SECTION 8

LITTLE GOOSE DAM

Little Goose Dam

1. Fish Passage Information. The locations of fish passage facilities at Little Goose Lock and Dam are shown in Figure LGS-1. Dates of project operations for fish purposes and special operations are listed in Table LGS-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. The Little Goose juvenile facilities consist of a bypass system and juvenile transportation facilities. The bypass system contains extended length submersible bar screens (ESBS) with flow vanes, vertical barrier screens (VBS), 12" 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 LGS-2. 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 that may impact juvenile fish passage or facility operations should be conducted during the maintenance season.

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 operating 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

Insert Figure LGS-1

Table LGS-1. Dates of project operations for fish purposes at Little Goose Dam, 1999.

Table LGS-2. Juvenile migration timing at Little Goose Dam based on juvenile fish collection numbers.

% Collection	1995	1996	1997	1998	1999
Yearling Hatchery Chinook					
10%	5/1	4/27	4/25	4/26	4/27
90%	5/24	5/25	5/23	5/16	5/25
Yearling Wild Chinook					
10%	4/22	4/21	4/19	4/25	4/20
90%	6/12	5/22	5/18	5/28	5/31
Subyearling Chinook					
10%	7/13	6/25	7/7	7/5	6/21
90%	8/30	8/13	8/25	8/12	8/7
Hatchery Steelhead					
10%	5/6	4/23	4/25	5/1	4/28
90%	5/26	5/21	5/25	5/26	5/29
Wild Steelhead					
10%	5/1	4/14	4/22	4/29	4/25
90%	5/25	5/21	5/19	5/27	5/30

downstream facing entrances and a side entrance into the spillway basin with the two downstream entrances operated. 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 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 and February to minimize the impact on upstream migrants. Table LGS-3 lists primary passage periods by species and shows the earliest and latest date of peak passage that 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.

2. Project Operations.

2.1. Spill Management. Involuntary spill at Little Goose is the result of river flow exceeding powerhouse capacity, insufficient generation loads to pass the river flow, turbine unit outages (forced or scheduled), 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 Little Goose shall be distributed in accordance with the spill pattern included at the end of this section, Table LGS-8. Special spills for juvenile

Table LGS-3. Adult migration timing at Little Goose Dam from 1969-1999 based on fish counts.

Species	Counting Period	Date of Peak Passage	
		Earliest	Latest
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

fish passage will be provided as detailed in Appendix A (Special Project Operations and Research). Spills for juvenile fish passage normally take place during the spring, from April 3 through June 20.

2.2. Dissolved Gas Management and Control. Total dissolved gas (TDG) levels at Little Goose are monitored in accordance with the Dissolved Gas Monitoring Program, Appendix D. The TDG levels will be monitored in the Little Goose forebay and tailrace from April 1 through September 30. Data will be collected every half-hour and transmitted via computer every hour. Data on spill volume and total project flow will be reported at the same time. Implementation of spill management requests will be based in part upon TDG 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 (TMT).

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 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 the NMFS biological opinion.

2.3.1.1. Winter Maintenance Period (December 16 through March 31). Check and perform maintenance as required on the items listed below.

a. Forebay Area and Intakes.

1. Remove debris from forebay and gatewell slots.

2. Rake trashracks just prior to the operating season.

3. Measure drawdown in gatewell slots after cleaning trashracks and with ESBSs in place.

b. Extended-length Submersible Bar Screens, Flow Vanes, and Vertical Barrier Screens.

1. Maintenance completed on all screens.

2. Inspect ESBSs prior to installation and operate debris cleaner (dogged off on deck) to ensure proper operation.

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. Water-up valve operating correctly.

2. Orifice lights are operational.

3. Orifices clean and valves operating correctly.

4. Automatic orifice cycling and backflush system maintained and operating correctly.

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 and air burst systems maintained and operating correctly.

3. Overflow weirs should be maintained, tested and operating correctly.

4. All valves should be operating correctly.

5. Flume interior should be smooth with no rough edges.

e. Transportation Facilities.

1. Flume switch gate maintained and in good operating condition.

2. Flume interior smooth with no rough edges.

3. Perforated plate smooth with no rough edges.

4. Wet separator and fish distribution system maintained and ready for operation as designed.

5. Brushes and screens on crowders in good condition with no holes in screens or rough edges.

6. Crowders maintained, tested, and operating correctly.

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

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

9. Barge and truck loading pipes free of debris, cracks, or blockages and barge loading boom maintained and tested.

10. All sampling equipment should be maintained and in good operating condition prior to watering up the facilities.

f. Avian Predation Areas (Forebay and Tailrace). Inspect bird wires and other deterrent devices and repair or replace as needed. Where possible, install additional bird wires or other deterrent devices to cover areas of known avian predation activity.

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. Log drawdown differentials in bulkhead slots at least once a week.

3. Remove debris from forebay and trashracks as required to maintain less than 1' of additional drawdown in gate slots. Additional raking may be required when heavy debris loads are present in the river or when fish condition requires it.

4. 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 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.

5. 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.

6. Coordinate cleaning efforts 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 and Vertical Barrier Screens.

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 (see paragraph 3.1.2.1). 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 ESBS bar screen panels and debris cleaner brushes and replace components as necessary.

7. Measure head differentials across VBSs at least once per week from April 1 through June 30 (more frequently if required) and biweekly for the remainder of the operating season. Clean VBS when head differentials reach 1.5'. When a head differential of 1.5' 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. Operate at least one 12" 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.

2. Orifice lights operational and operating on open orifices.

3. Orifice jets hitting no closer than 3' from wall (bypass gallery 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. If debris is causing continual orifice plugging problems in a particular turbine unit gatewell, the respective turbine unit generation may be restricted to the lower end of the 1% turbine efficiency range to minimize orifice plugging problems.

5. If utilizing the automatic orifice backflush system, inspect as determined by the project biologist (but at least once per work shift unless coordinated differently) to ensure that the orifices are opening and closing correctly and are clear of debris. The project biologist will determine the frequency of automatic orifice cycling and backflushing to maintain clear orifices.

6. Water-up valve operational.

d. Dewatering Structure.

1. Trash sweep and air burst systems operating correctly. The frequency of screen cleaning should be set as necessary to maintain a clean screen.

2. Hand clean trapezoidal section as often as required to maintain in clean condition, with a minimum of once per day.

3. Check overflow weirs to make sure they are operating correctly, perform maintenance as required.

4. There should be no gaps between screen panels or damaged panels in the inclined screen. Screen panels in place and tightly secured.

e. Transportation Facilities.

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

2. Crowder screen brushes should be maintained in good operating condition, with no holes or sharp edges on crowder screens. Crowders in good operating condition

3. Inspect raceway and tank retainer screens to make sure they are clean with no holes or protruding wires.

4. Barge and truck loading pipes and related equipment free of debris, cracks, or blockages and in good condition. Barge loading boom in good operating condition

f. Avian Predation Areas (Forebay and Tailrace).

1. Bird wires and other avian deterrent devices should be monitored to assure they are in good condition. Any broken wires or devices should be replaced as soon as possible.

2. Harassment program in place to deter avian predation in areas actively used by birds and not covered by bird wires or other devices.

3. Project biologists shall routinely monitor project areas to determine areas of active avian predation and, if possible, adjust harassment program to cover these areas or install bird wires or other deterrent devices to discourage avian predation activities.

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 February

28).

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 annually by dewatering and physically inspecting the gratings and chambers or by using divers or video inspection techniques. All diffuser gratings and chambers are to be dewatered and physically inspected at least every 3 years. Repair deficiencies.

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

d. Calibrate all mechanical and electronic water level measuring devices, as necessary, for proper facility operations.

e. Inspect all spill gates and ensure that they are operable.

f. Fish pumps maintained and ready for operation.

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' msl, 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' to 1.3'.

b. Counting Window. The counting window and backboard should be clean to allow best video taping of adult fish passing through the counting slot. When possible, the minimum counting slot width should be 18". All equipment should be maintained and in good condition.

c. Head on all Fishway Entrances. Head range: 1' to 2'.

d. North Shore Entrances (NSE 1 & 2). Elevation of top of gates when on sill = 529'.

1. Operate both downstream gates.

2. Weir depth: 6' or greater below tailwater.

e. North Powerhouse Entrances (NPE 1 & 2). Elevation of top of gates when on sill = 532'.

1. Operate both downstream gates.

2. Weir Depth: 7' or greater below tailwater, tailwater permitting. At tailwater below elevation 539', entrance weirs should be on sill.

f. Powerhouse Collection System. Operate 4 floating orifices (numbers 1, 4, 6, and 10). **Note: All floating orifices will be closed for the 2000 operating season as part of an adult fish passage study.**

g. **South Shore Entrances (SSE 1 & 2).** Elevation of top of gates when on sill = 529'.

1. Operate both gates.

2. Weir depth: 8' or greater below tailwater.

h. Transportation Velocity. 1.5' to 4' per second.

i. Tunnel Lights. The lights in the tunnel section under the spillway shall be on during fish passage period.

j. Head on Trashracks.

1. Maximum head of 0.5' on ladder exit.

2. Maximum head on picket leads shall be 0.3'.

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

l. 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 CENWW-OD-TF by noon the following Monday via electronic mail. Project biologists 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. The annual report shall also include a description of all actions taken to discourage avian predation at the project, with an overview of the effectiveness of the activities in discouraging avian predation. Project biologists also inspect project facilities once per month and during dewaterings for the presence of zebra mussels. Biologists shall provide a report to CENWW-OD-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 that may involve fish handling. All dewaterings shall be accomplished in accordance with approved project dewatering plans. Dewatering and fish handling plans were reviewed and revised in 1997 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 that 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 that 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 CENWW-OD-TF notified for further coordination. Unscheduled maintenance that will have a significant impact on juvenile fish passage shall be coordinated with the CBFWA and NMFS on a case-by-case basis by CENWW-OD-TF. CENWW-OD-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 CENWW-OD-TF when in his opinion delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENWW-OD-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 and proposed measures to mitigate them.

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 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 TDG 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, by either observing injured fish in the gatewells or injured fish appearing on the separator, 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" orifices (gatewell slot 1A has one 14" test orifice) 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 orifice and air 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 can be used, if required, 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, at a minimum of every 2 hours, 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 that 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" pipe while repairs are made.

3.1.2.5. Transportation Facilities. The transportation facilities can be operated either to 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 that must be unwatered to work on or whose maintenance will have a significant effect on fish passage will be done during the January and February winter maintenance period. Maintenance of facilities that 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 or August, 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 fish agencies and tribes.

3.2.2. Unscheduled Maintenance. Unscheduled maintenance that 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 picket 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, picket 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 coordination with the fish agencies and tribes.

3.2.2.2. Auxiliary Water Supply System. Three turbine-driven pumps on the south shore supply the auxiliary water for the fish ladder and the powerhouse collection system. All three pumps are required for normal operation. Approximately 150 to 180 cfs of excess water from the juvenile fish passage facilities is also added to the auxiliary water supply system. 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' to 2' head differential. If the desired head differential cannot be maintained at a depth of 5' or greater, then NSE 1 should be raised until a depth of 5' 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 1' increments until 6' below tailwater is reached. Note that all floating orifices will be closed for the 2000 operating season as part of an adult fish passage study. 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' 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.

3.2.2.4. Diffuser Gratings. Diffuser chambers for adding auxiliary water to fish ladders and collection channels are covered by gratings attached by several different methods. Diffuser gratings are normally checked during the winter maintenance period to make sure they are in place. These inspections are done either by dewatering the fish passage way and physically inspecting the diffuser gratings, or by using underwater video cameras and divers or other methods to inspect the gratings. Diffuser gratings may come loose during the fish passage season due to a variety of reasons. Daily inspections of fish ladders and collection systems should include looking for

any flow changes that may indicate problems with diffuser gratings. If a diffuser grating is known to or suspected of having moved, creating an opening into a diffuser chamber, efforts must immediately be taken to correct the situation and minimize impacts on adult fish in the fishway. Coordination of the problems should begin immediately through the established unscheduled maintenance coordination procedure (see paragraph 3.1.2). If possible, a video inspection should be made as soon as possible to determine the extent of the problem. If diffuser gratings are found to be missing or displaced, creating openings into the diffuser chambers, a method of repair shall be developed and coordinated with the fish agencies and tribes through the established coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

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 priority order shown in Table LGS-4. 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 favor the north units as shown in Table LGS-4. 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 through the main bypass flume, nighttime unit operating priority shall be unit 1, then units 4 through 6 (Table LGS-4. 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 fish measures. Project personnel shall record when turbine units are

Table LGS-4. Turbine unit operating priority for Little Goose Dam.

Season	Time of Day	Unit Priority
March 1 - November 30	24 hours	1, 2, 3, then 4-6 (any order)
April 1 - October 31 (Project IS Spilling)	Nighttime (0600 to 1800 hours)	1, 4-6 , 2, 3
April 1 - October 31 (During juvenile bypass through main flume and no spill)	Nighttime (2000 to 0400 hours)	1, 4-6 (in any order, then 2-3 (as needed)
December 1 - February 28	24 hours	Any Order

operated outside the 1% turbine 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% turbine 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 the 1% efficiency range at various heads are shown in Tables LGS-4 through LGS-7. The 1% 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.

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 fish items may cause increased spill at a project in order to maintain reservoir levels within operating levels. This may result in TDG 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

Table LGS-4. The 1% turbine operating range at Little Goose Dam for units 1-3 with extended-length submersible bar screens installed.

Head (ft)	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. These tables contain the best information currently available.

Table LGS-5. The 1% turbine operating range at Little Goose Dam for units 1-3 without extended-length submersible bar screens.

Head (ft)	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 regarding extended-length submersible bar screens. These tables contain the best information currently available.

Table LGS-6. The 1% turbine operating range at Little Goose Dam for units 4-6 with extended-length submersible bar screens installed.

Head (ft)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	(MW)	(CFS)
85	83.3	13,505	105.8	17,152
86	84.3	13,488	107.3	17,167
87	85.2	13,470	108.7	17,182
88	86.2	13,453	110.2	17,195
89	87.2	13,435	111.7	17,208
90	88.1	13,418	113.1	17,220
91	89.3	13,437	114.8	17,274
92	90.4	13,455	116.5	17,328
93	91.6	13,473	118.1	17,379
94	92.7	13,490	119.8	17,430
95	93.9	13,507	121.5	17,479
96	94.9	13,504	122.9	17,490
97	95.9	13,501	124.3	17,500
98	96.9	13,498	125.7	17,510
99	97.9	13,495	127.1	17,520
100	98.9	13,492	128.5	17,529
101	100.1	13,510	129.2	17,431
102	101.3	13,527	129.8	17,335
103	102.5	13,544	130.5	17,240
104	103.7	13,560	131.1	17,147
105	104.9	13,576	131.8	17,056

NOTE: The turbine efficiency tables were revised to reflect new information using a 1995 index test and the 1975 model test and extended-length submersible bar screens. These tables are based on data from Lower Granite Dam.

Table LGS-7. The 1% turbine operating range at Little Goose Dam for units 4-6 without extended-length submersible bar screens.

Head (ft)	Lower Generator Limits		Upper Generator Limits	
	(MW)	(CFS)	MW)	(CFS)
85	85.1	13,532	113.0	17,972
86	86.1	13,515	114.6	17,988
87	87.1	13,497	115.6	17,914
88	88.1	13,480	116.6	17,842
89	89.1	13,463	117.6	17,771
90	90.0	13,446	120.8	18,045
91	91.2	13,465	122.6	18,102
92	92.4	13,483	124.4	18,158
93	93.6	13,501	126.2	18,212
94	94.7	13,519	128.0	18,265
95	95.9	13,535	129.8	18,317
96	96.9	13,533	131.3	18,329
97	98.0	13,530	132.8	18,340
98	99.0	13,527	134.3	18,350
99	100.0	13,524	135.8	18,360
100	101.1	13,521	137.3	18,370
101	102.3	13,539	138.0	18,268
102	103.5	13,557	138.7	18,167
103	104.7	13,574	139.4	18,068
104	105.9	13,590	140.1	17,971
105	107.1	13,606	140.8	17,876

NOTE: The turbine efficiency tables were revised to reflect new information using a 1995 index test and the 1975 model test and extended-length submersible bar screens. These tables are based on data from Lower Granite Dam.

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 TDG levels exceeding standards. The activities covered under these operations will be coordinated with and approved by the TMT 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' 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 CENWW-OD-TF and Reservoir Control Center (RCC) by the same time period and inform them of the intended work.

c. The RCC will coordinate the work activities with regional parties of the work at the TMT meeting on the following Wednesday.

d. After coordination with the TMT, RCC 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' above the normal MOP range (a 2' 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 CENWW-OP-TF and RCC 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' 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 turbine unit maintenance schedule will be reviewed annually by project and Operations Division biologists for fish 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 that 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 best efficiency range. 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 or early September time period to minimize impacts on adult and juvenile fish passage.

Unwatering turbine units should be accomplished in accordance with project dewatering plans. Prior to dewatering a turbine unit for maintenance, the turbine unit should be spun at speed-no-load, if possible, immediately before installing tailrace stoplogs and headgates to minimize the number of fish in the draft tube and scroll case. If a turbine unit is out of service for maintenance for an extended period of time without tailrace stoplogs in place, efforts should be made to not open the wicket gates if the scroll case must be dewatered at a later date without the unit being spun before hand.

5. Forebay Debris Removal. Debris at projects can impact fish

passage conditions. Debris can plug or block trashracks, VBSs, gatewell orifices, dewatering screens, separators, and facility piping resulting in impingement, injuries, and descaling of fish. Removing debris at its source in the forebay is sometimes necessary to maintain safe and efficient fish passage conditions, navigation, and other project activities. Debris can be removed from the forebay by: physically encircling the debris with log booms and pulling it to shore with boats where it can be removed with a crane, removing the debris from the top of the dam using a crane and scoop, or passing the debris through the spillway with special powerhouse operations and spill. The preferred option is to remove debris at each project when possible to avoid passing debris on to the next project downstream. This is not always possible at each project as some projects do not have forebay debris removal capability. In this case, the only viable alternative is to spill to pass the debris.

All special spills (other than normal spill patterns for ongoing spill operations) and project operations for passing debris will be coordinated prior to the operations taking place. Each project shall contact CENWW-OD-TF at least two work days prior to the day they want the special project operations for spilling to pass debris. CENWW-OD-TF shall coordinate the special operations with RCC and NMFS. Project personnel shall provide CENWW-OD-TF the reason for the debris spill request including an explanation of project facilities being impacted by the debris, the date and time of the requested spill, and any special powerhouse or other operations required to move the debris to the spillway. When a debris spill is coordinated and approved, RCC shall issue a teletype detailing the specifics of the special operations.

Table LGS-8. Little Goose Dam spill pattern for adult fish passage and for minimizing total dissolved gas levels.

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
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 LGS-8. Little Goose Dam spill pattern for adult fish passage and for minimizing total dissolved gas levels (Continued).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
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 LGS-8. Little Goose Dam spill pattern for adult fish

passage and for minimizing total dissolved gas levels (Continued).

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
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