Grant County
PUBLIC UTILITY DISTRICT
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Priest Rapids Fish Forum Meeting

Wednesday, 3 December 2014
9:00 a.m. – 12:00 p.m.
Grant PUD, 11 Spokane St., Suite 205B, Wenatchee, WA
Call-In Number: 1-800-977-8002, Bridge: 7422882

AGENDA

I. Welcome and Introductions (9:00 to 9:10)

II. Agenda Review (9:10 to 9:15)
   - A. Additional agenda items (All)
   - B. Approve November Meeting Notes (All)
   - C. Review Action Items from November meeting (All)

III. Update on Wanapum Dam (9:15-9:45)

IV. Update on WSMP (9:45-10:30)
   - A. Update on juvenile rearing (Rose and Miller)
   - B. Monitoring updates (Clement)
   - C. Phase 2 Sturgeon Conservation Program (Ecopath/Ecosim) (All)
   - D. Other white sturgeon items (All)

V. Update on PLMP (10:30-11:40)
   - A. Lamprey passage and monitoring (Clement)
   - B. NNI Concept Paper Discussion (Rose)
   - C. Other lamprey items (All)

VI. Update on Benthic Surveys (11:40-11:55)
   - A. Results from the 2014 benthic surveys (Clement)

VII. Next Meeting: 7 January 2015 – Grant PUD Natural Resources Wenatchee Office

Priest Rapids Fish Forum

Wednesday, 3 December 2014
Grant PUD Wenatchee Office

PRFF Members

Stephen Lewis, USFWS
Bob Rose, YN
Carl Merkle, Umatilla Tribe
Tom Dresser, GCPUD
Aaron Jackson, CTUIR
Patrick Verhey, WDFW
Keith Hatch, BIA
Pat McGuire, WDOE
Mike Clement, GCPUD
Jason McLellan, CCT

Attendees:

Patrick Verhey, WDFW
Bob Rose, YN (Via phone)
Jim Powell, CAHS (Via phone)
Steve Lewis, USFWS (Via phone)
Mike Clement, GCPUD
Chris Mott, GCPUD
Chad Jackson, WDFW (Via phone)
RD Nelle, USFWS
Doris Squeochs, Wanapum
Tom Skiles (Via phone)
Pat McGuire, WDOE (Via phone)
Tracy Hillman, Chair

Distributed Items:

1. No Net Impact and Mid-Columbia Regional Coordination, 5-Year Action Plan for Pacific Lamprey

Action Items:

1. Grant PUD will provide their clarification and understanding of NNI and identify which tasks and associated elements relate to the Pacific Lamprey Management Plan.
2. The Pacific Lamprey Small Group will meet on Monday, 5 January at the USFWS office in Wenatchee to discuss lamprey NNI.
3. Debbie Williams will send the PRFF Box.net link to Patrick Verhey.
4. Jim Powell will check with biologists at the University of British Columbia to see if they have used the Ecopath with Ecosim model on white sturgeon. Chris Mott will check with the Colville Tribes to see if they have used the model on sturgeon in the Upper Columbia. Tracy Hillman will contact Paul Anders to see if he has used the model on sturgeon in the Kootenai system.
5. Chris Mott will prepare a memo that describes the information currently available and what information is needed to populate the Ecopath with Ecosim model in the Priest Rapids Project Area.
6. Chad Jackson will prepare an SOA for the release of juvenile sturgeon in 2016. The SOA will be similar to the 2015 SOA.

Final Meeting Minutes

I. Welcome and Introductions – Tracy Hillman welcomed everyone to the PRFF meeting. Attendees introduced themselves.

II. Agenda Review

A. Additional agenda items – No additions were made to the agenda.

B. Meeting Minute approval – 5 November 2014 – Members asked for additional time to review the meeting minutes. The notes will be reviewed during the January meeting.

C. Action Items from last meeting

1. PRFF members will identify tasks within the "No Net Impact and Mid-Columbia Regional Coordination, 5-Year Action Plan for Pacific Lamprey" that differ from the PLMP. Complete.
2. Bob Rose will link the nine tasks identified in the "No Net Impact and Mid-Columbia Regional Coordination, 5-Year Action Plan for Pacific Lamprey" to the four objectives identified in the PLMP. Complete.
3. Tracy Hillman will ask Donella Miller for growth and survival data for juvenile sturgeon rearing at Marion Drain. Complete. The information was provided to the PRFF.
4. Mike Clement will send Kirk Truscott the last couple years of the WSMP annual reports. Complete.
5. Debbie Williams will send the PRFF Box.net link to Kirk Truscott. Complete. Need to send the information to Patrick Verhey.
6. Mike Clement and Chris Mott will work with Chelan PUD and Golder on the use of the Ecopath with Ecosim model to estimate sturgeon carrying capacity. Ongoing.
7. Mike Clement will send Chad Jackson information on the Upper Columbia River White Sturgeon Recovery meeting being held on 18-19 November in Coeur d'Alene, ID. Complete.
8. Tracy Hillman will find out if Donella Miller has sent white sturgeon histological samples to Idaho? Complete. No histological samples have been collected.

III. Update on Wanapum Dam and Fish Passage – Tracy Hillman noted that he has been sending updates from Tom Dresser to the PRFF. Mike Clement noted that the interim proposal to raise the pool elevation to 558-562 feet was approved by the Board of Consultants and FERC. As a result, Grant PUD initiated the refilling of Wanapum pool on 25 November. At about 1:43 pm on Monday, 1 December, Wanapum pool reached an elevation of 561.82 feet. This is slightly below the 562 foot elevation to ensure that Grant PUD does not overshoot the 562 foot mark. Engineers at Grant PUD are taking surveillance readings to monitor the dam to ensure there are no issues. After this surveillance is complete, and if no issues are found, the pool will be operated in the 558-562 foot range. Mike indicated that the adult fishways are fully operational. The spiral chute and supporting infrastructure for the spiral chute were removed in mid-November. The remaining structures will be removed in December. Mike also noted that the reservoir shoreline continues to remain closed. The Department of Lands and Cultural Resources is evaluating erosion along the shoreline and will provide an update on 10 December on when the shoreline may be opened. Finally, Mike said that after all 35 tendons have

been installed; the pool will be raised to its normal elevation (571.5 feet). This will likely occur by late March or early April.

IV. Update on the Pacific Lamprey Management Plan

A. NNI Update – On Tuesday, 2 December, the PRFF received a revised draft of the "No Net Impact and Mid-Columbia Regional Coordination, 5-Year Action Plan for Pacific Lamprey" (Concept Paper) prepared by the Yakama Nation, Umatilla's, WDFW, Colville Tribes, and WDFW (see Attachment 1). The purpose of the Concept Paper is to develop a five-year action plan for Pacific lamprey. To that end, the Concept Paper provides context and meaning of NNI, and clarity in its application. As requested by the PRFF, Bob Rose linked the nine tasks in the Concept Paper to Grant PUD's Pacific Lamprey Management Plan (PLMP), NNI, and/or adaptive management.

Bob Rose reviewed the changes made to the Concept Paper and asked if everyone was okay with the definitions and tasks. Mike Clement indicated that he did not agree with the definition of NNI in the Concept Paper. Bob asked Mike to edit the existing definition or provide a new definition of NNI. Patrick Verhey asked that Grant PUD also review each of the nine tasks and their associated elements and identify which ones they support and which ones they do not support. Mike said that he will meet internally and clarify Grant's definition and understanding of NNI. He will also identify which tasks or elements that Grant would support. He reiterated that Grant will continue to support those Tasks that are consistent with Grant's Pacific Lamprey Management Plan.

The Forum agreed that after Mike has time to discuss this issue internally, the Pacific Lamprey Subgroup should meet to discuss the definition of NNI and what tasks and elements link with the management plan. The Group agreed to meet from 9:00 am to 4:00 pm on Monday, 5 January at the USFWS building in Wenatchee, WA.

B. Lamprey Passage and Monitoring – Mike Clement said that there are no new updates on lamprey passage and monitoring. He indicated that about 91% of tagged adult lamprey passed Priest Rapids Dam and about 61% tagged adults passed Wanapum Dam. Passage efficiency results may change slightly as there are a few tagged lamprey holding in the Left Bank Ladder at Wanapum Dam.

Mike noted that after the adult ladders are dewatered this winter, PIT arrays will be installed upstream and downstream from the OLAFT in the left-bank ladder at Priest Rapids Dam. These arrays will help identify possible lamprey passage issues near the OLAFT. Mike also said that early next year, Blue Leaf will give a presentation to the PRFF that describes and summarizes all the monitoring data collected since the start of the lamprey monitoring program. The PRFF will tour the adult fish ladders in January or February.

C. Other Lamprey Items – None

V. Update on the White Sturgeon Management Plan

A. Update on Rearing – Tracy Hillman shared the e-mail he received from Donella Miller about the status of juvenile sturgeon at Marion Drain. He noted that juvenile sturgeon rearing at Marion Drain from the 2014 brood year are doing well. He pointed out that on 24 November, numbers of juveniles from Spawn #1 averaged 20.8 per pound, while those from Spawn #2 averaged 32.9 per pound. There was some question as to why the two groups differed in numbers per pound. It was suggested that the difference is likely because of sampling error (i.e., only a sample of juvenile sturgeon are collected and measured within each group; that

sample may not represent the entire group) and different spawning times. Tracy noted that the differences between the two groups have declined over time. Finally, Tracy said that Donella had not yet collected histological samples from fish at Marion Drain.

B. Monitoring Updates – Mike Clement said that Golder will download receivers and provide monitoring results in January or February. Mike noted that next year, Grant PUD will conduct the full suite of monitoring and evaluation, natural production, and broodstock collection, but would prefer to push the juvenile indexing back a year because it was conducted in August 2014 and the requirement is to conduct indexing every other year.

C. Phase 2 Sturgeon Conservation Program – Chris Mott reported that he has spent some time evaluating the Ecopath with Ecosim model and also had a discussion with Lance Keller at Chelan PUD about the model. He indicated that the model is a data-intensive model, meaning that it requires a lot of empirical data, or data from other studies. In simple terms, it is a food-web model that tracks biomass from one organism (or functional group) to another. Tracy Hillman described Ecopath as a series of linear equations that describe flows of mass into and out of the biomass pools. He provided the general biomass accumulation equation and described its terms (see Attachment 2). He then described the Ecosim portion of the model, which is used to compare the responses of sturgeon to various management actions (e.g., stocking, harvest, species introductions, etc.). He presented the differential equation and described its terms (see Attachment 2).

Mike Clement noted that a lot of the information may be available from the resident fish surveys and benthic surveys conducted in the project area as well as information gathered during comprehensive water quality evaluations during relicensing. In addition, the White Sturgeon Monitoring Program will provide useful information. Chad Jackson noted that the Council's ISRP indicated that the Upper Columbia group should consider using Ecopath with Ecosim to evaluate recovery targets for sturgeon populations in the Upper Columbia. Jim Powell indicated that he will check with biologists at the University of British Columbia to see if they have or are using the model. Tracy Hillman will check with Paul Anders to see if they have used the model in the Kootenai system, and Chris Mott will check with the Colville Tribes on the use of the model in the Upper Columbia. Chris will also prepare a technical memo on what information we currently have to populate the model and what information would be needed.

Chad Jackson recommended that in the interim, the PRFF consider using the same SOA as used this year for the number of juvenile sturgeon to release in 2016. He also suggested the use of pilot larval collection upstream from Bonneville Dam. Members supported this suggestion and recommended that Chad write up an SOA for the release of juvenile sturgeon in 2016. The Forum will review the SOA and vote on it next year.

D. Other White Sturgeon items – Chad Jackson said that they are close to having a signed contract on analysis of histological samples collected from the WDFW hatcheries. He noted that there has been a slight increase in juvenile sturgeon mortality at the Wells and Chelan hatcheries. No virus was identified in the first round of samples. The second round of samples will be collected when the fish are tagged (about 1-1.5 months before release).

VI. Benthic Surveys – Mike Clement reported that Grant PUD received and reviewed the draft report on assessment of benthic organisms stranded in Wanapum Reservoir due to water level reductions. They sent comments to the authors of the report. The draft report should be available for review by the PRFF later this month or early January.

VII. Next Meeting – 7 January 2015 at Grant PUD's Hatchery/Habitat office in Wenatchee.

Attachment 1

No Net Impact and Mid-Columbia Regional Coordination

5-Year Action Plan for Pacific Lamprey

Proposed by

Yakama Nation
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Colville Reservation
Washington Department of Fish and Wildlife
U. S. Fish and Wildlife Service

Concept Paper

For Evaluations to Determine Project Effects

and

Implementation of No Net Impact

Presented to the

Priest Rapids Fish Forum

Dec 3, 2014

Introduction

The Priest Rapids Fish Forum (Forum) functions to support the implementation of the Priest Rapids Settlement Agreement in general, and the Pacific Lamprey Management Plan (PLMP) specifically in addition to implementation of the 401 Water Quality Certification. Given that so little is understood about many aspects of the biology and behaviors of Pacific lamprey, the PLMP was written with a full expectation by the Forum that the notion of Adaptive Management would be central in our progress towards determining and eliminating Project effects on the species. Additionally, it was understood during the development of the PLMP that there would likely be Project effects that cannot be completely eliminated (either in the near term or longer term) and that mitigation would be required such as to render the Project operations as having No Net Impact (NNI) on the species.

To date, the majority of the ongoing effort has been associated with improving and measuring adult passage in the Project fishways. Many members of the Forum believe there are Project effects beyond adult passage issues but are stymied by the lack of technology and proven methods to quantify these potential effects. These members also recognize it is a responsibility of the Forum to implement reasonable and feasible actions to advance our understanding of these potential impacts in the face of uncertainty and to advance our goals and objectives as effectively and efficiently as possible, as discussed in more detail below. Therefore, the Forum concludes it is reasonable and useful to employ the NNI concept to mitigate ***and*** to advance our knowledge of lamprey biology and behaviors relevant to Project operations and Project effects.

Recognizing this need a regional holistic proposal incorporating 10 Objectives has been introduced to the Forum by the Yakama Nation (YN), Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Washington Department of Fish and Wildlife (WDFW) and the United States Fish and Wildlife Service (USFWS). This same proposal has been introduced and discussed in the Douglas County PUD and the Chelan County PUD Fish Forum and its core components are embedded in the USFWS Pacific Lamprey Conservation Agreement. This holistic approach goes beyond addressing potential direct effects within the Project Area with the objective of substantially increasing lamprey productivity and spatial structure within the tributary streams of the Upper Columbia River (from Priest Rapids Dam to Chief Joseph Dam). By necessity, this approach recognizes the severely reduced lamprey population is a regional problem, which necessitates a regional response.

As stated above, many of the Forum members believe there are Project impacts related to the operation of the Priest Rapids and Wanapum dams and that it is appropriate to apply the NNI concept. Furthermore many Forum members agree that it is warranted to define and incorporate mitigation measures into the existing PLMP, as provided by the State of Washington 401 Certification fish use section 5.3. As such, the Forum concludes and recommends that the proposal provided in this document, with an intended effective time frame of 5-years, is the appropriate manner in which to sufficiently address mitigation during this time and advance our understanding of Pacific lamprey in relation to the Priest Rapids hydroelectric Project. The following outlines the general concept and identifies specific actions to be applied under the FERC License requirement and actions implemented under the NNI concept.

Purpose

The purpose of this document is to provide to the Forum a conceptual context and meaning of No Net Impact (NNI) and clarity in its application over the next five years (2015 – 2019).

Goal

The goal of the PLMP is to identify ongoing Project-related impacts on Pacific lamprey; implementing reasonable and feasible measures to reduce or eliminate such impacts; and implementing on-site or off-site measures to address unavoidable impacts in an effort to achieve NNI as identified in the 401 Certification.

The PLMP will be based on adaptive management, allowing for the adjustment of goals and objectives through a collaborative process, based on new information and ongoing monitoring results. Adaptive management is defined in Grant PUD's Water Quality 401 Certification (Section (6.2 (2)), which specifies that "the Adaptive Management process has been and will continue to be used for the protection of aquatic species.

The PLMP emphasizes a monitoring program that will necessitate future consultation with the PRFF to evaluate monitoring results and develop recommendations for program direction. Accordingly, the PLMP will be reviewed on a periodic basis by the PRFF to allow for planning and future adjustments over the term of the license.

Objective 1: No Net Impact (NNI). Identify, address, and fully mitigate Project effects to the extent reasonable and feasible.

Objective 2: Provide safe, effective, and timely volitional passage (as defined by the PRFF) for adult upstream and downstream migration.

Objective 3: Provide safe, effective, and timely volitional passage (as defined by the PRFF) for juvenile downstream migration.

Objective 4: Avoid and mitigate Project impacts on rearing habitat.

The PMEs contained in this [PLMP] management plan will: 1) protect, mitigate, and enhance lamprey resources for the term of the New License; 2) ensure that the ongoing operation of the Project will not adversely impact lamprey; 3) minimize the effect of any incidental injury or mortality to lamprey that may occur as a result of Project operation or Project effects to lamprey habitat; and 4) ensure adequate monitoring and reporting of results.

No Net Impact – The Concept

Definition: The Forum defines No Net Impact as actions provided by Grant County PUD that mitigate Project effects on Pacific lamprey such that the presence and operation of the Priest Rapids Hydroelectric Projects, including the reservoir up to the tailwater of Rock Island Dam, is essentially "invisible" to impacts towards abundance, productivity, spatial distribution and genetic diversity of the species.

More specifically, during the term of this 5-year Action Plan, GCPUD will substantially support a trap and haul (translocation) program guided by the fisheries co-managers and will contribute $X dollars to an account managed by the PUD for the purpose of (1) measuring the benefits of this translocation program, (2) to assist resource managers in identifying and correcting passage problems in the tributary streams and to (3) support identification of potential juvenile entrainment issues in the tributary streams and correction of these issues. Actions associated with this account are discussed in more detail below.

Application: Ideally, this definition requires perfect knowledge of both lamprey biology and Project effects. The Forum acknowledges problems associated with enumerating adult or juvenile mortality due to Project operations (either direct or indirect effects) and the incomplete understanding of lamprey biology. However, neither of these limitations precludes the Forum

from using existing information and, through consensus, define reasonable mitigation actions that are appropriate over a defined timeframe. The definition of Adaptive Management within the Settlement Agreement recognizes this notion. In addition, it is appropriate and reasonable to define NNI actions in a way that not only benefits the species but also implements actions that increases our knowledge of lamprey behavior and biology useful in measuring Project effects at some future time. It is intended that this information will be useful in determining reasonable and feasible actions to reduce, eliminate or as necessary mitigate for Project effects. These actions are described in more detail below.

***Rational for Employing NNI**:* The Forum recognizes three specific facts that are the basis for the use of NNI at this time, including – but not necessarily limited to adult passage, uncertainties related to the reservoir and predation of juveniles in the turbine boils:

First, adult passage in the Priest Rapids fish ladders, as currently being measured, is likely below 80%. This does not include any unmeasured effects from ladder entrance efficiency or potential issues associated with the reservoir. Although it might be argued that this passage rate is *similar to other passage measurements on the Columbia River*, a passage rate of 80% contributes substantially to cumulative effects. For example, if three dams had 80% passage efficiency in the upper Columbia, less than half of the adults "destined" to migrate above these dams would make it (33% for 5 dams). Currently passage rate of 80% has not been achieved by any of the dams on the Columbia River. Applying NNI is consistent with Objectives 1 and 2 of the PLMP as stated above.

Second, nearly 70% of the fish that enter the Priest Rapids Project are not accounted for at the Rock Island Dam count window. There are no significant tributary streams for these fish to enter into from the reservoir. This situation may be attributed partly to Rock Island passage issues, but this is unknown. The Forum is well aware of this situation and it is appropriate for Grant County PUD to work closely with the PRFF in providing an appropriate evaluation, consistent with Objectives 1 and 2 of the PLMP. It is also consistent with the principles of Adaptive Management, outlined below.

Third, although not confirmed, there is reasonable cause to believe that predation on juveniles by Northern pikeminnow may be pronounced in the turbine boils where these predators are generally known to exist in established feeding stations. Although the PUD has an active predator control program, it is not clear to what extent the current pikeminnow removal program benefits lamprey. It is reasonable to evaluate the potential for increased predator control in the turbine boil area, consistent with Objective 3 of the PLMP.

Adaptive Management

Adaptive Management is defined in the 401 Certification.

Within this Certification, Ecology has required the use of an Adaptive Management process to meet a number of State water quality standards. As used in this Certification, Adaptive Management means an iterative and rigorous process used to improve decision-making and achieve objectives in the face of uncertainty. It is intended to improve the management of natural resources affected by Project in order to achieve desired objectives as effectively and efficiently as possible. For purposes of this Certification, Adaptive Management involves the following steps:

a) Develop initial hypothesis regarding any Project effects and potential remedial measures
b) Develop objectives for addressing such impacts

c) Develop and implement reasonable and feasible measures in accordance with an established schedule
d) Develop or identify monitoring and evaluation methodologies for determining whether such objectives have been achieved
e) Monitor and evaluate the implementation of such measures and their effectiveness toward achieving such objectives
f) Review monitoring and evaluation efforts
g) Confirm such objectives have been achieved or, if not achieved, evaluate additional or revised measures, and implement any appropriate and reasonable measures.

The Forum recognizes the importance of several key concepts in this definition, including:

- iterative and rigorous process …in the face of uncertainty,
- intended to improve the management of natural resources…
- in order to achieve desired goals and objectives as effectively and efficient as possible…

With this understood, it is the intention (and the obligation) of the Forum to apply these Adaptive Management principles to actions directed under the FERC License and mitigation actions developed under the NNI. The importance of this cannot be understated because it is only through these principles that the Forum can measure and be assured that actions implemented by Grant PUD are in fact, *achieving the desired goals and objectives in an effective and efficient manner*.

Implementation Plan

The following is a brief summary of the nine Tasks, each of which are related to the PLMP Objectives. These have been under consideration by the Forum and proposed to be fully developed for both FERC License Requirements and NNI. The first four Tasks are relevant to the FERC license and must be accomplished accordingly. The last five Tasks are appropriate for NNI considerations.

Appropriate Actions Implemented through the FERC License

Task 1: Mainstem Fishway Entrance, Passage and Exit Efficiency

Determine the proportion of tagged adult lamprey that successfully (1) enter fishways entrances (Fishway Efficiency), (2) ascend and exit mainstem fishways (Passage Efficiency) and (3) leave the forebay area without falling back. Describe behavioral attributes associated with general lamprey movements and elapsed time at fishway entrance and within fishways.

Actions	Continue to evaluate specific areas within the fishways (as identified by the Forum) for passage improvement and implement actions recommended by the Forum in a timely manner.
Relationship to the PLMP	Consistent with the Goal and Objectives 1 and 2 of the PLMP and the 401 Certification.
Timing	Ongoing

Task 2: Fate of Adults in Reservoirs

Determine fate of adults that enter into PUD reservoirs with regards to:

- movement behavior through reservoir (passage success and timing, over-winter and potential spawning behavior),
- successful passage up to the next counting window, and
- mortality / predation within reservoir.

Actions	Evaluate efficacy of using active tags to track or locate adults in the reservoir especially during the winter months of inactivity.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP and the intent of the 401 Certification. It is unknown what is happening with a substantial number of migrating adults within the Project Area after they exist the Priest Rapids and Wanapum fishways.
Timing	Initial evaluations in 2016-2017, utilizing tagged adults for other evaluations. Study period anticipated to be approximately 3-years.

Task 3: Predation on Juveniles in Tailrace

Determine the relative level of predation on juvenile lamprey in turbine boils and tailrace areas and implement measures to further reduce excessive predation, as warranted.

Actions	Tasks not yet identified. Evaluation of additional fishing effort from powerhouse deck.
Relationship to the PLMP	Consistent with the Goal and Objectives 1 and 3 of the PLMP and the intent of the 401 Certification.
Timing	Initial evaluations anticipated to begin in 2017.

Task 4: Juvenile Occupancy and Use of Reservoir Habitat Measure juvenile lamprey presence and relative abundance in habitat areas that may be affected by ongoing Project operations. Identify and measure Project effects on lamprey in these areas, if any.	
Actions	Continue to evaluate presence/absence and relative abundance in habitat areas that may be affected by ongoing Project operations.
Relationship to the PLMP	Consistent with the Goal and Objective 4 of the PLMP and the intent of the 401 Certification.
Timing	Planning for future actions completed in 2016. Begin implementation in 2017-2018.

Appropriate Actions Implemented through NNI

Task 5: Adult Translocation Research Implement a translocation program and evaluate the success of translocated adult lamprey in producing viable redds, eggs, larvae and early age ammocoetes in key stream reaches (many of which are identified in the Pacific Lamprey Artificial Propagation and Rearing Investigations: Rocky Reach Pacific Lamprey Management Plan).	
Actions	Trap and Haul: Grant PUD will provide sufficient effort trap X adults from Priest Rapids Project and translocate into tributary streams. Adult Tagging – Radio: Grant PUD will provide $X sufficient funding to radio tag 120 (TBD) adults per year for three years (2015 - 2017) to be released at locations specified by the Forum. (Funded by PUD) Telemetry Equipment Setup: Grant PUD will provide $X sufficient funding into the NNI Account to support establishing radio receivers at the mouths of the W-E-M-O prior to 2015 adult migration and maintain equipment through 2017 migration. Air Radio Telemetry Surveys: Grant PUD will provide $X sufficient funding into the NNI Account to support performance of air surveys twice per year for two years in the W-E-M-O preferably in October and May-June, or as determined by the Forum (2015 – 2017). Field Radio Telemetry Surveys: Grant PUD will provide $X sufficient funding into the NNI Account to support USFWS survey capacity to provide mobile field telemetry tracking of adults to determine spawning locations (2015 – 2017).

	Field Juvenile Distribution and Abundance Surveys: Grant PUD will provide $X sufficient funding into the NNI Account to support existing tribal survey capacity providing surveys in Index Sites to determine juvenile relative abundance and spatial distribution. Genetic Samples: Grant PUD will provide sufficient funding into the NNI Account to support genetic analysis of translocated adults and subsample of juveniles found in the W-E-M-O during 2019 field surveys. Analyze genetic samples from W-E-M-O to estimate proportion of juveniles produced from translocation program. Numbers of adults and juveniles sampled to be determined by the Forum.
Relationship to the PLMP	Translocation is the primary means to mitigate for Project effects. Appropriate monitoring is obligated through the PLMP and 401 Certification to determine benefits to the species for this mitigation.
NNI Funding	$X to support field efforts for both adult surveys (2015-2017) and juvenile surveys (2017-2019) and genetic analysis.

Task 6: Proportion of Adults Ascending Tributaries

Estimate the proportion of migrating adult lamprey that leave the Mid-Columbia reservoirs and permanently ascend the Wenatchee, Entiat, Methow and Okanogan tributaries. Describe behavioral attributes associated with general lamprey movements and elapsed time as lamprey leave the reservoir and enter lower mainstem tributary reaches ("affirming" establishment into that tributary).

Actions	Contribute $X into the NNI Account funding to support for radio telemetry in the upper Columbia. Support trapping and tagging sufficient adults (TBD by Forum) for migration – behavior evaluation. Employ USFWS to establish and maintain receivers, download and evaluate information and report on findings.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP and the intent of the 401 Certification.
Timing	Equipment in place for the 2015 adult migration.

Task 7: Regional Establishment Baseline / Status and Trend Information

Establish baseline information by enumerating (relative abundance) local populations (watershed scale) of adults and juveniles in priority watersheds and stream reaches.

- Track and understand behavioral characteristics and long-term changes of both juvenile and adult local populations in priority monitoring locations (index sites) over time.
- Compare and evaluate these changes relative to other Columbia Basin regions.

Actions	Establish long term "Index Sites" in the Wenatchee, Entiat, Methow and Okanogan subbasins to monitor and track changes in juvenile abundance, spatial distribution and population age/size-class characteristics. Monitor juvenile presence, relative abundance and age/size class characteristics using screw traps, fyke-nets, electroshocking or other monitoring methods. Consolidate and evaluate data and report on findings.
Relationship to the PLMP	Baseline information is critical to establish to determine long-term benefits of lamprey NNI mitigation measures associated with supplementation and natural production of the local populations.
NNI Funding	Grant PUD will provide $X sufficient funding into the NNI Account for two years (2015-2016) to support existing tribal juvenile survey capacity at Index Sites to determine juvenile relative abundance and spatial distribution.
Timing	Funding available in Years 1 and 2. Baseline juvenile information completed in 2017.

Task 8: Adult Passage in Tributary Streams

Identify primary spawning areas of adult lamprey and establish, where feasible specific spawning locations and timing. Identify, evaluate and correct adult passage issues in priority areas within the Upper Columbia subbasin tributary streams.

Actions	Provide sufficient funding and excess telemetry receivers to support identification of potential adult passage issues in the W-E-M-O and implementation of corrective actions.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP. Mitigation for passage issues associated with the Priest Rapids and Wanapum dams.
NNI Funding	Grant PUD will provide $X sufficient funding into the NNI Account to support USFWS for radio telemetry installation and maintenance of equipment and retrieval, evaluation and reporting of information.
Timing	Established prior to March 2016 and maintained through 2018 to insure full two year (minimal) analysis.

Task 9: Juvenile Entrainment: Irrigation Structures Evaluate and correct juvenile entrainment into irrigation facilities within priority watersheds / stream reaches in the Upper Columbia subbasin tributary streams.	
Actions	Evaluate alternative strategies to prevent or minimize juvenile entrainment into irrigation ditches.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP.
NNI Funding	Grant PUD will provide $X funding into the NNI Account to support agency actions associated with this Objective.
Timing	Funding available for 3-years, 2016 - 2018.

Summary of Actions to be Implemented through NNI and/or Regional Coordination			
Objective	**Grant**	**Chelan**	**Douglas**
FERC Required Actions			
1. Mainstem Fishway Entrance, Passage and Exit Efficiency	Passage improvements needed – continued evaluation		
2. Proportion of Adults Ascending Tributaries	Evaluation required. 2015 - 2016		
3. Fate of Adults in Reservoirs	Ongoing consideration, preliminary acoustic evaluations warranted.		
4. Predation on Juveniles in Tailrace	Ongoing consideration Evaluation warranted	Contribution to JLAT development (Section 4.2.3)	Ongoing consideration Evaluation warranted
5. Juvenile Occupancy and Use of Reservoir Habitat	Additional evaluations deferred until 2018-2019	Additional evaluations deferred until 2018-2019	Preliminary evaluation needed (2016)
6. Juvenile Propagation Research	No Requirement	Contribution to ongoing efforts. Section 4.2.3	No Requirement
NNI / Regional Coordination Actions			
7. Adult Translocation Research	Trap and Haul for passage studies. Trap and Haul into Tribs. Contribute Funds to NNI.	Trap and Haul for passage studies. Trap and Haul into Tribs. Contribute Funds to NNI	Trap and Haul for passage studies. Trap and Haul into Tribs. Contribute Funds to Reg. Coord
8. Regional Establishment Baseline / Status and Trend Information	Contribute Funds to NNI.	Contribute Funds to NNI.	Contribute Funds to Reg Coord.
9. Adult Passage in Tributary Streams	Contribute telemetry equipment. Contribute Funds to NNI.	Contribute telemetry equipment. Contribute Funds to NNI.	Contribute telemetry equipment. Contribute Funds to Reg Co.
10. Juvenile Entrainment: Dryden Ditch / Other Irrigation Structures	Contribute Funds to NNI.	Contribute Funds to NNI. Evaluate and correct Dryden.	Contribute Funds to Reg. Co.

Attachment 2

Ecopath with Ecosim

Ecopath Equation:

$$BA_i = B_i \times \left(\frac{P}{B}\right)_i \times EE_i - \sum_{j=1}^{n} B_j \times \left(\frac{Q}{B}\right)_j \times DC_{ji} - Y_i - E_i$$

where,

BA_i = Biomass accumulation of sturgeon (i)

B_i = Biomass of sturgeon

$(P/B)_i$ = The production : biomass ratio

EE_i = Ecotrophic efficiency (proportion of total mortality that is attributable to other model groups

$\sum$ = Summation term represents losses to all predators

B_j = Biomass of predator j

Q/B = The consumption : biomass ratio of j

DC_{ji} = The proportion of sturgeon in the diet of predator j

Y_i – Fishery Yield

E_i = Net emigration

Ecosim Equation:

$$\frac{dB_i}{dt} = g_i \times \sum_j C_{ji} - \sum_j C_{ij} + I_i - (M_i + F_i + e_i) \times B_i$$

where,

g_i = Growth efficiency

$\sum C_{ji}$ = Rate of consumption of all prey j by group i

$\sum C_{ij}$ = Rate of consumption of group i by all predators j

I_i = Immigration rate

M_i = Mortality not attributable to other model groups

F_i = Fishing mortality rate

e_i = Emigration rate

B_i = Biomass

No Net Impact and Mid-Columbia Regional Coordination

5-Year Action Plan for Pacific Lamprey

Proposed by

Yakama Nation
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Colville Reservation
Washington Department of Fish and Wildlife
U. S. Fish and Wildlife Service

Concept Paper

For Evaluations to Determine Project Effects

and

Implementation of No Net Impact

Presented to the

Priest Rapids Fish Forum

Dec 3, 2014

Introduction

The Priest Rapids Fish Forum (Forum) functions to support the implementation of the Priest Rapids Settlement Agreement in general, and the Pacific Lamprey Management Plan (PLMP) specifically in addition to implementation of the 401 Water Quality Certification. Given that so little is understood about many aspects of the biology and behaviors of Pacific lamprey, the PLMP was written with a full expectation by the Forum that the notion of Adaptive Management would be central in our progress towards determining and eliminating Project effects on the species. Additionally, it was understood during the development of the PLMP that there would likely be Project effects that cannot be completely eliminated (either in the near term or longer term) and that mitigation would be required such as to render the Project operations as having No Net Impact (NNI) on the species.

To date, the majority of the ongoing effort has been associated with improving and measuring adult passage in the Project fishways. Many members of the Forum believe there are Project effects beyond adult passage issues but are stymied by the lack of technology and proven methods to quantify these potential effects. These members also recognize it is a responsibility of the Forum to implement reasonable and feasible actions to advance our understanding of these potential impacts in the face of uncertainty and to advance our goals and objectives as effectively and efficiently as possible, as discussed in more detail below. Therefore, the Forum concludes it is reasonable and useful to employ the NNI concept to mitigate ***and*** to advance our knowledge of lamprey biology and behaviors relevant to Project operations and Project effects.

Recognizing this need a regional holistic proposal incorporating 10 Objectives has been introduced to the Forum by the Yakama Nation (YN), Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Washington Department of Fish and Wildlife (WDFW) and the United States Fish and Wildlife Service (USFWS). This same proposal has been introduced and discussed in the Douglas County PUD and the Chelan County PUD Fish Forum and its core components are embedded in the USFWS Pacific Lamprey Conservation Agreement. This holistic approach goes beyond addressing potential direct effects within the Project Area with the objective of substantially increasing lamprey productivity and spatial structure within the tributary streams of the Upper Columbia River (from Priest Rapids Dam to Chief Joseph Dam). By necessity, this approach recognizes the severely reduced lamprey population is a regional problem, which necessitates a regional response.

As stated above, many of the Forum members believe there are Project impacts related to the operation of the Priest Rapids and Wanapum dams and that it is appropriate to apply the NNI concept. Furthermore many Forum members agree that it is warranted to define and incorporate mitigation measures into the existing PLMP, as provided by the State of Washington 401 Certification fish use section 5.3. As such, the Forum concludes and recommends that the proposal provided in this document, with an intended effective time frame of 5-years, is the appropriate manner in which to sufficiently address mitigation during this time and advance our understanding of Pacific lamprey in relation to the Priest Rapids hydroelectric Project. The following outlines the general concept and identifies specific actions to be applied under the FERC License requirement and actions implemented under the NNI concept.

Purpose
The purpose of this document is to provide to the Forum a conceptual context and meaning of No Net Impact (NNI) and clarity in its application over the next five years (2015 – 2019).

Goal
The goal of the PLMP is to identify ongoing Project-related impacts on Pacific lamprey; implementing reasonable and feasible measures to reduce or eliminate such impacts; and implementing on-site or off-site measures to address unavoidable impacts in an effort to achieve NNI as identified in the 401 Certification.

The PLMP will be based on adaptive management, allowing for the adjustment of goals and objectives through a collaborative process, based on new information and ongoing monitoring results. Adaptive management is defined in Grant PUD's Water Quality 401 Certification (Section (6.2 (2)), which specifies that "the Adaptive Management process has been and will continue to be used for the protection of aquatic species.

The PLMP emphasizes a monitoring program that will necessitate future consultation with the PRFF to evaluate monitoring results and develop recommendations for program direction. Accordingly, the PLMP will be reviewed on a periodic basis by the PRFF to allow for planning and future adjustments over the term of the license.

Objective 1: No Net Impact (NNI). Identify, address, and fully mitigate Project effects to the extent reasonable and feasible.

Objective 2: Provide safe, effective, and timely volitional passage (as defined by the PRFF) for adult upstream and downstream migration.

Objective 3: Provide safe, effective, and timely volitional passage (as defined by the PRFF) for juvenile downstream migration.

Objective 4: Avoid and mitigate Project impacts on rearing habitat.

The PMEs contained in this [PLMP] management plan will: 1) protect, mitigate, and enhance lamprey resources for the term of the New License; 2) ensure that the ongoing operation of the Project will not adversely impact lamprey; 3) minimize the effect of any incidental injury or mortality to lamprey that may occur as a result of Project operation or Project effects to lamprey habitat; and 4) ensure adequate monitoring and reporting of results.

No Net Impact – The Concept

Definition: The Forum defines No Net Impact as actions provided by Grant County PUD that mitigate Project effects on Pacific lamprey such that the presence and operation of the Priest Rapids Hydroelectric Projects, including the reservoir up to the tailwater of Rock Island Dam, is essentially "invisible" to impacts towards abundance, productivity, spatial distribution and genetic diversity of the species.

More specifically, during the term of this 5-year Action Plan, GCPUD will substantially support a trap and haul (translocation) program guided by the fisheries co-managers and will contribute $X dollars to an account managed by the PUD for the purpose of (1) measuring the benefits of

this translocation program, (2) to assist resource managers in identifying and correcting passage problems in the tributary streams and to (3) support identification of potential juvenile entrainment issues in the tributary streams and correction of these issues. Actions associated with this account are discussed in more detail below.

Application: Ideally, this definition requires perfect knowledge of both lamprey biology and Project effects. The Forum acknowledges problems associated with enumerating adult or juvenile mortality due to Project operations (either direct or indirect effects) and the incomplete understanding of lamprey biology. However, neither of these limitations precludes the Forum from using existing information and, through consensus, define reasonable mitigation actions that are appropriate over a defined timeframe. The definition of Adaptive Management within the Settlement Agreement recognizes this notion. In addition, it is appropriate and reasonable to define NNI actions in a way that not only benefits the species but also implements actions that increases our knowledge of lamprey behavior and biology useful in measuring Project effects at some future time. It is intended that this information will be useful in determining reasonable and feasible actions to reduce, eliminate or as necessary mitigate for Project effects. These actions are described in more detail below.

Rational for Employing NNI: The Forum recognizes three specific facts that are the basis for the use of NNI at this time, including – but not necessarily limited to adult passage, uncertainties related to the reservoir and predation of juveniles in the turbine boils:

First, adult passage in the Priest Rapids fish ladders, as currently being measured, is likely below 80%. This does not include any unmeasured effects from ladder entrance efficiency or potential issues associated with the reservoir. Although it might be argued that this passage rate is *similar to other passage measurements on the Columbia River*, a passage rate of 80% contributes substantially to cumulative effects. For example, if three dams had 80% passage efficiency in the upper Columbia, less than half of the adults "destined" to migrate above these dams would make it (33% for 5 dams). Currently passage rate of 80% has not been achieved by any of the dams on the Columbia River. Applying NNI is consistent with Objectives 1 and 2 of the PLMP as stated above.

Second, nearly 70% of the fish that enter the Priest Rapids Project are not accounted for at the Rock Island Dam count window. There are no significant tributary streams for these fish to enter into from the reservoir. This situation may be attributed partly to Rock Island passage issues, but this is unknown. The Forum is well aware of this situation and it is appropriate for Grant County PUD to work closely with the PRFF in providing an appropriate evaluation, consistent with Objectives 1 and 2 of the PLMP. It is also consistent with the principles of Adaptive Management, outlined below.

Third, although not confirmed, there is reasonable cause to believe that predation on juveniles by Northern pikeminnow may be pronounced in the turbine boils where these predators are generally known to exist in established feeding stations. Although the PUD has an active predator control program, it is not clear to what extent the current pikeminnow removal program benefits lamprey. It is reasonable to evaluate the potential for increased predator control in the turbine boil area, consistent with Objective 3 of the PLMP.

Adaptive Management

Adaptive Management is defined in the 401 Certification.

Within this Certification, Ecology has required the use of an Adaptive Management process to meet a number of State water quality standards. As used in this Certification, Adaptive Management means an iterative and rigorous process used to improve decision-making and achieve objectives in the face of uncertainty. It is intended to improve the management of natural resources affected by Project in order to achieve desired objectives as effectively and efficiently as possible. For purposes of this Certification, Adaptive Management involves the following steps:

a) Develop initial hypothesis regarding any Project effects and potential remedial measures
b) Develop objectives for addressing such impacts
c) Develop and implement reasonable and feasible measures in accordance with an established schedule
d) Develop or identify monitoring and evaluation methodologies for determining whether such objectives have been achieved
e) Monitor and evaluate the implementation of such measures and their effectiveness toward achieving such objectives
f) Review monitoring and evaluation efforts
g) Confirm such objectives have been achieved or, if not achieved, evaluate additional or revised measures, and implement any appropriate and reasonable measures.

The Forum recognizes the importance of several key concepts in this definition, including:

- iterative and rigorous process …in the face of uncertainty,
- intended to improve the management of natural resources…
- in order to achieve desired goals and objectives as effectively and efficient as possible…

With this understood, it is the intention (and the obligation) of the Forum to apply these Adaptive Management principles to actions directed under the FERC License and mitigation actions developed under the NNI. The importance of this cannot be understated because it is only through these principles that the Forum can measure and be assured that actions implemented by Grant PUD are in fact, *achieving the desired goals and objectives in an effective and efficient manner*.

Implementation Plan

The following is a brief summary of the nine Tasks, each of which are related to the PLMP Objectives. These have been under consideration by the Forum and proposed to be fully developed for both FERC License Requirements and NNI. The first four Tasks are relevant to the FERC license and must be accomplished accordingly. The last five Tasks are appropriate for NNI considerations.

Appropriate Actions Implemented through the FERC License

Task 1: Mainstem Fishway Entrance, Passage and Exit Efficiency Determine the proportion of tagged adult lamprey that successfully (1) enter fishways entrances (Fishway Efficiency), (2) ascend and exit mainstem fishways (Passage Efficiency) and (3) leave the forebay area without falling back. Describe behavioral attributes associated with general lamprey movements and elapsed time at fishway entrance and within fishways.	
Actions	Continue to evaluate specific areas within the fishways (as identified by the Forum) for passage improvement and implement actions recommended by the Forum in a timely manner.
Relationship to the PLMP	Consistent with the Goal and Objectives 1 and 2 of the PLMP and the 401 Certification.
Timing	Ongoing

Task 2: Fate of Adults in Reservoirs Determine fate of adults that enter into PUD reservoirs with regards to: • movement behavior through reservoir (passage success and timing, over-winter and potential spawning behavior), • successful passage up to the next counting window, and • mortality / predation within reservoir.	
Actions	Evaluate efficacy of using active tags to track or locate adults in the reservoir especially during the winter months of inactivity.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP and the intent of the 401 Certification. It is unknown what is happening with a substantial number of migrating adults within the Project Area after they exist the Priest Rapids and Wanapum fishways.
Timing	Initial evaluations in 2016-2017, utilizing tagged adults for other evaluations. Study period anticipated to be approximately 3-years.

Task 3: Predation on Juveniles in Tailrace Determine the relative level of predation on juvenile lamprey in turbine boils and tailrace areas and implement measures to further reduce excessive predation, as warranted.	
Actions	Tasks not yet identified. Evaluation of additional fishing effort from powerhouse deck.
Relationship to the PLMP	Consistent with the Goal and Objectives 1 and 3 of the PLMP and the intent of the 401 Certification.
Timing	Initial evaluations anticipated to begin in 2017.

Task 4: Juvenile Occupancy and Use of Reservoir Habitat Measure juvenile lamprey presence and relative abundance in habitat areas that may be affected by ongoing Project operations. Identify and measure Project effects on lamprey in these areas, if any.	
Actions	Continue to evaluate presence/absence and relative abundance in habitat areas that may be affected by ongoing Project operations.
Relationship to the PLMP	Consistent with the Goal and Objective 4 of the PLMP and the intent of the 401 Certification.
Timing	Planning for future actions completed in 2016. Begin implementation in 2017-2018.

Appropriate Actions Implemented through NNI

Task 5: Adult Translocation Research Implement a translocation program and evaluate the success of translocated adult lamprey in producing viable redds, eggs, larvae and early age ammocoetes in key stream reaches (many of which are identified in the Pacific Lamprey Artificial Propagation and Rearing Investigations: Rocky Reach Pacific Lamprey Management Plan).	
Actions	Trap and Haul: Grant PUD will provide sufficient effort trap X adults from Priest Rapids Project and translocate into tributary streams. Adult Tagging – Radio: Grant PUD will provide $X sufficient funding to radio tag 120 (TBD) adults per year for three years (2015 - 2017) to be released at locations specified by the Forum. (Funded by PUD) Telemetry Equipment Setup: Grant PUD will provide $X sufficient funding into the NNI Account to support establishing radio receivers at the mouths of the W-E-M-O prior to 2015 adult migration and maintain equipment through 2017 migration. Air Radio Telemetry Surveys: Grant PUD will provide $X sufficient funding into the NNI Account to support performance of air surveys twice per year for two years in the W-E-M-O preferably in October and May-June, or as determined by the Forum (2015 – 2017). Field Radio Telemetry Surveys: Grant PUD will provide $X sufficient funding into the NNI Account to support USFWS survey capacity to provide mobile field telemetry tracking of adults to determine spawning locations (2015 – 2017).

	Field Juvenile Distribution and Abundance Surveys: Grant PUD will provide $X sufficient funding into the NNI Account to support existing tribal survey capacity providing surveys in Index Sites to determine juvenile relative abundance and spatial distribution. Genetic Samples: Grant PUD will provide sufficient funding into the NNI Account to support genetic analysis of translocated adults and subsample of juveniles found in the W-E-M-O during 2019 field surveys. Analyze genetic samples from W-E-M-O to estimate proportion of juveniles produced from translocation program. Numbers of adults and juveniles sampled to be determined by the Forum.
Relationship to the PLMP	Translocation is the primary means to mitigate for Project effects. Appropriate monitoring is obligated through the PLMP and 401 Certification to determine benefits to the species for this mitigation.
NNI Funding	$X to support field efforts for both adult surveys (2015-2017) and juvenile surveys (2017-2019) and genetic analysis.

Task 6: Proportion of Adults Ascending Tributaries Estimate the proportion of migrating adult lamprey that leave the Mid-Columbia reservoirs and permanently ascend the Wenatchee, Entiat, Methow and Okanogan tributaries. Describe behavioral attributes associated with general lamprey movements and elapsed time as lamprey leave the reservoir and enter lower mainstem tributary reaches ("affirming" establishment into that tributary).	
Actions	Contribute $X into the NNI Account funding to support for radio telemetry in the upper Columbia. Support trapping and tagging sufficient adults (TBD by Forum) for migration – behavior evaluation. Employ USFWS to establish and maintain receivers, download and evaluate information and report on findings.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP and the intent of the 401 Certification.
Timing	Equipment in place for the 2015 adult migration.

Task 7: Regional Establishment Baseline / Status and Trend Information	
Establish baseline information by enumerating (relative abundance) local populations (watershed scale) of adults and juveniles in priority watersheds and stream reaches. • Track and understand behavioral characteristics and long-term changes of both juvenile and adult local populations in priority monitoring locations (index sites) over time. • Compare and evaluate these changes relative to other Columbia Basin regions.	
Actions	Establish long term "Index Sites" in the Wenatchee, Entiat, Methow and Okanogan subbasins to monitor and track changes in juvenile abundance, spatial distribution and population age/size-class characteristics. Monitor juvenile presence, relative abundance and age/size class characteristics using screw traps, fyke-nets, electroshocking or other monitoring methods. Consolidate and evaluate data and report on findings.
Relationship to the PLMP	Baseline information is critical to establish to determine long-term benefits of lamprey NNI mitigation measures associated with supplementation and natural production of the local populations.
NNI Funding	Grant PUD will provide $X sufficient funding into the NNI Account for two years (2015-2016) to support existing tribal juvenile survey capacity at Index Sites to determine juvenile relative abundance and spatial distribution.
Timing	Funding available in Years 1 and 2. Baseline juvenile information completed in 2017.

Task 8: Adult Passage in Tributary Streams	
Identify primary spawning areas of adult lamprey and establish, where feasible specific spawning locations and timing. Identify, evaluate and correct adult passage issues in priority areas within the Upper Columbia subbasin tributary streams.	
Actions	Provide sufficient funding and excess telemetry receivers to support identification of potential adult passage issues in the W-E-M-O and implementation of corrective actions.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP. Mitigation for passage issues associated with the Priest Rapids and Wanapum dams.
NNI Funding	Grant PUD will provide $X sufficient funding into the NNI Account to support USFWS for radio telemetry installation and maintenance of equipment and retrieval, evaluation and reporting of information.
Timing	Established prior to March 2016 and maintained through 2018 to insure full two year (minimal) analysis.

Task 9: Juvenile Entrainment: Irrigation Structures Evaluate and correct juvenile entrainment into irrigation facilities within priority watersheds / stream reaches in the Upper Columbia subbasin tributary streams.	
Actions	Evaluate alternative strategies to prevent or minimize juvenile entrainment into irrigation ditches.
Relationship to the PLMP	Consistent with the Goal and Objective 1 of the PLMP.
NNI Funding	Grant PUD will provide $X funding into the NNI Account to support agency actions associated with this Objective.
Timing	Funding available for 3-years, 2016 - 2018.

Key Provisions and Interpretations

GCPUD Pacific Lamprey Management Plan
4.0 Protection, Mitigation, and Enhancement Measures

The goal of the PLMP is to identify ongoing Project-related impacts on Pacific lamprey; implementing reasonable and feasible measures to reduce or eliminate such impacts; and implementing on-site or off-site measures to address unavoidable impacts.

The PLMP will be based on adaptive management, allowing for the adjustment of goals and objectives through a collaborative process, based on new information and ongoing monitoring results.

The PLMP emphasizes a monitoring program that will necessitate future consultation with the PRFF to evaluate monitoring results and develop recommendations for program direction. Accordingly, the PLMP will be reviewed on a periodic basis by the PRFF to allow for planning and future adjustments over the term of the license. Adaptive management is defined in Grant PUD's Water Quality 401 Certification (Section (6.2 (2)), which specifies that "the Adaptive Management process has been and will continue to be used for the protection of aquatic species.

The PMEs contained in this management plan will: 1) protect, mitigate, and enhance lamprey resources for the term of the New License; 2) ensure that the ongoing operation of the Project will not adversely impact lamprey; 3) minimize the effect of any incidental injury or mortality to lamprey that may occur as a result of Project operation or Project effects to lamprey habitat; and 4) ensure adequate monitoring and reporting of results.

4.1 Objective 1: No Net Impact (NNI). Identify, address, and fully mitigate Project effects to the extent reasonable and feasible.

Under this objective, Grant PUD will evaluate any reasonable and feasible improvements to the upstream fishways at Priest Rapids and Wanapum dams which are identified through passage evaluations throughout the Columbia Basin.

4.2 Objective 2: Provide safe, effective, and timely volitional passage (as defined by the PRFF) for adult upstream and downstream migration.

4.2.2 - Develop Adult Pacific Lamprey Passage Criteria Grant PUD will develop adult lamprey passage criteria that are not inconsistent with the anadromous fish passage criteria. Criteria will include consideration of success achieved at other Columbia River Basin projects and will take into consideration Priest Rapids Project-specific conditions.

4.2.4 - *Comprehensive Passage Evaluation* Within four years of license issuance Grant PUD should have a determination as to whether the FLA-proposed modifications significantly improve adult passage. If not, then Grant PUD shall develop and implement additional measures in consultation with the PRFF.

4.2.7 Evaluation of Modifications to all Fishways

For example, the results of baseline telemetry studies could serve as a building block for evaluating the effectiveness of future reasonable and feasible modifications.

4.2.9 Conduct 10-year Monitoring and Evaluation Studies

However, if Ecology concludes following issuance of the Year Ten status report that a Pacific Lamprey Biological Objective has not been met (Section 5.3 [5.e] under Certification Conditions), Grant PUD shall continue to implement the Adaptive Management process as described in Section 5.3 (2) under Certification Conditions.

4.3 Objective 3: Provide safe, effective, and timely volitional passage (as defined by the PRFF) for juvenile downstream migration.

4.3.1 Identification and Mitigation of Project effects on Juvenile Pacific Lamprey

In a timely manner, but no later than 10 years following license issuance, identify and mitigate Project effects on juvenile Pacific lamprey with the intention of meeting juvenile lamprey passage criteria referred to in 4.3.2 below.

4.3.3 Regional Studies

Grant PUD will participate in regional studies and cooperate with other entities performing those studies when useful information may be obtained about Project impacts to lamprey.

4.4 Objective 4: Avoid and mitigate Project impacts on rearing habitat.

In a timely manner, but no later than 10 years following license issuance, Grant PUD will determine juvenile Pacific lamprey presence/absence, habitat use, and relative abundance within the Priest Rapids Project.

State Section 401 Certification

FERC License

Summary of Actions to be Implemented through NNI and/or Regional Coordination			
Objective	**Grant**	**Chelan**	**Douglas**
FERC Required Actions			
1. Mainstem Fishway Entrance, Passage and Exit Efficiency	Passage improvements needed – continued evaluation		
2. Proportion of Adults Ascending Tributaries	Evaluation required. 2015 - 2016		
3. Fate of Adults in Reservoirs	Ongoing consideration, preliminary acoustic evaluations warranted.		
4. Predation on Juveniles in Tailrace	Ongoing consideration Evaluation warranted	Contribution to JLAT development (Section 4.2.3)	Ongoing consideration Evaluation warranted
5. Juvenile Occupancy and Use of Reservoir Habitat	Additional evaluations deferred until 2018-2019	Additional evaluations deferred until 2018-2019	Preliminary evaluation needed (2016)
6. Juvenile Propagation Research	No Requirement	Contribution to ongoing efforts. Section 4.2.3	No Requirement
NNI / Regional Coordination Actions			
7. Adult Translocation Research	Trap and Haul for passage studies. Trap and Haul into Tribs. Contribute Funds to NNI.	Trap and Haul for passage studies. Trap and Haul into Tribs. Contribute Funds to NNI	Trap and Haul for passage studies. Trap and Haul into Tribs. Contribute Funds to Reg. Coord
8. Regional Establishment Baseline / Status and Trend Information	Contribute Funds to NNI.	Contribute Funds to NNI.	Contribute Funds to Reg Coord.
9. Adult Passage in Tributary Streams	Contribute telemetry equipment. Contribute Funds to NNI.	Contribute telemetry equipment. Contribute Funds to NNI.	Contribute telemetry equipment. Contribute Funds to Reg Co.
10. Juvenile Entrainment: Dryden Ditch / Other Irrigation Structures	Contribute Funds to NNI.	Contribute Funds to NNI. Evaluate and correct Dryden.	Contribute Funds to Reg. Co.

FISH PASSAGE CENTER

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MEMORANDUM

TO: Joe Skalicky, USFWS

FROM: Michele DeHart

DATE: November 14, 2014

RE: Review of PIT-tag data for juvenile lamprey in the Columbia River Basin

In response to your request, we have reviewed all available data for PIT-tagged lamprey in the Columbia River Basin. Specifically, you asked us to summarize available data for the juvenile life-stage. Below is a general overview of our findings from this review, including some recommendations that could increase the utility of PIT-tag data, particularly for juvenile lamprey.

- To date a total of 14,053 lamprey have been PIT-tagged and released into the Columbia River Basin, of which 3,647 (26%) were determined to have been tagged and released as juveniles.
- Approximately 81% of the PIT-tagged juvenile lamprey that we identified were tagged and released at a dam for specific studies on passage conditions. Many of these fish were collected from downstream projects and transported upstream to the release site for these studies. Therefore, any downstream detections of these fish would not be useful in assessing passage timing, travel times, diel passage, survival, etc., because they do not represent the run-at-large. Marking and handling effects have been documented in salmonids and steelhead from similar marking, transport, and release activities.
- The only group of PIT-tagged juvenile lamprey that were useful to assess timing patterns, travel times, etc., were 690 PIT-tagged Pacific macropthalmia that were tagged and released into the Umatilla River in 2012 and 2013.
    - Of these, only 25 were detected at John Day Dam and none were detected at Bonneville Dam.

    - With only 25 downstream detections, assessing passage timing, travel times, diel passage patterns, etc., is limited and estimating survival is not possible.

- Based on our review of the available PIT-tag data for juvenile lamprey we offer the following recommendations which could improve the potential to develop travel time, timing, and survival data for juvenile lamprey:
    - It would be useful if researchers PIT-tagging lamprey could clearly identify adults from juveniles. For example, researchers from the Confederated Tribe of the Umatilla Indian Reservation used a two-letter code in the Conditional Comments field to identify that the lamprey they marked in 2012 and 2013 were macropthalmia (i.e., juveniles).
    - Increased marking of juvenile lamprey is needed in order to better inform passage timing, travel times, diel passage, and survival.

To date, 14,053 total lamprey have been PIT-tagged and released into the Columbia River Basin. However, this release total includes individuals that were tagged and released as juveniles or adults. Currently, all PIT-tagged lamprey are recorded in PTAGIS with the Species Code of "A". This means that there is currently no simple way of determining whether an individual was PIT-tagged and released as an adult or as a juvenile. However, it is possible to use other information from the tag file to determine juveniles from adults. To determine how many of the 14,053 total PIT-tagged lamprey may have been tagged and released as juveniles, we relied on three different pieces of information.

1. We used Capture Method. Specifically, we assumed that all PIT-tagged lamprey with a Capture Method of LADDER were tagged and released as adults, as intentionally capturing juvenile lamprey in an adult fish ladder for PIT-tagging purposes would be extremely difficult. Of the 14,053 PIT-tagged lamprey, approximately 6,894 (49%) had a Capture Method of LADDER.
2. We used Session Message to inform life-stage at tagging. All individuals whose Session Message contained the word "adult" were assumed to have been tagged and released as adults.
3. We used length at tagging to determine the life-stage at tagging. It is worth noting that length at tagging is a voluntary field for PIT-tagged fish which means that not all PIT-tagged lamprey had a length. For example, approximately 8% of the total PIT-tagged lamprey were missing length data all together. This means that using length at tagging to determine life-stage at tagging likely eliminated some juveniles from the data set. To determine an appropriate length "cut point," we relied on condition monitoring data from John Day, McNary, and Bonneville dams, as part of the Smolt Monitoring Program (SMP). As part of the condition monitoring program, Pacific lamprey macropthalmia that are collected by the SMP are measured to the nearest mm TL (total length). In all, 25,307 Pacific lamprey macropthalmia have been examined for condition at these three projects over the past four years. The maximum length of these fish is 455 mm TL. However, this is likely an erroneous length, as the next highest length was 228 mm TL. Based on these data, we used 250 mm TL as the "cut point" for determining juvenile lamprey.

After using the criteria discussed above, we estimate that approximately 3,647 (26%) of the 14,503 PIT-tagged lamprey were tagged and released as juveniles. Of the 3,647 lamprey that were tagged as juveniles, 2,941 (81%) were tagged and released at Lower Granite Dam in 2013 and 2014, McNary Dam in 2005, or the Sullivan Hydroelectric Plant at Willamette Falls in 2004 as part of studies to assess passage conditions at these sites. Many of the lamprey juveniles that were used in these studies were collected at a downstream dam and transported to the study site for PIT-tagging and release. Therefore, downstream detections of these individuals are not useful for informing juvenile passage metrics, as they do not represent the run-at-large because of the additional handling and transportation. Of the remaining 706 PIT-tagged juveniles that were not tagged for these passage condition studies, one was tagged and released into the Methow River in 2011, one was tagged and released into Lolo Creek on the Clearwater River in 2014, 14 were tagged and released into Newsome Creek on the Clearwater River in 2014, and 690 were tagged and released into the Umatilla River in 2012 and 2013. The tagging on the Umatilla River was conducted by researchers from the Confederated Tribes of the Umatilla Indian Reservation (CTUIR).

Based on these data, it appears that the 690 PIT-tagged juveniles from the Umatilla River marking in 2012 and 2013 are likely the only juvenile lamprey that may be useful in assessing patterns in timing, travel times, etc. All 690 of these PIT-tagged juveniles had a Conditional Comment (i.e., Flag Code) of MP, which stands for Macropthalmia Pacific (Aaron Jackson, CTUIR, personal communication), which verifies that these were juveniles. The average length and weight at tagging for these PIT-tagged Pacific macropthalmia were 147.7 mm TL (95% CI: 146.8–148.7 mm TL) and 4.9 grams (95% CI: 4.8–5.0 grams). In comparison to our juvenile lamprey "cut point," the maximum length at tagging for these PIT-tagged macropthalmia was 197 mm TL.

All of the Umatilla River macropthalmia were tagged and released over the span of about three months, from December 7, 2012, to March 19, 2013. Figure 1 is provided below to illustrate the daily proportions of PIT-tags that were released into the Umatilla River over this period. Of the 690 macropthalmia that were PIT-tagged for this project, only 25 were detected at a downstream project. All 25 of the downstream PIT-tag detections were at John Day Dam and occurred between March 28 and July 21, 2013. To date, one of the 690 PIT-tagged Pacific macropthalmia released into the Umatilla River in 2012 and 2013 have been detected at an adult detection site in the Columbia River Basin.

With only 25 downstream detections, estimates of passage timing, travel time, and diel passage patterns are limited. Furthermore, estimation of juvenile survival is not possible. Although limited, we used the 25 PIT-tagged macropthalmia that were detected at JDA to assess passage timing, travel time (release to John Day), and diel passage patterns. Figure 2 is provided to illustrate the passage timing of these 25 detected fish.

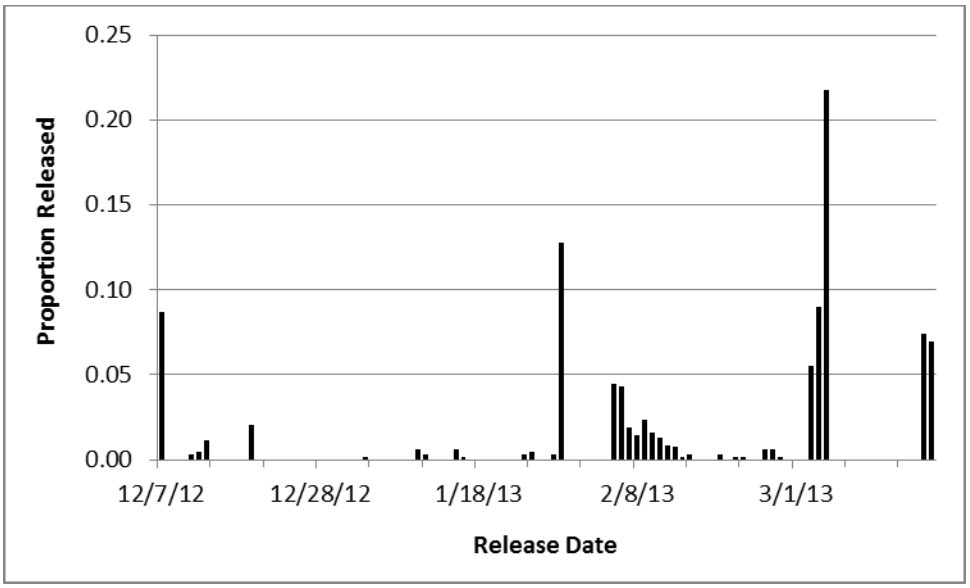


Figure 1. Daily tagging (expressed as a proportion) of PIT-tagged juvenile lamprey from the Umatilla River in 2012 and 2013.

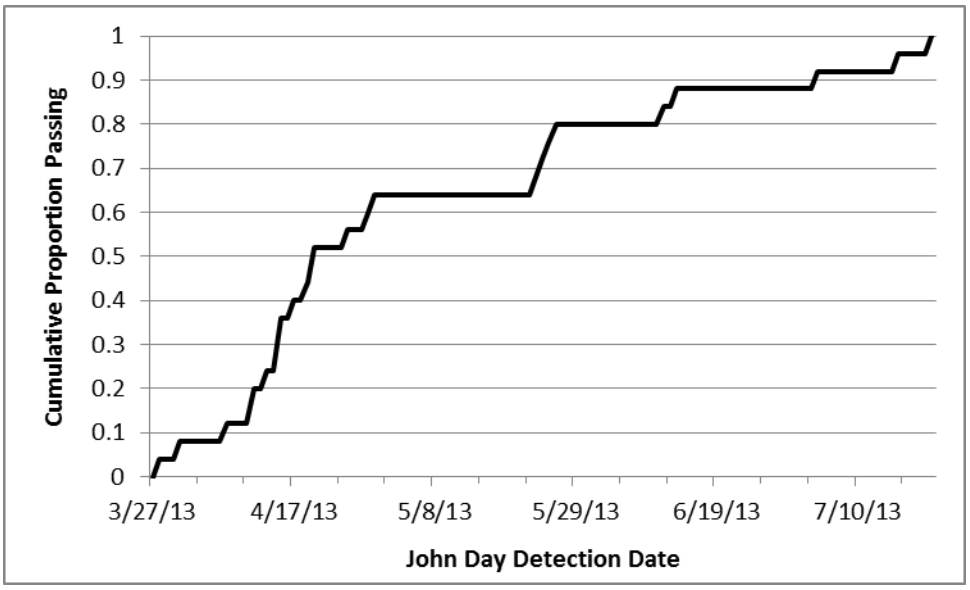


Figure 2. Cumulative proportion of PIT-tagged Pacific macropthalmia released from the Umatilla River and detected at John Day Dam.

Table 1 presents the minimum, median, and maximum travel times from release in the Umatilla River to John Day Dam for the 25 PIT-tagged Pacific macropthalmia that were detected at John Day Dam in 2013. Also provided are estimates of the 95% confidence limits around the estimated median travel time. Finally, Figure 3 is a histogram of the passage time (i.e., hour) of the 25 PIT-tagged Pacific macropthalmia that were detected at John Day Dam in 2013. From these limited data, it appears that Pacific macropthalmia pass the project at night, from approximately 20:00 to 04:00 (Figure 3).

Table 1. Estimated travel times from release to John Day Dam of Umatilla River Pacific macropthalmia tagged and released from December 2012 to March 2013.

Travel Time (Days)			95% Confidence Limits	
Minimum	**Median**	**Maximum**	**Lower**	**Upper**
13.8	68.1	173.4	39.7	85.6

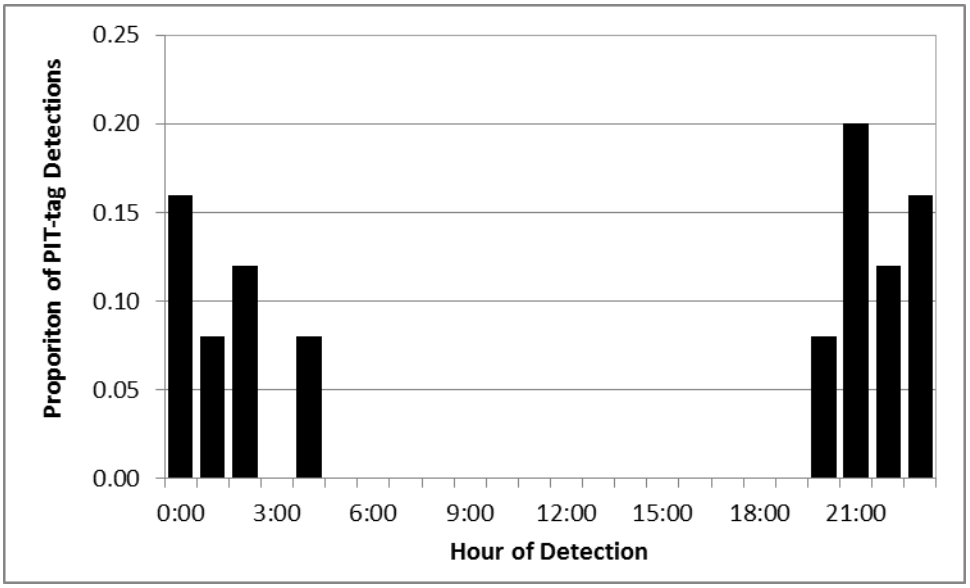


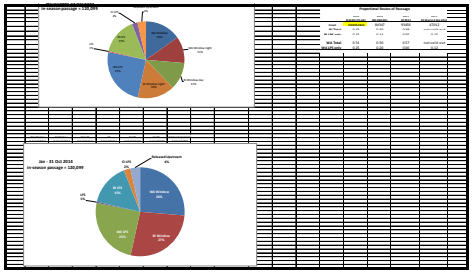
Figure 3. Hourly PIT-tag detections (expressed as a proportion) for Pacific macropthalmia tagged and released into the Umatilla River and detected at John Day Dam in 2013.

Conclusions

Based on our review of the available PIT-tag data for lamprey it appears that current PIT-tagging levels are not sufficient to effectively assess passage timing, travel times, diel passage distributions, survival, etc., for juvenile lamprey in the Columbia River Basin. In addition, we would recommend that researchers PIT-tagging lamprey clearly identify individuals that were tagged as adults versus those tagged as juveniles. Although length at tagging can be used to distinguish adults from juveniles, it would be beneficial if the researcher conducting the tagging made that distinction. For example, researchers from CTUIR used a two-letter code in the Conditional Comments field to identify that the lamprey they marked in 2012 and 2013 were macropthalmia (i.e., juveniles).

Date	DAY COUNTS Washington Shore Fish Ladder Day Count (Window)	Bradford Island Fish Ladder Day Count (Window)	WA AWS LPS Day Count	WA AWS LPS correction factor	WA AWS LPS Day Count corrected	BI AWS LPS Day Count	CI Entrance LPS Day Count	NIGHT COUNTS Washington Shore Fish Ladder Night Count (Window)	Bradford Island Fish Ladder Night Count (Window)	WA AWS LPS Night Count	WA AWS LPS Night Count corrected	BI AWS LPS Night Count	CI Entrance LPS Night Count	Washington Shore LPS Lamprey Released Upstream of BON	Collected Lamprey Released Upstream of BON	Estimated BON Escapement (24 Hr) corrected	Estimated BON Escapement (24 Hr)
1 Jan 14	0	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Not recorded	Not recorded	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	NA	0	0
8 Jan 14	0	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Not recorded	Not recorded	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	NA	0	0
17 Jan 14	0	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Not recorded	Not recorded	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	NA	0	0
28 Oct 14	0	0	0	0.051	0	Dewatered	0	Not recorded	Not recorded	0	0	Dewatered	0	Dewatered	0	0	0
4 Nov 14	0	-1	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Not recorded	Not recorded	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	0	1	1
13 Nov 14	0	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	Not recorded	Not recorded	Dewatered	Dewatered	Dewatered	Dewatered	Dewatered	0	0	0

BON Lamprey routes
Jan through 31 Oct 2014



Proportional Rates of Passage

Mid Window	24%			
Mid Window right	14%			
Window Sky	14%			
Mid Window left	24%			
Mid Left	24%			
Left	0%			
Mid	0%			
Release of Ephemeris	4%			
ID LHS	2%			
LHS	2%			
ID LHS	23%			
Mid LHS	23%			
Mid Window	24%			
ID Window	22%			

From:	Tracy Hillman
To:	"Aaron Jackson"; Alyssa Buck; "Andrew Gingerich"; "Bill Tweit"; "Blaine Parker"; "Bob Dach"; "Bob Rose"; "Brad James"; "Brian McIlraith"; "Bruce Suzumoto"; "Bryan Nass"; "Bryan Nordlund"; "Carl Merkle"; "Chad Jackson"; Chris Mott; Debbie Williams; "Denny Rohr"; "Donella Miller"; Doris Squeochs; "Jason McLellan"; Jeff Grizzel; "Jeff Korth"; "Jim Bellatty"; Jim Powell; "John Easterbrooks"; John Monahan; "Keith Hatch"; "Kirk Truscott"; "Larry Hildebrand"; "Mark Timko"; Mike Clement; Mike Nicholls; "Pat Irle"; "Patrick McGuire"; "Patrick Verhey"; "Paul Anders"; "Ralph Lampman"; "RD Nelle"; Rex Buck, Jr.; Ross Hendrick; "Steve Hemstrom"; "Steve Lewis"; "Steve Parker"; Tom Dresser; "Tom Skiles"
Subject:	PRFF: Update on Juvenile Sturgeon Rearing at Marion Drain
Date:	Wednesday, November 26, 2014 11:17:23 AM

Hello PRFF,

Donella kindly provided the following update on the status of juvenile sturgeon at Marion Drain. Please let Donella know if you have questions.

Thanks,
Tracy

We haven't had anything out of the ordinary occur, no major die off or health concerns. The fish are doing well and no we haven't done any histological samples.

10/21/14 Average Fish/Lb
Spawn 1- 39.68
Spawn 2- 84.2

11/24/14 Average Fish/Lb
Spawn 1- 20.8
Spawn 2- 32.9

If you have any further questions please feel free to contact me.

Thanks
Donella

From: Tracy Hillman
To: "Aaron Jackson"; Alyssa Buck; "Andrew Gingerich"; "Bill Tweit"; "Blaine Parker"; "Bob Dach"; "Bob Rose"; "Brad James"; "Brian McIlraith"; "Bruce Suzumoto"; "Bryan Nass"; "Bryan Nordlund"; "Carl Merkle"; "Chad Jackson"; Chris Mott; Debbie Williams; "Denny Rohr"; "Donella Miller"; Doris Squeochs; "Jason McLellan"; Jeff Grizzel; "Jeff Korth"; "Jim Bellatty"; Jim Powell; "John Easterbrooks"; John Monahan; "Keith Hatch"; "Kirk Truscott"; "Larry Hildebrand"; "Mark Timko"; Mike Clement; Mike Nicholls; "Pat Irle"; "Patrick McGuire"; "Patrick Verhey"; "Paul Anders"; "Ralph Lampman"; "RD Nelle"; Rex Buck, Jr.; Ross Hendrick; "Steve Hemstrom"; "Steve Lewis"; "Steve Parker"; Tom Dresser; "Tom Skiles"
Subject: PRFF: Wanapum Pool Refill Update
Date: Friday, November 14, 2014 4:24:24 PM

Hello PRFF,

Please see the email below from Tom Dresser regarding the partial filling of Wanapum Pool.

Please let me, Tom, or Mike know if you have questions.

Cheers,
Tracy

PRCC; Great News!

Grant PUD is very close to initiating a partial refill of Wanapum reservoir. Pending further approval by FERC and Board of Consultants approval of our refill plan, raising the reservoir could begin as early as Saturday, November 22nd. However, there is still considerable spillway repair work left to be completed before the refill can begin. Therefore, while November 22nd is within the realm of possibility, it is an optimistic date. At this point, we are relatively confident the refill will begin sometime between Saturday, November 22nd and Friday, December 11th.

Once the refill begins, it will take between 6 and 18 days to reach our target forebay elevation of 562' msl. The speed at which the refill progresses will be dependent on river inflows (which are a function of weather and upriver dam operations). Once there, we will have a 4' operating range (from a minimum of 558' to a maximum of 562') just as we've had for the past 9 months since the reservoir was drawn down. Note that while the operating range of 558' to 562' represents a water level increase of 17', it is still short of our normal pool elevation of approximately 571.5'. The good news is that the forebay elevation range of 558 to 562' will provide for volitional fish passage at both the left and right bank ladders, eliminating the need for the infrastructure modifications that have been in place since mid-April (but which have worked remarkably well).

As you are likely aware, Curt Dotson has contacted you (via email and/or phone) regarding the removal of the Wanapum Fishway Exit Passage Systems, which will begin on Monday Nov 18th with the removal of the spiral chute on the right-bank. Once that is completed, we will jump over to the left-bank and begin complete removal. Curt

will be able to provide a status update at our PRCC meeting on Nov 19th.

It's been nine long months since the fracture in the Wanapum spillway was discovered so it's gratifying to see us on the verge of raising the reservoir to a point where the vast majority of our environmental issues are resolved. I appreciate the support, patience, and understanding each of you has shown during these challenging times. It has truly been a collaborative effort involving dozens of agencies, tribes, and organizations and I believe we all have much to be proud of given what we faced in early March.

I'll keep all posted once refill is complete. Meanwhile, if you have questions, please don't hesitate to e-mail or call.

Tom Dresser
Fish, Wildlife & Water Quality Manager
Public Utility District No. 2 of Grant County, Washington
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Ephrata, Washington 98823

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