debris cleaner brush and replace components as necessary.

7. Measure head differentials across VBSs twice per week from April 1 through June 15 and weekly for the remainder of the operating season. Clean VBS when head differentials reach 1.5 feet. When a head differential of 1.5 feet is reached, the respective turbine unit should be operated at a reduced loading, not more than 110 MW, to minimize loading on the VBS and potential fish impingement.

8. Inspect at least 2 VBSs at random across the powerhouse between the spring and summer migration periods. If a debris accumulation is noted, inspect other VBSs and clean debris as necessary.

c. Collection Gallery Checks.

1. Orifices clean and operating.

2. Orifice lights operating on open orifices.

3. Orifice jets not hitting back wall, bypass gallery full.

4. Operate at least one orifice per bulkhead slot (preferably the north orifice)(18 open). If the project is operating at MOP, additional orifices may be operated to maintain a full collection channel. If orifices must be closed to repair any part of the facility, <u>do not close orifices in operating turbine units with ESBSs in place for longer than 5 hours</u>.

Monitor fish condition in gatewells hourly during orifice closure period.

5. Alternate orifices in fish screens slots periodically (6 open).

6. Backflush orifices once per day. During periods of high debris, orifices may need to be backflushed more than once per day. During periods of high debris, orifices should be inspected and backflushed several times per day, as determined by the project biologist, to keep orifices clean.

7. Makeup water gates and associated float controls operational.

d. Transportation Facilities.

1. 42-inch and 48-inch sluice gate operational.

2. Maintain stable water conditions in upwell and separator.

3. No holes in inclined screen.

4. Crowder and brushes in good operating order.

5. All valves, slide gates, and switch gates in and around separator and raceways operational.

6. Raceway retainer screens to be clean and have no holes or protruding wire.

e. Barge and Truck Loading Facilities.

Barge and truck loading pipes free of debris, cracks, or blockages.

f. Inspection and Record Keeping.

1. Inspect fish facilities once each shift. Inspect facilities according to fish facilities monitoring program.

2. Record all maintenance and inspections.

2.3.2. Adult Fish Passage Facilities. Operate the adult fish passage facilities according to the following criteria:

2.3.2.1. Winter Maintenance Period (January 1 through March 1).

a. Inspect all staff gages and water level indicators, repair and/or clean where necessary.

b. Dewater all ladders and inspect all dewatered sections of fish facilities for projections, debris, or plugged orifices which could injure fish or impede fish passage up the ladder.

Inspect all diffuser gratings and chambers either visually or by video according to CENPW-OP-T approved inspection program. Repair deficiencies.

c. Inspect for, and, when necessary, clear debris in the ladder exits.

d. Calibrate all mechanical water level sensing devices, as necessary, for proper facilities operations.

e. Inspect all spillgates and ensure that they are operable.

2.3.2.2. Fish Passage Period (March 1 through December 31).

Note: Little Goose pool may be operated at minimum operating pool (MOP), between elevations 633 and 634, as part of the Corps' efforts to improve migration conditions for juvenile salmonids. This will result in some of the adult fishway entrances at Lower Granite bottoming out on their sills prior to reaching criteria depths. Continuous operation at MOP may also result in increased pumping head on the auxiliary water supply pumps, decreasing the amount of water by the pumps.

a. Fishway Ladder. Water depth over weirs: 1.0 to 1.3 feet

b. Head on all Fishway Entrances. Head range: 1.0 to 2.0 feet.

c. North Shore Entrances (NSE 1 & 2). Elevation of top of gates when on sill = 625.

1. Operate both downstream gates.

2. Weir depth: 7 feet or greater below tailwater.

d. North Powerhouse Entrances (NPE 1 & 2). Elevation of top of gates when on sill = 628.

1. Operate both downstream gates.

2. Weir depth: 8 feet or greater below tailwater. At tailwater below elevation 636, weirs should be on sill.

e. Powerhouse Collection System. Operate 4 floating orifices (numbers 1, 4, 7, and 10).

f. South Shore Entrances (SSE 1 & 2). Elevation of top of gates when on sill = 625.

1. Operate both gates.

2. Weir depth; 8 feet or greater below tailwater.

g. Transportation Velocity. 1.5 to 4 feet per second.

h. Tunnel Lights. Lights in the tunnel section, under the spillway, shall be on during fish passage period.

i. Head on Trashracks:

1. Maximum head of 0.5 feet on ladder exits.

2. Maximum head on picketed leads shall be 0.3 feet.

j. Staff Gages and Water Level Indicators. Shall be readable at all water levels encountered during fish passage period.

k. Facility Inspections.

1. Powerhouse operators shall inspect facilities once per day.

2. Project biologist shall inspect facilities three times per week. Inspect facilities according to fish facilities monitoring program.

3. Project personnel shall check calibration of fishway control system twice per month to ensure that it is kept within calibration.

4. Inspect fishways daily for foreign substances, (particularly oil). If substances are found, corrective actions should be undertaken immediately.

5. Record all inspections.

2.3.3. Facility monitoring and reporting: Project biologists shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Project biologists shall prepare weekly reports, from March 1 through December 31, summarizing project operations. The weekly reports should provide an overview of how the project and the fish passage facilities operated during the week and an evaluation of resulting fish passage conditions. The reports shall include: any out of criteria situations observed and subsequent corrective actions taken; any equipment malfunctions, breakdowns, or damage along with a summary of resulting repair activities; adult fishway control calibrations; ESBS and VBS inspections; and any unusual activities which occurred at the project which may effect fish passage. The weekly reports shall cover a Friday through Thursday time period and shall be sent to CENPW-OP-TF by noon the following Monday via electronic mail. Project biologist shall prepare a draft annual report by February 10 and a final report by March 15 summarizing the operation of the project fish passage facilities for the previous year. Project biologist inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENPW-OP-TF on a monthly basis summarizing zebra mussel inspections.

3. Project Maintenance.

Project biologists shall be present to provide technical guidance at all project activities which may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering plans. Dewatering and fish handling plans shall be reviewed to ensure that they comply with Appendix G, Guidelines for Dewatering and Fish Handling Plans.

3.1. Juvenile Fish Passage Facilities.

3.1.1. Scheduled Maintenance. Scheduled maintenance of the juvenile facilities is conducted during the entire year. Long-term maintenance or modification of facilities which require them to be out of service for extended periods of time are conducted during the winter maintenance period from December 16 to March 31. During the fish passage season parts of the facilities are maintained on a daily, weekly, or longer interval to keep them in proper operating condition.

3.1.2. Unscheduled Maintenance. Unscheduled maintenance is the correction of any situation which prevents the facilities from operating according to criteria or which will impact fish passage and survival. Maintenance of facilities such as ESBSs, which sometimes break down during the fish passage season, will be carried out according to procedures described below. In these cases, repairs will be made as prescribed and CENPW-OP-TF notified for further coordination. Unscheduled maintenance which will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA and NMFS on a case-by-case basis by CENPW-OP-TF. CENPW-OP-TF will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Manager has the authority to initiate work prior to notifying CENPW-OP-TF when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENPW-OP-TF includes:

a. Description of the problem.

b. Type of outage required.

c. Impact on facility operation.

4. Length of time for repairs.

5. Expected impacts on fish passage.

3.1.2.1. Extended-length Bar Screens. ESBSs are inspected periodically throughout the juvenile migration season with a video monitoring system. If a screen is found to be damaged or malfunctions at any time it will be removed and either replaced with a spare ESBS or repaired and returned to service. A turbine unit shall not be operated during the juvenile bypass season with a missing, known damaged, or non-operating ESBS (except as detailed below). If an ESBS fails on a weekend or at night when maintenance crews are not available, the respective turbine unit will be shut down and generation switched to another, fully screened unit. If all screened turbine units are in service, water may be spilled until the affected ESBS can be removed and repaired or replaced.

During the spring runoff when river flows are at the level where taking a unit out of service and spilling will exceed the total dissolved gas limits allowed by state standards, project personnel may operate a turbine unit at 110 MWs or less with a failed screen cleaner if there is evidence that the ESBS will not plug with debris. This will only happen if an ESBS screen cleaner fails after 1400 hours on a regular work day or any time on a weekend. Project personnel will pull and replace the screen the next morning, weekday or weekend inclusive. If the screen can not be pulled and repaired first thing the next morning, the turbine unit will be removed from service until the screen can be repaired. If there is evidence that fish are being injured under this operation, the turbine unit will be removed from service immediately. This operation will not take place when daily average river flows are less than total powerhouse capacity and the turbine unit will not be operated during power peaking operations where turbine units are being turned on and off.

3.1.2.2. Gatewell Orifices. Each turbine intake has 4 orifices, 2 10-inch orifices with air operated valves in the bulkhead slot and 2 8-inch orifices with manually operated slide gates in the fish screen slot, for allowing the fish to exit the slots. Under normal operation, a total of 24 orifices are operated with 18 being bulkhead slot orifices and 6 being fish screen slot orifices. At least 1 orifice is open in each bulkhead slot with the fish screen slot orifices rotated. If an orifice becomes blocked with debris it will normally be cleaned and remain in operation. If an orifice is damaged, it will be closed and the alternate orifice for that gatewell operated until repairs can be made. If both orifices are blocked with debris or damaged, the turbine unit will be taken out of service until repairs can be made. If repairs are to take longer than 48 hours, juvenile fish will be dipped from the gatewell with a gatewell dip basket.

3.1.2.3. Bypass Pipe. The bypass pipe goes from the end of the powerhouse bypass channel to the transportation facilities downstream of the dam. All juvenile fish in the bypass system must pass through this to the transportation facilities or to the tailrace. If any part of the bypass pipe is damaged, the gatewell orifices will be closed and the bypass system unwatered until repairs can be made. Turbine units will not be operated for longer than 5 hours with ESBSs in place and orifices closed. If an outage takes longer than 5 hours, spill will be provided to bypass juvenile fish. During any orifice closure, gatewells shall be monitored by project personnel for signs of fish problems or mortality. During periods of high fish passage, orifice closure times may be less than 5 hours depending on fish numbers and condition.

3.1.2.4. Transportation Facilities. The transportation facilities can be operated to either collect and hold juveniles for the transportation program or to bypass them back to the river. If part of the facility malfunctions or is damaged, efforts will first be made to bypass the fish around the damaged area. If this is not possible, the fish will be bypassed around the transportation facilities or the entire bypass system unwatered until repairs are made. Spill may be used as an alternative avenue for fish passage during a bypass system outage.

3.2. Adult Fish Passage Facilities.

3.2.1. Scheduled Maintenance. Scheduled maintenance of a facility which must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the winter maintenance period from January 1 to March 1. Maintenance of facilities which will not have a significant effect on fish passage may be conducted during the rest of the year. When facilities are not being maintained during the winter maintenance period, they will be operated according to normal operating criteria unless otherwise coordinated with the fishery agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance which will significantly affect the operation of a facility will be coordinated with the fishery agencies and tribes. Coordination procedures for unscheduled maintenance of the adult facilities are the same as for juvenile facilities. If part of a facility malfunctions or is damaged during the fish passage season and the facility can still be operated within criteria without any detrimental effects on fish passage, repairs may not be conducted until the winter maintenance period or until fewer numbers of fish are passing the project. If part of a facility is damaged or malfunctions that may significantly impact fish passage, it will be repaired as soon as possible.

3.2.2.1. Fish Ladder and Counting Station. The fish ladder contains fixed weirs, a counting station with picketed leads, an adult fish trap located in an offshoot from the ladder, and a fish exit with trashrack. If any part of the ladder fails or is blocked with debris during the fish passage season, efforts will first be made to correct it without unwatering the ladder. Trash racks, picketed leads, and counting stations can sometimes be repaired or maintained without unwatering the ladder. If the fish trap malfunctions or is damaged, fish may be passed around it until repairs are made. The decision to dewater the ladder and make repairs during the fish passage season or wait until the winter maintenance period will be made after consultation with the fishery agencies and tribes.

3.2.2.2. Auxiliary Water Supply System. The auxiliary water for the fish ladder and the powerhouse collection system is supplied by three electric pumps. During normal operations and most flow conditions, two pumps are capable of providing the required flows. If a pump fails during the two-pump operation, the pump on standby will be operated to make up the flows. If two pumps fail, NSE 2 and NPE 2 will be closed and NPE 1 raised in one-foot increments to provide the required 1.0 to 2.0-foot head differential. If the head cannot be maintained by the time the top of the weir reaches 5 feet, the floating orifices should be closed in the following order: OG-4, OG-7, OG-10, and OG-1. If the head in the system still cannot be maintained at this point, SSE 1 and SSE 2 should be raised in one-foot increments until 5 feet below tailwater is reached. If all three pumps fail, NSE 1 and NPE 1 should be closed, the powerhouse collection channel bulkheaded off at the junction pool, and SSE 1 and SSE 2 operated at 6 feet below tailwater regardless of the head.

3.2.2.3. Fishway Entrances. The fishway entrances consist of main entrance weirs with hoists and automatic controls, and floating orifices which regulate themselves with tailwater level. If any of the automatic controls malfunction, the weirs can be operated manually by project personnel and kept within criteria. If there is a further failure which prevents an entrance from being operated manually. The weirs can usually be left in a lowered position while repairs are being conducted or the entrance closed and the water redistributed to other entrances while repairs are made. If a floating orifice is damaged, it will be pulled out of the water and the entrance bulkheaded off until it is repaired.

4. Turbine Unit Operation and Maintenance.

4.1. Turbine Unit Operation. When in operation, turbine units will be operated to enhance adult and juvenile fish passage from March 1 through December 15. During this time period, turbine units will be operated (as needed to meet generation requirements) in the following order: 1, 2, 3, and then 4 through 6 (in any order) when units are available for operation. Unit operating priority may be coordinated differently to allow for fish research, construction, or project maintenance activities. To minimize mortality to juvenile fish passing through the turbine units from April 1 through October 31 (or as long as there is sufficient river flow and/or generation requests to operate turbine units 4, 5, and 6 within 1 percent of peak efficiency), operating priority during nighttime hours from 2000 to 0400 hours shall be units 4, 5, and 6 (in any order) and then units 1, 2, and 3 as needed. If a turbine unit is taken out of service for maintenance or repair, the next unit in the priority list shall be operated.

Turbine units will be operated within 1% of best efficiency from March 15 through November 30 (or as specified in BPA's load shaping guidelines) unless operation outside of that range is necessary to: 1) meet the load requirements of the BPA

Administrator whose load requirements will be made in accordance with BPA's policy, statutory requirements, and load shaping guidelines (Appendix C); or 2) be in compliance with other coordinated fishery measures. Project personnel shall record when turbine units are operated outside the 1% best efficiency range and shall provide the information to BPA on a weekly basis according to the load shaping guidelines. Between December 1 and March 15, turbine units will continue to be operated within the 1% best efficiency range except when BPA load requests require the units to be operated outside the 1% range.

Guidelines for operation of the turbine units within 1% of best efficiency at various head ranges are listed below. The following 1% best efficiency ranges were calculated using results from 1994 index testing of turbine unit 3 at Little Goose Dam. Maximum generation of units 1 through 6 at 115% overload is 155 MW.

The CBFWA recommends that turbine units be operated within 1% of peak efficiency unless otherwise agreed.

4.2 Turbine Unit Outages During High River Flow Periods. During high spring flows, turbine unit outages for inspecting fish screens, repairing research equipment such as hydroacoustic or radio telemetry equipment, and other fishery items may cause increased spill at a project in order to maintain reservoirs levels within operating levels. This may result in total dissolved gas levels exceeding standards. It is important that this work be conducted when scheduled to ensure that facilities are working correctly and not injuring migrating fish, and that important fish research data is collected. To facilitate this work, reservoir storage may be utilized to minimize impacts from taking turbine units out of service and increasing spill. At Lower Granite, this special operation shall take place when river flows are above 120 kcfs or when increasing spill levels will result in total dissolved gas levels exceeding standards. The activities covered under these operations will be coordinated with and approved by the Technical Management Team whenever possible.

For scheduled inspection or repair of research equipment, reservoirs shall be drafted to the bottom of MOP and allowed to fill to 1 foot above the MOP operating range as the work is

Turbine Units 1-3 With Extended-Length Submersible Bar Screens Installed:

Head Feet	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	69	11,204	128	20,769
86	70	11,256	130	20,866
87	72	11,308	133	20,963
88	73	11,360	135	21,058
89	74	11,424	137	21,177
90	75	11,462	140	21,247
91	77	11,525	142	21,364
92	78	11,575	144	21,457
93	79	11,611	147	21,523
94	80	11,673	149	21,638
95	82	11,708	151	21,703
96	83	11,742	154	21,767
97	84	11,803	155	21,724
98	86	11,850	155	21,478
99	87	11,897	155	21,237
100	88	11,957	155	21,024
101	89	12,017	155	20,816
102	91	12,062	155	20,588
103	92	12,107	155	20,365
104	93	12,152	155	20,146
105	95	12,210	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information regarding extended-length submersible bar screens. This table is based on data from Little Goose Dam.

Turbine Units 1-3: Without Screens Installed:

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	75	12,168	137	22,317
86	76	12,168	140	22,441
87	76	12,010	141	22,331
88	77	12,009	142	22,238
89	78	12,006	144	22,151
90	79	12,003	145	22,067
91	79	11,872	146	21,982
92	80	11,874	149	22,106
93	81	11,878	150	22,023
94	82	11,887	151	21,943
95	83	11,897	152	21,866
96	83	11,790	154	21,792
97	84	11,803	155	21,724
98	85	11,813	155	21,478
99	86	11,814	155	21,237
100	86	11,713	155	21,024
101	87	11,717	155	20,816
102	88	11,720	155	20,588
103	89	11,723	155	20,365
104	89	11,628	155	20,146
105	90	11,733	155	19,954

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best information currently available.

Turbine Units 4-6 With Extended-Length Submersible Bar Screens Installed:

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	93	14,630	121	19,069
86	94	14,716	123	19,181
87	96	14,785	125	19,270
88	98	14,869	127	19,380
89	99	14,937	130	19,468
90	101	15,003	132	19,555
91	103	15,069	134	19,641
92	105	15,135	136	19,727
93	106	15,166	138	19,767
94	108	15,247	141	19,873
95	110	15,311	143	19,956
96	111	15,374	145	20,038
97	113	15,454	148	20,142
98	115	15,516	150	20,223
99	117	15,595	152	20,326
100	118	15,673	154	20,428
101	120	15,734	155	20,280
102	122	15,794	155	20,059
103	124	15,871	155	19,864
104	126	15,948	155	19,673
105	127	16,024	155	19,486

NOTE: The turbine efficiency tables are being revised to reflect new information regarding extended-length submersible bar screens. This table is based on data from Little Goose Dam.

Turbine Units 4-6: Without Screens Installed:

Head Feet	Lower Generator Limits (MW)	Lower Generator Limits (CFS)	Upper Generator Limits (MW)	Upper Generator Limits (CFS)
85	98	15,421	126	19,896
86	99	15,410	128	19,968
87	100	15,402	131	20,037
88	102	15,394	133	20,103
89	103	15,386	135	20,164
90	104	15,377	137	20,221
91	105	15,370	139	20,279
92	106	15,366	141	20,336
93	107	15,364	142	20,221
94	108	15,361	144	20,273
95	110	15,357	145	20,167
96	112	15,460	147	20,231
97	113	15,454	148	20,142
98	114	15,446	149	20,060
99	116	15,543	150	19,982
100	119	15,643	151	19,907
101	121	15,744	151	19,686
102	122	15,736	151	19,472
103	123	15,730	151	19,262
104	124	15,724	153	19,343
105	126	15,717	155	19,359

NOTE: The turbine efficiency tables are being revised to reflect new information. This table contains the best information currently available.

accomplished. After the work, reservoirs will be drafted back to the MOP operating range. When inspection or repair work can be scheduled ahead of time, the following process will be followed:

a. Project personnel shall schedule turbine unit outages through the approved turbine outage scheduling procedure by noon of the Tuesday of the week prior to the outage.

b. Project personnel shall also contact CENPW-OP-TF and CENPD-ET-WM (Reservoir Control Center) by the same time period and inform them of the intended work.

c. CENPD-ET-WM will coordinate the work activities with regional parties of the work at the Technical Management Team meeting on the following Wednesday.

d. After coordination with the TMT CENPD-ET-WM shall issue a teletype through the CBTT issuing instructions to project and BPA personnel for the scheduled work.

e. Spill will be increased by one spillbay stop setting (about 1.7 kcfs) above passing inflow to lower the level of Little Goose pool to the bottom of the MOP range prior to the scheduled work taking place.

f. When the work takes place, additional spill will not be provided and the reservoir will be allowed to refill until the reservoir is 1 foot above the normal MOP range (a 2 foot pondage from where the pool was when the work started). At this point, screen inspections shall stop. (At Snake River projects, this should allow about one normal work day for the scheduled work.)

g. At the conclusion of the work, the reservoir shall be drafted back down to the MOP range utilizing a one spillbay stop increase in spill above passing inflow.

h. If work, such as screen inspections, is not finished, project personnel shall schedule another turbine unit outage for a date where it can be implemented again.

If the work that needs to be done is of an emergency type nature that does not normally require the turbine unit to be taken out of service (such as a failed hydroacoustic transducer versus a failed fish screen), and can not wait for the above process to be implemented, project personnel shall notify CENPW-OP-TF and CENP-ET-WM to get approval to do the work. If approval to do the work is given, the turbine unit shall be taken out of service and the reservoir level allowed to increase until it reaches 1 foot above the MOP operating range. At this point, the turbine unit must be returned to service and the reservoir will be drafted back to the MOP range using one spillbay stop setting above passing inflows.

4.3. Turbine Unit Maintenance. The project's turbine unit maintenance schedule will be reviewed annually by project and

Operations Division biologists for fishery impacts. If possible, maintenance of priority units will be scheduled for non-fish passage periods, or when there are low numbers of fish passing the project. Each turbine unit requires annual maintenance which may take from several days to two weeks. Annual maintenance of all turbine units is normally scheduled during the mid-July to late November time frame. The maintenance of priority units for adult passage is normally conducted during mid-August, when fewer adults are migrating, to minimize impacts on migrating adults. Turbine units may occasionally require overhauls to repair major problems with the turbine or generator. Overhauls may take over one year to accomplish. Turbine units, governors, exciters, and control systems require periodic maintenance, calibration, and testing which may take them outside of the one percent peak efficiency. This work will be scheduled in compliance with BPA load shaping guidelines (Appendix C) to minimize impacts on juvenile fish. Transformers are Doble tested every 3 years. Testing may need to be more frequent if there is a known problem with a transformer. These tests normally take 2 to 3 work days. To conduct the testing, the transmission lines have to be disconnected from the transformers and normal generation stopped. One turbine unit will operate in a speed-no-load condition to provide project power and operation of fish passage facilities. Spill may be provided to meet minimum required project discharges during the testing hours. The Doble tests are normally scheduled for the August time period to minimize impacts on adult and juvenile fish passage.

Table 4. Lower Granite spillway pattern for adult fish passage.

Elevation 737

Gate Number								Total	
1	2	3	4	5	6	7	8	Stops	kcfs
1								1	1.75
1							1	2	3.5
1						1	1	3	5.25
1	1				1	1	1	4	7.00
1	1				1	1	1	5	8.75
1	1	1			1	1	1	6	10.50
1	2	1			1	1	1	7	12.37
1	2	1			1	2	1	8	14.25
1	2	1	1		1	2	1	9	15.99
1	2	2	1		1	2	1	10	17.86
1	2	2	1	1	1	2	1	11	19.61
1	2	2	2	1	1	2	1	12	21.48
1	2	2	2	2	1	2	1	13	23.35
1	2	2	3	2	1	2	1	14	25.27
2	2	2	3	2	1	2	1	15	27.14
2	2	2	3	3	1	2	1	16	29.06
2	2	2	3	3	2	2	1	17	30.93
2	2	3	3	3	2	2	1	18	32.85
2	3	3	3	3	2	2	1	19	34.77
2	3	3	4	3	2	2	1	20	36.67
3	3	3	4	3	2	2	1	21	38.61
3	3	4	4	3	2	2	1	22	40.53
3	3	4	4	3	3	2	1	23	42.45
3	4	4	4	3	3	2	1	24	44.37
3	4	4	4	4	3	2	1	25	46.29
3	4	4	5	4	3	2	1	26	48.21
3	4	5	5	4	3	2	1	27	50.13
4	4	5	5	4	3	2	1	28	52.05
4	5	5	5	4	3	2	1	29	53.97
4	5	5	5	4	4	2	1	30	55.89
4	5	5	5	5	4	2	1	31	57.81
4	5	5	6	5	4	2	1	32	59.73
4	5	6	6	5	4	2	1	33	61.65
4	6	6	6	5	4	2	1	34	63.57

NOTE: Spills over 64,000 should be employed only at night if possible. Schedule is based on model studies and needs to be verified

SECTION 10

APPENDICES

Appendix A	Special Project Operations and Studies
Appendix B	Corps of Engineers Juvenile Fish Transportation Plan
Appendix C	BPA's System Load Shaping Guidelines to Enable Operating Turbines at Best Efficiency
Appendix D	Dissolved Gas Monitoring Program Plan of Action
Appendix E	Section VIII.A.2. of the NMFS Biological Opinion on FCRPS Operation -- Spill at Snake and Columbia River Projects
Appendix F	North Pacific Division Policy on Spill and Total Dissolved Gas

APPENDIX A: BONNEVILLE

Bonneville Dam

1. Spring Creek Hatchery Release. Project operated to achieve 70 percent fish passage efficiency (FPE) during Spring Creek Hatchery Release which normally occurs in March. The latest subyearling chinook (before 6/15) fish guidance efficiency (FGE) data will be used to calculate FPE. The first powerhouse will operate as first priority during the hatchery release operation. The second powerhouse can be operated only after the first powerhouse has been fully loaded. If the second powerhouse is started, it must continue to be operated through the daylight hours.

2. Special Project Operations. Powerhouse priority during the spring juvenile salmon outmigration season and bypass screen operation during the summer juvenile salmon outmigration season are being reviewed in consultation with NMFS, and may be revised.

2.1. Spring Operations. The first powerhouse will operate as first priority during the spring juvenile salmon outmigration season. The second powerhouse can be operated only after the first powerhouse has been fully loaded. If the second powerhouse is started it must continue to be operated through the daylight hours. Initial spring operations to achieve 70 percent FPE for lower river outmigrants, including spill, will begin after the first 10 percent of the spring migration has passed the project, but no later than 2000 hours 15 April. Spill to achieve 80 percent FPE, as requested in the NMFS Biological Opinion to protect endangered salmon species, will commence at 0001 hours on 20 April. All voluntary spill is subject to limitations to avoid producing excessive TDG levels downstream. Initially, the latest yearling chinook FGE (Table 1) will be used to calculate the project FPE. If migrating juvenile Snake River sockeye are detected in sufficient numbers in the lower Columbia River, changing to the latest sockeye FGE to calculate the project FPE will be considered.

2.2. Summer Operations. The first powerhouse will operate as first priority during the summer juvenile salmon outmigration season. The second powerhouse can be operated only after the first powerhouse has been fully loaded. If the second powerhouse is started it must continue to be operated through the daylight hours. Operations to achieve 80 percent FPE for summer migrants will occur from 1 July through 31 August. The latest subyearling chinook (after 6/15) FGE data will be used to calculate project FPE.

2.3. Additional Special Project Operations. The following priorities are in effect throughout the juvenile and adult fish passage season (March 1 through November 30). Maintain first powerhouse flows of at least 60 kcfs to provide favorable tailwater conditions for juvenile outmigration. If the second powerhouse is operating, also maintain flows of at least 60 kcfs. Both powerhouse can be reduced below 60 kcfs to minimum unit loading if needed to achieve the desired FPE and if necessary due to low river flows. The minimum loading in the first powerhouse is units 1, 2, 9, and 10. Units 9 and 10 are required to provide suitable flow to disperse juvenile fish from the JBS release site. Units 1 and 2 are necessary to provide energy to meet critical project loads including station service for the first powerhouse, navigation lock, fish hatchery, sewage treatment plant, project office buildings, well pumps, and an emergency first and second powerhouse interconnection. Normally, unit 1 is tied to the feeder bus and unit 2 remains on line, as a redundancy, in the event unit 1 fails. The minimum loading in the second powerhouse is units 11, 17 and 18. These units provide suitable flow conditions for migrating fish.

Any spill occurring during the daylight hours will not exceed 75,000 cfs or be reduced below 50,000 cfs, without special coordination and to the extent possible, depending on powerhouse limitations and special flow requirements. Nighttime spill to achieve 80 percent FPE will be limited as necessary to avoid producing excessive TDG downstream. The Corps' RCC will determine maximum nighttime spill to avoid producing excessive dissolved gas levels, and provide specific flow distribution guidelines to the project.

Table I. FGE values for the first and second powerhouses used to calculate FPE.

Species	Bonneville First	Bonneville Second
Chinook yearlings	37%	48%
Chinook subyearlings (before 6/15)	39%	50%
Chinook subyearlings (after 6/15)	10%	32%
Coho	63%	55%
Sockeye	23%	37%
Steelhead	56%	41%

3. Studies.

3.1. Smolt Passage at Bonneville Dam. This work will be conducted by Waterways Experimental Station (WES) personnel and private contractor(s).

3.1.1. Hydroacoustic transducers will be deployed in unit 11 and the sluice chute at the second powerhouse for an evaluation of the sluice chute as a corner collector associated with the District Surface Bypass Evaluation. We expect approximately one working day plus for installation of transducers per unit, and one day plus for removal of transducers, both of which require unit outage. Again, if deployment is by divers, adjacent units will require outage. All efforts will be made for installation and removal to occur prior to and after the main fish passage season. Additionally, to insure evaluation of the sluice chute with hydroacoustics, one or more Turbine Intake Extension (TIE) at the south end of the powerhouse will not be deployed. Unit outage for installation of transducers in the sluice chute, approximately one day is necessary. Further, we anticipate four additional unit outages during the fish passage season for transducer repair, approximately one day each. Associated with the sluice chute evaluation, the sluice chute will be operated according to a stratified random design, open or closed for 24 hour periods. The sluice chute weir will be opened or closed each day at 0500 hours according to the randomized block schedule at the end of this section (see Table II.). When the weir is open, the crest elevation will be 60 feet msl. The operation of the sluice chute will occur for a period beginning in early April and ending in mid to late July. Test unit 11 will be operated as a priority unit throughout the testing season.

3.1.2. Hydroacoustic transducers will be deployed on three spill gates at the spillway, preliminary design calls for deployment at a north, middle, and south spill gate. We expect approximately one working day plus for installation of transducers per gate, and one day plus for removal of transducers per gate, both of which require spillgate outage All efforts will be made for installation and removal to occur prior to and after the main fish passage season. Depending on transducer deployment method, adjacent spillbays may require outages if divers are used. Further, we anticipate two to four additional spillgate outages during the fish passage season for transducer repair, approximately one day each. No priority is required for spillgate operation. Spillgate operation will be coordinated with the FPP guidelines.

3.2. Hydroacoustic standardization associated with the District Fish Guidance Efficiency (FGE) program. One unit (to be determined) will have hydroacoustic transducers deployed in order to evaluate and standardize FGE data collection. We expect approximately one working day plus for installation of transducers, and one day plus for removal of transducers, both of which require unit outages. All efforts will be made for installation and removal to occur prior to and after the main fish passage season. The position of these transducers will need to be changed approximately five times during the fish passage season, requiring unit outages during the repositioning. The repositioning effort dates are unknown, but will be flexible. This study is not associated with the Surface Bypass program and no association with units 3 and 5 outages is expected or required.

3.3. Movement, Distribution, and Passage Behavior of Radio-Tagged Juvenile Salmonids at Three Lower Columbia River Dams. No specific operational requirements are anticipated at this time for conducting this study outside access to the project Boat Restricted Zone (BRZ).

3.4. Flat Plate PIT tag detection of juvenile salmonids at the first powerhouse smolt monitoring DSM. The installation and testing of this equipment is not expected to require any special project operations. However, since this program is in the developmental phase, and water control within the DSM is questionable, possible problems with the operation may arise. In the case of needed repairs to the system, one or two occasions of one or two hour reversal of flow through this system may be required to adjust the equipment, no serious effects to fish passage are expected.

3.5. Temporary PIT tag detection at the second powerhouse associated with the spillway survival study being conducted at The Dalles dam. The installation and operation of a PIT tag detection system at the second powerhouse juvenile salmonid DSM system will occur in 1997. This is a new and developmental system that is not expected to require special operations for installation. However, due to possible unforeseen circumstances the operation of the second powerhouse Fish Evaluation Research Laboratory (FERL) system could have a slight delay. Further, some adjustment may be necessary to the system requiring unknown adjustments to the DSM and/or FERL systems. As an example, it may be necessary to reduce flow over the incline screen for one to two hours in order to remove the downwell porosity plate in the case of PIT tag detection malfunction. The new PIT tag detection system dictates that the old 10% sampler will not be functional. With the new system an additional switch gate will allow for normal sub-sampling at the second powerhouse. However, in the event the new system needs to be taken out of service for repairs, sub-sampling will not be possible until the system is put back in service. Additionally, this system will need to monitored on a 24 hour basis, requiring that the lights be left on, a change from past operation.

3.6. Movement, Distribution, and Behavior of Radio-Tagged Adult Northern Squawfish in the Bonneville dam forebays. No special project operational needs are anticipated for the installation of equipment. However, during the testing season , sluiceways and/or sluice chute gates will need to be closed for duration's of approximately 2 to 3 hours for electrofishing. This is expected to occur four or five times from April to mid July.

3.7. Additional studies to be conducted at Portland District Columbia River Projects will include the Lower Columbia River Adult Salmon and Steelhead Passage Evaluation. Adult fish will be collected at the Bonneville Dam adult collection facility, tagged and released for tracking throughout the basin.

3.8. Near-Field Gas Dynamics Field Study. During February, a gas abatement study spill test will be conducted to determine near field gas dynamics of the spillway. The spill test will last 24 hours with spill volumes ranging from 25 kcfs to approximately 270 kcfs. A complete outage of the spillway is required for 6 hours prior to and immediately after the test for deployment and retrieval of monitoring instruments.

3.9. All special operational requests will be coordinated through the Anadromous Fish Evaluation Program.

4. Fish Counting Program.

4.1. 1 January - 31 March: Video count 24 hours per day.

4.2. 1 April - 31 October: Visual count 16 hours per day (0400 - 2000 PST).

4.3. 1 April - 31 October: Video count 8 hours per day (2000 - 0400 PST).

4.4. 1 November - 31 December: Video count 24 hours per day.

5. Other. Water temperature will be monitored in an adult fishway during fishway inspections at the project in 1997.

Table II. Bonneville Powerhouse 2 Sluice Chute Weir Randomized Block Schedule.

SPRING		SUMMER	
25 Apr	O	13 Jun	O
26 Apr	C	14 Jun	C
27 Apr	C	15 Jun	C
28 Apr	O	16 Jun	O
29 Apr	C	17 Jun	C
30 Apr	O	18 Jun	O
1 May	C	19 Jun	C
2 May	O	20 Jun	O
3 May	O	21 Jun	O
4 May	C	22 Jun	C
5 May	O	23 Jun	C
6 May	C	24 Jun	O
7 May	C	25 Jun	O
8 May	O	26 Jun	C
9 May	C	27 Jun	C
10 May	O	28 Jun	O
11 May	O	29 Jun	O
12 May	C	30 Jun	C
13 May	C	1 Jul	C
14 May	O	2 Jul	O
15 May	O	3 Jul	C
16 May	C	4 Jul	O
17 May	C	5 Jul	O
18 May	O	6 Jul	C
19 May	O	7 Jul	O
20 May	C	8 Jul	C
21 May	O	9 Jul	C
22 May	C	10 Jul	O

APPENDIX A: THE DALLES

The Dalles Dam

1. Special Project Operations; Spill. Spill will be provided continuously from 20 April through 31 August to achieve 80 percent FPE for spring and summer migrants, consistent with TDG management to avoid excessive gas supersaturation conditions. Spill and TDG management will be implemented in accordance with NMFS recommendations contained in Section VIII.A.2. of their ESA Biological Opinion on hydrosystem operation, dated 2 March 1995, Reasonable and Prudent Alternative.

2. Studies.

2.1. Numerous evaluations will be conducted at the projects to document salmonid behavioral responses to particular hydraulic flow fields. This information will be used to evaluate specific structural modifications intended to improve passage conditions. Hydroacoustics, radio telemetry, sonic tags, and various acoustic methodologies will be used to survey, and in some cases (i.e. acoustic technologies) attempt to modify fish behaviors. Direct capture and mark and recapture studies will be used to evaluate fish condition and migration patterns, and hydraulic velocity mapping (ADCP) will document and verify forebay flow fields. Survival studies will also be conducted at The Dalles Dam spillway.

2.2. Special operations required to support these studies will be conducted outside of the juvenile and adult fish migration periods to the extent practicable. However, some modifications to standard project operations will be necessary to complete specific studies. These could include increasing or reducing spill and sluiceway volumes, adjusting powerhouse or turbine unit loads, and manipulating pool elevations. The following paragraphs provide the most current information regarding these changes.

2.3. The Dalles Dam spill efficiency will be tested at 30% and 64% of the total river flow. Beginning the week of 4/28/97, a total of 22 30% spill days will be required, two days each week until the conclusion of the test on 7/14/97. 64% spill will be required on the remaining days as described in the NMFS Biological Opinion for Operation of the Federal Columbia River Power System (BiOp). Data will not be collected on the weekends so no restrictions will be requested if the study progresses as designed. The required 30% days are: 4/29/97, 5/2/97, 5/6/97, 5/8/97, 5/12/97, 5/16/97, 5/19/97, 5/22/97, 5/26/97, 5/29/97, 6/2/97, 6/6/97, 6/9/97, 6/13/97, 6/17/97, 6/19/97, 6/24/97, 6/26/97, 7/1/97, 7/3/97, 7/8/97, and 7/10/97. Adult fish passage will also be evaluated at both spill volumes, and juvenile survival will be assessed on the 64% spill days. On the 30% spill days, turbine units on the west end of the powerhouse will be the priority units.

Velocity data collected in 1995 and 1996 will be verified on the WES sectional model following calibration with field measurements to be conducted in 1997. Blocked trashracks will be installed in front of FU-1, FU-2, and MU-1 through MU-5 on 4/14/97 for one week. An Acoustic Doppler Velocimeter (ADV) unit will collect point velocity readings in front of FU-1, FU-2, and MU-1 through MU-5 from 4/7/97 to 4/18/97. The blocked trashracks will be removed on 4/19/97 for the remainder of the season.

Equipment installation will begin in March at The Dalles Dam and will include hydroacoustic transducers and the release mechanisms for the survival studies. Transducer installation at the spillway should not require special outages, although installation of hydroacoustic equipment at the powerhouse and sluiceway will require turbine unit outages to allow for diver access. It will take approximately one week to install and align all of the transducers at the powerhouse. Therefore, beginning 3/24/97 three turbine units should be out of service for approximately 8 hours each day beginning at 0800 hrs. The fish units will be taken out of service on 3/25/97 and 3/26/97 between 2000 hrs and 0500 hrs. Installation should be complete by 3/28/97. Typically, we can expect approximately 12 transducer failures over the three month period. Each failure will require a turbine unit outage of approximately 4 hours, if a dive is required to repair the problem, the two adjacent units will be required out of service as well. Equipment will be removed between 7/21/97 and 8/1/97 with procedures and outages similar to the installation outages discussed above.

Approximately four of the spillbays will have to be out of service to assist installation of the survival study release mechanisms for about three days each. These outages will be required from 3/31/97 through 4/11/97 so not to interfere with the powerhouse outages required for transducer installation. Outages will be required continuously until each unit has been installed. Although this type of study has not been conducted at The Dalles in the past, we expect approximately four failures over the three month period. Each failure may require up to 48 hours to repair, and the effected spillbay will have to be out of service for the work. If the repair requires a dive, all of the spillbays may need to be out of service for up to six hours each day. Control fish will be released in the tailrace for the duration of the study, but this activity should not impact project operations. The equipment can be removed after the spill season has ended, if necessary to not interrupt fish passage. If removal is required during the spill season, approximately two weeks will be required from 8/4/97 through 8/15/97 and may require daily outages of the spillway.

2.4. Additional studies to be conducted at The Dalles Dam will include the Lower Columbia River Adult Salmon and Steelhead Passage Evaluation. Adult fish will be collected at the Bonneville Dam adult collection facility, tagged and released for tracking throughout the basin. Evaluation of the 30% and 64% spill levels will be coordinated with other activities already mentioned.

2.5. All special operational requests will be coordinated through the Anadromous Fish Evaluation Program.

3. Fish Counting Program. 1 April - 31 October: Visual count 16 hours per day (0400 - 2000 PST).

4. Other. Water temperature will be monitored in an adult fishway during fishway inspections at the project in 1997.

APPENDIX A: JOHN DAY

John Day Dam

1. Special Project Operations.

1.1. Spill. Spill will be provided for 12 hours each night from 20 April through 31 August to achieve 80 percent FPE for spring and summer migrants, consistent with TDG management to avoid excessive gas supersaturation conditions. Spill and TDG management will be implemented in accordance with NMFS recommendations contained in Section VIII.A.2. of their ESA Biological Opinion on hydrosystem operation, dated 2 March 1995, Reasonable and Prudent Alternative.

1.2. Special Operation for Adult Passage. From 0400 to 2000 hours, March 1 through November 30, operate unit 1 in the 90 to 110 MW range to provide best ladder entrance condition for adult fish passage, except as required under special coordinated conditions.

2. Studies.

2.1. At the John Day Dam, surface collection studies will involve two overflow weirs at spillbays 18 and 19. They will be delivered to the dam the week of 4/21/97 and field tested at spillbay 10 for one day that week from 1000 hrs. through 1600 hrs. Once accepted, they will be moved to spillbays 18 and 19 for the fish evaluation. If the physical test interferes with the flow deflector contractor, it will be delayed until 5/1/97. The fish evaluation of the overflow weirs will be conducted from 5/5/97 through 7/12/97. In addition, a minimum of 50 kcfs will be required on a 24 hour basis from 5/5/97 through 7/12/97. Up to 30 kcfs will be required for the overflow weirs, and approximately 20 kcfs will be required as training flow from the remaining spillbays. No flow will be permitted through spillbays 18 and 19 from 0600 hrs through 2000 hrs on the following 14 days to permit removal/installation of the weirs as required by the study design: 5/7/97, 5/14/97, 5/21/97, 5/28/97, 5/31/97, 6/4/97, 6/11/97, 6/14/97, 6/18/97, 6/21/97, 6/25/97, 7/2/97, 7/9/97, and 7/12/97. Spill will be manipulated if possible, such that 120% TDG will not be surpassed due to the study.

Hydroacoustic transducer installation will take approximately two weeks from 3/17/97 through 3/28/97. Up to three main turbine units will be required out of service at a time to allow for diver access, and outages will occur between

0800 hrs and 2000 hrs., unless restricted by flow deflector construction. Depending on the method of installation, turbine unit outages may be decreased to only 1 main unit at a time if flow control becomes an issue. Times of installation may also be modified to support river operations. Spillbays 18 and 19 will be required out of service from 3/25/97 through 3/28/97 for equipment installation, also by diver. The remaining spillway transducers will be mounted on the spillway parapet wall and should not require additional outages. Removal of the equipment will be coordinated with equipment removal at The Dalles Dam, and will occur from 7/21/97 through 8/8/97. Three turbine units will again be required out of service at a time from 0500 hrs to 2000 hrs. Spillbays 18 and 19 will be out of service from 8/4/97 through 8/8/97. Typically, we can expect approximately 12 transducer failures over the three month period. Each failure will require a turbine unit outage of approximately 4 hours. If a dive is required to repair the problem, the two adjacent units will be required out of service as well. Measures will be taken to reduce these outages, and minimize operational impacts to the extent practicable.

2.2. Additional studies to be conducted at John Day Dam will include: 1) The Lower Columbia River Adult Salmon and Steelhead Passage Evaluation. Adult fish will be collected at the Bonneville Dam adult collection facility, tagged and released for tracking throughout the basin; 2) Three modified ESBSs will be installed in MU7 on 9/1/97 for a 30 day wet test of the new screen support frame design. No fish testing will occur, although increased inspection of the ESBSs will take place during unit operation. The ESBSs will be removed by 10/2/97 and the STSs reinstalled; 3) Evaluation of adult attraction spill at the John Day Dam will occur from 7/14/97 through 10/31/97 with alternating periods of 1.8 kcfs spill from spillbay 1 and no spill; and 4) An evaluation of the hydraulic sills in the John Day fish ladder flow control sections will occur during the fall steelhead migration from 9/1/97 through 10/31/97. This evaluation will require a change in operation of the fish ladders' flow control sections on a random basis, but will not require modification to spillway or powerhouse operations. The fish ladders have been designed to accommodate varying forebay elevations with removable hydraulic sills in the flow control sections. At forebay elevations above 262.5' msl, the sills are normally installed. This evaluation would remove those hydraulic sills on a random basis at forebay elevations up to 265' msl in an attempt to reduce the additional auxiliary water required at the upper ladder diffusers. In theory, if diffuser discharge is reduced, passage conditions will improve through the upper ladders.

Radio telemetry evaluations, acoustic studies and behavioral analyses will also be conducted but will be coordinated with the above requested outages.

2.3. Construction of spillway flow deflectors is currently being scheduled through April, 1997 on a 24 hour basis at the John Day Dam. During construction, only 10 spillbays will be available to pass required spill. Spill patterns will therefore be compromised during construction, and TDG will likely exceed 120% for total spill volumes above 32 kcfs. Construction will begin again in September, 1997 with similar limitations to spill. Although patterns will not significantly improve during construction of the deflectors, total river spill will increase by between approximately six and 9 kcfs per completed deflector without increasing TDG to above 120%.

2.4. All dates shown are approximate and could be advanced or delayed by a week or so depending on various factors such as river flows, contractor schedules, equipment failures, etc.

2.5. All special operational requests or changes in the above schedules will be coordinated with the fishery agencies and tribes through the Anadromous Fish Evaluation Program and with BPA and the Corps Reservoir Control Center.

2.6. Additional studies to be conducted at John Day Dam will include the Lower Columbia River Adult Salmon and Steelhead Passage Evaluation. Adult fish will be collected at the Bonneville Dam adult collection facility, tagged and released for tracking throughout the basin.

2.7. All special operational requests will be coordinated through the Anadromous Fish Evaluation Program.

3. Fish Counting Program. 1 April - 31 October: Visual count 16 hours per day (0400 - 2000 PST).

4. Other. Temperature monitoring will continue in adult fishways, forebays, and tailraces in 1997 as required by the NMFS Biological Opinion.

APPENDIX A: McNARY

McNary Dam

1. Special Project Operations.

1.1. North Shore Fish Ladder. North Wasco County PUD is constructing a hydroelectric facility on the north shore fish ladder auxiliary water supply system. As part of the construction work, the high velocity/gravity flow diffuser system is being converted to a low velocity/low head orifice and overflow weir system. The 1997 winter maintenance season is the last of 3 winter maintenance periods where the north shore adult facilities are dewatered for longer then the maintenance period. The adult facilities are scheduled to be out of service from December 1, 1996 through March 15, 1997 for the construction of the project. The turbine unit is scheduled to be in operation sometime during the summer of 1997. Prior to that, adult attraction water will be provided to the new diffuser system through the juvenile bypass/turbine bypass system. Endangered Species Act consultation with National Marine Fisheries Service has placed specific requirements on the contractor's activities to minimize impacts to fish passage.

1.2. Gatewell Debris Testing. An evaluation of gatewell debris will be conducted in the turbine unit intakes 1A and 2B. Outlet flow control devices (OFC) will be installed in these slots. OFC's are hinged flaps mounted on the downstream side of the VBS bases and were designed to reduce bulkhead slot flow if the additional flow and turbulence caused by the ESBS's increased fish injury. The OFC test will determine if their use will decrease debris plugging of vertical barrier screens or, by reducing flows through the bulkhead slot, reduce gatewell slot head differentials across the VBS caused by debris plugging thereby decreasing the frequency of VBS cleaning. The porosity plates for the VBS's in turbine intakes 2A and 3A will be modified to provide a more even distribution of gatewell flow through the VBS's with the operating gates installed in the operating gate slots. The test will begin on April 1 and will proceed for the length of the juvenile fish passage season with both OFC's set in the open (operating) position. An a monthly basis throughout the season the VBS in turbine intake slots 1A will be swapped with the VBS in 3A and the VBS in 2A will be swapped with the VBS in 2B. Gatewell slot head differentials will be measured daily and the VBS's will be monitored at least weekly with a video camera. VBS's will be cleaned according to normal operating criteria. For most of the test, turbine units 1, 2, and 3 should be operated at the upper end of the 1% best efficiency range. For the first 2 weeks in June and October, turbine units 1 and 2 should operate at 80 MW for determining the benefit of the OFC's under full turbine loading. A 2 to 3 hour outage per turbine unit will be required monthly for swapping VBS's.

1.3. Spillgate Repair. Eleven spillgates at McNary Dam have to be repaired during 1997 to ensure that the project can pass the standard project flood. Spillgates will be taken out of service 2 at a time beginning in late July for repair. If the project is spilling at this time, work will not be done if the outages will result in total dissolved gas levels exceeding state standards.

1.4. Spill. Spill for fish passage will be provided during the spring outmigration season, in accordance with spill specifications in the NMFS Biological Opinion on hydrosystem operation (Appendix E) as updated in 1997 through the TMT Water Management Plan. Special daytime or nighttime spill patterns may be implemented to control dissolved gas levels to agreed upon levels, while attempting to achieve desired spillway discharges. Alternative spill patterns to reduce TDG levels should be coordinated through the TMT.

2. Studies.

2.1. Near-Field Gas Dynamics Field Study. During February, a gas abatement study spill test will be conducted to determine near field gas dynamics of the spillway. The spill test will last 24 hours with spill volumes ranging from 35 kcfs to approximately 300 kcfs. A complete outage of the spillway is required for 6 hours prior to and immediately after the test for deployment and retrieval of monitoring instruments.

2.2. Evaluation of Vertical Barrier Screens and Flow Control Devices. VBS's in turbine intakes 5A and 5B will be modified with a different perforated plate arrangement to more evenly distribute flow through the VBS's. Outlet flow control devices will be installed in the operating gate slots of intakes 4B and 5B. This study will compare orifice passage efficiency (OPE) and fish descaling rates of the modified VBS to the unmodified VBS in intakes 4A and 5A. The study will also evaluate fish descaling rates in intakes 4B and 5B with modified and unmodified VBS's and outlet flow control devices installed. Research will be conducted from approximately April 24 through July 31. Tests will be conducted with the turbine units operated at the normal upper end of the 1% best efficiency curve (approximately 12,500 cfs discharge) and with turbine units operated at the upper end of unit operation at 80 MW (approximately 16,000 cfs discharge), which is outside the 1% best efficiency range. The outlet flow control devices in the B-slot gatewells will be adjusted so that the flow up the gatewell slots when the turbine unit is operated at 80 MW is decreased by up to 30%. This would make bulkhead slot conditions at 80 MW closer to those seen at the upper end of the 1% range. Estimates are based on model studies at 13,000 cfs turbine discharge. This could restrict the gatewell flow from approximately 570 cfs to approximately 400 cfs. Turbine units 4 and 5 will operate at 80 MW on 10 test days during May. These test days will be alternated with 10 test days of turbine unit operation at the upper end of the 1% best efficiency range. Test periods will run from 1800 hours to 1800 hours the next day with turbine units operated for up to 20 hours in a 24 hour period at set test conditions. Turbine units will periodically be out of service for 2 to 3 hours on test days to allow gatewell dipping and removal of fish. On a weekly basis, the VBS's will be rotated between intakes 4A and 5A. This will require a 2 to 3 hour outage per turbine unit. Otherwise, turbine units will be available for normal operation. The test will be repeated during the June 15 to July 15 time period with 10 test days of 80 MW operation alternated with 10 test days of 1% best efficiency operation.

2.3. Adult Fish Passage. An evaluation of adult fish passage at the 4 lower Columbia River projects, including McNary Dam, is scheduled to continued in 1997. The objectives of the 1997 study at McNary Dam are to determine dam and reservoir passage times, fishway entrance use and passage, and impacts of project operations on fish passage. No special operations are required for this study.

APPENDIX A: ICE HARBOR

Ice Harbor Dam

1. Special Project Operations.

1.1. Spillbay Deflector Construction. Spillbay deflectors (fliplips) were scheduled to be constructed on 8 spillbays prior to the 1997 juvenile fish outmigration. Unexpected high river flows and spill at the end of December, 1997 destroyed the contractors bulkheads used for dewatering the spillbays for construction. Continued high flows during the rest of the winter period prevented any additional construction from taking place. For the 1997 spring spill season, 8 spillbays will be available for service at Ice Harbor Dam. Spillbays 3 and 8 will not be in operation due to excavation of some of the concrete for construction of the deflectors. Spillbays 4 through 7 have new deflectors and will be operated along with spillbays 1, 2, 9, and 10 which do not have deflectors. Construction of the remaining 4 deflectors will resume on September 1, 1997 and last through the winter period. A complete spillway outage will be required for construction of the remaining spillway deflectors.

1.2. Spill. Spill for fish passage will be provided during spring and summer outmigration seasons, in accordance with spill specifications in the NMFS Biological Opinion on hydrosystem operations (Appendix E as updated in 1997 through the TMT Water Management Plan. Special daytime and nighttime spill patterns may be implemented to control dissolved gas levels to agreed upon levels, while attempting to achieve desired spillway discharges. Alternative spill patterns to reduce TDG levels should be coordinated through the TMT.

2. Studies.

2.1. Spill Effectiveness Evaluation Using Radio Tagged Fish. This study will utilize radio tagged juvenile salmonids to determine spillway effectiveness through various spill volumes. Juvenile fish will be tagged at Lower Monumental Dam and monitored as they pass Ice Harbor Dam. The fish monitoring portion of the study will occur from April 25 through June 11. Radio tag antennas will be installed in the project forebay, spillbay bulkhead slots, turbine units, and juvenile bypass system. Spillbay and turbine unit outages will be required for installation and removal of antenna systems. All antennas which require outages for installation will be installed prior to April 1. Outages lasting up to approximately 4 hours may be requested during the study period to replace or repair antennas. Antenna systems will be removed after river flows drop to where outages will not impact project operations. During the test period, 25, 40, and 60 kcfs spill volumes will be required for 2 to 4 days per spill volume in repeating blocks. The 60 kcfs flow volume will only be tested if tailrace total dissolved gas levels are less then 120% as monitored at the downriver fixed location or if forced spill conditions in a higher runoff year provide this condition.

2.2. Adult Fish Passage Study. Spring/summer chinook tagged at Bonneville Dam from early April through June will be monitored as they pass the Ice Harbor Dam to determine the effects of the new spillway deflectors on adult fish passage. Spill will provided according to the adult spill pattern in the project operating criteria. Some adjustments to the spill pattern may be made during the year if the study indicates there is an adult passage problem.

APPENDIX A: LOWER MONUMENTAL

Lower Monumental Dam

1. Special Project Operations.

1.1. Spill. Spill for fish passage will be provided during the spring outmigration season under certain conditions of higher flow, according to specifications in the NMFS Biological Opinion on hydrosystem operation (Appendix E) as updated in 1997 through the TMT Water Management Plan. Special nighttime spill patterns may be implemented to control dissolved gas levels to agreed upon levels, while attempting to achieve desired spillway discharges. Alternative spill patterns to reduce TDG levels should be coordinated through the TMT.

2. Studies.

2.1. Near-Field Gas Dynamics Field Study. A gas abatement study spill test will be conducted in March to determine near field gas dynamics of the spillway. The spill test will last 24 hours with spill volumes ranging up to approximately 110 kcfs, depending on available water supply. A complete outage of the spillway is required for 6 hours prior to and immediately after the test for deployment and retrieval of monitoring instruments.

2.2. Juvenile Fish Separator Evaluation. The exit from the large fish side of the separator will be modified and fish behavior within the separator evaluated during the spring. No special project operations are required for this study. If there are fishery related problems with the new exit, the transportation facilities will switch to bypass for approximately 8 hours while the separator is changed back to the original downwell exit configuration.

2.3. Adult Fish Passage. Spring/summer chinook salmon radio tagged at Bonneville Dam from early April through June will be monitored as they pass Lower Monumental Dam. If daytime involuntary spill is provided, spill patterns will alternate between the standard adult spill pattern, Table 31, and a 6 bay pattern, Table 32, designed for dissolved gas control. Spill patterns will rotate after each block of 5 radio tagged adults pass the project.

APPENDIX A: LITTLE GOOSE

Little Goose Dam

1. Special Project Operations.

1.1. Spill. Spill for fish passage will be provided during the spring outmigration season under certain conditions of higher flow, according to specifications in the NMFS Biological Opinion on hydrosystem operation (Appendix E) as updated in 1997 through the TMT Water Management Plan. Special nighttime spill patterns may be implemented to control dissolved gas levels to agreed upon levels, while attempting to achieve desired spillway discharges. Alternative spill patterns to reduce TDG levels should be coordinated through the TMT.

2. Studies.

2.1. Near-Field Total Dissolved Gas Monitoring. Total dissolved gas monitoring instruments will be installed in the tailrace directly below the spillway to measure near-field total dissolved gas levels. Equipment will be in place from April 1 through June 20. Every 2 weeks, a 3 to 4 hour spillway outage will be required for installation and retrieval of monitoring equipment if the project is spilling during daytime hours. No special spill operations are required for this study.

2.2. Juvenile Fish PIT Tag Survival Study. A juvenile fish passage survival study using PIT tagged steelhead smolts will be conducted in the spring of 1997. PIT tagged juvenile steelhead will be released into 2 spillbays (with and without deflectors), a turbine unit, and the juvenile bypass system. Tagged fish will be released approximately 3 times per week from April 1 through June 4, depending on the availability of test fish. The turbine release hose will be attached to an ESBS and installed at the same time as the ESBS, prior to April 1. The bypass system release hose will be attached to the top section of turbine unit intake 6B trashrack and will be installed prior to April 1. A one day turbine unit outage will be required for removing and reinstalling the trashrack panel and release hose. Spillbay release hoses will be installed in spillbays 1 and 4, and will be attached to spillbay stoplogs. The stoplog for spillway 1 will have legs attached to it to hold the bottom of the stoplog approximately 2 meters above the spillbay crest and will be in place for the entire study. The stoplog for spillbay 4 will be suspended from the spillway crane at a similar elevation above the spillway crest. The stoplog will be in place only during test hours. Short outages (approximately 1 hour) of spillbay 4 will be required before and after spill test hours for installation and removal of the stoplog. Spillbay 1 will be out of service for all non-test hours during the testing period with the exception of additional testing detailed in paragraph c. below. Spillbay 4 will be available for normal spillway operations outside of the outage periods and test hours. Fish will be released during evening hours utilizing spill provided for juvenile fish passage as required by the Biological Opinion.

Special project operations for fish releases will last 2 to 3 hours per test. The spill volumes through spillbays 1 and 4 should be the same during test hours and steady project operating conditions (spill volumes and generation loading) should be provided for the 2 to 3 hours of the test. Turbine unit 6 will also be required to be operated during test hours.

2.3. Direct Spillway Survival Evaluation Using Tagged Fish. A survival study utilizing direct recapture of tagged fish in the project tailrace will be conducted on an estimated 10 test days from approximately April 1 through April 14. Spill will be provided through spillbays 1 and 4 ranging from 3 to 8 kcfs per spillbay to simulate a modified spill pattern of 25, 40, and 60 kcfs total spill volumes. Fish will be released through hoses installed for the PIT tag survival study described above. Spill for this study will be provided during the day from 0600 to 1800 hours with each spill volume provided during each test day in 4 hour blocks.

2.4. Spill Effectiveness Evaluation Using Hydroacoustics. This study will use hydroacoustic equipment to determine spill effectiveness for passing juvenile salmonids across a range of project operations. The study will be conducted from April 13 through June 20. Hydroacoustic transducers will be installed in turbine intakes and spillbays prior to April 1. Individual turbine unit and spillbay outages will be required for the installation of transducers. Short-term outages (less than one work day) may be required during the study to repair or replace damaged transducers. No special project operations (powerhouse loading or spill volumes) are required for this study.

2.5. Adult Fish Passage. An adult fish passage study will be conducted at the 4 lower Columbia River projects. Radio telemetry equipment will be installed at Little Goose to monitor radio tagged adult salmonids as they pass the project. Radio telemetry equipment will be installed within the adult fishway during the winter maintenance period. Adult fish passage at Little Goose will be evaluated to determine if there are any impacts to adult fish passage caused by the installation of permanent fallout prevention fences at the north powerhouse entrances. The adult fallout fences will be installed during the 1997 winter maintenance period. If daytime involuntary spill is provided, spill patterns will alternate between the standard adult spill pattern, Table 31, and a 6 bay pattern, Table 32, designed for dissolved gas control. Spill patterns will rotate after each block of 5 radio tagged adults pass the project.

APPENDIX A: LOWER GRANITE

Lower Granite Dam

1. Special Project Operations.

1.1. Surface Bypass Collector Modifications. The surface bypass collector constructed in 1996 will be modified prior to the 1997 juvenile fish outmigration. Turbine unit outages will be required for the removal and installation of the floating modules and for modification of other parts of the structure. Installation of testing equipment may also be done at the same time.

1.2. Fish Screen Slot Closure. Closure devices were installed in the fish screen slots and associated Wagner horns at Lower Granite Dam in 1995. In 1997, project personnel may periodically dip fish screen slots to determine if fish are getting past the slot closure devices.

1.3. Spill. Spill for fish passage will be provided during the spring outmigration season under certain conditions of higher flow, according to specifications in the NMFS Biological Opinion on hydrosystem operation (Appendix E) as updated in 1997 through the TMT Water Management Plan. Special nighttime spill patterns may be implemented to control dissolved gas levels to agreed upon levels, while attempting to achieve desired spillway discharges. Alternative spill patterns to reduce TDG levels should be coordinated through the TMT.

2. Studies.

2.1. Near-Field Total Dissolved Gas Monitoring. Total dissolved gas monitoring instruments will be installed in the tailrace directly below the spillway to measure near-field total dissolved gas levels. Equipment will be in place from April 1 through June 20. Every 2 weeks, a 3 to 4 hour spillway outage will be required for installation and retrieval of monitoring equipment if the project is spilling during daytime hours. No special spill operations are required for this study.

2.2. Surface Bypass Collector (SBC) Operation. A prototype SBC will be operated and evaluated at Lower Granite Dam during the 1997 juvenile fish outmigration. The SBC is in front of turbine units 4, 5, and 6 and is connected to spillbay 1. When the SBC is operated, spillbay 1 will be used for discharging the flow. Spill from spillway 1 will be determined by the daily surface bypass collector test schedule and will be limited to 4,000 cfs. Spillbay 1 will not be operated when the SBC is not operated. The operation of the SBC will also require a minimum of 1,750 cfs to be discharge through spillbay 2 for training of the spillbay 1 flow. The operation and evaluation of the SBC will require changes in the turbine operating priority, special turbine generation loading, spill levels, and pool fluctuations to achieve proper test conditions. The specifics on these operations will be contained in the final study plan for the evaluation. Spill patterns will also be adjusted due to the special and restrictive uses of spillbays 1 and 2.

2.3. Surface Bypass Collector Hydroacoustic Evaluation. Juvenile fish passage through the SBC, turbine units, and spillbays will be evaluated with hydroacoustic equipment. The evaluation will be conducted from April 14 through May 31 and July 1 through August 17. Installation of hydroacoustic equipment should be completed by April 1. Installation of hydroacoustic transducers will require turbine unit and spillbay outages. As much as possible, installation of equipment will be coordinated with outages for modifying the SBC. Hydroacoustic transducers for determining turbine passage will be attached to ESBS's, which are installed prior to the juvenile fish passage season. Short term turbine outages of 4 hours in duration may occur during the study for repair or replacement of damaged transducers. Short term spillbay and turbine outages in March will also be required to install transducers on spillbays and turbine piernoses. Up to 3 short term spillbay outages may also be required during the study to repair or replacing damaged transducers. A log boom system will be installed directly in front of spillbays 2-8 to protect hydroacoustic transducers from surface debris. A spillway outage during March will be required for installation of the log system.

2.4. Surface Bypass Collector Radio Telemetry Evaluation. Radio tagged juvenile fish will be used to evaluate passage through the SBC, turbine units, and spillbays. The study will be conducted from April 13 through June 1 and July 1 through August 16. Installation of radio telemetry equipment will be during March and early April. Most radio telemetry equipment should be installed on the SBC during turbine outages for modification of the SBC. Some additional outages in March may be needed for this work. Spillbay outages will be required for installing radio antenna systems in spillbay stoplog slots. Outages of turbine units 2 and 5 may also be required for installation of antenna frames in draft tube stoplog slots.

2.5. Surface Bypass Collector Fish Condition Evaluation. Juvenile fish condition after passage through the SBC and spillbay 2 may be evaluated from April 8 through April 13. Test equipment will be installed between April 1 and April 7. Release hoses will be installed in the SBC and just upstream of the spillgate opening of spillbay 2. An outage of spillbay 2 will be required for installation of the release hose. Spillbays 1 and 2 will be operated several times daily during the test to provide the correct SBC and spillbay flows. Once the release hose is installed through the end of the test, spillbay 2 will be out of service except for test hours.

2.6. Adult Fish Passage. An adult fish passage study will be conducted at the 4 lower Columbia River projects. Radio telemetry equipment will be in place at Lower Granite to monitor radio tagged adult salmonids as they pass Lower Granite project.

Adult fish passage at Lower Granite will be evaluated to determine if there are any impacts to adult fish passage caused by the installation of permanent fallout prevention fences at the north powerhouse entrances. The effects of the SBC on adult fish passage will also be evaluated. Radio tagged squawfish will also be monitored at Lower Granite in 1997. Radio telemetry equipment will be installed within the adult fishway and on the SBC during the winter maintenance period and during SBC modification.

Corps of Engineers' Juvenile Fish Transportation Plan

1. Introduction:

a. The Juvenile Fish Transportation Plan describes operations and establishes criteria for the transportation of juvenile salmon and steelhead from Lower Granite, Little Goose, Lower Monumental, and McNary dams (collector dams) to release areas below Bonneville Dam. This work plan supplements normal operating criteria presented in Appendix A of the Fish Passage Plan for the collector dams.

b. Collection and transportation is accomplished by the Walla Walla District, Corps of Engineers (CENPW), under an Endangered Species Act (ESA) permit from the National Marine Fisheries Service (NMFS). On-site biological oversight is provided by fishery agencies through Cooperative Agreements between CENPW and the Washington Department of Fish and Wildlife (WDFW), and Oregon Department of Fish and Wildlife (ODFW). On-site quality control is provided by WDFW at Lower Granite, Lower Monumental and McNary Dams, and ODFW at Little Goose Dam.

c. The transport program will be coordinated with other fishery monitoring, research, and management activities by CENPW. Coordination will be achieved with the fishery agencies and tribes through the Fish Passage Advisory Committee (FPAC), the Fish Passage Center (FPC), and other agencies as required.

2. Objective: The objective of CENPW and the transportation program is to maximize survival of fish collected and transported by:

a. Providing safe and efficient collection and barge or truck transport of juvenile salmon and steelhead from collector dams to release areas below Bonneville Dam;

b. Identifying and recommending programs or facility changes that would benefit fish collection and transportation or bypass operations;

c. Assuring that collection, transport, and release site facilities are ready for operation prior to the beginning of transport operations;

d. Assuring that collection, transport, and release site facilities are properly maintained throughout the transport season;

e. Establishing operating criteria for facilities, barges, and trucks including fish holding and transport densities, sampling rates, and facility operations and maintenance;

f. Coordinating changes needed to accommodate fluctuations in the outmigration with project, FPAC, and FPC personnel;

g. Coordinating transport evaluation and other research with the transportation program;

h. Providing the training of new personnel associated with collection and transport facilities and equipment;

i. Providing all parties involved a list of emergency points of contact and appropriate telephone numbers so that any emergency can be coordinated and corrected efficiently;

j. Preparing an annual report detailing transportation activities and results for the previous year, and identifying maintenance, replacement, or modifications needed for the next transport season.

3. Program Duration:

a. Starting Operations: Transport operations will start during the last week of March at Lower Granite Dam. Start-up at Little Goose and Lower Monumental dams will be keyed off fish collection numbers at Lower Granite Dam and the anticipated migration times to Little Goose and Lower Monumental dams. McNary Dam will begin sampling for PIT tags, monitoring facility operations. and the Smolt Monitoring Program during the last week of March. Transport operations at McNary Dam will not begin until conditions specified under paragraph 4.a.(2) are met.

b. Summer Transport Operations: At McNary Dam, summer operations will begin when the number of subyearling chinook exceeds the number of yearling salmon in the daily sample for 3 consecutive days. At Lower Granite, Little Goose, and Lower Monumental dams, summer operations will begin either when fish numbers have dropped below 500 fish per day, or water temperatures have reached approximately 70 degrees Fahrenheit (70°F) and sheltered holding areas are required. Sampling will convert to 100% and mini-tankers may be used. Steelhead, which

state biologists determine are in poor condition or are reverting to the parr stage, may be bypassed to the river.

c. Ending Operations: Transport operations are anticipated to continue through approximately October 31 at Lower Granite, Little Goose, and Lower Monumental dams, and December 15 at McNary Dam.

d. Emergency Termination Criteria: Project Biologists will report to the CENPW Transportation Coordinator when high water temperatures or other factors increase collection mortality to 6 percent of daily collection for 3 consecutive days or if daily collection mortality exceeds 10,000 fish. The Transportation Coordinator will evaluate the situation and shall notify or arrange a conference call with FPAC and FPC to discuss the options of continuing collection and transportation or to bypass fish. In the event of a fish loss exceeding conditions set forth in the ESA Section 10 Permit for the transportation program, the Corps shall notify NMFS and reopen consultation as needed. If icing conditions threaten facility integrity or present unsafe conditions on the transport route, transport operations may be terminated early by the Project Manager. Emergency termination will be coordinated by the CENPW Transportation Coordinator with NMFS, FPAC, and FPC.

4. Operating Criteria:

a. Collection and Transportation: Juvenile fish shall be transported in accordance with the ESA Section 10 permit, the Biological Opinion prepared under ESA Section 7 consultation with NMFS, and transportation program criteria. During transport operations, collected juvenile fish will be bypassed back to the river if the number of collected fish exceed facility and barge holding capacities. Holding for transportation will resume when adequate capacities are available to hold and transport fish according to transportation program criteria. Maximum holding time and loading criteria will not be exceeded without CENPW review and approval. Marked or PIT tagged fish will be released to the river if they are part of an approved research study or smolt monitoring program travel time evaluation. Specifics of the transportation may be altered during the transportation season based on recommendations from the Technical Management Team.

(1) At Lower Granite, Little Goose, and Lower Monumental dams, all juvenile fish collected shall be transported.

(2) At McNary Dam, fish collected during the spring shall be bypassed through the transportation facilities back to the river until subyearling chinook predominate the daily total chinook collection for 3 consecutive days. When this occurs, fish will be collected and held for transportation with all fish collected being transported. During the spring, juvenile fish may be sampled for the Smolt Monitoring program and for monitoring facility operations.

b. Peak Migration Periods: For the purpose of transport operations, the peak migration period is defined as beginning when total collection at an individual project reaches 20,000 fish per day (actual peak days may range from 250,000 to 830,000 fish per day). Normally, truck transportation will be used before and after the peak, and barge transportation will be used during the peak. Peak migration generally occurs between April 15 and May 31 at Lower Granite, Little Goose, Lower Monumental, and McNary Dams. At McNary Dam, a summer peak also occurs from late June through August.

c. Collection Facility Operations:

(1) Once transport operations begin, collection facilities will be staffed 24 hours per day until operations cease.

(2) Flows at the juvenile fish separator will be monitored at least every 15 minutes throughout separator operations.

(3) When collection systems are not providing safe fish passage or meeting operating criteria, project managers and biologists will make operational changes that are in the best interests of the fish, then notify CENPW as soon as possible. The CENPW Transport Coordinator will coordinate changes with NMFS, FPAC and FPC.

d. Sampling Procedures:

(1) Sampling will be accomplished in accordance with sampling guidelines recommended by FPAC.

(2) Fish that are sampled will be counted by electronic counting tunnels and the counts verified and adjusted by hand counts. All fish number estimates, raceway, truck, and barge loading densities and rates will be based on a sample of fish collected. Samples will be taken hourly 24 hours per day.

Sample rates will be coordinated with smolt monitoring personnel and set by project biologists.

(3) Species composition and weight samples will be taken to determine loading densities for raceways, barges, and trucks. Project personnel will keep a running total of hourly estimates of fish numbers, raceway totals, and direct loading totals for barges based on these estimates. Daily samples for monitoring descaling will include a minimum of 100 fish of the dominant group(s) for which descaling information is recorded. During periods of low fish passage, descaling will be monitored daily for facility operations. During extended transport operations, samples may be evaluated every other day to minimize handling stress and to allow all collected fish to be held in the sample holding tanks.

(4) Where smolt monitoring activities are conducted at collector dams, project biologists may utilize daily total information gathered by those personnel.

e. Loading Criteria:

(1) Raceways: Maximum raceway holding capacity will be 0.5 lbs. of fish per gallon of water. Inflow to raceways is approximately 1,200 gallons per minute (gpm) at Lower Granite and Little Goose dams, and 2,600 gpm at Lower Monumental and McNary dams. Individual raceway volume is approximately 12,000 gallons of water at Lower Granite and Little Goose, and 24,000 gallons at Lower Monumental and McNary.

(2) The 0.5 pounds per gallon criterion is not to be exceeded without CENPW review and approval. Such decisions will be coordinated with FPAC, FPC, and NMFS, and a joint decision whether to exceed criteria or bypass fish to the river will be made based on: (1) species composition; (2) total anticipated collection during the critical holding period; (3) in-river fish passage conditions; and (4) fish condition. Project biologists will provide information to the CENPW Transport Coordinator upon which to base these decisions.

(3) Distribution Among Raceways: Collected fish should be spread among raceways to minimize crowding and stress, and to reduce the risk of disease transmission. Additional groups should be added to each raceway at the discretion of the project biologist until holding capacity is reached. Whenever possible, small fish will be held in raceways separate from large fish.

(4) Holding Time: Maximum holding time in raceways will be 2 days.

(5) Truck and Barge Capacities: Loading criteria are 5 pounds of fish per gpm inflow for barges and 0.5 pounds of fish per gallon of water for trucks. Capacities per vehicle are:

Barge	Capacity (gal)	Inflow(gpm)	Fish Capacity(lbs)
SOCKEYE (2127)	85,000	4,600	23,000
BLUEBACK (2817)	85,000	4,600	23,000
STEELHEAD (4382)	100,000	10,000	50,000
COHO (4394)	100,000	10,000	50,000
CHINOOK (8105)	150,000	15,000	75,000
KING SALMON (8106)	150,000	15,000	75,000
Truck	3,500		1,750
Mini-tank	150		75

f. Summer (Extended) Transport Operations:

(1) During the extended season all collected fish at Lower Granite and Little Goose dams will be routed to the sample holding tanks, which are shaded. All collected fish will be handled for Smolt Monitoring Program requirements, and for

loading from the sample holding tanks into trucks. To minimize handling stress, facility samples may be processed every other day.

(2) At Lower Monumental Dam, all collected fish will be routed to the sample tanks when fish numbers drop to an acceptable handling level. At that time all fish collected will be handled as part of the daily sample. To minimize handling stress, facility samples may be processed every other day. When large trucks are used, fish will be loaded from the raceways. When mini-tankers are used, Corps and agency project biologists will select the best method of transferring fish from the lab to the mini-tanker.

(3) During summer months at McNary Dam, from June 15 through August 31, water temperatures will be measured along the face of the powerhouse, in B-slot gatewells, and within the collection channel on a daily basis. These temperature measurements will be used for management of north powerhouse loading criteria contained in appendix A of the Fish Passage Plan. During warm water periods, collected fish may be transported by truck or barge on a daily basis to minimize stress and mortality from warm water conditions. Other special operations may be required at McNary Dam during summer months to minimize impacts of project operations on juvenile fish collection during warm water temperature periods.

g. Facility and Equipment Logbooks and Records: To document collection and transportation activities, the following items will be logged at each dam by either project personnel or state biologists:

(1) Juvenile fish facilities: Records will be maintained recording fish counts by hour, by day, and by species, numbers and species of fish trucked or barged, number and species of fish sampled, descaling rates, and mortality rates. Records will be transmitted daily to CENPW for processing and transmittal to CENPD. Facility personnel will follow standard operating procedures (SOPs), and will note in facility logbooks accomplishment of SOPs at various stations at the collection facilities. General observations of fish condition and juvenile fish passage will be documented in facility logbooks by state biologists.

(2) Truck and Barge Logbooks: Each truck and barge shall have a logbook for recording fish loading rates, fish condition, estimated mortalities, area of release, equipment malfunctions, and accomplishment of scheduled work under the SOPs. When consecutive loading of trucks or barges occurs at downstream projects, truck drivers or barge riders will record numbers and condition of fish loaded. Towboat captains will keep logbooks on towboat activities. Barge riders will be authorized as inspectors by the Contracting Officer's Representative to initial entries noting towboat passage, loading, or fish release

activities, and comments on barging operations. State biologists will report truck and barge mortality information in their weekly reports.

(3) Weekly Reports: State biologists shall prepare weekly reports documenting daily and weekly collection and transportation numbers, sampling information, facility and sampling mortality, descaling rates, and adult fallbacks. The weekly reports will be used by CENPW for any weekly reports required in the ESA Section 10 permit issued by NMFS.

5. Transport Operations:

a. Truck Operations: Seven fish transport trucks and three mini-tanks are available for hauling fish. One mini-tank will be provided at each Snake River project. Mini-tanks are small units that can be mounted onto pickup trucks. Normally trucks will be distributed two at Lower Granite Dam, one at Little Goose Dam, one at Lower Monumental Dam, and two at McNary Dam. A spare truck will be kept at McNary Dam. Trucks may be redistributed to meet transport demands.

(1) Truck/Mini-tank Release Sites: The normal spring release site for trucked fish will be at Bradford Island adjacent to Bonneville First Powerhouse. From mid-June through the end of the transport season, trucks and mini-tanks will be transported by barge from a boat ramp located several miles below Bonneville dam to a mid-river release area. Mid-river releasing of trucked fish will continue as long as river levels allow safe loading of trucks onto the barge.

(2) Operation of Truck Life Support Systems: Truck drivers will be trained by project biologists and maintenance personnel on the operation of truck life support systems, the requirements of fish to be met, and signs of stress for which to watch. Routine checks will be made on support systems and fish condition at check points identified by project biologists. Life support system data and information on fish condition will be entered into the truck driver's logbook at each check point and at the release point. The truck driver's logbook will be reviewed by the project biologist upon the truck driver's return after each trip.

(3) If required to maintain transport schedules, transport trucks and mini-tanks leaving Lower Granite may take on additional fish at Little Goose Dam, or trucks leaving Little Goose may take on additional fish at Lower Monumental Dam. Loading schedules will be coordinated so that fish will be kept separated by size.

b. Barge Operations: Six fish barges will be available for use.

(1) Barge Scheduling: By combining small and medium sized barges in tandem and alternating the tandem barges with large barges, 73,000 to 75,000 pounds of fish can be transported daily. It takes approximately 81 hours to make a trip from Lower Granite Dam to the release area near the Skamania light buoy below Bonneville Dam and return. When collection exceeds 20,000 fish per day at Lower Granite Dam, one barge will leave Lower Granite Dam every other day. At the highest part of the migration, a large barge, medium barge, or a combination of small and medium-sized barges in tandem will leave Lower Granite Dam each day. The sequence will operate in reverse as fish numbers decline. During spring operations, barges will take on additional fish at Little Goose, and Lower Monumental dams as barge capacity allows. When daily collection exceeds barge capacity, juvenile fish will be bypassed to the river until collection numbers drop to where juvenile fish can be barged within barge carrying capacity criteria. During the summer, two barges will be used from McNary Dam. A round trip from McNary Dam to the release area takes less than 48 hours. One barge will leave McNary Dam every two days when numbers allow, and every day during higher fish collection days. Summer barge operations will continue while collection at McNary exceeds 3,500 pounds of fish per day (the capacity of two trucks) or trends indicate numbers will exceed the 3,500 pound trigger number. The number of barges used will be governed by fish collection rates, with the second towboat used on an intermittent basis shifting from one to two barge operation as authorized by CENPW.

(2) Barge Loading: Whenever possible, small and large fish will be loaded in separate compartments in barges.

(3) Barge Riders: Project barge riders will accompany each barge trip, supervising all loading and release operations, and barge operations en-route. Barge riders will be trained on barge operation, maintenance, and emergency procedures by project biologists and maintenance personnel. Barge riders will also be cross-trained in facility operations, and may rotate with facility operators as decided by project management. Barge riders shall be responsible for monitoring fish condition, barge equipment operations, and water quality (temperature and dissolved oxygen levels) at regular intervals during downriver trips. Barge riders shall maintain logbooks recording loading activities and times, loading densities by barge compartment, information on equipment operations, and release locations. Standard operational procedure forms shall be filled out during routine monitoring of equipment operation and shall include fish mortality and water quality data. At each subsequent dam where fish are loaded onto the barge, the barge rider shall make appropriate notations in the logbook. The barge rider shall also serve as an inspector for the towboat contract, and record information required by the Contracting Officer's Representative, and shall initial the towboat captain's logbook confirming operational information and lockage times. Any unresolved differences between barge riders and towboat crews shall

immediately be reported to the Contracting Officer's Representative.

(4) Barge Release Area: The barge schedule is based on release at the Skamania light buoy (approximately RM 140) with arrival at that point pre-determined to occur during night-time hours to minimize predation impacts. Barge travel time is affected by weather and river flows. As allowed by arrival time at Bonneville Dam, barge riders will randomly select barge release sites from Skamania light buoy upstream to Warrendale (approximately RM 141) to further decrease the ability of predators to prey on fish released from the barge. Project biologists will provide maps designating specific release sights to ensure that fish will not be released in the same area on consecutive trips.

6. Emergency Procedures:

a. Emergency procedures will be followed at any time an emergency occurs, 24 hours per day, 7 days per week during the transport season. Emergencies will be reported to the CENPW Transport Coordinator as soon as possible.

b. In the event of an emergency (equipment failure at a facility or on a truck or barge, emergency lock outage, chemical spill in the river, etc.), facility workers, truck drivers, and barge riders will be expected to take immediate appropriate actions to protect fish. If time allows, the worker, driver, or rider should consult with his/her supervisor by phone or radio to jointly make emergency decisions. If time does not allow consultation, the worker, driver, or rider must take appropriate action on his/her own initiative, then report to his/her supervisor as soon as possible after the action has been completed.

c. A complete listing of persons to be notified in case of emergencies and their business and home telephone numbers will be provided to each person involved in the transport program. Facility operators, truck drivers, and barge riders will be trained on emergency notification procedures by project biologists and CENPW. For the purpose of reporting an emergency, the person involved will immediately notify his/her supervisor, or the next person up the line until the emergency has been properly reported and corrective action has been initiated. In addition to telephone reporting, barge riders will report emergencies by the towboat radio to the nearest Corps dam. The operator on duty will relay the message to the person or persons identified by the barge rider.

7. Fishery Agency Roles:

a. The fishery agencies provide biological oversight of fish at transportation dams. CENPW funds state fish biologists at each collector facility by Cooperative Agreements with WDFW and ODFW.

b. Task Orders under the Cooperative Agreements specify that state agency personnel at collector dams accomplish specific tasks for the Project Manager including:

(1) Supervising or conducting handling, inspection, and recording of data from fish sampled at the collection facility;

(2) Evaluating and recording fish condition, and recommending operational changes or inspection of facilities if fish condition indicates a problem;

(3) Providing hand counts of sampled fish, assisting the project biologist in adjusting electronic fish counts, checking hourly and daily fish counts for accuracy, and coordinating facility counts with counts of FPC smolt monitoring teams where appropriate;

(4) Conducting quality control inspections of collection facilities and transport equipment including visits to other collection facilities when work schedules can be so arranged;

(5) Monitoring the effects of smolt monitoring and research projects on fish condition and transportation activities and reporting impacts, including numbers of fish handled for research purposes and the disposition of those fish, to the project biologist;

(6) Participating in gatewell dipping as required to monitor fish condition;

(7) Preparing weekly reports summarizing fish numbers and transport activities, and;

(8) Preparing text and tabular information in the correct format for project annual reports.

8. Dissemination of Information:

a. Project biologists or agency biologists at each collector dam will be responsible for entering all pertinent information into the computer database and for transmitting daily reports to CENPW. Weekday information will be transmitted by 1500 hours on the day collected. Weekend information will be transmitted to CENPW by 1200 hours on the following Monday.

b. CENPW will process the reports and will transmit reports to CENPD on a weekly basis.

c. CENPW will coordinate daily reporting with the FPC Smolt Monitoring Program for their dissemination of information to user groups. The FPC will provide weekly summary reports of fish collected and transported in conjunction with their reports on Water Budget management, smolt monitoring activities, and hatchery release information.

d. Agency biologists will provide weekly reports detailing fish collection and transportation numbers, descaling estimates, and facility and transportation mortality estimates. The report will also contain a narrative on project activities and compliance with operating criteria. If research or smolt monitoring activities are occurring at the project, the weekly reports will include information on the number of fish sampled and sacrificed also.

9. Project Requirements for Fishery Agency Activities and Research:

a. Coordination: Agencies and tribes expecting to work at Corps dams will provide early coordination including work proposals, evidence of approval by CBFWA, information for preparation of the ESA permit for the collection and transportation program if their operation requires additional fish to be handled in the daily sample, copies of ESA permits, and project needs and requirements through written correspondence to the Chief, Operations Division, of CENPW, and shall not start work until written approval has been received;

b. Protocol: To maintain good working relationships and safe working conditions, fishery agencies, tribes, and research organizations will be required to follow courtesy and safety protocols as follows.

(1) Check in with the Project Manager upon first arrival at the project to receive information on who will be the project point of contact, and what courtesy and safety requirements must be followed;

(2) Notify the point of contact whenever arriving or departing from the project so they will know where personnel will be working and when they will be on the project;

(3) Adhere to project clearance, safety, and work procedures, and;

(4) Notify the Project Manager or his/her representative of unscheduled or non-routine work and activities.

(5) Notify the point of contact of expected guests or changes in personnel and assure that these individuals are aware of safety and work procedures.

BONNEVILLE POWER ADMINISTRATION'S SYSTEM LOAD SHAPING GUIDELINES TO ENABLE OPERATING TURBINES AT PEAK EFFICIENCY

Background

Outmigrating juvenile salmonids have several potential routes of passage past hydroelectric dams on the mainstem Columbia and Snake Rivers, including turbines, mechanical bypass, sluiceways, and spillways. Fish passage survival varies depending on the route of passage. As a result of reported high mortality rates for fish passage through turbines (Long 1968; Schoeneman et al. 1961), regional efforts have been focused on providing non-turbine passage routes for juvenile fish as a means to reduce turbine-related mortality and improve fish survival. Nevertheless, substantial numbers of juvenile fish may continue to pass through turbines; therefore, effort to minimize turbine-related mortality is a priority of the fishery agencies and Indian Tribes, National Marine Fisheries Service (NMFS), U.S. Army Corps of Engineers (Corps), and Bonneville Power Administration (BPA).

Turbine operating efficiency has a relatively direct effect on fish passage survival; the relationship between survival of juvenile fish passing through Kaplan turbines is positively correlated and roughly linear to the efficiency at which the turbines are operated. Bell (1981) recommended making every effort to operate turbines at peak efficiency at a given head during periods of peak fish passage to minimize fish mortality.

A. Turbine Efficiency

For the purposes of this document, peak turbine efficiency operation shall be based on efficiency tables provided by the Corps for each project in the Fish Passage Plan (FPP). The Corps shall ensure that these efficiency ranges are based on the best available information, and that updates are coordinated with BPA, and the Fish Facility Operation and Maintenance Committee and operating agencies. The tables will be distributed to all operating agencies prior to implementation, allowing at least two working days after receipt of the tables for implementation.

Operating efficiency of turbines is a result of wicket gate opening and blade angle for a given head (Bell 1981). As a result, there is a family of turbine efficiency curves for each project (or turbine design) for various head differentials. Operational decisions affecting turbine operations are based on efficiency curves for incremental changes in head, as provided by turbine manufacturers or empirical testing.

B. Guidelines

Objective: To reduce the mortality of outmigrating juvenile salmonids, BPA will provide the Corps' hydrosystem projects with generation requests that allow turbines at the Lower Snake (LSN) and Lower Columbia (LCOL) projects to operate within one percent of peak efficiency, or as otherwise specified, during the Peak Efficiency Operating Period, within the guidelines outlined below.

1. Peak Efficiency Operating Period.

This period is defined as 24 hours per day from March 15 through October 31 for the LCOL river projects and through November 30 for the LSN river projects. BPA will maintain generation requests that allow turbines to operate within 1 percent of peak efficiency in accordance with these guidelines however, operation may occur outside 1 percent of peak efficiency subject to the limitations listed in C and D..

Reporting of generation requests outside the 1 percent peak efficiency range relative to the applicable peak efficiency limitations during the Peak Efficiency Operating Period will be provided as outlined in E.

2. Unit Priorities.

The Corps should make every effort to adhere to unit priorities. The Corps shall follow a unit priority list that specifies which units at each LSN and LCOL project should be operated within the range of peak efficiency, to minimize impact to salmon stocks. Likewise, the Corps will also indicate the priority for operating units outside the one percent peak efficiency minimum or maximum ranges. The list will be based on the best available fish passage and turbine efficiency information, developed by the Corps and will be included in the FPP.

3. Project Priorities.

If units must be operated out of the 1 percent peak efficiency range, then BPA will make every effort to assure that generation requests to the Corps projects adhere to project priorities. Project priority may be developed weekly, based on in-season fish passage information, by the Technical Management Team (TMT).

4. Coordination.

Coordination processes should facilitate implementation by taking advantage of pre-existing interagency coordinating mechanisms (such as the COE, BOR, BPA and NMFS in-season management process, as described in the 1995 Biological Opinion on Operation of the Federal Columbia River Power System (FCRPS).

Coordination is also intended to minimize frequent disruption of FCRPS by allowing the action agencies sufficient lead time to include system operational changes in their planning activities. Sufficient time is defined as a minimum of two working days <u>before</u> implementation, unless an emergency situation exists. In the event of an emergency, implementation will begin as soon as practical given concurrent operations, hydraulic situations and loads.

Reasonable and prudent operation outside of peak efficiency for limitations listed in C.1 and C.2 below is at the discretion of the BPA and Corps. BPA and the Corps will coordinate with NMFS when operation of turbines outside of the peak efficiency range may be appropriate under provisions C.3 through C.9. Coordination will occur during the weekly in-season management team meetings, as described in the 1995 Biological Opinion on Operation of the FCRPS.

Emergency situations, described in limitations C1 and C2 below, that require an immediate change in FCRPS operation to avoid excessive take of listed salmonids may be directly coordinated at any time between NMFS and the action agencies. Coordination of an emergency change in FCRPS operation shall normally be completed immediately, with information supplied to the in-season management team described above as soon as practical. Implementation of the change(s) will occur as soon as practical given operational, hydraulic and load conditions. The action agencies shall provide points of contact to allow such emergency coordination to occur.

C. Limitations for the period March 15 through October 31 for the LCOL river projects and through November 30 for the LSN river projects

Conditions that may affect BPA's ability to operate in such a manner include:

1. System Reliability.

BPA's ability to operate the power system in a manner that enables the Corps to maximize operation of turbines within peak range will be constrained by requirements to maintain system reliability (including requirements necessary for transient and voltage stability of the transmission system), and the ability to meet system response criteria. Additionally, it is necessary to maintain a margin of resource generation on line to fulfill Northwest Power Pool (NWPP), Western System Coordinating Council (WSCC), and the North American Electric Reliability Council (NERC) reliability requirements.

BPA's Reliability Criteria for Operations[1], the Northwest Power Pool Operating Manual[2], the Western Systems Coordinating Council Operations Committee Handbook[3], and the North American Electric Reliability Council Operating Manual [4]define system response criteria and margin of resource generation.

Predictable instances of deviation from within the peak range as a consequence of prudent utility operation for control of short term system dynamics include:

-Routine responses to loss of generation, load or transmission within the interconnection including delivery of Operating Reserve Obligation to NWPP members upon request. The duration of these deviations is minimal, but dependent upon recovery by the interconnection member with the problem.

-Routine starting and stopping of generation units. These deviations are unavoidable, but very short in duration.

-Deliberate dropping of generation, i.e., instantaneous interruption of output, to preserve system integrity. This dropping could cause a brief excursion.

2. **Firm and Direct Service Industry (DSI) load.**
The LCOL and LSN projects will be operated within one percent of peak efficiency to the extent that the ability to meet firm loads is not jeopardized. According to the Regional Act, the Power Sales Contract[5] with the DSI's and House Report 96-976[6]

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[1]Section 4.

[2]Minimum Operating Reliability Criteria Sections I and II. 1.-3. and 8.

[3]Minimum Operating Reliability Criteria Section II 1.-4. and 8., and Section III 1.1 and 1.2.

[4]The entire manual has relevance. However, particularly concise portions are - Guide II.A. and the Reliability Criteria for Interconnected Systems Operation, especially the Preamble, Section I.A., B., and C., Section II.A. and B., and Section III.A.

[5]Section 8.(a).(1)

[6]Part II, page 48

dated September 16, 1980," the total DSI load will be considered firm for purposes of resource operation."

3. **Gas Supersaturation.**
Total dissolved gas saturation levels will be monitored at each project during the fish passage season. Signs of gas bubble disease will be monitored at all Smolt Monitoring Program sampling sites and selected in-river sites. Peak turbine efficiency operation may be modified if representative monitoring data indicate that gas saturation is affecting fish survival. Necessary operational modifications will be coordinated through the process outlined in B.4, above.

4. **Coordinated fishery operations.**
In the event that coordinated fishery operations and approved fishery research are not in accord with operating turbines at peak efficiency, operational modifications will be coordinated through the process outlined in B.4.

5. **Grand Coulee (GCL) and Chief Joseph (CHJ) flexibility.**
Within system reliability and firm load limitations, flexibility at GCL and CHJ will be fully used, whenever possible, before generation requests to LCOL and LSN projects are outside the peak efficiency range.

6. **Flow augmentation operations.**
Flow augmentation requests for LCOL flows at McNary (MCN) are primarily met by water releases from GCL. The decision on whether to use GCL flexibility to provide inflows to MCN at the level necessary to meet the week's LCOL flow request when fish collection is maximized for transport during the flow augmentation period shall be made through the coordination process outlined in B.4.

In-season management team flow augmentation requests for flows may exceed the one percent peak efficient operation range at LCOL/LSN projects. Meeting this flow request will take precedent over peak efficient operations. Coordination of the implementation of the flow requests will occur through the process outlined in B.4.

7. **Transport projects.**
Resolution of the conflict between spill management and turbine operation within one percent of peak efficiency at transport projects during the transport season shall be determined through the coordination process outlined in B.4, and in accordance with fish transportation guidelines, based on in-season flow and fish passage information. Care should be taken during transition

periods close to the upper flow boundary to avoid frequent switching of priorities between spill and generation.

8. **Routine maintenance and testing.**
All units at all projects must undergo maintenance and associated testing. The testing necessitates deviation from the 1 percent peak efficiency band for periods of from 15 minutes to 8 hours. Scheduling of maintenance testing will be coordinated through the process outlined in B.4 above, to ensure that it is conducted during times of low fish passage within a day to minimize impacts on fish.

9. **Flood Control.**
The FCRPS provides multiple benefits to the region. Flood control is the primary function of many of the projects on the Columbia River. In the event that river flow conditions require flood control operations, operation of turbines within the 1% peak efficiency range may be modified or suspended based on the Corps' direction. Allowing excursions from 1% peak efficiency for flood control operations would facilitate transportation, reduce excessive dissolved gas levels, and lower the risk of gas bubble disease in fish. Coordination of flood control operations will occur as outlined in B.4. See also Limitations C.3 and C.5.

During flood control operation, compliance reporting will follow procedures outlined in Section E.2.

10. **Other.**
In the event that the excursion was not explainable or caused by human error.

D. Limitations for the period March 15 through March 31, and September 1 through October 31 for the LCOL river projects and through November 30 for the LSN river projects.

Conditions that may affect BPA's ability to operate in such a manner include all limitations in C.1 through C.10, plus the requirement for prudent use of the FCRPS storage capability necessary to import energy into the FCRPS for fish storage and firm load requirements.

E. Quality Control.

The purpose of compliance reporting is to provide quality control for implementation of the Guidelines. BPA will consolidate information for the reports from BPA's system operation data, data provided by Corps project operators at LCOL and LSN projects, as well as other appropriate data sources.

BPA will provide these reports to NMFS, the FPC, and the Corps on an annual basis.. Excursions outside 1% due to unknown causes will also be documented in category 10.

The reports compiled by BPA will summarize reportable events on a per project basis for each reporting period, as allowed under limitations listed in Section C of these Guidelines. Reportable events include: (1) 1% excursions of greater than 15 minutes in duration; and (2) more than five, five minute excursions within a day. The report will also include the total number of hours units were run. Raw 1% data will be kept for four years from date of collection.

1. Normal river operation. BPA will consolidate information and prepare an annual report describing the ratio of project time outside the 1% peak efficiency range to total turbine unit operating time.

A brief explanation of the reason(s) for unit operation outside the peak efficiency range, the date, and the associated period of time will also be provided for documented excursions. Other excursions (e.g., excursions for unknown reasons) will also be reported.

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DISSOLVED GAS MONITORING PROGRAM
PLAN OF ACTION FOR 1997
Draft/24 February/Final

INTRODUCTION

This Plan of Action for 1997 summarizes the role and responsibilities of the Corps of Engineers as they relate to dissolved gas monitoring, and identifies channels of communication with other cooperating agencies and interested parties. The Plan summarizes what to measure, how, where, and when to take the measurements and how to analyze and interpret the resulting data. It also provides for periodic review and alteration or redirection of efforts when monitoring results and/or new information from other sources justify a change.

GENERAL APPROACH

The total dissolved gas (TDG) monitoring program consists of a range of activities designed to provide management information about dissolved gas and spill conditions. These activities include time-series measurements, data analysis, synthesis and interpretation, and calibration of numerical models. Four broad categories of objectives are involved:

- data acquisition, to provide decision-makers with synthesized and relevant information to control dissolved gas supersaturation on a real-time basis,
- compliance, to ascertain the extent to which existing state dissolved gas standards and federal criteria are being met;
- trend monitoring, to identify long-term changes in basin wide dissolved gas saturation levels resulting from water management decisions; and
- model refinement, to enhance predictive capability of existing models used to evaluate management objectives.

Portland, Seattle and Walla Walla Districts will continue to assume direct responsibilities for TDG monitoring at their respective projects, including data collection, transmission, analysis and reporting. The Division's Reservoir Control Center (RCC) will coordinate this activity with the Districts and other State and Federal agencies and private parties as needed to insure the information received meet all real-time operational and regulatory requirements. Districts and Division roles and functions are described in more detail in later sections of this document.

The Corps considers TDG monitoring a high priority activity with considerable potential for adversely affecting reservoir operations and ongoing regional efforts to save the salmon. It will make all reasonable efforts toward achieving at least a data quality and reliability level comparable to that provided in 1996.

Furthermore, the Corps believes it is important to maintain a two-way communication between those conducting the monitoring and the users of monitoring information. These interactions give decision-makers and managers an understanding of the limitations of monitoring and, at the same time, provide the technical staff with an understanding of what questions should be answered. Therefore, comments and recommendations received from users were and continue to be very useful in establishing monitoring program priorities and defining areas requiring special attention.

DISTRICTS/DIVISION RESPONSIBILITIES

Portland, Seattle and Walla Walla Districts Functions. Portland, Seattle and Walla Walla Districts will perform all the activities required at their TDG monitoring sites. Data will be collected and transmitted from those sites systematically and without interruption to the Columbia River Operational Hydromet Management System (CROHMS) (or any alternate data base as may be specified). Normal monitoring season will be from 1 April through 15 September for all stations except Bonneville and the stations below Bonneville. Because of the Spring Creek hatchery release, monitoring for Bonneville and stations below Bonneville will be from 10 March through 15 September. Winter monitoring, where applicable, will be at least from 15 December through 15 March.

Districts responsibilities include but are not limited the following tasks:

- preparing annual monitoring plan of action and schedule
- procuring data collection/transmission instruments
- preparing and awarding equipment and service contracts
- performing initial instrument installation and testing
- setting up permanent monitoring installations, if requested
- relocating existing stations, if warranted

- collecting and transmitting TDG data to CROHMS
- reviewing data for early detection of instrument malfunction
- making periodic biweekly service and maintenance calls
- providing emergency service calls as needed and/or when so notified
- performing special TDG measurements, if needed
- keeping records of instrument calibration and/or adjustments
- retrieving, servicing, and storing instruments at the end of the season
- making final data correction and posting in separate data base
- performing data analysis to establish/strengthen spill vs. TDG relationship
- preparing an annual activity report

All three Districts will also be responsible for (1) preparing an annual report on instrument performances, and (2) providing the necessary material including test and data analyses, charts, maps, etc. for incorporation in the Corps Annual TDG Report, which will be finalized by the Division. Additional monitoring at selected locations may be required on an as-needed-basis. Dissemination of data to outside users will remain a Division responsibility to avoid duplication and uncoordinated service.

Division's Functions. The Division will be responsible for overall coordination of the TDG monitoring program with the Districts, other State and Federal agencies and cooperating parties. The Chief, Fish & Water Quality Section, CENPD-ET-WR, is the designated TDG Division Program Coordinator. He will report through the chain of command through Chief, Reservoir Control Center and Chief, Water Management Division to Director, Engineering & Technical Services Directorate. He will consult as needed with interested staff in Planning Division, Pacific Salmon Coordination Office, Construction-Operations Division, and others.

The Division TDG Program Coordinator will provide overall guidance to his District counterparts to ensure that the monitoring program is carried out in accordance with the plan outlined in this document, including close adherence to a general schedule and operating QA/QC protocols. He will be the main point of contact for all technical issues related to the TDG monitoring at Corps projects. He will refer problems of common regional interest to relevant forums such as the NMFS's Dissolved Gas Team (DGT) for peer review and open discussion. He will make the final decisions on technical issues after considering all relevant input from interested parties.

The Division TDG Program Coordinator will meet with his District counterparts in January to discuss and firm up detailed implementation plan and schedule for the current year. Discussion will cover monitoring sites, equipment, data collection and transmission procedures, service and maintenance, budget, etc. A set of specific performance standards will be jointly prepared as a basis for reviewing and monitoring District performances. A post-session review meeting will be held annually to provide a critique of the operations and identify areas needing changes and/or improvements.

1997 ACTION PLAN

The 1997 Action Plan consists of the usual seven phases observed in previous years, plus winter monitoring. These phases are as follows :

(1) Program start-up;
(2) Instrument Installation;
(3) In-season Monitoring and Problem Fixing;
(4) Instrument Removal and Storage;
(5) Winter Monitoring
(6) Data Compilation, Analysis and Storage;
(7) Program Evaluation and Report; and
(8) Special Field Studies

The Plan of Action for all three Districts is essentially the same as in 1996. Portland and Seattle Districts will continue to use the USGS to do their TDG monitoring. Walla Walla District water quality staff will continue to operate their TDG monitoring system mainly by themselves. In general the 1997 plan is as follows.

<u>Phase 1: Program Start-Up</u>

Responsible parties (See Table 1) will be invited for a coordination meeting some time in January for preliminary discussions on a draft plan of action. This will ensure a good mutual understanding of the most current objectives of the dissolved gas monitoring program, including data to be collected, instrument location, procedures to be used, special requirements, etc. The draft plan will be presented for peer review at a January meeting of the DGT.

All three Districts will ensure that adequate funding is available for 1997 monitoring activities. Portland and Seattle Districts, having decided to continue to use the service of the USGS in 1997, will prepare the necessary MIPRs to secure those services and provide for rental and associated maintenance of the USGSs Sutron data collection platforms. Walla Walla District will review their equipment inventory and proceed with the necessary orders for new TDG instruments and DCPs, if applicable.

All three Districts will review existing instrument maintenance and service contracts and extend them as needed. Steps will be taken to ensure that all TDG equipment are serviced at least two weeks before their proposed field installation date. Where applicable, the Districts will ensure that real estate agreements and right of entry are finalized between the land owners and the Corps. All paper work for outside contracting will be completed no later than 31 January.

To date, Portland District has already initiated the MIPR process. Walla Walla District is also in the process of buying and testing additional Zeno 3200 data collection platforms. They will use short haul modems, where appropriate, to eliminate phone line and standard modem problems. Pentium computer with internal modems and watchdog timers have been purchased to replace the old 386 computers and external modems used in 1996. This equipment will eliminate past problems associated with data transmission timing, modems, and system resets. Walla Walla District is also buying at least ten state-of-the-art multi-probe gas sensors and separate barometers to gradually replace the existing Common Sensing equipment for improved overall system reliability. Seattle District is scheduling a site survey below Chief Joseph in early March to identify a suitable location for their new monitor.

At the last post-session review of the 1996 monitoring activities held 1 October 1996, EPA, the State fisheries and environmental quality departments, and the Tribes recommended that two additional stations be added to the existing network. These stations would be located one in the upper part of Lower Granite Reservoir on the Snake River, and the other, on the Columbia River upstream from its confluence with the Snake River. They are useful in reflecting TDG levels entering Corps projects from upstream river reaches. The Corps will continue to consider that recommendation in the light of other work priorities and funding limitations and capabilities. We understand that Idaho Power Company will be monitoring TDG in the Hells Canyon area this year as part of their Federal Energy Regulatory Commission's license renewal requirement.

To the extent that spill is also often scheduled at Hungry Horse, TDG monitoring below that project has also been recommended. While this recommendation is being evaluated, the BOR is planning to add a new TDG station in the forebay of Grand Coulee Dam in early 1997.

Phase 2: Instrument Installation

Instruments to be installed and their assigned locations are listed in Table 2 and shown in Figure 1. This is basically the same instrument setup as in 1996, except for two stations in the Portland District, two stations on the Clearwater River added by the Walla Walla District, and one station below Chief Joseph to be added by the Seattle District.

- The Dalles tailwater station will be repositioned at River Mile 188.9, about 1 mile downstream from the old station (same location as last September)
- Difficulty in reaching a right of entry agreement with the property owners at Wauna Mill may result in moving this monitor to another suitable location
- Peck and Lewiston stations will be reinstalled at their 1996 Clearwater River locations
- A new station will be installed on a test basis below Chief Joseph. At a minimum a recorder will be installed, with manual retrieval once every week during the peak spill season.

All instruments are scheduled to have been in place and duly connected to their Sutron or Zeno DCPs no later than 10 March at Bonneville and downstream stations, and no later than 1 April at all other stations. The station below Libby will be reactivated in May, or at least two weeks before the start of flow releases for white sturgeon. Monitoring stations below Bonneville are scheduled to be in place first, prior to the release of Spring Creek Hatchery fish, which is scheduled to start on 13 March 1997.

Stations that remain in service during the 1996-1997 winter will continue their operation with minimum interruption into the spring, following the necessary instrument service and maintenance checkup. These stations include at least the followings: International Boundary, Dworshak tailwater, Lower Granite forebay, Ice Harbor forebay, McNary forebay (Oregon and Washington sides) and tailwater, Bonneville forebay, and Warrendale. An assessment of monitoring site integrity will be conducted; any damages that may have occurred over the winter will be fixed before proceeding on to calibration and testing. Selected project personnel may be requested to assist on this task as needed.

Phase 3: In-season Monitoring and Problem Fixing

Actual data collection and transmission will start prior to the first Spring Creek Hatchery release, but no later than 15 March for stations below Bonneville, and no later than 1 April for the remainder of the monitoring network. Exact starting dates will be coordinated with the

Corps' Reservoir Control Center (CENPD-ET-WR), project biologists and cooperating agencies, based on run-off, spill, and fish migration conditions.

The following data will be collected approximately every hour:

- WC, Water Temperature (^{O}C)
- BH, Barometric Pressure (mm of Hg)
- NT, Total Dissolved Gas Pressure (mm of Hg)
- OP, Dissolved Oxygen Pressure (mm of Hg)
- NP, Nitrogen + Argon Pressure (mm of Hg)

Data will be collected at least hourly and transmitted every four hours. If feasible, the previous 12 hours of data will also be sent to improve the capability of retrieving any data that may have been lost during the preceding transmission. For Portland and Seattle Districts, data transmission will be done via the GOES Satellite, to the Corps' ground-receive station in Portland. After decoding, all data will be stored in the CROHMS data base. The USGS is planning to have the satellite data going into CROHMS and ADAPS (internal to the USGS) simultaneously to allow for some pre-screening and expeditious posting. The Walla Walla District will transmit their data hourly to CROHMS and the District's Home page on the Internet. Transmission will be through routes other than the GOES satellite.

Given their direct relevance to fish mortality, the first three parameters (WC, BH and NT) will be collected on a first priority basis. Also, given the importance of the Ice Harbor tailwater and McNary forebay data, response time for fixing any instrumentation problems at those sites will as quick as possible. The fact that Walla Walla District equipment can be interrogated from the District office will help minimize downtime. If necessary, backup non-transmitting monitors will also be installed at those sites.

Daily reports summarizing TDG and related information will be posted on the CROHMS system and the Technical Management Team's home page. To the extent feasible, the measured TDG data will be compared with model predicted values so that suspicious values can be flagged and/or discarded before they are released. Data filtering through other methods will also be made. Information provided in CROHMS Reports 101, 102, and 103 will include the following data:

- Station Identifier
- Date and Time of the Tensionometer Probe Readings
- Water Temperature, ^{O}C
- Barometric Pressure, mm of Hg
- TDG Pressure, mm of Hg

- Calculated TDG Saturation Percent (%)
- Project Hourly Spill, Kcfs (QS)
- Project Total Hourly Outflow, Kcfs (QR)
- Number of Spillway Gates Open

Stop settings, if different from the numbers provided in the Fish Passage Plan, will also be given.

This information will be available for viewing by all those who have access to CROHMS. Reconciliation between data received via the CBT and those manually recorded on the coding sheets will be made by the Reservoir Control Center staff based on the input from the field, before the data are permanently stored in the Corps' Water Quality Data Base. Additional data posting in the Technical Management Team or Portland, Seattle and Walla Walla Districts' home page will continue.

Instrument reliability and accuracy will be monitored through QA/QC procedures followed in 1996. This is a systematic maintenance and service program implemented at least once every two weeks (or more frequently if required by specific site conditions). Every two weeks, competent personnel (Contractor or Corps staff) will visit the monitoring sites to check for and, if necessary, fix site problems (probes clogging, instruments out of calibration, etc.) using a portable calibration instrument as reference. If data recorded by the fixed sensors are different from those recorded by the portable sensors, appropriate corrections will be made to current as well as past data already stored in CROHMS as soon as possible. Significant and/or unusually large changes will be reported immediately to all customary users, including the Fish Passage Center. Adequate inventory of spare instruments will be maintained to ensure that at least one backup monitor will be made available for deployment as necessary in each Corps District. A malfunctioning instrument will be repaired within 24 to 48 hours, depending on the remoteness of the instrument location and TDG conditions. High priority will be on fixing a faulty instrument when TDG are or expected to be in excess of the current state standards.

TDG instruments will be maintained by Contractor and/or Corps staff. Instruments needing repairs that are beyond the staff's capability will be shipped to the manufacturer. Repairs of communication network will be done by in-house water quality and information management staff. Service and repairs of the Sutron DCPs will be handled by USGS Stennis Center (MS) staff. Service and repairs of the Zeno DCPs will be performed by a contractor.

To better understand the physical process of dissolved gas distribution across the reservoirs and its dissipation along the various pools, selected transect studies will continue to be conducted on an as-time-permits basis. An additional objective for this activity is to be able to define how representative readings from current monitoring sites are with respect to the entire river reach. Model runs using GASSPILL and other acceptable tools such as a Neural Network model will be performed as needed to define the range of expected/acceptable TDG levels under various spill conditions.

Phase 4: Instrument Removal and Storage

Tensionometers will be removed shortly after the end of the monitoring season (15 September) by Corps staff or the USGS, except for those that are slated for continued winter monitoring. They will be serviced by the maintenance and service contractors and stored at a convenient location until the beginning of the next monitoring season. Sutron DCPs used by Portland and Seattle through the USGS will be returned to USGS Stennis Center, MS . A selected number of tensionometers and spare DCPs will be available for off-season special monitoring activities upon request.

Phase 5: Winter Monitoring.

The same few stations that were selected for winter operation in 1996-1997 will be retained for compliance monitoring in the winter of 1997-1998. These included, at a minimum, stations located at Dworshak tailwater, Lower Granite forebay, Ice Harbor forebay, McNary forebay and tailwater, Bonneville forebay, and Warrendale. Implementation details will be worked out as needed.

Phase 6: Data Compilation, Analysis and Storage

Time and staff availability permitting, statistical analyses will be conducted by Corps staff and contractors to fill data gaps and develop trends and relationships between spill and TDG saturation. Efforts will continue to be expanded on the calibration and application of GASSPILL (Dissolved Gas) and COLTEMP (Water Temperature) models, and finding ways to facilitate and/or improve user access to the TDG and TDG-related data base. The GASSPILL model will be periodically modified to incorporate the latest findings brought about by the Gas Abatement Study. Data collected at and transmitted from all network stations will be ultimately stored at CENPD-ET-WR, where they can be accessed through a data management system such as HEC-DSS.

Phase 7: Program Evaluation and Summary Report

An annual report will be prepared after the end of the normal (spring and summer) monitoring season to summarize the yearly highlights of the TDG monitoring program. It will include a general program evaluation of the adequacy and timeliness of the information received from the field, and how that information is used to help control TDG supersaturation and high water temperature in the Columbia River basin. Information on the performance of the instruments (including accuracy, precision and bias associated with each parameter) and the nature and extent of instrument failures will be documented. The Annual TDG Monitoring Report will be prepared by Division staff, based on field input and other material provided by each District. It will also contain suggestions and recommendations to improve the quality of the data during the FY97 monitoring program.

Phase 8: Special Field Studies

As provided for in Phase 3, additional monitoring of dissolved gas saturation will be conducted on a as-needed basis. Current plan for additional monitoring includes transect measurements below selected dams to : 1) establish the relationship between various spill amounts and TDG saturation, and 2) plot TDG variations within a given cross-section of the river, especially a cross-section that includes a fixed monitoring station. Special consideration will be made at evaluating improvements (or any other changes) to TDG levels brought about by the new flip-lips now under construction at Ice Harbor and John Day Dams. Efforts will also be expanded in learning more about dissolved gas saturation dissipation along the fish migration route, using monitoring made from moving fish barges and deployment of self-contained wireless probes. These on-going efforts are expected to continue for several years.

Table 1. List of Contact Persons

Project	**Name**	**Position**	**Phone #**	**E-Mail/ Fax**
Intern'al Boundary	Jim Doty	BOR	(208)378-5272	
	Norbert Cannon	BOR	(208) 334-1540	(208) 334-1858
Grand Coulee	Dave Zimmer	BOR	(208) 378-5088	(208) 378-5066
	Norbert Cannon	BOR	(208) 334-1540	
Chief Joseph	Marian Valentine	NPS	(206) 764-3529	
	Joe Munk	Chief of Ops.	(509) 686-5501	
	Bob Drzyemkowski Ray Smith	USGS	(509)353-2633	
Wells	Rick Klinge	Biologist	(509) 884-	(509) 884-0553

(Douglas)			7191	rklinge@televar.com
Rocky Reach (Chelan)	Robert MacDonald	Biologist	(509) 663-8121	(509) 664-2898 robertm@televar.com
	Steve Hays	Biologist	(509) 663-8121	
Rock Island (Chelan)	Robert MacDonald	Biologist	(509) 663-8121	
	Steve Hays	Biologist	(509) 663-8121	
Wanapum (Grant)	Chris Carlson	Biologist	(509) 754-3541 x2154	(509) 754-5095
	Mable Rooker		(509) 754-3541	
Priest Rapids (Grant)	Chris Carlson	Biologist	(509) 754-3541	
	Mable Rooker			
Dworshak	Rick Jones	Limnologist	(509) 527-7281	
	Ben Tice		(509) 527-7267	
	Russ Heaton		(509) 527-7282	
Lower Granite	Jones/Tice	Biologist		
	Jesse Smiley	Chief of Ops.	(509) 843-1493	
Little Goose	Jones/Tice			
	Ray Eakin	Chief of Ops.	(509) 399-2233	
Lower Monumental	Jones/Tice			
Ice Harbor	Jones/Tice			
McNary	Jones/Tice			(503) 326-6900
John Day	Faith Ruffing	Biologist	(503) 326-6468	
	Jim Williams	Project. Supt.	(541) 298-7502	
The Dalles	Faith Ruffing			
	Jim Williams	Project Supt.	(541) 298-7535	
Bonneville	Faith Ruffing			
	Darrell Hunt	Chief of Ops.	(541) 374-8338	
Warrendale	Faith Ruffing			
Skamania	Faith Ruffing			
Camas/Washougal	Faith Ruffing			

Kalama	Faith Ruffing			
Wauna Mill	Faith Ruffing			
	USGS Portland			
	Joe Rinella	USGS	(503) 251-3278	
	Greg Fuhrer	USGS	(503) 251-3231	gjfuhrer@usgs.gov
	Dwight Tanner	USGS	(503) 251 3289	
	Howard Harrison	USGS	(503)251-3235 (cell) 816-1336	heharris@usgs.gov (503)251-3470
Division Program Coordination	Bolyvong Tanovan	Hydraulic. Engineer	(503) 326-376 fax (503) 326-4161	Bolyvong.S.Tanovan@NPD01.usace.army.mil
	Mary Todd Uhlir		(503) 326-4938	Mary.T.Uhlir@NPD01.usace.army.mil

Table 2. 1997 Dissolved Gas Monitoring Network

Station ID	**Location**	**Owners**
CIBW	International Boundary	USBR
GCGW	below Grand Coulee	USBR
CHJ	Chief Joseph Forebay	NPS
	Chief Joseph Tailwater	NPS
LIBM	below Libby	NPS
WEL	Wells Forebay	Douglas Co. PUD
RRH	Rocky Reach Forebay	Douglas Co. PUD
RIS	Rock Islands Forebay	Chelan Co. PUD
WAN	Wanapum Forebay	Grant Co. PUD
WANW	Wanapum Tailwater	Grant Co. PUD
PRD	Priest Rapids Forebay	Grant Co. PUD
PRXW	Priest Rapids Tailwater	Grant Co. PUD
DWQI	below Dworshak	NPW
PEKI	Peck, Clearwater River	NPW
LEWI	Lewiston, Clearwater River	NPW
LWG	Lower Granite Forebay	NPW
LWNW	Lower Granite Tailwater	NPW
LGS	Little Goose Forebay	NPW
LGSW	Little Goose Tailwater 0.7 mi. RB	NPW
LMN	Lower Monumental Forebay	NPW
LMNW	Lower Monumental Tailwater 0.8 mi. LB	NPW
IHR	Ice Harbor Forebay	NPW
IDSW	Ice Harbor Tailwater 3.6 mi. RB	NPW
MCQW	McNary Forebay (WA)	NPW
MCQO	McNary Forebay (OR)	NPW
MCPW	McNary Tailwater (WA) 1.4 mi. RB	NPW
JDA	John Day Forebay	NPP
JHAW	John Day Tailwater	NPP
TDA	The Dalles Forebay	NPP
TDDO	The Dalles Tailwater (new site at RM 1[illegible]9)	NPP
BON	Bonneville Forebay	NPP
WRNO	Warrendale, OR	NPP
SKAW	Skamania, WA	NPP
CWMW	Camas-Washougal, WA	NPP
KLAW	Kalama, WA	NPP
WANO	Wauna Mill, OR	NPP

USBR= U.S. Bureau of Reclamation NPP= Portland District
NPS= Seattle District NPW= Walla Walla District
LB=Left bank RB=Right bank MC=mid-channel

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NMFS Biological Opinion on operation of the FCRPS in 1995 and future years

signed 2 March 1995

VIII. Reasonable and Prudent Alternative to the Proposed Action

Immediate Actions to Improve Survivals

2. The COE shall spill at the Snake and Columbia River projects in order to increase fish passage efficiency and survivals at the dams.

The COE, during the juvenile spring/summer chinook migration season (April 10 - June 20 in the Snake River and April 20 - June 30 in the Columbia River), shall spill at all projects, including collector projects, to achieve a fish passage efficiency target of 80%, except under the following low flow conditions: During any week in which unregulated weekly average flows at Lower Granite Dam are projected to be less than 100 kcfs, no spill shall occur at Lower Granite Dam; during any week in which unregulated weekly average flows at Lower Granite Dam are projected to be less than 85 kcfs, no spill shall occur at Lower Granite, Little Goose, and Lower Monumental dams, unless the TMT recommends that spill occur. During the fall chinook migration season (June 21 to August 31 in the Snake River and July 1 to August 31 in the Columbia River) the COE shall spill at all non-collector projects to achieve a fish passage efficiency target of 80%.

It is NMFS' view that the best condition for an evaluation of the effects and efficacy of spill to improve inriver survival would be for a single spill regime to prevail throughout the spring migration season. NMFS' first draft of the biological opinion used a volume runoff forecast in the Snake River to trigger spill operations, which would then remain constant during the season. In making recommendations to spill at collector projects when flows are below target levels, the TMT should take into consideration the objective of having a credible evaluation of the spill program. Accordingly, TMT recommendations to spill at the above projects in the Snake and Columbia rivers at flows below the triggers specified should take into account past flow conditions and future flow projections, how close flows are to the trigger levels and how much augmentation is planned, the timing of the juvenile migration, and the need for a credible evaluation. If the use of weekly flow triggers compromises an evaluation, NMFS will consider returning to a volume runoff approach.

During low flow periods, spill at collector projects is reduced or eliminated in order to increase the proportion of fish transported. The discussion under measure 3 explains the rationale for increasing transportation under low flow conditions.

Spill levels calculated to obtain an 80 percent fish passage efficiency are listed below for each lower Snake and lower Columbia River dam. These levels are expressed in percent of instantaneous project flow during the spill period and were calculated with the best available information regarding spring and fall chinook salmon guidance efficiency, spill efficiency, fish passage diel and project operating conditions. Spill periods are 24 hours at Ice Harbor, The Dalles and Bonneville Dams and 12 hours (1800-0600) at all others.

DAM	LGR	LGS	LMN	IHR	MCN	JDA	TDA	BON
% Flow, Spring	80	80	81	27	50	33	64	*
% Flow, Summer	**	**	**	70	**	86	64	*

* An 80% FPE level is not obtainable at Bonneville Dam given a day time spill cap of 75 kcfs and the current low fish guidance efficiency levels. This spill cap (in place to reduce adult fallback) limits obtainable spring FPE to 74% and summer FPE to 59% at 100 percent nighttime spill.

** Spill is not recommended at these projects for summer migrants.

The spill levels necessary to obtain this FPE may be limited by total dissolved gas (TDG) in the river between each project. Specific monitoring sites for the purposes of in-season dissolved gas management should be selected on the basis of data consistency and relationship to fish exposure. Until it can be determined how tailrace monitoring stations relate to the river reaches between monitoring sites and how TDG data collected at these sites relate to fish experience, forebay monitoring data will be used for in-season management. Water quality and other fishery management agencies have recommended that monitoring sites be located below mixing areas, the forebay monitors are the only presently established monitors that consistently provide mixed flow data. Tailrace monitors are of limited usefulness at this time, however, they probably best estimate maximum acute exposure, particularly for adults.

Spill will be reduced as necessary when the 12 hour average TDG concentration exceeds 115% of saturation (or as limited by state water quality standard modifications) at the forebay monitor of any Snake or lower Columbia river dam or at the Camas/Washougal station below Bonneville Dam or another suitable location to measure accurately chronic exposure levels. Spill will also be reduced when 12 hour average TDG levels exceed 120% of saturation (or as limited by state water quality standard modifications) at the tailrace monitor at any Snake or lower Columbia River dams. Average concentrations of dissolved gas will be calculated using the 12 highest hourly measurements per calendar day. The use of 12-hour averages, rather than 24-hour averages, is an attempt to set a more conservative standard, and to relate the measured concentrations of dissolved gas to the 12-hour spill cycles. Spill will also be reduced when instantaneous TDG levels exceed 125% of saturation (or as limited by state water quality standard modifications) for any two hours during the 12 highest hourly measurements per calendar day at any Snake or lower Columbia River monitor.

The intent of these gas caps is to ensure that the long term exposure of adult and juvenile migrants is to TDG levels that do not exceed 115%. NMFS concludes this operation accomplishes that goal for several reasons. Radio telemetry studies indicate that juvenile salmonids tend to move out of tailrace areas within a few hours (Snelling and Schreck unpublished) and that adults tend to move about laterally in tailraces prior to ascending ladders (Johnson et al. 1982, Turner et al. 1983). These movement patterns limit exposure to high spill basin TDG levels. As spilled water moves out of the tailrace the TDG level decreases at some point below the project (depending on ratio of these flows and river topography) because the spilled water mixes with water from the powerhouse. For instance, Blahm (1974) found that, given moderate spill levels, the river was well mixed within 2.5 miles of The Dalles Dam and 15 miles below Bonneville Dam. The requirement that TDG levels in the forebay be limited to 115% will help ensure that areas where migrating juveniles may spend long periods of time do not have TDG levels in excess of 115%. Radio tag studies have indicated that some spring migrating juvenile salmon may be delayed from several hours to several days in these areas (Snelling and Schreck unpublished, D. Rondorf, NBS, February 24, 1995, pers. comm.). Finally, the fact that spill is intermittent at many projects will help limit dissolved gas exposure of fish holding in the forebays and other areas between the projects. This is particularly true for adult migrants.

After reviewing available information on dissolved gas exposure as well as information and recommendations submitted by the parties during the IDFG v. NMFS discussions, NMFS concluded that 115% TDG measured in the forebays was a reasonable interim measure to adopt. Several commenters argued that the Environmental Protection Agency's recommended water quality limit of 110% represented an appropriate level and should not be varied. State and tribal entities developed a risk assessment that suggested that long term exposure to 120% did not pose significant risks to migrating fish and that the benefits of improved dam passage outweighed these minimal risks of TDG exposure at 120%. Still other commenters noted the spill at collector projects reduced the numbers of fish transported and that any risk assessment had to consider the benefits of transportation. The issue of transportation is addressed more fully in measure 3 below.

NMFS concluded that it was appropriate to seek an operation that would result in the EPA criteria of 110% being exceeded primarily because of: 1) the ability of fish in a river environment to compensate hydrostatically for the effects of dissolved gas supersaturation, and 2) the daily fluctuation in levels of dissolved gas throughout most of the river. In a river environment, depth of migration reduces TDG effects on migrants. Each meter of depth provides pressure compensation equal to a 10% reduction in TDG. Shew et al. (Undated) and Turner et al. (1984b) noted through tunnel studies that net entry rates through McNary and Bonneville dam ladder entrance tunnels were highest for the deepest (3.4m) tunnels. Other studies indicate that adult and juvenile salmon tend to spend most of their time at or below one meter of depth (Smith 1974). Blahm (1975) concluded that shallow water tests were "not representative of all river conditions that directly relate to mortality of juvenile salmon and trout in the Columbia River." In deep tank tests, salmonids exposed to 115% TDG levels did not experience significant mortality until exposure time exceeded approximately 60 days (Dawley et al. 1976).

NMFS also concluded that it was not appropriate as an initial interim level to seek an operation that would result in chronic exposure to TDG level of 120%, as recommended by the states and tribes. In general, chronic exposure to TDG levels of 120% with hydrostatic compensation does not cause significant mortality until exposure time exceeds 40 days (Dawley et al. 1976). This is generally more time than it takes Snake River juvenile and adult migrants to travel between Lower Granite and Bonneville dam. Nevertheless, NMFS concluded that the more conservative level of 115% is appropriate because of concerns about the potential sublethal effects of gas bubble disease. The state and tribal report on "Spill and 1995 Risk Management" summarized the studies showing evidence that swimming performance, growth and blood chemistry are affected by high dissolved gas levels. The report correctly states that it is only inferential that these symptoms may result in susceptibility to predation, disease and delay. In fact, studies conducted in 1993 and 1994 by the National Biological Service indicated that juvenile chinook salmon that have been exposed for eight hours to high TDG (and exhibiting microscopic signs of gas bubble disease) are no more vulnerable to northern squawfish predation than control fish that had been held in equilibrated water (Mesa and Warren, in review). Ultimately the analysis in the state and tribal report did not assume any level of mortality as a result of these sublethal effects.

NMFS concludes that the impairments to migrating fish as a result of the sublethal effects of dissolved gas may be sufficiently grave to warrant caution in setting long term exposure levels above 110%. In particular, long term exposure to levels in excess of 110% decrease swimming ability (Dawley and Ebel, 1975); fish stressed with high levels of dissolved gas have been reported to have less swimming stamina (Dawley et al., 1975); and gas bubbles in the lateral line can impair sensory ability. In addition, although fish in deep tank studies are less affected by high levels of TDG than fish in shallow tanks, some mortalities still occur despite a water depth that is apparently adequate for protection. There is no evidence that fish can 'sense" TDG supersaturated water and deliberately sound to compensate.

At specific projects where specific levels of spill, particularly daytime spill have been shown to be detrimental to fish passage, timing and/or amounts of spill may have to be adjusted (for specific details see NMFS 1994b). Spill may also be limited at projects where it can be demonstrated that spill may be detrimental to system spill allocation. One such project is John Day Dam, where very low amounts of spill result in very high TDG levels. These high TDG levels then limit the amount of spill possible at dams downstream. For instance, by reducing spill by 10 to 20 kcfs at John Day Dam, it may be possible to increase spill at The Dalles or Bonneville dams by 20 to 40 kcfs. The exact relationship will need to be developed through in-season spill/TDG testing. The limitation of spill may also apply at The Dalles Dam to minimize the passage of spilled flow and fish over the high predation risk area in the shoals below the dam (see specific details in NMFS (1994b). The details regarding this limitation will be decided in-season through consultation with predation experts and will likely depend on ambient flow and the spill levels obtainable under the TDG limitations. In 1995, spill at Ice Harbor, The Dalles, and John Day Dams may be modified to accommodate research activities if NMFS determines that the spill modifications will not affect the validity of the transport vs. in-river survival study. These spill operations should be treated as interim until the effects of TDG on migrating salmonids are more fully evaluated and until a spill/transport rule curve can be developed. The rationale for flow targets associated with spill at collector projects is related to transportation policy and discussed under measure 3 below.

Migration over the spillways or through the bypass systems are the safest routes of passage at the dams. Injury and mortality can occur through each route of passage (turbines, spillways, ice and trash sluiceways, juvenile fish bypass systems), but loss rates via the spillways and bypass systems are low relative to passage by the turbines. For both spring/summer and fall chinook salmon, mortality of fish passing over the spillways or through the bypass systems generally ranges from 0-3% (Schoeneman et al. 1961; Heinle 1981; Ledgerwood et al. 1990; Raymond and Sims 1980; Iwamoto et al. 1994). Direct turbine mortality can range from 8-19% for yearling chinook salmon and 5-15% for subyearling chinook salmon (Holmes 1952; Long 1968; Ledgerwood et al. 1990; Iwamoto et al. 1994). Values of turbine and spill mortality are not available for sockeye salmon. However, it is reasonable to assume that these values are similar to or greater than values for yearling chinook salmon due to size and timing of migration and due to the greater susceptibility of sockeye to physical injury and mortality in project passage and handling (Gessel et al. 1988; Johnsen et al. 1990; Koski et al. 1990; Parametrix 1990; Hawkes et al. 1991).

This spill program is experimental due to uncertainties about benefits of transportation of smolts relative to in-river migration, as well as uncertainties about the effect of nitrogen supersaturation on free-swimming fish in the river. Gas supersaturation is a negative effect of spill and the precise relationship between spill levels and gas bubble disease in juvenile and adult salmon migrating in the Columbia and Snake Rivers is not known. The spill program will be accompanied by an extensive physical and biological dissolved gas monitoring effort (see measure 16) as well as studies to assess reach survival and to compare survival of transported versus in-river migrants, as well as studies that compare adult returns from transported fish versus fish that migrate in-river under improved in-river migration conditions (i.e., improved flows and improved passage survival at dams through spill). Ideally a spill program, rather than setting a gas cap across all projects, would be based on a project-by-project analysis, with the benefits of spill passage balanced against the risks of gas bubble disease at each project. Such an analysis will require more information about the TDG levels that result at different levels of spill at each project, in relation to spill at other projects, and more information about the lethal and sublethal effects of creating supersaturated conditions through the river.

Water Management Division
Environmental Resources Division
Operations and Construction Division

21 November 1996

North Pacific Division Policy
on Spill and Total Dissolved Gas
IMPLEMENTATION GUIDELINES

1. Instances that could lead to spill and potential high levels of TDG include but are not limited to the following:

- special reservoir operations associated with endangered species or water quality elements
- scheduled and unscheduled unit outages
- flood control or dam safety operations
- pre-approved research studies
- special operational constraints allowed/required for construction or maintenance
- contract work.

In those instances, types of remedial and/or preventive actions that may be considered include the following:

- storing excess runoff at upstream reservoir(s);
- minimizing the number of nonfunctioning turbine units;
- distributing the spill over longer hours;
- spreading spill to other projects;
- operating turbines outside the 1% peak efficiency flow range;
- changing spillway gate settings and/or spill patterns;
- avoiding spill that produces excess TDG during fish passage periods;
- revising or rescheduling activities to occur during low flow periods.

2. When there is a voluntary or planned spill operation that is likely to cause high TDG levels, the states and other affected parties will be kept informed in a timely manner directly or through existing management processes (such as Technical Management Team). Information to be provided will include:

- spill location(s) and amount(s);
- time duration and area coverage;

- predicted dissolved gas levels;
- monitoring plan(s); and
- preventive measure(s) planned or already in place.

If the spill operation mentioned earlier has also the potential for impacting ESA-listed fish species, information will be provided to the National Marine Fisheries Service and/or the U.S. Fish and Wildlife Service (depending on which agency has jurisdiction), and other interested federal and regional agencies or offices via direct communication or existing mechanism (such as the Technical Management Team). This information will be updated periodically as long as conditions warrant. Coordination through established forums (e.g. Technical Management Team) will be extended to all other state, tribal, Federal and regional agencies that are interested in the effects of spill on aquatic resources, including but not limited to ESA-listed stocks.

3. During periods of high runoff or other circumstances that require spilling over several or all projects in the hydropower system, a spill priority list will be developed in coordination with the Technical Management Team and other entities and implemented. The spill priority list will specify the order in which the projects should spill and the spill caps at each of those projects. The overall objective is to avoid creating localized detrimental dissolved gas concentrations where ESA-listed species and other resident species are present.

4. To minimize the cumulative effects of dissolved gas supersaturation, consideration will be given to spilling at the lower Columbia River projects before spilling at the upper Columbia and lower Snake Rivers projects. Projects that show the least propensity to create high TDG levels will be given first consideration. All projects in the Columbia River Basin, including appropriate Willamette River projects, may be placed on the spill priority.

5. Although water quality monitoring is a year-round responsibility, it is recognized that currently dissolved gas monitoring instruments are usually not in operation in the winter and that not all sites are monitored on a continuous basis. To carry out this water quality policy, both short and long-term actions will be implemented as explained below.

a. For the short-term, the Corps plans to respond quickly to meet data collection, analysis and additional monitoring requirements. Adequate inventory of data collection and transmission equipment will be maintained to allow for rapid installation at critical points along the river. The necessary predictive modeling capability will also be developed and maintained to evaluate operational scenarios. Data from short-term sampling stations will be correlated with the data from the regular network to fill in data gaps.

b. For the long-term, a small skeleton network will be established for year-round monitoring of dissolved gas at projects where spill is most likely to occur and where conditions exist for controlling spill. The Corps will also continue to evaluate and monitor various aspects of water quality management and its effects on the ecosystem in the framework of overall water resources management, and ensure that the results are shared with all interested parties.

6. Functional elements responsible for carrying out this policy and their respective roles are as follows:

North Pacific Division

Reservoir Control Center:

- develop and update the spill priority list to reflect fish movement or input received from the Districts;
- coordinate field monitoring with the districts;
- perform data analysis and model prediction;
- coordinate with Division and District Environmental Resources staff on biological constraints and requirements and any potential ESA implications;
- plan and coordinate real-time operation with BPA, the districts and the projects and other project owners;
- assure implementation of the Fish Passage Plan or coordinate necessary deviations;
- issue operational instructions to the projects;
- monitor actual implementation of these instructions and make adjustments as needed; and
- provide status reports to other Division and District elements and outside agencies.

Environmental Resources:

- coordinate necessary deviations of the Fish Passage Plan as needed;
- in consultation with District elements, provide biological support, including determination if an action has the potential for affecting an ESA-listed stock or result in adverse modification of critical habitat;
- coordinate or participate in coordination with NMFS and/or U.S. Fish and Wildlife Service and District staff as needed on ESA issues involving listed stocks;
- make recommendations on biological constraints (e.g. inwater work windows) and requirements, in consultation with the Districts

Operations and Construction:

- coordinate planned actions (e.g. maintenance) developed by the districts with appropriate Division elements;

- assure that any operations that may impact ESA-listed stocks have been coordinated prior to implementation; and
- provide an after-the-fact documentation for emergency actions.

Pacific Salmon Coordination Office:
- provide guidance on policy decisions; and
- provide regional interface on spill-related issues at the policy level

Office of Counsel:
- provide legal advice and support as needed.

Alaska, Portland, Seattle and Walla Walla Districts

Districts Water Quality/Water Management Elements:
- install, operate and maintain dissolved gas monitoring stations;
- collect and transmit total dissolved gas and other data to the Reservoir Control Center;
- conduct TDG abatement studies;
- evaluate station accuracy in representing TDG conditions in the river/reservoir;
- advise and recommend operations to minimize high dissolved gas levels to the RCC, and
- coordinate planning and scheduling of special reservoir operations with the Reservoir Control Center and other District elements.

District Operations and Construction Division:
- develop schedules for maintenance and service of project facilities and equipment that potentially require spill;
- coordinate planning and scheduling of special reservoir operations required by maintenance and schedule and construction activities with the Reservoir Control Center, other District elements; and contractors; and
- advise and recommend operations to minimize high dissolved gas levels.

District Environmental Resources Section
- in consultation with Division's Environmental Resources staffs, provide biological support, including determination if an action has the potential for affecting an ESA-listed stock or result in adverse modification of critical habitat;
- in coordination with Division Environmental Resources, assure implementation of the Fish Passage Plan or coordinate necessary deviations;
- coordinate or participate in coordination with NMFS and/or U.S. Fish and Wildlife Service and Division Environmental Resources staff as needed on ESA issues involving listed stocks;

- make recommendations on biological constraints (e.g. inwater work windows) and requirements, in consultation with the Division Environmental Resources staff, and.
- in cooperation with the Projects, provide reports on emergency operations that may have impacted aquatic resources (particularly ESA-listed stocks) and estimated duration and extent of effects.

<u>District Office of Counsel:</u>
- provide legal advice and support as needed, especially for ESA/NEPA issues, and
- provide litigation support.

<u>Projects:</u>
- identify maintenance requirements as far in advance as possible to enable proper advance coordination;
- carry out reservoir operations as instructed by the Reservoir Control Center;
- report back on operational and other problems needing attention, including fish conditions affected by TDG;
- advise and recommend operations to minimize high TDG levels;
- identify and recognize ESA requirements in implementing reservoir operations; and
- provide reports on emergency operations that may have impacted aquatic resources (particularly ESA-listed stocks) and estimated duration and extent of effects.

Guidelines for Dewatering and Fish Handling (Salvage) Plans

Each Corps of Engineers mainstem project on the Columbia and Snake rivers have dewatering and fish handling plans which cover the dewatering of various project facilities which may contain fish at the time of dewatering. The plans contain procedures for any handling or salvaging of fish within a facility or project area when it is dewatered. During 1997, all dewatering and fish handling plans should be reviewed and revised where appropriate to reflect any new information and guidelines listed below. The plans shall be reviewed by the Fish Passage O&M Coordination Team during 1997.

- **Coordination:** The dewatering and fish handling (salvage) plan for each project shall include coordination procedures for planned and emergency fish salvage activities. The project fishery biologist shall coordinate all fish salvage activities with project and District personnel.

- **Fish Salvage Briefing:** The plans shall include a requirement that a fish salvage briefing for <u>all participants</u> involved in a dewatering activity be held prior to each dewatering activity. The briefings should lay out responsibilities for each participant in the dewatering activity. All emergency fish salvage operations will be coordinated and overseen by the project fishery biologist or fisheries staff if possible.

- **Personnel:** The dewatering plans shall specify the number and specialization of personnel required for each type of dewatering activity. Personnel for fish salvage include the project fishery biologist, fisheries staff, crane operators, riggers, winch operators, forklift operators, and maintenance workers. To minimize fish stress and mortality, adequate personnel must be available for fish salvage activities.

- **Facilities and Dewatering Procedures:** The salvage plans shall be project specific and shall contain step by step dewatering and fish salvaging procedures for all facilities and project features which may contain fish. The most common areas include adult fish ladders and collection channels, juvenile bypass systems, juvenile fish sampling facilities, turbines scroll cases and draft tubes, gatewell slots, and navigation locks. Individual projects may have other facilities or features which contain fish. The plans shall specify how the facility is to be dewatered and where and how fish are to be salvaged. Each project shall have designated release sites for the various types of fish expected to be encountered during each dewatering activity.

- **Fish Handling Equipment:** The plans shall specify all fish handling equipment required for handling fish during each type of dewatering activity. Typical fish salvage equipment includes gloves, hand held fish nets, seines, fish buckets, gatewell dip baskets, and fish transportation tanks and vehicles. All equipment should be in good condition and pre-positioned before dewatering begins.

- **Support Equipment:** The plans shall include a detailed listing of all support equipment required for each dewatering activity. This should include items such as hard-hats, boots, safety harnesses, flashlights, portable radios, ladders, cranes, man-baskets, pumps, forklifts, and any other equipment required for a dewatering activity. The plans shall specify where equipment is required for use during a dewatering and where certain equipment should be pre-positioned before work begins. the heavy equipment needed for fish salvage activities.

- **Fish Safety Pools:** The fish salvage plans shall identify the areas in each facility which pond enough water to hold fish temporarily. The plan shall specify whether the safety pools are usually maintained by leakage or a controlled water flow. The plans shall specify how long and under what conditions each safety pool can be used to hold fish safely. If the there is the potential for the safety pools to freeze over or loose their water source, the fish should be evacuated as soon as possible.

- **Fish Handling Procedures/Practices:** The plans shall include procedures to minimize fish mortality and stress. The primary fish handling objective will be to collect and transport fish to release sites with minimal stress and without injury or mortality to any fish. Plans shall specify the details of all fish handling activities including how to crown and handle fish within each facility, specifics on the number of fish which can be hauled or transported in containers or transport tanks at varying water temperatures, and how to release fish at each project.

- **Fish Handling Guidelines:** General fish handling guidelines which should be reflected in fish handling/salvage plans are detailed here. Adult salmonids and other large adult fish should be salvaged first. Netting of fish should be minimized whenever possible. Fish should not be crowded in the holding containers. Fish will be less stressed in larger containers (300 gallons or larger preferred), in colder water, and with supplemental oxygen or aeration. If fish are transported in warmer water (>65° F), fewer fish should be transported in a container and holding times should be shorter. All fish will be returned to the river as soon as possible at specified, predetermined release sites. Fish should not be held in holding tanks or containers for more than two hours under any circumstances. Fish should be released from the holding tanks into the river as soon as the fish salvage operation stops for any reason. Fish should be carefully released into the tailwater or forebay with a short vertical drop to the river. Fish release slides are desirable. The water temperature in the transport tank should be monitored. The water temperature in the transport or holding tanks will not be more than 2° F different from the river water. Fish should be removed prior to debris removal if possible.

- **Fish Salvage Report:** The fish salvage plan should include a report form for the fish salvage operations. These forms should be completed for all fish salvage activities and kept permanently on file at each project.