

Appendix A

Special Project Operations & Studies

Table of Contents

1. INTRODUCTION	1
1.1. Purpose.....	1
1.2. Schedule	1
1.3. Spill for Juvenile Fish Passage.....	1
1.4. Navigation Lock Maintenance	1
1.5. Doble Testing.....	2
2. BONNEVILLE DAM	3
2.1. BON Special Operations.....	3
2.2. BON Studies	3
3. THE DALLES DAM.....	4
3.1. TDA Special Operations	4
3.2. TDA Studies.....	4
4. JOHN DAY DAM	4
4.1. JDA Special Operations.....	4
4.2. JDA Studies	4
5. McNARY DAM	5
5.1. MCN Special Operations.....	5
5.2. MCN Studies	6
6. ICE HARBOR DAM	8
6.1. IHR Special Operations	8
6.2. IHR Studies.....	9
7. LOWER MONUMENTAL DAM.....	11
7.1. LMN Special Operations	11
7.2. LMN Studies.....	13
8. LITTLE GOOSE DAM.....	14
8.1. LGS Operations	14
8.2. LGS Studies	14
9. LOWER GRANITE DAM	16
9.1. LWG Special Operations	16
9.2. LWG Studies.....	18

1. INTRODUCTION

1.1. Purpose

This Appendix to the *Fish Passage Plan* (FPP) describes special project operations and studies planned to occur during the current year that may affect fish passage at the four Lower Snake River and four Lower Columbia River projects. All special operations and studies will be coordinated with the project and appropriate regional agencies. The Corps RCC will issue a teletype to authorize all necessary operational changes and provide guidance to project operators.

1.2. Schedule

All dates shown for special operations and studies are approximate and could shift earlier or later due to a variety of factors, including river flow, contractor schedules, equipment failures, or other real-time conditions.

Some studies in this Appendix may not be implemented. Therefore, a final description of studies and outages/operations being conducted will be regionally coordinated prior to April 1 as part of the Corps' Anadromous Fish Evaluation Program (AFEP) via the Fish Facilities Design Review Workgroup (FFDRWG) and/or the Studies Review Workgroup (SRWG).

The Action Agencies will coordinate all significant operational requests and/or schedule changes with fish agencies and tribes through the appropriate regional forum to inform the final decision.

1.3. Spill for Juvenile Fish Passage

Spring and summer spill operations for juvenile fish passage will be implemented as defined in the *Fish Operations Plan* (FOP; included in the FPP as **Appendix E**), or as otherwise coordinated in-season through TMT. Spill for juvenile fish passage will begin April 3 at the Lower Snake River projects (IHR, LMN, LGS, LWG) and April 10 at the Lower Columbia River projects (BON, TDA, JDA, MCN), and continue through August 31. Alternative spill patterns to manage total dissolved gas (TDG) and/or fish passage conditions will be coordinated through the Fish Passage Operations & Maintenance (FPOM) workgroup. During periods of high river flow, the spill rate and forebay elevation at Lower Monumental and Lower Granite may need to be adjusted daily or every-other-day if necessary to provide safe conditions for the fish transport barge in the tailrace.

1.4. Navigation Lock Maintenance

Annual lock outages are scheduled for routine maintenance and inspections, as well as some non-routine work such as repairs of gate structures, concrete, and machinery. In 2018, the annual navigation lock maintenance outage at Corps Walla Walla District projects (LWG, LGS, LMN, IHR, MCN) is scheduled to begin at 6:00am March 3, 2018. Lower Granite and Little Goose locks will be closed through March 25 (3 weeks); all other Walla Walla District projects will be closed through March 18 (2 weeks). Additional information about Corps Walla Walla District navigation lock outages is available online at: www.nww.usace.army.mil/Missions/Navigation/

1.5. Doble Testing¹

Transformers at the Lower Snake River projects are required to undergo Doble testing¹ every three years to ensure they are functioning correctly and identify any issues that need repair. The testing must be conducted during warm, dry conditions (July–August) and requires an outage of the transformer and associated units. Testing is performed during already scheduled outages to the extent possible and timed to avoid or minimize impacts to fish. The schedule for the current year is defined below in **Table A-1**. For more information, refer to the project-specific sections below and FPP Chapters 2-8.

Table A-1. Doble Testing Schedule in 2018.*

Project	2018 Dates for Doble Testing	Outage (Transformer/Units)	Notes
MCN	Jun 4-8 Jun 11-15 Jun 18-22	T1 (Units 1-2) T6 (Units 11-12) T7 (Units 13-14)	T1 Doble will take both attraction Units 1 and 2 offline at the same time. No choice as the Power Line has to be isolated from T1.
IHR	Jul 23-27	TW5, 6 (Units 5-6)	Unit 5 OOS daily from 0700-1700. Unit 6 already OOS for annual maintenance (Jul 16-Aug 10).
LMN	Jul 27–Aug 2	T2 (Units 5-6)	All units OOS ≤ 4 hrs on first/last day for clearances. T1 (Units 1-4) RTS after clearances.
LGS	Aug 6-11	T1 (Units 1-4)	All units OOS on first/last day. T2 (Unit 6) RTS nightly 1800-0530.
LWG	Aug 13-17	T2 (Units 5-6)	All units OOS daily 0600-1800 for clearances. T1 (Units 1-4) RTS nightly 1800-0600.

*BON, TDA, JDA: No specific outage for Doble tests (testing is done concurrent with outages for maintenance).

¹ Common term referring to a power factor test of transformers to measure performance of electrical insulation. *Doble* is a manufacturer of the test equipment.

2. BONNEVILLE DAM

2.1. BON Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** for special operations related to spill for juvenile fish passage and navigation lock outages for maintenance.

2.2. BON Studies

2.2.1. Juvenile Salmon and Steelhead System Survival (Lower Granite to Bonneville).

a) Dates: Spring 2018

b) Description: In spring 2018, Pacific Northwest National Laboratory (PNNL) will conduct a system-wide (Lower Granite Dam to Bonneville Dam) acoustic telemetry survival study to better understand the impacts of Gas Cap Spill on juvenile fish. Reach survival estimates will also be assessed from Lower Granite to McNary and from McNary to Bonneville. Fish tagged from the Lower Granite Survival Study (see **section 9.2**) will be used to estimate survival from Lower Granite to McNary. An additional fish collection, tagging, and release effort will take place at McNary to estimate survival from McNary to Bonneville. In addition, Little Goose will be monitored for passage distribution and tailrace delay to better understand the unintended consequences of Gas Cap Spill. Cabled JSAT hydrophones and receivers will be installed at Little Goose on the upstream face of the dam to monitor the major passage routes. At McNary and Bonneville, autonomous receivers will be deployed in the forebay and tailrace a few kilometers from the dam. This study will require access at Little Goose and McNary dams for fish collection and tagging, maintenance and service of telemetry and associated equipment, and will require assistance from the project to provide power for electronics and water supply for holding fish. Dead fish with JSATs tags will be released into all major passage routes (spill, turbine, powerhouse JBS) at McNary and Bonneville Dams to estimate probability of dead fish detections (false positives) on downstream arrays and researchers will need access to these dams for this purpose.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

3. THE DALLES DAM

3.1. TDA Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** for special operations related to spill for juvenile fish passage and navigation lock outages for maintenance.

3.2. TDA Studies

There are no studies scheduled for The Dalles Dam in 2018.

4. JOHN DAY DAM

4.1. JDA Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** for special operations related to spill for juvenile fish passage and navigation lock outages for maintenance.

4.2. JDA Studies

There are no studies scheduled for John Day Dam in 2018.

5. McNARY DAM

5.1. MCN Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

5.1.1. Fish Ladder Exit, Entrance, Regulating/Tilting Weir Maintenance.

- a) Dates: January–February (Long-Term).
- b) Description: The Washington shore fish ladder (WAFL) entrance diffuser gratings are being inspected during the 2018 winter outage. These diffuser gratings may need extra work done to them if substantial corrosion is identified.

WASCO will be conducting their 10-year inspection of their underwater generator tailrace weir cables and connection points. This may impact the WAFL watering up times.

The *Oil Accountability Program* identified oil leaks in the WA/OR fish ladder Tilting Weirs and prioritized repairs. McNary maintenance will be effecting repairs/replacement of leaking gear boxes on 2 weirs in the ORFL and WAFL. Maintenance efforts also revealed that the original seals and gaskets failed due to not being actively operated to prevent drying out and tearing. Now that seals and bushings have been replaced, the project needs to operate all equipment monthly and semi-annually to assess oil/grease requirements and to ensure seals do not dry out or stick to shafts. The motors for each weir can be operated during back shifts or periods of inactivity to exercise seals. The manual greasing of Zerk fittings requires a mechanic during normal working hours. McNary maintenance personnel will work with Project Biologists to perform this maintenance during low impact periods as appropriate.

- c) Impacts to FPP Criteria: Minimal due to coordination of outages and use of non-peak adult fish passage times.

5.1.2. Juvenile Collection Channel Upgrade.

- a) Dates: December 27, 2017 – March 19, 2018.
- b) Description: Upgrading cleaning brushes, air bubbler, alarm annunciation, new PLC, new hoist, and improved air components associated with orifice gates. Upgrade will improve reliability for JCC passage.
- c) Impacts to FPP Criteria: None.

5.1.3. Fish Attraction Pumps (FPs).

- a) Dates: January 2018 – December 2018.
- b) Description: Critical maintenance is scheduled for fish pumps (FP) 1 and 3 in 2018 due to extended operation for 7-9 years without relief from FP2. Maintenance may consist of replacing or repairing exciters, exciter brushes, lube oil systems, heat exchangers, alarm annunciation equipment, etc. This maintenance will improve reliability for attraction water for adult salmonids utilizing the Oregon fish ladder system.

- c) Impacts to FPP Criteria: None during scheduled outage.

5.1.4. NERC/WECC Main Unit Reactive Limit Tests.

- a) Dates: February 2018–August 2018.
- b) Description: The purpose of this testing requirement is to ensure that there is accurate information on generator gross and net Real and Reactive Power capability for planning models used to assess Bulk Electric System (BES) reliability. Testing requires all Main Unit Generators to operate outside of the 1% range for at least 1 hour and will typically be performed in February. However, operational restrictions may require some units to be tested later in the year during fish passage season. Testing dates are not currently scheduled and will be coordinated with BPA and NWW NERC/WECC Engineers.
- c) Impacts to FPP Criteria: None, unless operational restrictions require testing after April 1.

5.1.5. Waterfowl Nesting.

- a) Dates: April–July (annually).
- b) Description: Annually since 1982, McNary pool is operated for waterfowl nesting on Lake Wallula late April through early July. During this operation, the McNary pool may be restricted to an operating range of 337'–340' elevation. Pool elevations are also operated in the range of 338.5'–339.5' for 4-6 hours during daylight hours at least once every 4 days.
- c) Impacts to FPP Criteria: None. Provided for informational purposes.

5.1.6. Doble Testing.

- a) Dates: See schedule in Table A-1 above.
- b) Description: See section 1.5 above.
- c) Impacts to FPP Criteria: None. Since McNary Dam has multiple transformer banks and transmission lines and redundant switching capability, most turbine units will be available for operation during testing and operated pursuant to FPP priority order within $\pm 1\%$ of peak efficiency (1% range).

5.2. MCN Studies

5.2.1. Evaluation of McNary Dam Adult Fish Ladder Modifications to Improve Pacific Lamprey Passage.

- a) Dates: Ongoing.
- b) Description: This study will use radio telemetry (RT) and half-duplex (HD) PIT-tag systems to evaluate passage success of adult Pacific lamprey through the lower Columbia River (including McNary Dam). Adult Lamprey will be captured and tagged at Bonneville Dam. This study will continue to require electrical power for electronics and access to maintain and download data from the RT and PIT-tag detection equipment. Maintenance of equipment will occur during the winter maintenance period when adult fishways are dewatered.
- c) Impacts to FPP Criteria: None.

5.2.2. Juvenile Salmon and Steelhead System Survival (Lower Granite to Bonneville).

- a) Dates: Spring 2018
- b) Description: In spring 2018, PNNL will conduct a system-wide (Lower Granite Dam to Bonneville Dam) acoustic telemetry survival study to better understand the impacts of Gas Cap Spill on juvenile fish. Reach survival estimates will also be assessed from Lower Granite to McNary and from McNary to Bonneville. Fish tagged from the Lower Granite Survival Study (see **section 9.2**) will be used to estimate survival from Lower Granite to McNary. An additional fish collection, tagging, and release effort will take place at McNary to estimate survival from McNary to Bonneville. In addition, Little Goose will be monitored for passage distribution and tailrace delay to better understand the unintended consequences of Gas Cap Spill. Cabled JSAT hydrophones and receivers will be installed at Little Goose on the upstream face of the dam to monitor the major passage routes. At McNary and Bonneville, autonomous receivers will be deployed in the forebay and tailrace a few kilometers from the dam. This study will require access at Little Goose and McNary dams for fish collection and tagging, maintenance and service of telemetry and associated equipment, and will require assistance from the project to provide power for electronics and water supply for holding fish. Dead fish with JSATs tags will be released into all major passage routes (spill, turbine, powerhouse JBS) at McNary and Bonneville Dams to estimate probability of dead fish detections (false positives) on downstream arrays and researchers will need access to these dams for this purpose.
- c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

5.2.3. Hydrographic Survey of Stilling Basin.

- a) Dates: 2-3 days per project during the work window of September 15– October 31, 2018.
- b) Description: Multi-beam hydrographic surveys of the stilling basin to assess impacts from the spring Gas Cap spring spill operation. Survey work will take an estimated 2-3 days at each project, starting in September.
- c) Impacts to FPP Criteria: Units may need to operate out of priority order to accommodate the survey.

6. ICE HARBOR DAM

6.1. IHR Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

6.1.1. Unit 2 and Unit 3 Turbine Runner Replacement.

- a) Dates: Unit 2 through spring 2018 and Unit 3 starting in spring 2018 (after Unit 2).
- b) Description: Unit 2 was taken out of service in March 2016 to replace the turbine runner and is currently scheduled to return to service in spring 2018. After the replacement is complete, Unit 2 will undergo several days of testing with STSs in place while the unit is operating. When Unit 2 has returned to service, Unit 3 will undergo pre-commission testing with STSs installed prior to being taken out of service for runner replacement.
- c) Impacts to FPP Criteria: Through spring 2018 (estimated March-April), Unit 2 will be out of service and unavailable for operation as the second priority unit for fish passage. After Unit 2 returns to service, Unit 3 will be out of service and unavailable for operation as the third priority unit. The project will operate the next available unit in the FPP priority order.

6.1.2. Units 4, 5, 6 Oil Replacement.

- a) Dates: April 2018 – May 2018 (approximately 3 weeks for each unit).
- b) Description: Tentatively scheduled to begin April 16, 2018, Units 4, 5, 6 will be out of service for approximately 3 weeks each to replace the turbine oil. The outages will overlap one week to facilitate preparation for the next unit while the contractor replaces the turbine oil on the previous unit. Tentative schedule is Unit 4 April 16–May 4, Unit 5 April 30–May 18, and Unit 6 May 14–25.
- c) Impacts to PP Criteria: None. When a unit is out of service for maintenance, the project will operate the next available unit in the FPP priority order.

6.1.3. Doble Testing.

- a) Dates: See schedule in Table A-1 above.
- b) Description: See section 1.5 above.
- c) Impacts to FPP Criteria: None. Doble testing is conducted in conjunction with scheduled unit maintenance. Since Ice Harbor has multiple transformer banks and transmission lines and redundant switching capability, remaining units will be available and operated pursuant to FPP priority order within $\pm 1\%$ of peak efficiency (1% range).

6.1.4. 115 kV Disconnects and Surge Arrester Replacement.

- a) Dates: August 2018 – December 2018.

b) Description: Large Capital work to replace manually operated equipment with Motor Operated Sectionalizer Switches will require outages of two or three units at a time.

Tentative schedule is:

- Units 1, 2, 6: Aug 15
- Units 2, 3, 4: Sep 4–Oct 3
- Units 5, 6: Oct 4–Nov 25
- Unit 2: Nov 26–Dec 15

c) Impacts to FPP Criteria: None. When a unit is out of service for maintenance, the project will operate the next available unit in the FPP priority order.

6.2. IHR Studies

6.2.1. Adult Spring Chinook Passage and Behavior in the Lower Snake River.

a) Dates: Spring 2018

b) Description: In spring 2018, adult spring Chinook salmon will be tagged with acoustic transmitters and monitored to evaluate tailrace behavior in relation to gas cap spill and turbine unit priorities at Little Goose Dam. Adult spring Chinook will be collected and acoustically tagged at the Ice Harbor Adult Fish Trap and released above the dam between early April and mid-June 2018. Study fish will be monitored for behavior (3-D) and passage at Little Goose and monitored for passage at Lower Granite. At Little Goose, a combination of cabled and autonomous JSATs acoustic telemetry receiver arrays will be deployed in the tailrace and inside the fishway entrances to study the 3-D behavior and preferred fishway entrance locations in relation to gas cap spill operations and unit priorities. Deployment of the tailrace receiver arrays will require coordination of unit outages and BRZ boat access to install equipment in January–March. Further project coordination may be required in-season to access the BRZ and service the North tailrace autonomous rays located downstream of the earthen portion of the dam. At Lower Granite Dam, a few JSATs receivers will be installed in the junction/transition pool of the adult fishway to monitor tagged fish passage. This study will require access for the collection and tagging of fish at Ice Harbor Dam, to maintain and service telemetry equipment at Little Goose and Lower Granite Dams, and will require assistance from the project to provide power for electronics and associated telemetry equipment. An adult fish transport trailer may be needed from Ice Harbor for the release of adult fish above the dam. The Ice Harbor adult trap will be operated according to FPP protocol.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

6.2.2. IHR Unit 2 Direct Injury and Sensor Fish Characterization.

a) Dates: September 2018 – October 2018

b) Description: Juvenile spring Chinook salmon and Sensor Fish will be directly released into turbine unit 2 to evaluate the new fixed-blade runner. The study is expected to require approximately four weeks of total study time. Direct release pipes will be installed in all three intakes of Unit 2 for direct fish and Sensor Fish releases. Release pipes will be installed

on the STS frames. Three specific turbine operations will be tested. Project support will be provided for equipment install, removal, and turbine operations. A one-day Unit 2 outage is expected for release pipe install and removal. Another consideration will be river flow and unit priority during the study period. Specific dates for Project support, outages, and operations will be scheduled appropriately with the Project and through FPOM closer to study implementation.

c) Impacts to FPP Criteria: Any modification to unit priority order or other FPP criteria will be coordinated through FPOM.

6.2.3. Hydrographic Survey of Stilling Basin.

a) Dates: 2-3 days per project during the work window of September 15– October 31, 2018.

b) Description: Multi-beam hydrographic surveys of the stilling basin to assess impacts from the spring Gas Cap spring spill operation. Survey work will take an estimated 2-3 days at each project, starting in September.

c) Impacts to FPP Criteria: Units may need to operate out of priority order to accommodate the survey.

7. LOWER MONUMENTAL DAM

7.1. LMN Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

7.1.1. Lower Monumental Head Gate Rehab.

- a) Dates: Ongoing through 2019.
- b) Description: Under the BPA Large Cap Program, parts and materials have been acquired to rehabilitate the head gates at Lower Monumental Dam. To facilitate the process, units will be scheduled out-of-service to remove or replace head gates. The head gates will be serviced in the repair pit and then placed back into service. The work started in December of 2012.
- c) Impacts to FPP Criteria: Deviation from unit priority will be necessary to swap head gates from the unit to the pit. The duration of the outages is expected to be one day.

7.1.2. Adult Fish Collection Channel Bulkhead Maintenance.

- a) Dates: Ongoing through December 2018.
- b) Description: Work began in June 2016 to rehabilitate Adult Fish Collection Channel Bulkheads along the powerhouse to support Diffuser Grating replacement during the FY19 or 20 in-water work period. This work will require short duration (≤ 5 hours) Fish Pump outages and adjustment of the NPE and SPEs to minimize the pressure differential to facilitate removal and replacement of bulkheads. The bulkheads will be rehabilitated on the tailrace deck, then returned to service. The work is expected to continue into the second half of 2018.
- c) Impacts to FPP Criteria: None anticipated. Work would be scheduled to occur during time frames which will have minimal impact to adult passage (i.e., early in the morning or late at night when fewer adults are moving).

7.1.3. Unit 1 Rehab to Kaplan.

- a) Dates: Ongoing through June 2018.
- b) Description: Work started in February 2016 and is currently scheduled through June 2018. The unit will be removed from the hole to disassemble the hub, install new blade linkages, repair cavitation to the blades and scroll case, and install a new discharge ring. The unit will then be reinstalled and final machining done to achieve proper profiles of the scroll case, blades, and hub. There may be other work, not part of the contract, which will occur at this same time (e.g., replace blade packing, inspect wicket gates, refurbish servo-motor). The generator is also scheduled to be re-wound as part of the job.
- c) Impacts to FPP Criteria: During the rehab, Unit 1 will be out of service and unavailable for operation as the priority unit for fish passage. The project will operate the next available unit in the FPP priority order. During commissioning, the unit will be run outside 1%.

7.1.4. Unit 3 or Unit 4 Blade Seal Replacement & Return to Kaplan.

- a) Dates: February 2018 through September 2018.
- b) Description: Work is scheduled to start on either Unit 3 or Unit 4 in early February 2018 to replace suspected leaking blade seals and to restore to full Kaplan. If blade seals are received for Unit 4, it will be completed first and will require re-commissioning the governor. The project currently has blade seals for Unit 3 and if work begins on it in February, additional commissioning following work completion will be required as all testing was performed with the blades fixed at approximately 26.5 degrees. Following the spring freshet, whichever Unit was not repaired will be removed from service, un-watered and the suspected leaking blade seals will be replaced, after which the digital governor for that unit will be re-commissioned.
- c) Impacts to FPP Criteria: During the blade seal replacement, the Unit will be out of service and unavailable for operation. The project will operate the next available unit in the FPP priority order. During commissioning, performance testing, and model validation testing, units will run out of FPP priority and outside 1% (see model validation testing section below).

7.1.5. Model Validation Testing.

- a) Dates: September 1 through March 31 (annually).
- b) Description: Western Electricity Coordinating Council (WECC) requires steady state model validation testing periodically to ensure generating equipment will meet real and reactive power ratings. All units are tested on a 1–2 year cycle. Tests are also required when equipment is replaced or upgraded. Tests will require running the unit out of FPP priority and outside the 1% range. Testing can occur any time from September 1–March 31 and will not occur during peak juvenile fish passage season (April 1–August 31). Tests will preferably be conducted just after annual maintenance, but may happen at other times. Test durations will be minimized to the extent possible and will only be run for the purpose of completing required model validation testing.
- c) Impacts to FPP Criteria: None anticipated. During validation testing, Units will be out of commercial service. The project will operate the next available unit in the FPP priority order.

7.1.6. Doble Testing.

- a) Dates: See schedule in Table A-1 above.
- b) Description: See section 1.5 above.
- c) Impacts to FPP Criteria: On the first and last day of testing, clearance procedures will require a total powerhouse outage for up to 4 hours and all project outflow will be spilled except approximately 5 kcfs for station service. During testing, available units will be operated pursuant to FPP priority order within $\pm 1\%$ of peak efficiency (1% range).

7.1.7. Digital Governor Installation & Commissioning.

- a) Dates: Mid to Late 2018.

b) Description: Digital Governors have been installed on Units 2–6 with the governors on Units 4 and 6 commissioned as a Kaplan Unit. Unit 3 was commissioned with fixed blades and is scheduled to have index testing performed in late January 2018. Unit 5 is scheduled to be commissioned as a Kaplan Unit in late January 2018 and Unit 2 will be commissioned as a fixed bladed unit similar to Unit 3 also in late January 2018. The digital governor on Unit 1 will be scheduled to occur as soon as possible after the peak of the adult passage season, but it will not occur unless Unit 2 is available.

c) Impacts to FPP Criteria: None anticipated. During work, the unit will be out of service and the project will operate the next available unit in the FPP priority order.

7.2. LMN Studies

7.2.1. Hydrographic Survey of Stilling Basin.

a) Dates: 2-3 days per project during the work window of September 15– October 31, 2018.

b) Description: Multi-beam hydrographic surveys of the stilling basin to assess impacts from the spring Gas Cap spring spill operation. Survey work will take an estimated 2-3 days at each project, starting in September.

c) Impacts to FPP Criteria: Units may need to operate out of priority order to accommodate the survey.

8. LITTLE GOOSE DAM

8.1. LGS Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

8.1.1. Fish Ladder Cooling Water Pump Install.

- a) Dates: March 26 and March 30, 2018
- b) Description: Support for this work will require connection of electrical components to XJ-O7 in March 2018. This will require a powerhouse line outage in order to isolate the breaker to safely conduct this work. During the switching operations, all Units 1-6 will be out of service on March 26 and again on March 30. The JFF will be on emergency diesel generator during this time. This schedule is also dependent on flows from the spring freshet and could be delayed if flows are too high. The schedule continues to be refined.
- c) Impacts to FPP Criteria: On March 26 and March 30, all units are scheduled to be out of service and all project outflow will be passed via the spillway.

8.1.2. Doble Testing.

- a) Dates: See schedule in Table A-1 above.
- b) Description: See section 1.5 above.
- c) Impacts to FPP Criteria: None. Doble testing is conducted in conjunction with scheduled unit maintenance. Available units will be operated pursuant to FPP priority order within $\pm 1\%$ of peak efficiency (1% range).

8.2. LGS Studies

8.2.1. Adult Spring Chinook Passage and Behavior in the Lower Snake River.

- a) Dates: Spring 2018
- b) Description: In spring 2018, adult spring Chinook salmon will be tagged with acoustic transmitters and monitored to evaluate tailrace behavior in relation to gas cap spill and turbine unit priorities at Little Goose Dam. Adult spring Chinook will be collected and acoustically tagged at the Ice Harbor Adult Fish Trap and released above the dam between early April and mid-June 2018. Study fish will be monitored for behavior (3-D) and passage at Little Goose and monitored for passage at Lower Granite. At Little Goose, a combination of cabled and autonomous JSATs acoustic telemetry receiver arrays will be deployed in the tailrace and inside the fishway entrances to study the 3-D behavior and preferred fishway entrance locations in relation to gas cap spill operations and unit priorities. Deployment of the tailrace receiver arrays will require coordination of unit outages and BRZ boat access to install equipment in January–March. Further project coordination may be required in-season to access the BRZ and service the North tailrace autonomous rays located downstream of the

earthen portion of the dam. At Lower Granite Dam, a few JSATS receivers will be installed in the junction/transition pool of the adult fishway to monitor tagged fish passage. This study will require access for the collection and tagging of fish at Ice Harbor Dam, to maintain and service telemetry equipment at Little Goose and Lower Granite Dams, and will require assistance from the project to provide power for electronics and associated telemetry equipment. An adult fish transport trailer may be needed from Ice Harbor for the release of adult fish above the dam. The Ice Harbor adult trap will be operated according to FPP protocol.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

8.2.2. Juvenile Salmon and Steelhead System Survival (Lower Granite to Bonneville).

a) Dates: Spring 2018

b) Description: In spring 2018, PNNL will conduct a system-wide (Lower Granite Dam to Bonneville Dam) acoustic telemetry survival study to better understand the impacts of Gas Cap Spill on juvenile fish. Reach survival estimates will also be assessed from Lower Granite to McNary and from McNary to Bonneville. Fish tagged from the Lower Granite Survival Study (see **section 9.2**) will be used to estimate survival from Lower Granite to McNary. An additional fish collection, tagging, and release effort will take place at McNary to estimate survival from McNary to Bonneville. In addition, Little Goose will be monitored for passage distribution and tailrace delay to better understand the unintended consequences of Gas Cap Spill. Cabled JSAT hydrophones and receivers will be installed at Little Goose on the upstream face of the dam to monitor the major passage routes. At McNary and Bonneville, autonomous receivers will be deployed in the forebay and tailrace a few kilometers from the dam. This study will require access at Little Goose and McNary dams for fish collection and tagging, maintenance and service of telemetry and associated equipment, and will require assistance from the project to provide power for electronics and water supply for holding fish. Dead fish with JSATs tags will be released into all major passage routes (spill, turbine, powerhouse JBS) at McNary and Bonneville Dams to estimate probability of dead fish detections (false positives) on downstream arrays and researchers will need access to these dams for this purpose.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

8.2.3. Hydrographic Survey of Stilling Basin.

a) Dates: 2-3 days per project during the work window of September 15– October 31, 2018.

b) Description: Multi-beam hydrographic surveys of the stilling basin to assess impacts from the spring Gas Cap spring spill operation. Survey work will take an estimated 2-3 days at each project, starting in September.

c) Impacts to FPP Criteria: Units may need to operate out of priority order to accommodate the survey.

9. LOWER GRANITE DAM

9.1. LWG Special Operations

Special project operations that may require deviations from FPP criteria will be coordinated with FPOM either by inclusion in this Appendix or in-season via a Memo of Coordination (MOC), pursuant to **FPP Chapter 1 – Overview**. See **Introduction section 1** above for special operations related to spill for juvenile fish passage, navigation lock maintenance, and Doble testing.

9.1.1. Head Gate Repair.

- a) Dates: Bi-Monthly (long-term).
- b) Description: This is a long-term program to return head gates to a safe operating condition by adding new roller chain, seals, anodes, and other miscellaneous components. The plan will require brief unit outages throughout the year while transporting rebuilt gates from the turbine units to the repair pit and back. Each swap will take 4–6 hours to complete and occur approximately every 2 months.
- c) Impacts to FPP Criteria: None anticipated. Head gate movements are expected to take place concurrently with other outages. As the program progresses and fewer head gates need repair, it may require an occasional outage on a priority unit. Available units will be operated pursuant to FPP priority order within $\pm 1\%$ of peak turbine efficiency.

9.1.2. ESBS Repair.

- a) Dates: Bi-Monthly (long-term).
- b) Description: This is a long-term program to return ESBSs to a safe operating condition by tearing down, repainting and rebuilding the screens. The plan will require brief unit outages throughout the year while transporting rebuilt ESBSs from the turbine units to the repair pit and back. Each swap will take 4–6 hours to complete and occur approximately every 2 months.
- c) Impacts to FPP Criteria: None anticipated. ESBS movements are expected to take place concurrently with other outages. As the program progresses and fewer screens need repair, it may require an occasional outage on a priority unit. Available units will be operated pursuant to FPP priority order within $\pm 1\%$ of peak turbine efficiency.

9.1.3. Juvenile Fish Bypass System Upgrade.

- a) Dates: Ongoing through March 2019.
- b) Description: Construction activities associated with the Lower Granite Dam juvenile bypass system (JBS) upgrade began in 2014 and are expected to continue through March 2019. Initial project commissioning activities are expected to occur in January-March 2018 (FPOM MOC: 16LWG10) for the 2018 fish passage season. Due to time necessary to complete construction efforts, some final construction and commissioning activities are anticipated to continue into April 2018 in order to provide a functional JBS for the 2018 fish passage season by mid-April. Construction and commissioning efforts not required for the 2018 fish passage season will be completed by March 2019. All fish salvage operations will

follow standard dewatering procedures and will be coordinated through Lower Granite's fisheries staff in accordance with standard operation procedures.

c) Impacts to FPP Criteria: Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

9.1.4. Lower Granite Digital Governor Upgrade.

a) Dates: July 2018 – March 2019.

b) Description: Lower Granite will be updating Digital Governors during 2018 with relay valve inspections beginning the first two weeks in February. Outages for replacement are scheduled to begin July 2, 2018 and continue through March 29, 2019. Replacement outages will be one unit at a time and require about six weeks to complete work and commissioning. The current plan is to schedule replacement of priority units outside the fish passage season. Commissioning will require starts, stops, and load rejections to verify proper governor operation and may require operating units out of FPP priority order.

c) Impacts to FPP Criteria: Commissioning may require operating units out of FPP priority order. Activities that may impact FPP compliance will be coordinated with FPOM via MOC.

9.1.5. Doble Testing.

a) Dates: See schedule in Table A-1 above.

b) Description: See section 1.5 above.

c) Impacts to FPP Criteria: On the first and last day of testing, clearance procedures will require a total powerhouse outage for up to 4 hours and all project outflow will be spilled except approximately 5 kcfs for station service. During testing, available units will be operated pursuant to FPP priority order within $\pm 1\%$ of peak efficiency (1% range).

9.1.6. Lower Granite Spillbay 1 PIT-Tag Detector Installation.

a) Dates: Fall 2018 through March 2019.

b) Description: Construction activities associated with PIT-tag detection system installation at Lower Granite Dam will begin in fall 2018 and are expected to continue through winter 2019, with project completion expected in March 2019. Construction activities will primarily be in, or near, spillbay 1 and will include reshaping of the ogee, installation of a new spillway flow deflector, and installation of a PIT-tag detection system installation. To facilitate these construction activities, including concrete removal and installation of new equipment, the Corps anticipates needing to request an extended in-water work window of November 15, 2018, to February 28, 2019. The type of work and level of effort is expected to be similar to what was needed for the reshaping of the ogee and new flow deflector for the Ice Harbor Dam spillbay 2 during the winter of 2015/16. An MOC will be distributed to FPOM once sufficient project details are available.

c) Impacts to FPP Criteria: Activities that require special project operations, FPP deviations, or outages will be coordinated with FPOM via MOC.

9.2. LWG Studies

9.2.1. Adult Spring Chinook Passage and Behavior in the Lower Snake River.

a) Dates: Spring 2018

b) Description: In spring 2018, adult spring Chinook salmon will be tagged with acoustic transmitters and monitored to evaluate tailrace behavior in relation to gas cap spill and turbine unit priorities at Little Goose Dam. Adult spring Chinook will be collected and acoustically tagged at the Ice Harbor Adult Fish Trap and released above the dam between early April and mid-June 2018. Study fish will be monitored for behavior (3-D) and passage at Little Goose and monitored for passage at Lower Granite. At Little Goose, a combination of cabled and autonomous JSATs acoustic telemetry receiver arrays will be deployed in the tailrace and inside the fishway entrances to study the 3-D behavior and preferred fishway entrance locations in relation to gas cap spill operations and unit priorities. Deployment of the tailrace receiver arrays will require coordination of unit outages and BRZ boat access to install equipment in January–March. Further project coordination may be required in-season to access the BRZ and service the North tailrace autonomous rays located downstream of the earthen portion of the dam. At Lower Granite Dam, a few JSATs receivers will be installed in the junction/transition pool of the adult fishway to monitor tagged fish passage. This study will require access for the collection and tagging of fish at Ice Harbor Dam, to maintain and service telemetry equipment at Little Goose and Lower Granite Dams, and will require assistance from the project to provide power for electronics and associated telemetry equipment. An adult fish transport trailer may be needed from Ice Harbor for the release of adult fish above the dam. The Ice Harbor adult trap will be operated according to FPP protocol.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

9.2.2. Lower Granite Dam Juvenile Bypass System (JBS) Post-Construction Evaluation.

a) Dates: Spring 2018

b) Description: In spring 2018, researchers will conduct a biological post-construction evaluation of the new Juvenile Bypass System (JBS) at Lower Granite Dam. Lab-reared fish, and run-of-river fish if necessary, will be PIT-tagged and released into the gatewell/collection channel and recaptured via the Separation-by-Code (SbC) system to estimate survival, travel time, and fish condition after passage through the new system. Sensor fish will also be released into various sections of the JBS to characterize hydraulic data of the new system. JSATs-tagged fish from the Lower Granite Dam survival study (separate effort described in **section 9.2.3**) will also provide estimates of survival through the new system. This study will require access to the dam for holding and release of study fish, access to the SbC tanks, JFF wet lab, and most components of the JBS from the gatewell to the JFF. This project will need assistance from the project to provide power for electronics and water supply for holding release and recovery fish.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

9.2.3. Juvenile Salmon and Steelhead System Survival (Lower Granite to Bonneville).

a) Dates: Spring 2018

b) Description: In spring 2018, PNNL will conduct a system-wide (Lower Granite Dam to Bonneville Dam) acoustic telemetry survival study to better understand the impacts of Gas Cap Spill on juvenile fish. Reach survival estimates will also be assessed from Lower Granite to McNary and from McNary to Bonneville. Fish tagged from the Lower Granite Survival Study (see below) will be used to estimate survival from Lower Granite to McNary. An additional fish collection, tagging, and release effort will take place at McNary to estimate survival from McNary to Bonneville. In addition, Little Goose will be monitored for passage distribution and tailrace delay to better understand the unintended consequences of Gas Cap Spill. Cabled JSAT hydrophones and receivers will be installed at Little Goose on the upstream face of the dam to monitor the major passage routes. At McNary and Bonneville, autonomous receivers will be deployed in the forebay and tailrace a few kilometers from the dam. This study will require access at Little Goose and McNary dams for fish collection and tagging, maintenance and service of telemetry and associated equipment, and will require assistance from the project to provide power for electronics and water supply for holding fish. Dead fish with JSATs tags will be released into all major passage routes (spill, turbine, powerhouse JBS) at McNary and Bonneville Dams to estimate probability of dead fish detections (false positives) on downstream arrays and researchers will need access to these dams for this purpose.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

9.2.4. Juvenile Salmon and Steelhead Passage and Survival at Lower Granite Dam.

a) Dates: Spring and Summer 2018

b) Description: In 2018, PNNL will conduct a passage and survival study at Lower Granite Dam. This evaluation will utilize JSATs acoustic telemetry to estimate dam passage survival for spring and summer run-of-river salmon and steelhead. Cabled hydrophones will be deployed on the upstream face of the dam to monitor all major routes of passage available to juvenile salmon. In addition, autonomous receiver arrays will be deployed in both the forebay and tailrace a few kilometers from the dam. Fish collection will occur at Little Goose Dam. Dead fish with JSATs tags will be released into all major passage routes (spill, turbine, powerhouse JBS) to estimate probability of dead fish detections (false positives) on downstream arrays. This study will require access to Little Goose Dam to collect and tag the fish and access to Lower Granite dam for holding and releasing tagged fish, to maintain and service telemetry equipment, and will need assistance from the Projects to provide power for electronics and water supply for holding fish. No spillway or turbine outages are anticipated at Lower Granite Dam.

c) Impacts to FPP Criteria: None anticipated. Activities that require special project operations, FPP deviations, or outages will be coordinated through FPOM and/or FFDRWG, as appropriate.

9.2.5. Hydrographic Survey of Stilling Basin.

- a) Dates: 2-3 days per project during the work window of September 15– October 31, 2018.
- b) Description: Multi-beam hydrographic surveys of the stilling basin to assess impacts from the spring Gas Cap spring spill operation. Survey work will take an estimated 2-3 days at each project, starting in September.
- c) Impacts to FPP Criteria: Units may need to operate out of priority order to accommodate the survey.