

SECTION 3

THE DALLES DAM

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The Dalles Dam

1. Fish Passage Information. The locations of fish passage facilities at The Dalles Dam are shown on Figures TDA-1 through TDA-3. Dates for project operations for fish purposes and special operations are listed in Table TDA-1.

1.1. Juvenile Fish Passage.

1.1.1. Facilities Description. Turbine units at The Dalles Dam are not screened. Juvenile fish passage consists 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 primary juvenile fish passage period at The Dalles Dam is April through November. Currently juvenile migration timing is monitored by PSMFC at John Day Dam. Table JDA-2 in section 4 of the FPP reports data from 1994 to 2000. Since no juvenile monitoring is done at The Dalles Dam, refer to this table, and add approximately 1 day to the dates reported for each species to estimate juvenile fish arrival at The Dalles.

Diel passage at The Dalles sluiceway is affected by spill and flow conditions. In years of consistently high flow and spill, fish may be distributed higher in the water column and daytime passage may increase.

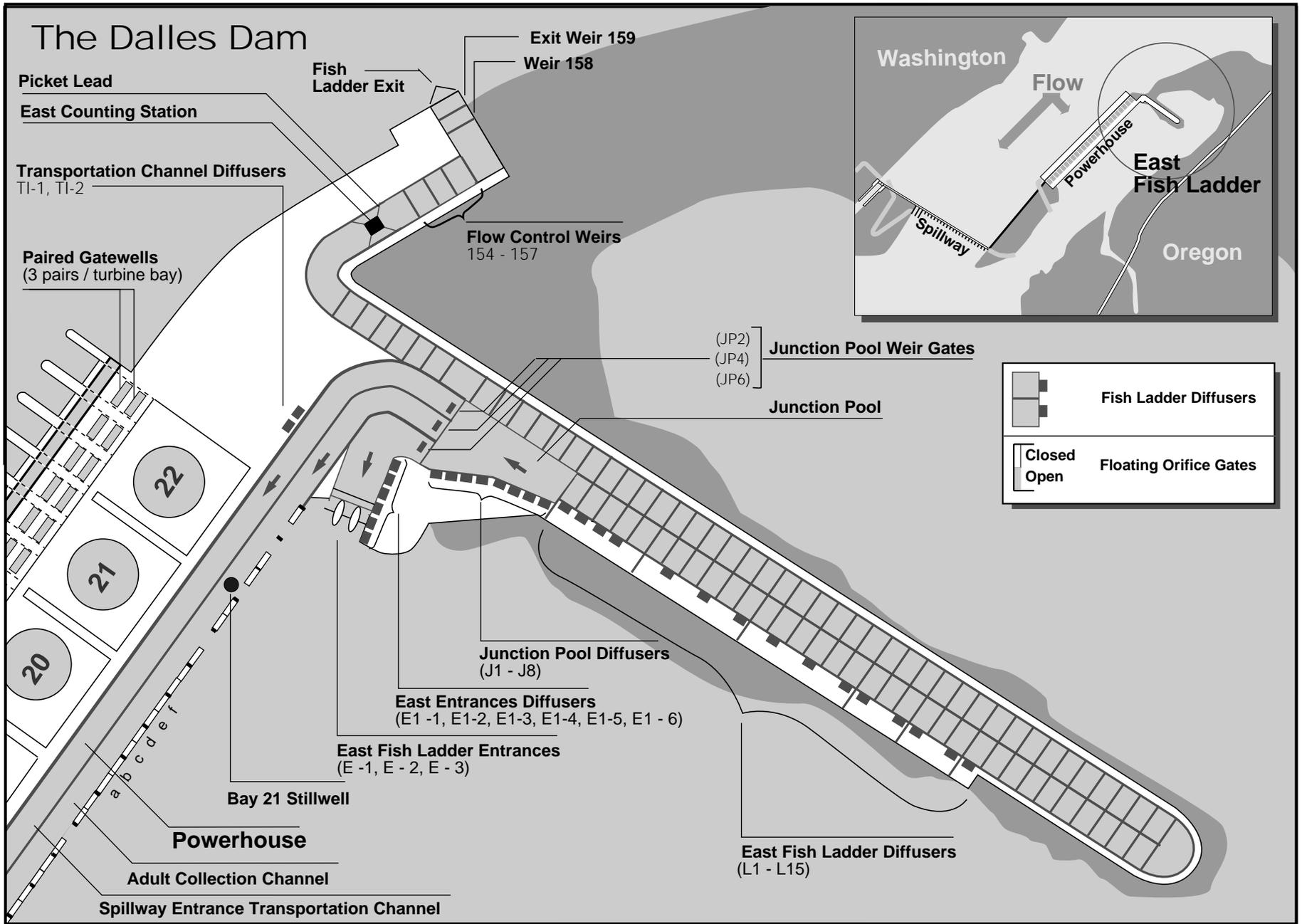


Figure TDA-1 The Dalles Dam east fish ladder.

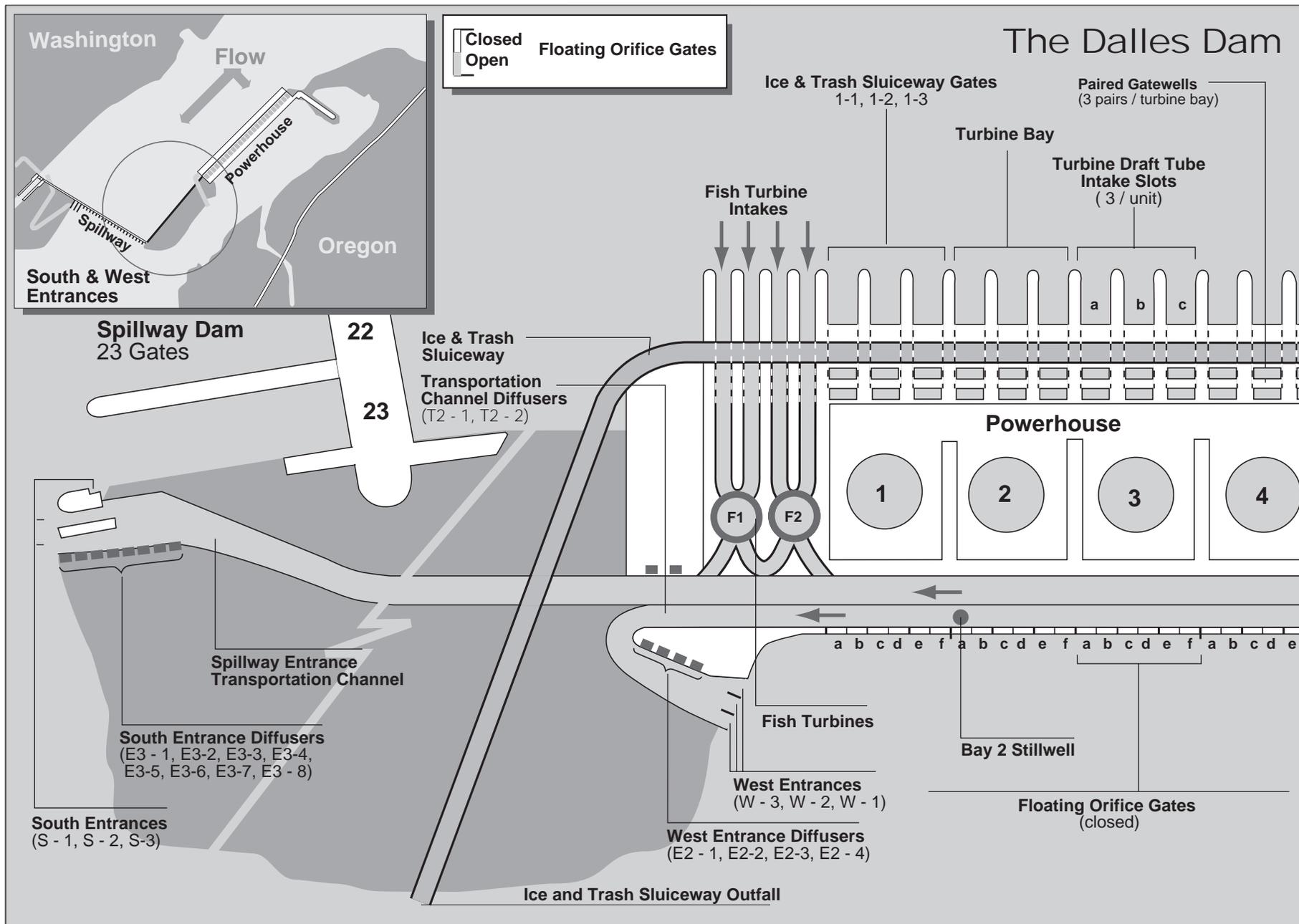


Figure TDA-2 The Dalles Dam south and west fish ladder entrances.

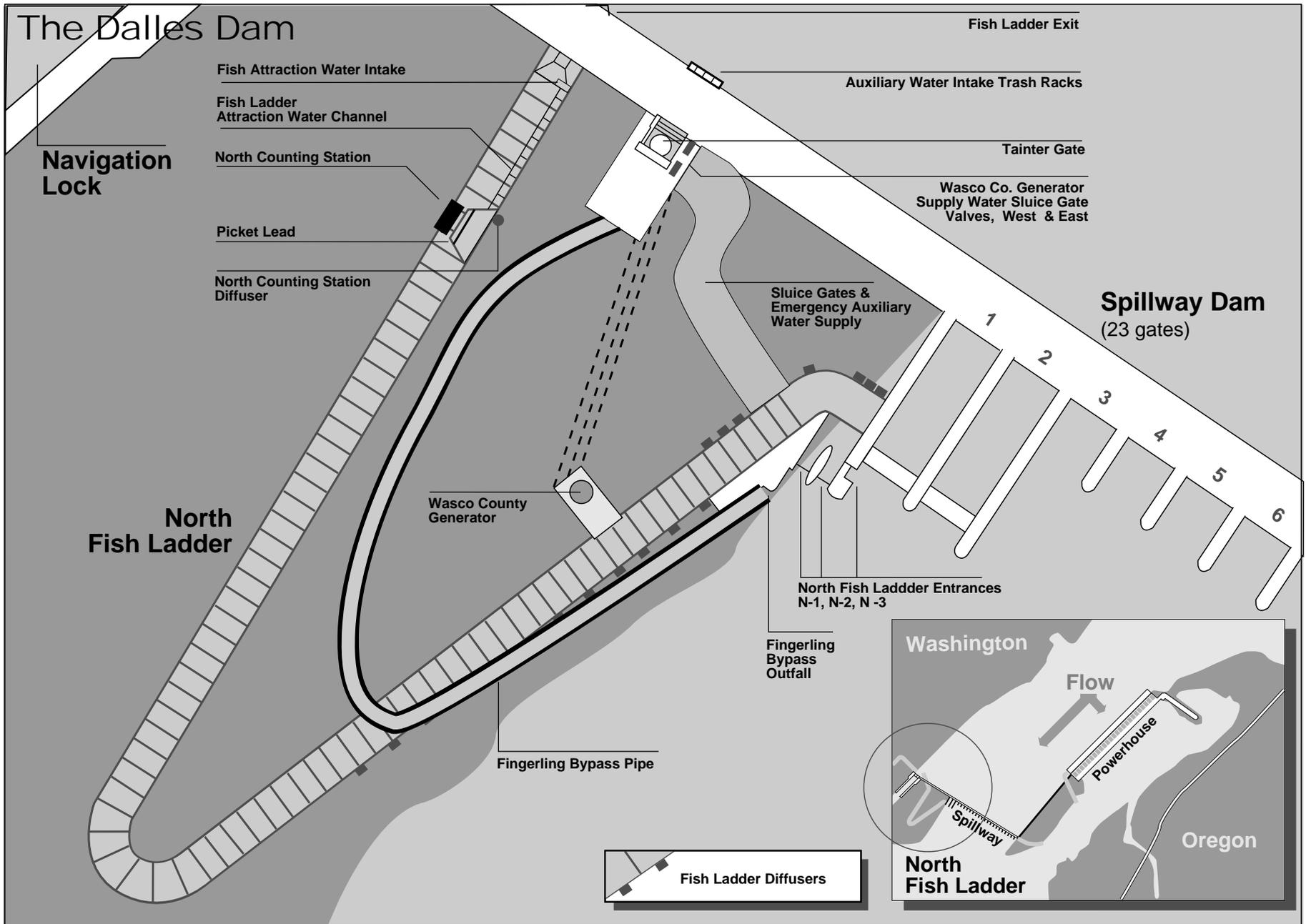


Figure TDA-3 The Dalles Dam north fish ladder and spillway.

Table TDA-1. Dates of project operations for fish purposes at The Dalles Dam, 2002

Task Name	Start	Finish	Reference	002		Qtr 2, 2002			Qtr 3, 2002			Qtr 4, 2002			Qtr 1, 2003		
				Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Juvenile Fish Maintenance Season	Fri 3/1/02	Sun 3/31/02	FPP Tda 2.4.1.1														
Adult Fish Passage Period	Fri 3/1/02	Sat 11/30/02	FPP Tda 2.5.1.2														
1% limitations	Fri 3/1/02	Fri 2/28/03	FPP Tda 4.4														
1% soft	Fri 3/1/02	Thu 3/14/02	FPP Tda 4.4														
1% hard	Fri 3/15/02	Thu 10/31/02	FPP Tda 4.4														
1% soft	Fri 11/1/02	Fri 2/28/03	FPP Tda 4.4														
Weekly Reports	Fri 3/1/02	Fri 2/28/03	FPP Tda 2.6														
Adult Salmon & Steelhead Eval	Fri 3/1/02	Thu 10/31/02	FPP App A Tda 2.4														
Equipment Installation	Fri 3/1/02	Sun 3/31/02	FPP App A Tda 2.5														
Juvenile Passage Period	Mon 4/1/02	Sat 11/30/02	FPP Tda 1.1.2														
Adult Fish Counting (Visual 0400 -2000)	Mon 4/1/02	Thu 10/31/02	FPP Tda 1.2.2														
TDG Monitoring	Mon 4/1/02	Sun 9/15/02	FPP App D Phase 2														
Avian Abatement in Place	Mon 4/1/02	Mon 4/1/02	FPP Tda 2.4.1.1 e														
Operate Ice and Trash Chute	Mon 4/1/02	Sat 11/30/02	FPP Tda 2.4.1.2 e														
Behavioral Studies	Mon 4/1/02	Thu 10/31/02	FPP App A Tda 2.3														
Spill for Fish	Wed 4/10/02	Sat 8/31/02	FPP App A Tda 1.1														
FPE & Blocked Trashrack Eval	Sat 4/20/02	Fri 7/12/02	FPP App A Tda 2.2														
Project Survival Evaluation	Wed 5/15/02	Wed 6/12/02	FPP App A Tda 2.1														
Rake Trash Racks Again	Sat 6/1/02	Sat 6/15/02	FPP Tda 2.4.1.2 a														
Equipment Removal	Fri 11/1/02	Sat 11/30/02	FPP App A Tda 2.5														
Winter Maintenance Adult Facilities	Sun 12/1/02	Fri 2/28/03	FPP Tda 1.2.2														
Juvenile Fish Maintenance Season	Sun 12/1/02	Fri 2/28/03	FPP Tda 2.4.1.1														
Annual Report	Fri 1/31/03	Fri 1/31/03	FPP Tda 2.6														

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, as it is no longer functional.

A small hydropower facility, utilizing the north fishway ladder auxiliary water supply, was constructed in 1991 and is operated by the North Wasco PUD. Fishway criteria associated with this facility are monitored and maintained during the daily fishway inspections. A backup auxiliary water supply system, unscreened for juveniles has been upgraded to facilitate its use if required.

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 fish counting. The adult fish counting schedule is shown in Table TDA-2. Annual winter maintenance of adult fish facilities is scheduled from December 1 through February (in-water work period) to minimize impacts on upstream migrants. Table TDA-3 shows the passage period by species and the earliest and latest recorded dates of peak passage since 1957.

Table TDA-2. Adult fish counting schedule at The Dalles Dam.

Period	Counting Method
April 1 - October 31	Visual count 16 hours/day (0400-2000 PST)
November 1 - March 31	No Counting

Table TDA-3. The Dalles Dam adult migration timing, 1957-2001

Species	Count Period	Earliest Peak	Latest Peak
Spring Chinook	4/1 - 6/3	4/17	5/13
Summer Chinook	6/4 - 8/3	6/6	8/1
Fall Chinook	8/4 - 10/31	9/2	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	10/25

2. Project Operation.

2.1. General.

2.1.1. Research, non-routine maintenance, other fish related activities, and construction activities will not be conducted within 100' of any fishway entrance or exit, or within 50' of any other part of the adult fishway, or directly in, above, or adjacent to any fishway, unless coordinated by the project with regional fish managers through ESA and other fish passage forums. Currently approved special operations are described in Appendix A. Alternate actions will be considered by district and project biologists in conjunction with the fish managers on a case by case basis. Emergency situations should be dealt with immediately by the project in coordination with the project or district biologist. If unavailable, the biologists will be informed of steps taken to correct the situation immediately following the incident. All activities within the boat restricted zone (BRZ) will be coordinated at least 2 weeks in advance with the project, unless it is deemed an emergency.

2.2. Spill Management. The spill schedule in Table TDA-5 at the end of this section will be used for juvenile fish passage.

2.3. Total Dissolved Gas Management and Control. Additional spill management will be based on total dissolved gas (TDG) monitoring data and the observed condition of migrant juvenile and adult fish, along with juvenile migration data. The Corps will monitor TDG at The Dalles Dam forebay and tailrace. Data from automated stations will be reported every four hours from April 1 until September 15. The TDG monitoring system is described in detail in Appendix D.

Excessive TDG 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 Reservoir Control Center (RCC), nighttime or daytime spill limits, and shaping of spill discharge.

2.4. Juvenile Fish Passage Facilities.

2.4.1. Operating Criteria.

2.4.1.1. Winter Maintenance Season (Preparation for Juvenile Passage Season) (December 1 through March).

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

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

c. Inspect and correct any epoxy or concrete deficiencies on the ice and trash sluiceway walls and floors.

d. Inspect and, where necessary, repair spill gates and control systems. The spillway, except for coordinated changes, must be able to achieve spill patterns on April 1.

e. Reinstall or repair avian predator control lines in the present locations as soon as possible following damage or removal. Install and maintain new avian predator control lines where possible, 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. These are performed under contract with the U.S. Department of Agriculture, Animal Damage Control. Abatement measures include selective hazing, pyrotechnics, propane cannon scare techniques, and lethal take where necessary. Avian abatement measures shall be in place by April 1 unless this work is delayed because of inclement weather. If this occurs, the work will be completed as soon as the weather permits after that date.

f. The results of all inspections and the readiness of the facility for operation will be reported to the FPOM immediately prior to the fish passage season.

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

a. Measure gatewell drawdown a minimum of once per week, and more frequently, three times per week or more, as needed during high debris periods. Clean trashracks as flow conditions dictate, or when drawdown in gatewell slots exceeds 1.5'. Rake trashracks in front of turbine units FU-1 through at least main unit 5 again between June 1 and June 15. (Note: Trashracks for fish units FU-1 and FU-2, and main units MU-1 through MU-5 cannot be raked in 2002 until the Sluiceway Guidance Improvement Device (SGID) occlusion plates can be moved using the Hammerhead crane. All trashracks east of main unit 6 (MU-6) can be raked using the

Hammerhead crane even though the crane needs repair. The Hammerhead portion of the crane will not rotate, which is required for moving the occlusion plates. Raking trash on main units without occlusion plates does not require the Hammerhead to rotate, therefore it is possible to rake trash on main units MU-6 through MU-22.

b. Remove debris from the forebay as needed by operating sluiceway.

c. Inspect all gatewells daily. The project will clean gatewells before the 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 fish measures, and then only on a last on/first off basis.

d. Operate all gate slot orifices full time.

e. Operate ice and trash sluiceway gates 1-1, 1-2, and 1-3. Ice-trash sluiceway will be operated on a 24-hour basis April 1 - November 30 with skimmer gates in place. In September through November, day/night passage will be investigated through FPOM and appropriate operations coordinated. During periods when gates do not operate, set the top of the bottom end gate at elevation 142' to create an 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, and 1-3, and open gates 17-3, 18-1, and 18-2 for 30 minutes 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' to create an orifice plunge pool, and install orifice blocker. After orifice-sealing devices are installed, end gate should be returned to its original elevation of 161' msl during the juvenile passage season.

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, the turbine unit will be shut down until cleaning is accomplished. Appropriate procedures to remove fish during this situation will be determined in coordination with FPOM. 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. Where possible, 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 in place by April 1 unless this work is delayed because of inclement weather. If this occurs, the work will be completed as soon as possible after that date.

i. During chain gate operation, maintain forebay level above elevation 158' to the extent practicable. Management of this operation will maintain a tailwater elevation of 158' or greater at John Day Dam to assure adequate adult fishway entrance and collection facility operation at John Day.

j. Maintain orifices clear of debris to the extent practicable.

k. Inspect facilities three times each day.

l. Follow the schedule in Table TDA-5 for spill. This schedule was developed for juvenile fish passage.

2.4.1.3. Winter Maintenance Season (December 1 through March).

a. Maintain orifices clear of debris.

b. Set top of bottom end gate at elevation 142' to create an orifice plunge pool.

c. Inspect operating facilities once per day by project fish staff.

2.5. Adult Fish Passage Facilities.

2.5.1. Operating Criteria.

2.5.1.1. Winter Maintenance Season (Preparation for Adult Passage Season) (December 1 through February).

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 that could injure fish or slow their progress up the ladder. Repair deficiencies.

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

d. Reinstall picket leads at counting stations prior to watering up the ladders during maintenance, and ensure the leads are properly seated.

e. The results of all inspections and the readiness of the facilities for operation will be reported at the Fish Passage O and M Coordinating Committee (FPOM) meeting immediately prior to the passage season.

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

a. All Adult Facilities.

1. Water depth over fish ladder weirs: 1.0' +/- 0.1'. During the shad passage season (> 5000 shad/countstation/day): 1.3' +/- 0.1'. (See 2.5.1.2.b.2. and 3. for an exception).

2. Water temperatures will be measured in each adult fishway and station service pen-stock. Temperatures will be recorded in the fishway status report. When water temperature reaches 70° F, all fish handling activities will be coordinated through FPOM prior to any action to verify protocols that will be followed.

3. Head on all entrances: 1' to 2' (1.5' optimum). Refer to paragraph 3.3.1., Scheduled Maintenance, when unable to achieve head criteria.

4. A water velocity of 1.5 to 4 fps (2 fps optimum) shall be maintained for the full length of the powerhouse collection channel and the lower ends of the fish ladders that are below the tailwater. Water velocities will be measured directly and monitored during fishway inspections to verify channels are operating within velocity criteria.

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 calibration checked weekly. Instruments will be recalibrated ASAP if out of calibration.

7. Main entrance weir depths: 8' or greater below tailwater. Maintain a minimum tailwater at 70' msl to remain in entrance weir criteria operating range

8. Count station crowders shall remain in the operating position while visual counting and/or video-taping is being conducted. The crowder shall be closed to allow the count slot width to be no less than 18". This will usually occur during high turbidity conditions to allow count accuracy criteria to be achieved. If passage is impaired by this condition, the count slot may be widened until proper passage conditions are achieved, even though count accuracy may be compromised to some degree. Project biologists, FFU, and fish counters shall coordinate to achieve optimum count slot passage and/or count accuracy conditions. The crowder shall remain fully open during hours that no fish counting is performed. Leave fish passage slot lighted overnight.

9. Inspect facilities three times 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 relative to the forebay) of 2.5' +/- 0.1'.

2. Telescoping weir #159 will adjust to maintain 1.2 +/- 0.1' depth over the weirs, measured below the counting station.

3. Telescoping weir #158 will track 1' +/- 0.1' below weir #159 at all times during fishway operation.

c. North Fishway Entrance. Operate one entrance weir, N1 or N2 regardless of spill. Entrance weirs shall be operated only by project fish biologists when in manual control. If the Wasco County PUD operates entrance weirs in automatic control, they shall be required to keep them within established fishway criteria.

d. Powerhouse.

1. West Powerhouse Entrance: Operate entrance weirs (W1 and W2).

2. East Powerhouse Entrance: Operate entrance weirs E2 and E3 to maintain gate crest at 8' or greater below tailwater. Set E1 with the gate crest at 81' msl. If 2' differential is exceeded, lower E2 and E3 in one-foot increments to achieve differential criteria or lower E1 in one foot increments if E2 and E3 cannot be lowered.

3. Operate east ladder junction pool weirs at the following minimum depths in relation to east entrance tailwater surface elevation,

JP2.....	12'
JP4.....	10'
JP6.....	7'

4. South Spillway Entrance: Operate entrance weirs S1 and S2.

5. Discharge from the two operating fish units will be adjusted to maintain criteria at all associated fishway entrances.

6. Orifice gates along the collection channel will be closed during 2002 in an effort to improve collection channel velocities.

2.5.1.3. Winter Maintenance Season (In-water Work Period) (December 1 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 the counting station at the end of the counting season.

b. Operate the north fishway adult fish passage facilities according to fish passage season standards listed 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 adult 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 operating facilities once per day by project fish staff.

2.6. Facility Monitoring and Reporting. Project staff shall inspect fish passage facilities at the frequencies listed in the juvenile and adult fish facilities operating criteria sections. Additional fishway inspections may be performed by FFU and/or fisheries agencies. The project fish biologist and fish biological staff shall prepare weekly reports, throughout the year, summarizing project operations. The weekly reports will provide an overview of how the project and 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; 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 CENWP-OP and other interested parties as soon as possible the following week, with a copy to RCC, Attention: Fish Team. The project biologist shall prepare an annual report by January 31, 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. The annual report will be provided to CENWP-OP in time for distribution to FPOM members at the February meeting.

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. This includes veliger sampling, colonization sample units, and dewatering inspections. These organisms have become a serious problem elsewhere in the country and may become introduced into the Columbia River basin.

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 to minimize impacts to migrating salmonids. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (paragraph 2.6).

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 throughout 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 (April 1), between June 1 and June 15, and whenever trash accumulations are suspected because of increased head across the trash racks.

3.2.1.2. Turbines and Spillways. 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 section 5. Dewatering Plans.) The schedule for this maintenance is reviewed by the project and district biologists and coordinated within NWP, NWD, BPA, and among fish agencies and tribes through the FPOM. Certain turbine and spillway discharges at the projects are secondarily used to attract adult fish to the fishway entrance areas. 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 turbine maintenance will require testing operation of the turbine throughout its full range before returning it to normal service. Units which should receive low priority for scheduling maintenance during the fish passage season are F1, F2, 1, 2, 3, 4 (during sluice way operation).

3.2.2. Unscheduled Maintenance. Maintenance of all fish related facilities will be carried out as described below. Unscheduled maintenance that 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 project and CENWP-OP biologists. The CENWP-OP biologists will be notified as soon as possible after it becomes apparent that maintenance repairs are required. The Project Operations Manager has the authority to initiate work prior to notifying CENWP-OP when delay of the work will result in an unsafe situation for people, property, or fish. Information required by CENWP-CO 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.

3.2.2.1. 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 gatewells before the 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 fish measures. This is to maintain clean orifices and minimize fish injury.

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 damaged, it will be repaired.

3.2.2.2. Turbines and Spillways- Spill Gate Failure. If a spill gate becomes inoperable, the operators will make the changes necessary to accommodate the spill and then immediately notify the Operations supervisor and the project biologist to determine the best pattern to follow until repairs can be made. This interim operation shall be coordinated with the FPOM through the district biologist, who will, depending on coordination, provide additional guidance to the project.

3.3. Adult Fish Passage Facilities.

3.3.1. Scheduled Maintenance. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (paragraph 2.6).

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 occur 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 Adult 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. An additional inspection during the fish passage season by dive or underwater video, will also be conducted. (see section 5. Dewatering Plans.). A diver or underwater video system may be used for 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 fish biologist or alternate Corps fish personnel will attend all dewatering activities potentially involving fish, as well as inspections to provide fish input (see section 5.).

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 within 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 diffuser valves, ladder orifice reduction plates, malfunctioning 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 are exceeded. When practicable, rake trashracks 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. Maintenance activities that occur during the fish passage period and that may affect fish passage will be reported in the weekly reports (section 2.6). Unscheduled maintenance that will significantly affect the operation of a facility, such as repair of displaced diffuser gratings, 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 (paragraph 3.2.2).

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 surveillance on the adult system to ensure that criteria are being met. In the event of AWS failure, FPOM will work with the project to determine the best operating procedure.

a. Powerhouse (spring/summer). If one of the two fishway auxiliary water turbines fails or malfunctions during the period March 1 - August 31, use the following sequential procedure until a fishway head of 1' is achieved:

1. Increase discharge of remaining operating unit to maximum operating capacity.

2. Raise the open west powerhouse entrance weirs W1 and W2 (W3 stationary at 78' msl) in 1' increments until the weirs reach 6' of depth below the tailwater surface.

3. Close west powerhouse entrance weir W2.

4. Raise the east entrance weirs E2 and E3 (E1 closed at tailwater below 81' msl) in 1' increments to 6' of depth below the tailwater surface.

5. Close one east entrance weir E2.

6. Raise the south spillway entrance weirs S1 and S2 in 1' increments to 6' of depth below the tailwater surface.

7. Close one south spillway entrance (S2).

8. If a fishway head of 1' is still not achieved, leave the fishway in this configuration until more auxiliary water becomes available. Then reverse the above procedure.

b. Powerhouse (fall/winter). If one of the fishway auxiliary water turbines fails, malfunctions, or is out of service for necessary maintenance during the period September 1 through February, assuming no spill during this period, use the following sequential procedure until a fishway head of 1' is achieved:

1. Increase discharge of remaining operating unit to maximum operating capacity.

2. 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.

3. Close west entrance weir W2, leaving W1 open to 8' below tailwater surface elevation.

4. Close entrance E2 (leaving E3 open at 8' depth).

5. Raise entrance weir W1 to 6' below tailwater surface elevation.

6. Raise entrance weir E3 to 7' below tailwater. If 1' of head is still not achieved, then raise it an additional 1' to a 6' minimum below tailwater surface.

7. If a fishway head of 1' is still not achieved, then leave in this configuration until more auxiliary water becomes available.

c. 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:

1. Close entrance weir S2 and raise S1 to 6' below tailwater.

2. Close junction pool weirs JP2 and JP4.

3. Close entrance weir E1 and E2 and raise E3 to 6' below tailwater.

d. **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' below the tailwater surface.

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 will be operated manually by project personnel until repairs are made. If this operation becomes necessary, project personnel will increase surveillance on 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 ladder structures include picket leads, counting stations, fishway exits, and overflow weirs with orifices. Picket leads 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 likely. 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 coordination with the fish agencies and tribes through the FPOM.

3.3.2.4. 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 by either dewatering the fish passage way and physically inspecting the diffuser gratings, or 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 which 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. 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 FPOM coordination procedure. Repairs shall be made as quickly as possible unless coordinated differently.

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 with FPOM.

4.2. The project turbine unit maintenance schedules will be reviewed by project and district biologists for fish impacts and be coordinated with FPOM.

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

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

4.5. When it is necessary to operate turbines outside of the 1% efficiency range, 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 are available to operate, the following sequence might be used: 7, 9, 11, 13, 15, 5, 3, 1, 8, etc. Since each successive unit in this list is thought to pass more fish, this outage priority sequence is intended to have a lower negative impact on fish during turbine unit passage, if units are taken out of service in this order.

4.6. The priority operation of powerhouse main units shall occur from west end toward east end to provide the best powerhouse passage conditions for juvenile salmonids.

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 fish personnel will attend all project activities involving fish handling.

5.3. The fish agencies and tribes are encouraged to participate at all ladder dewaterings.

5.4. Adult Fish Ladder.

5.4.1. Scheduled maintenance.

5.4.1.1. When possible, operate the 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. A 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" will be maintained in the ladder until fish are rescued.

5.4.1.5. The project biologist or alternate Corps fish personnel will oversee fish rescue when the ladders are dewatered. The fish are then transported to the forebay or tailwater, depending on the fish life stage (adults to forebay, juveniles to tailrace), for release. If a ladder is dewatered in the spring or summer, steelhead kelts should be released into the tailrace.

Table TDA-4. Ranges for turbine operation within 1% of best efficiency at The Dalles Dam.

Head (ft)	Units 1 - 14				Units 15 - 22			
	Lower Limit MW	Lower Limit Cfs	Upper Limit Mw	Upper Limit cfs	Lower Limit MW	Lower Limit cfs	Upper Limit Mw	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	97	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	54	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	9,011	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.

5.4.1.6. Orifice blocking devices, with attachment ropes tied to handrails, will be placed in the lower-most weirs to prevent fish from re-ascending the dewatered portion of the adult fishway. These will have clearances placed on them by project operations. Clearances shall be removed just before the fishway is returned to service. This will prevent the orifice blocks from being accidentally left in place after fishway water-up.

The fishway return to service checklist is as follows:

- a. Remove orifice blocking devices.
- b. Activate automation for weir crest depth.
- c. Assure all count station lighting is operational.
- d. Close count station crowder to desired width (minimum 18").
- e. Close picket leads.
- f. Remove all tools, equipment, and debris from inside ladder.
- g. Assure all entrance weir automation is operational and activated.
- h. Remove all safety clearances by the designated clearance holder.

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 so low it strands fish. Personnel shall remain present onsite during pumping operations to ensure stranding does not occur or a water level sensor that deactivates the dewatering process will be used.

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

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

5.6. Turbines.

5.6.1. Gatewells need not be dipped as is required at other projects due to the lack of VBSSs. 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 at speed/no load briefly to flush fish out of the draft tube.

5.6.2. When possible, place head gates and tail logs immediately after the turbine unit is shut down if the draft tube is to be dewatered. Install bottom two tail logs side-by-side first before stacking the remainder to minimize sturgeon from entering the draft tube before dewatering. This is necessary for both scheduled and unscheduled outages.

5.6.3. If a 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 to flush fish. Stop logs will then be placed immediately.

5.6.4. If a turbine unit is idle and partially dewatered, and tail logs are put into place, an adequate safety pool may be maintained for up to 4 days to accommodate fish trapped in the draft tube (If longer timeframes are needed for the safety pool, project fisheries will coordinate with FPOM on a case-by-case basis). Adequate inspections will need to be conducted to ensure the safety pool is maintained and fish are in good condition. Water levels in the draft tube will not be allowed to drop to a level which stresses fish. The appropriate level will be determined by the project biologist.

5.6.5. 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 fish personnel will provide technical guidance on fish safety, will assure that rescue equipment is available if needed, and will directly participate in fish salvage.

6. Forebay Debris Removal. Debris at projects can impact fish passage conditions. It can plug or block trashracks, 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 a debris problem 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 CENWP-OP at least two work days prior to the day they want the special project operations for spilling to pass debris. CENWP-OP shall coordinate the special operations with RCC and NMFS. Project personnel shall provide CENWP-OP 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 TDA-5. Spill patterns for juvenile fish passage at The Dalles Dam.

Gate # (Opening in feet)																							Total 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
2	1																							3	4.5
2	2																							4	6
2	2	1																						5	7.5
2	2	2																						6	9
2	2	2	1																					7	10.5
2	2	2	2																					8	12
2	2	2	2	1																				9	13.5
2	2	2	2	2																				10	15
2	2	2	2	2	1																			11	16.5
2	2	2	2	2	2																			12	18
2	2	2	2	2	2	1																		13	19.5
2	2	2	2	2	2	2																		14	21
2	2	2	2	2	2	2	1																	15	22.5
2	2	2	2	2	2	2	2																	16	24
2	2	2	2	2	2	2	2	1																17	25.5
2	2	2	2	2	2	2	2	2																18	27
2	2	2	2	2	2	2	2	2	1															19	28.5
2	2	2	2	2	2	2	2	2	2	1	1													20	30
2	2	2	2	2	2	2	2	2	2	2	1													21	31.5
2	2	2	2	2	2	2	2	2	2	2	2													22	33
2	2	2	3	2	2	2	2	2	2	2	2													23	34.5
2	2	2	3	3	2	2	2	2	2	2	2													24	36
2	2	3	3	3	2	2	2	2	2	2	2													25	37.5
2	2	3	3	3	3	2	2	2	2	2	2													26	39
2	2	3	3	3	3	2	2	2	2	2	2	1												27	40.5
2	2	3	3	3	3	2	2	2	2	2	2	2												28	42
2	2	3	3	3	3	3	2	2	2	2	2	2												29	43.5
2	2	3	3	3	3	3	3	2	2	2	2	2												30	45
2	2	3	3	3	3	3	3	3	3	2	2	2												31	46.5
2	2	3	3	3	3	3	3	3	3	3	2	2												32	48
2	2	3	3	3	3	3	3	3	3	3	2	2	1											33	49.5
2	2	3	3	3	3	3	3	3	3	3	2	2	2											34	51
2	2	3	4	3	3	3	3	3	3	3	2	2	2											35	52.5

Table TDA-5 (cont). Spill patterns for juvenile fish passage at The Dalles Dam.

Gate # (Opening in feet)																							Total 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	3	3	4	3	3	3	3	3	3	2	2	2											36	54
2	3	3	4	4	3	3	3	3	3	2	2	2											37	55.5
2	3	4	4	4	3	3	3	3	3	2	2	2											38	57
3	3	4	4	4	3	3	3	3	3	2	2	2											39	58.5
3	3	4	4	4	3	3	3	3	3	3	2	2											40	60
3	3	4	4	4	3	3	3	3	3	3	3	2											41	61.5
3	3	4	4	4	3	3	3	3	3	3	3	2	1										42	63
3	3	4	4	4	3	3	3	3	3	3	3	2	2										43	64.5
3	3	4	4	4	4	3	3	3	3	3	3	2	2										44	66
3	3	4	5	4	4	3	3	3	3	3	3	2	2										45	67.5
3	3	4	5	4	4	4	3	3	3	3	3	2	2										46	69
3	3	4	5	5	4	4	3	3	3	3	3	2	2										47	70.5
3	4	4	5	5	4	4	3	3	3	3	3	2	2										48	72
3	4	4	5	5	4	4	4	3	3	3	3	2	2										49	73.5
3	4	4	5	5	4	4	4	4	3	3	3	2	2										50	75
4	4	4	5	5	4	4	4	4	3	3	3	2	2										51	76.5
4	4	4	5	5	4	4	4	4	4	3	3	2	2										52	78
4	4	5	5	5	4	4	4	4	4	3	3	2	2										53	79.5
4	4	5	5	5	5	4	4	4	4	3	3	2	2										54	81
4	4	5	5	5	5	5	4	4	4	3	3	2	2										55	82.5
4	4	5	5	5	5	5	4	4	4	4	3	2	2										56	84
4	4	5	6	5	5	5	4	4	4	4	3	2	2										57	85.5
4	4	5	6	5	5	5	4	4	4	4	3	2	2	1									58	87
4	4	5	6	5	5	5	4	4	4	4	3	2	2	2									59	88.5
4	4	5	6	6	5	5	4	4	4	4	3	2	2	2									60	90
4	4	5	6	6	5	5	5	4	4	4	3	2	2	2									61	91.5
4	4	5	6	6	5	5	5	4	4	4	3	3	2	2									62	93
4	5	5	6	6	5	5	5	4	4	4	3	3	2	2									63	94.5
4	5	5	6	6	5	5	5	4	4	4	4	3	2	2									64	96
4	5	5	6	6	5	5	5	5	4	4	4	3	2	2									65	97.5
4	5	5	6	6	6	5	5	5	4	4	4	3	2	2									66	99
5	5	5	6	6	6	5	5	5	4	4	4	3	2	2									67	100.5
5	5	6	6	6	6	5	5	5	4	4	4	3	2	2									68	102
5	5	6	7	6	6	5	5	5	4	4	4	3	2	2									69	103.5
5	6	6	7	6	6	5	5	5	4	4	4	3	2	2									70	105

Table TDA-5 (cont). Spill patterns for juvenile fish passage at The Dalles Dam.

Gate # (Opening in feet)																							Total 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	6	6	7	6	6	5	5	5	4	4	4	3	3	2									71	106.5
5	6	6	7	7	6	5	5	5	4	4	4	3	3	2									72	108
5	6	6	7	7	6	6	5	5	4	4	4	3	3	2									73	109.5
5	6	6	7	7	6	6	5	5	5	4	4	3	3	2									74	111
5	6	7	7	7	6	6	5	5	5	4	4	3	3	2									75	112.5
5	6	7	7	7	6	6	5	5	5	4	4	4	3	2									76	114
5	6	7	7	7	6	6	6	5	5	4	4	4	3	2									77	115.5
5	6	7	7	7	6	6	6	5	5	5	4	4	3	2									78	117
6	6	7	7	7	6	6	6	5	5	5	4	4	3	2									79	118.5
6	6	7	7	7	6	6	6	6	5	5	4	4	3	2									80	120
6	6	7	7	7	7	6	6	6	5	5	4	4	3	2									81	121.5
6	6	7	7	7	7	6	6	6	5	5	5	4	3	2									82	123
6	6	7	7	7	7	6	6	6	6	5	5	4	3	2									83	124.5
6	6	7	8	7	7	6	6	6	6	5	5	4	3	2									84	126
6	6	7	8	7	7	7	6	6	6	5	5	4	3	2									85	127.5
6	6	7	8	8	7	7	6	6	6	5	5	4	3	2									86	129
6	7	7	8	8	7	7	6	6	6	5	5	4	3	2									87	130.5
6	7	7	8	8	7	7	7	6	6	5	5	4	3	2									88	132
6	7	7	8	8	8	7	7	6	6	5	5	4	3	2									89	133.5
6	7	7	8	8	8	7	7	6	6	6	5	4	3	2									90	135
6	7	8	8	8	8	7	7	6	6	6	5	4	3	2									91	136.5
6	7	8	8	8	8	7	7	7	6	6	5	4	3	2									92	138
7	7	8	8	8	8	7	7	7	6	6	5	4	3	2									93	139.5
7	7	8	8	8	8	8	7	7	6	6	5	4	3	2									94	141
7	8	8	8	8	8	8	7	7	6	6	5	4	3	2									95	142.5
7	8	8	9	8	8	8	7	7	6	6	5	4	3	2									96	144
7	8	8	9	9	8	8	8	7	7	6	6	5	4	3	2								97	145.5
7	8	8	9	9	9	8	8	7	7	7	6	5	4	3	2								98	147
7	8	9	9	9	9	8	8	7	7	7	6	5	4	3	2								99	148.5
7	8	9	9	9	9	9	8	7	7	7	6	5	4	3	2								100	150
7	8	9	9	9	9	9	8	7	7	7	6	5	4	3	2	1							101	151.5
7	8	9	9	9	9	9	8	7	7	7	6	5	4	3	2	2							102	153
7	8	9	9	9	9	9	8	7	7	7	6	5	4	3	3	2							103	154.5
7	8	9	9	9	9	9	8	7	7	7	6	5	4	4	3	2							104	156
7	8	9	9	9	9	9	8	7	7	7	6	5	5	4	3	2							105	157.5

Table TDA-5 (cont). Spill patterns for juvenile fish passage at The Dalles Dam.

Gate # (Opening in feet)																							Total 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		
7	8	9	9	9	9	8	7	7	7	6	6	5	4	3	2								106	159
7	8	9	9	9	9	8	7	7	7	6	6	5	4	3	2	1							107	160.5
7	8	9	9	9	9	8	7	7	7	6	6	5	4	3	2	2							108	162
7	8	9	9	9	9	8	7	7	7	6	6	5	4	3	3	2							109	163.5
7	8	9	9	9	9	8	7	7	7	6	6	5	4	4	3	2							110	165
7	8	9	9	9	9	8	7	7	7	6	6	5	5	4	3	2							111	166.5
7	8	9	9	9	9	8	7	7	7	6	6	5	5	4	3	2	1						112	168
7	8	9	9	9	9	8	7	7	7	6	6	5	5	4	3	2	2						113	169.5
7	8	9	9	9	9	8	7	7	7	6	6	5	5	4	3	3	2						114	171
7	8	9	9	9	9	8	7	7	7	6	6	5	5	4	4	3	2						115	172.5
7	8	9	9	9	9	8	8	7	7	6	6	5	5	4	4	3	2						116	174
7	8	9	9	9	9	9	8	7	7	6	6	5	5	4	4	3	2						117	175.5
7	8	9	9	9	9	9	8	8	7	6	6	5	5	4	4	3	2						118	177
7	8	9	9	9	9	9	8	8	7	7	6	5	5	4	4	3	2						119	178.5
7	8	9	9	9	9	9	8	8	7	7	6	6	5	4	4	3	2						120	180
7	8	9	9	9	9	9	8	8	7	7	6	6	5	5	4	3	2						121	181.5
7	8	9	9	10	9	9	8	8	7	7	6	6	5	5	4	3	2						122	183
7	8	9	9	10	9	9	8	8	7	7	6	6	5	5	4	3	2						123	184.5
7	8	9	9	10	9	9	8	8	7	7	7	6	6	5	4	3	2						124	186
7	8	9	9	10	9	9	8	8	8	7	7	6	6	5	4	3	2						125	187.5
7	8	9	9	10	9	9	9	8	8	7	7	6	6	5	4	3	2						126	189
7	8	9	9	10	10	9	9	8	8	7	7	6	6	5	4	3	2						127	190.5
7	8	9	9	10	10	9	9	8	8	7	7	7	6	5	4	3	2						128	192
7	8	9	9	10	10	9	9	8	8	8	7	7	6	5	4	3	2						129	193.5
7	8	9	9	10	10	9	9	9	8	8	7	7	6	5	4	3	2						130	195
7	8	9	10	10	10	9	9	9	8	8	7	7	6	5	4	3	2						131	196.5
7	8	9	10	10	10	10	9	9	8	8	7	7	6	5	4	3	2						132	198
7	8	9	10	10	10	10	9	9	8	8	7	7	6	6	4	3	2						133	199.5
7	8	9	10	10	10	10	9	9	8	8	7	7	6	6	4	3	2	1					134	201
7	8	9	10	10	10	10	9	9	8	8	7	7	6	6	4	3	2	2					135	202.5
7	8	9	10	10	10	10	9	9	8	8	8	7	6	6	4	3	2	2					136	204
7	8	9	10	10	10	10	9	9	9	8	8	7	6	6	4	3	2	2					137	205.5
7	8	9	10	10	10	10	9	9	9	8	8	7	6	6	4	3	3	2					138	207
7	8	9	10	10	10	10	9	9	9	8	8	7	6	6	4	4	3	2					139	208.5
7	8	9	10	10	10	10	9	9	9	8	8	7	6	6	5	4	3	2					140	210

Table TDA-5 (cont). Spill patterns for juvenile fish passage at The Dalles Dam.

Gate # (Opening in feet)																							Total 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		
7	8	9	10	10	10	10	10	9	9	8	8	7	6	6	5	4	3	2					141	211.5
7	8	9	10	10	10	10	10	9	9	9	8	7	6	6	5	4	3	2					142	213
7	8	9	10	10	10	10	10	10	9	9	8	7	6	6	5	4	3	2					143	214.5
7	8	9	10	10	10	10	10	10	9	9	8	7	7	6	5	4	3	2					144	216
8	8	9	10	10	10	10	10	10	9	9	8	7	7	6	5	4	3	2					145	217.5
8	8	9	10	10	10	10	10	10	9	9	8	8	7	6	5	4	3	2					146	219
8	9	9	10	10	10	10	10	10	9	9	8	8	7	6	5	4	3	2					147	220.5
8	9	9	10	10	10	10	10	10	9	9	9	8	7	6	5	4	3	2					148	222
8	9	9	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2					149	223.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2					150	225
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	1				151	226.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2				152	228
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2	1			153	229.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2	2			154	231
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2	2	1		155	232.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2	2	2		156	234
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2	2	2	1	157	235.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	2	2	2	2	2	158	237
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	3	2	2	2	2	159	238.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	3	3	2	2	2	160	240
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	3	3	3	2	2	161	241.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	3	3	3	2		162	243
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	3	3	3	3	3	3	163	244.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	4	3	3	3	3	3	164	246
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	4	4	4	3	3	3	3	165	247.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	4	4	3	3	3	3	166	249
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	4	4	4	3	3	3	167	250.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	4	4	4	4	3	3	168	252
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	4	4	4	4	4	3	169	253.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	4	4	4	4	4	4	170	255
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	4	4	4	4	4	171	256.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	5	4	4	4	4	172	258
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	5	5	4	4	4	173	259.5
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	5	5	5	4	4	174	261
8	9	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	5	5	5	5	4	175	262.5

Table TDA-5 (cont). Spill patterns for juvenile fish passage at The Dalles Dam.

Gate # (Opening in feet)																							Total 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	10	10	9	9	8	7	6	5	5	5	5	5	5	5	5	176	264
8	9	10	10	10	10	10	10	10	10	10	9	9	8	7	6	6	5	5	5	5	5	5	177	265.5
8	9	10	10	10	10	10	10	10	10	10	10	9	8	7	6	6	5	5	5	5	5	5	178	267
8	9	10	10	10	10	10	10	10	10	10	10	9	8	7	7	6	5	5	5	5	5	5	179	268.5
8	9	10	10	10	10	10	10	10	10	10	10	9	8	8	7	6	5	5	5	5	5	5	180	270
8	9	10	10	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	5	5	5	181	271.5
8	9	10	10	10	10	10	10	10	10	10	10	9	9	8	7	6	6	5	5	5	5	5	182	273
8	9	10	10	10	10	10	10	10	10	10	10	10	9	8	7	6	6	5	5	5	5	5	183	274.5
8	9	10	10	10	10	10	10	10	10	10	10	10	9	8	7	7	6	5	5	5	5	5	184	276
8	9	10	10	10	10	10	10	10	10	10	10	10	9	8	8	7	6	5	5	5	5	5	185	277.5
8	9	10	10	10	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	5	5	186	279
8	9	10	10	10	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	5	187	280.5
8	9	10	10	10	10	10	10	10	10	10	10	10	9	8	7	6	6	5	5	5	5	5	188	282
8	9	10	10	10	10	10	10	10	10	10	10	10	9	8	7	7	6	5	5	5	5	5	189	283.5
8	9	10	10	10	10	10	10	10	10	10	10	10	9	8	8	7	6	5	5	5	5	5	190	285
8	9	10	10	10	10	10	10	10	10	10	10	10	9	9	8	7	6	5	5	5	5	5	191	286.5
8	9	10	10	10	10	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	192	288
9	9	10	10	10	10	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	193	289.5
9	10	10	10	10	10	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	194	291
9	10	11	10	10	10	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	195	292.5
9	10	11	11	10	10	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	196	294
9	10	11	11	11	10	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	197	295.5
9	10	11	11	11	11	10	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	198	297
9	10	11	11	11	11	11	10	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	199	298.5
9	10	11	11	11	11	11	11	10	10	10	10	10	10	9	8	7	6	5	5	5	5	5	200	300
9	10	11	11	11	11	11	11	11	10	10	10	10	10	9	8	7	6	5	5	5	5	5	201	301.5
9	10	11	11	11	11	11	11	11	11	10	10	10	10	9	8	7	6	5	5	5	5	5	202	303
9	10	11	11	11	11	11	11	11	11	11	10	10	10	9	8	7	6	5	5	5	5	5	203	304.5
9	10	11	11	11	11	11	11	11	11	11	11	10	10	9	8	7	6	5	5	5	5	5	204	306
9	10	11	11	11	11	11	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	205	307.5
10	10	11	11	11	11	11	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	206	309
10	11	11	11	11	11	11	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	207	310.5
10	11	12	11	11	11	11	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	208	312
10	11	12	12	11	11	11	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	209	313.5
10	11	12	12	12	11	11	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	210	315

Table TDA-5 (cont). Spill patterns for juvenile fish passage at The Dalles Dam.

Gate # (Opening in feet)																							Total 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		
10	11	12	12	12	12	11	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	211	316.5
10	11	12	12	12	12	12	11	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	212	318
10	11	12	12	12	12	12	12	11	11	11	11	11	10	9	8	7	6	5	5	5	5	5	213	319.5
10	11	12	12	12	12	12	12	12	11	11	11	11	10	9	8	7	6	5	5	5	5	5	214	321
10	11	12	12	12	12	12	12	12	12	11	11	11	10	9	8	7	6	5	5	5	5	5	215	322.5
10	11	12	12	12	12	12	12	12	12	11	11	11	10	9	8	7	6	5	5	5	5	5	216	324
10	11	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	6	5	5	5	5	5	217	325.5
10	11	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	6	6	5	5	5	5	218	327
10	11	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	7	6	5	5	5	5	219	328.5
10	11	12	12	12	12	12	12	12	12	12	12	11	10	9	8	8	7	6	5	5	5	5	220	330
10	11	12	12	12	12	12	12	12	12	12	12	11	10	9	9	8	7	6	5	5	5	5	221	331.5
10	11	12	12	12	12	12	12	12	12	12	12	11	10	10	9	8	7	6	5	5	5	5	222	333
10	11	12	12	12	12	12	12	12	12	12	12	11	11	10	9	8	7	6	5	5	5	5	223	334.5
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	6	5	5	5	5	224	336
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	6	6	5	5	5	225	337.5
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	7	6	5	5	5	226	339
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	8	7	6	5	5	5	227	340.5
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	9	8	7	6	5	5	5	228	342
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	10	9	8	7	6	5	5	5	229	343.5
10	11	12	12	12	12	12	12	12	12	12	12	12	11	11	10	9	8	7	6	5	5	5	230	345
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	6	5	5	5	5	231	346.5
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	6	6	5	5	5	232	348
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	7	7	6	5	5	5	233	349.5
10	11	12	12	12	12	12	12	12	12	12	12	12	11	10	9	8	8	7	6	5	5	5	234	351