

MEMORANDUM FOR THE RECORD

Subject: FINAL minutes for the 13 June 2013 FPOM meeting.

The meeting was in the Auditorium, Bonneville Lock and Dam. Cascade Locks, OR. In attendance:

Last	First	Agency	Office/Mobile	Email
Bailey	John	USACE-NWW		
Bettin	Scott	BPA	503-230-4573	swbettin@bpa.gov
Bissel	Brian	NWP-BON		
Conder	Trevor	NOAA	503-231-2306	Trevor.conder@noaa.gov
Cordie	Bob	NWP-TDA	541-506-7800	Robert.p.cordie@usace.army.mil
Fone	Ken	USACE-NWW		
Fredricks	Gary	NOAA	503-231-6855	Gary.fredricks@noaa.gov
Gibbons	Karrie	NWP-FFU		
Hausmann	Ben	NWP-BON	541-374-4598	Ben.j.hausmann@usace.army.mil
Hevlin	Bill	NOAA	503-230-5415	Bill.hevlin@noaa.gov
Klatte	Bern	USACE-NWP	503-808-4318	Bernard.a.klatte@usace.army.mil
Lorz	Tom	CRITFC	503-238-3574	lorz@critfc.org
Mackey	Tammy	USACE-NWP	503-961-5733	Tammy.m.mackey@usace.army.mil
Martinson	Rick	PSMFC		rickdm@gorge.net
Mensik	Fred	PSMFC		
Pinney	Chris	USACE-NWW		
Sears	Shirley	Colville Tribes		
Setter	Ann	USACE-NWW	509-527-7125	Ann.l.setter@usace.army.mil
Scott	Shane	NWRP	360-576-4830	Sscott06@earthlink.net
Stansell	Robert	NWP-FFU	541-374-8801	Robert.j.stansell@usace.army.mil
Stephenson	Ann	WDFW		
Trachtenbarg	Dave			
Traylor	Andy	NWP-BON		
Whiteaker	John	CRITFC		
Wills	David	USFWS	360-604-2500	David_wills@fws.gov
Wright	Lisa	USACE-RCC	503-808-3943	Lisa.S.Wright@usace.army.mil
Zorich	Nathan	NWP-FFU	541-374-8801	Nathan.a.zorich@usace.army.mil
Zyndol	Miro	NWP-JDA	541-506-7860	Miroslaw.a.zyndol@usace.army.mil

Bailey, Lorz, Mensik, Pinney, Sears, Trachtenbarg called in.

June birthdays include: Eppard, Setter, Fredricks. HAPPY BIRTHDAY!!!!

1. Finalized results from this meeting.

- 1.1. May FPOM minutes approved.
- 1.2. BON LED testing. Fredricks said go ahead and do the test in the dry. He also said just replace with in-kind for now, but know that the lighting may change in the future.
- 1.3. TDA Shad Fishery. Cordie reported that this appears to be a hook and line effort to get bait for their sturgeon broodstock program. Hausmann said Whiteaker has been collecting shad for Yakama Nation at the AFF. FPOM agreed that they could get their shad from the AFF.
- 1.4. WDFW BON AFF study. Conder asked if this will be the final year of WDFW's study. Stephenson said this is the final year for this study.
- 1.5. Memos of Coordination

1.5.1. 13LWG08 – Transformer Bushing Replacement. Bettin asked if they looked at overlapping this outage with the double testing outage. Fone said they tried but BPA crews were not available. Bettin said he would like to go back and explain the impacts to the crew and see if they can re-arrange their time. **FPOM agreed with this MOC, with the understanding that if BPA can provide a crew during the double testing outage, this outage would be scheduled to occur at that time instead.**

1.5.2. 13LWG09 – JDA Screen Testing. Setter explained the MOC. Hevlin suggested doing the test but not going so far as saying the screens could be moved anywhere. He said there may be a need to collect more data next spring. Setter agreed. Fredricks asked about the differences between the screens. Setter said the JDA screens have been modified to have the same opening as the LWG screens. The JDA screens are more lamprey friendly. Conder asked about the sampling and confidence intervals. Setter said the tests were just gatewell dipping data. Hevlin said since it is just a comparison between gatewells they don't need 100 fish; 35 should be sufficient. Setter said that would be great to have to handle fewer fish. Fredricks agreed. **ACTION: Setter will send an email to FPOM when the Project starts the gatewell dipping. FPOM concurred with this MOC.**

1.5.3. 13LWG10 - AWS Pump #1 Test. **FPOM concurred.**

1.6. 14BON001. BPA- will follow NWD policy lead. NOAA, CRITFC, IDFG, WDFW, Colville, ODFW, USFWS all support the change form.

1.7. FPOM Task Groups.

1.7.1. Sea Lion task group. New group. Need to establish chair and team members. Chaired by Stansell. Team members include: Fredricks, Conder, J. Skidmore, Hausmann, Mackey, Whiteaker, VanderLeeuw, Cordie.

1.7.2. Avian task group. Chaired by NWW. Team members include: Cordie, Dugger, Fone, Fredricks, Hausmann, Madson, Setter, Skidmore, Trachtenbarg, Zorich, Zyndol. NWW will hold a meeting in the next few months.

1.7.3. BON VBS task group. (Hausmann). This group is now disbanded. Team members include Baus, Bettin, Fredricks, Hausmann, Lorz, Mackey, Rerecich, and Wills.

1.7.4. AFF mods (Rerecich). Modifications are not complete so task group will continue.

1.7.5. Sturgeon task group (Van der Leeuw or Hausmann). This group has now disbanded.

1.7.6. Fish counting task group (Setter). Team members include Fredricks, Klatte, Mackey, Setter, Tackley, and Wills. Setter pulled together existing needs and gave that to Klatte. A meeting will be tentatively scheduled for after the August FPOM. Setter suggested there may be a place for video counting at some projects. The team can look at all of the options.

1.7.7. BON unit operating range (Lorz). This team has now disbanded. Team members include Baus, Benner, Bettin, Chockley, Conder, Cooper, Fredricks, Hausmann, Hevlin, Lorz, Mackey, Meyer, Tackley, Rerecich, Wills.

2. The following documents were provided or discussed. Documents may be found at <http://www.nwd-wc.usace.army.mil/tmt/documents/FPOM/2010/>

2.1. *Agenda, Fish Passage O&M Coordination Team.*

2.2. *Cooling Water Strainers Lamprey Counts.xls.*

2.3. *Coordination/Notification Forms (NWW/NWP)*

2.4. *FPP change forms. (NWW/NWP)*

3. Action Items

3.1. NWW Action Items.

- 3.1.1. [May 13] Avian Task Group. **ACTION:** Setter/Fone will help create a Task Group and have a kick-off meeting in June. **STATUS:** *Setter said they will work on getting interested members on the task group. Members included Fredricks, N. Zorich, P. Madson, D. Trachtenbarg, Wills, Cordie, Zyndol, Hausmann, Setter, Fone, Dugger, J. Skidmore, G. Melanson, M. Plummer, B. Spurgeon, M. Halter. Wills asked what the main task would be. Fredricks said the island component was separated from the dam avian activities. FPOM should handle the dam avian activities and this task group should help address that need. Lethal and non-lethal activities would be included for discussion. Setter said she understands it to be looking at each dam and ensuring adequate protection at each dam. After the initial look at each dam and the protections in place, Project Bios can drop out as appropriate.*
- 3.1.2. [May 13] LWG ADCP data collection. **ACTION:** Setter said they will send out an updated MOC prior to making a decision on whether to go ahead with the operation. **STATUS:** *did not go forward with the data point previously coordinated. Still one more point to collect- 30 with spill. Setter responded to Lorz's question (when he joined after this discussion) about the data point collection. She said IDFG and CRITFC recommended that spill be increased at night to maintain overall planned spill volumes and SPE. After considering these recommendations, the Fish Accords, and BiOp commitments, the Corps decided to not pursue collecting this data.*
- 3.1.3. [Jun 13] MCN temperature profile. **ACTION:** NWW will continue to work on this.
- 3.1.4. [Jun 13] MCN debris spill. **ACTION:** NWW will provide the protocols so this can be inserted into the FPP as a normal operation prior to the TSWs being removed.
- 3.1.5. [Jun 13] MCN sampling without transport. **ACTION:** NWW will put together a proposal for the Region to consider. Wills said he would take the issue to FPAC as well.

3.2. NWP Action Items

- 3.2.1. [Feb 13] BON AFF PIT tag detector. **ACTION:** Fryer will have detailed drawings, an operating plan, and monitoring plan for FPOM review in October.
- 3.2.2. [Apr 13] FPOM meeting location. **ACTION:** Wills will check availability of his office for the July FPOM. **STATUS:** Wills said he would be gone for that meeting. *FPOM will be held at a different location for July.*
- 3.2.3. [May 13] BON JMF Separator Bar contract and condition sub-sampling. **ACTION:** Lorz said they will take the proposal to roll the sub-sampling into the SMP contract it to FPAC and Bettin will broach the subject again with BPA contracting. **STATUS:** *Lorz communicated via email that the change isn't as simple as maybe it should be. FPC may not be willing to add it to their work without the change in their contract with BPA and that may require funding. Mackey noted that the condition sub-sampling doesn't require additional cost now. Bettin said he is waiting to hear from FPC.*
- 3.2.4. [May 13] BON Kelt Monitoring. **ACTION:** NWP will develop a proposal for kelt monitoring from 1 March through 10 April. They will bring this back to FPOM for further discussion and development. **STATUS:** *This will be brought to FPOM in August or September.*
- 3.2.5. [Jun 13] BON PH2 tail logs. **ACTION:** Hausmann will put together a MOC with all of the details so FPOM can evaluate the risk to fish and make a recommendation.
- 3.2.6. [Jun 13] NWW hydrofoil test at B2CC. **ACTION:** A detailed discussion of the new study plan needs to be added to the NWW FFDRWG or a special meeting need to be set up.
- 3.2.7. [Jun 13] Diel fish passage graphs. **ACTION:** Wright will take the lead on figuring out where to insert the information into the FPP.

- 3.2.8. [Jun 13] BON debris loading reporting. **ACTION:** Hausmann will send weekly updated on debris to Benner and Baus prior to TMT.
- 3.2.9. [Jun 13] JDA-S lamprey trap temperature protocols. **ACTION:** A. Jackson has been asked to write up some justification and bring it back to FPOM. Zorich will continue to do a literature search for some guidance as will the rest of FPOM.

3.3. Action Items completed or to be discussed later in the agenda.

- 3.3.1. [May 13] BON WS Lamprey flume LPS pump installation. **ACTION:** Tackley to submit a MOC requesting concurrence for pump installation during 20 – 22 May. **STATUS: completed at the end of May/early June.**
- 3.3.2. [May 13] 14BON001 BON change form. . **ACTION:** FPOM will take the change form to their respective agencies and bring their position back to the June FPOM meeting. **STATUS: discussed later in the agenda.**
- 3.3.3. [May 13] Sea Lion Task Group. **ACTION:** Stansell will chair the TG. The first meeting will be after the June FPOM meeting. **STATUS: discussed later in the agenda.**

4. Updates

4.1. NWW Updates

- 4.1.1. McNary Debris Spill (13MCN08, 13MCN11). Fone provided the update. Spills were conducted on 21 May and 9 June. There is still fine debris in front of the powerhouse but most of the debris successfully went through the spillway. Fredricks asked if they were half gate spills. Setter said she believes they pulled the top. **ACTION: NWW will provide the protocols so this can be inserted into the FPP as a normal operation prior to the TSWs being removed.** Setter said MCN would like to make the language fairly general since the sequence of events may change each year. Cordie asked if the downstream dams are warned of the debris spills. Bettin said they have tried in the past but the debris doesn't appear to make it to JDA.
- 4.1.2. McNary boat safety video (13MCN10). Video was in-house and completed on 6 June. Setter said they were able to put some dummies in the boat for illustration purposes. Setter will forward the link to the video as soon as she gets it. A camera was strapped to the chest of one of the dummies so it should be interesting to see.
- 4.1.3. MCN entrance wheel replacement. Setter said they found the wheel wasn't the problem. Dugger has some thoughts but the main problem is the concrete wall inside the guides that the wheels are catching on. The cable goes slack in some spots and it likely caused by flow patterns and the guides need to be replaced. Fredricks asked for a detailed engineering update through NWW FFDRWG. Setter said it isn't going through FFDRWG but once the Project figures out a fix, they could bring it to FPOM. Cordie noted that TDA changed the wheels to try to get more life out of their guides. Bettin said it seems like the guides should be more durable and the wheels should be the component that would wear out and be replaced. Setter noted that the fishways may be higher priority for the Project in the future since they are aging infrastructure. In FY14, they hope to dewater areas that haven't been dewatered in years and look at what maintenance needs are looming over O&M. This will remain an update.

4.2. NWP Updates

- 4.2.1. BON Updated Dewatering Plans. Hausmann said the dewatering plans have not been completed yet. Traylor will be headed to NWP for a 120 day detail.
- 4.2.2. BON unit 8 RTS testing. Completed in about two days.

- 4.2.3. BON PH2 tail log needs. Hausmann explained that PH2 has two sets of tail logs, one set in Unit 11 and one in Unit 16. Unit 16 has shown air gap issues but the tail logs couldn't be left in Unit 16 due to impacts to the digital governor contract. The Project would like to pull tail logs from Unit 11 but then that will mean the draft tube will be open to fish and there will be no option for flushing fish prior to reinstalling tail logs. Tail logs will need to be put back into Unit 11 so the work in that unit could continue. The air gap issue in Unit 16 is such that the unit should be forced out of service but the engineers can't say the problem hasn't been there for years so they want the unit to return to service and watch it. There was some discussion about the fish impacts for the moving of tail logs from Unit 11 now or later in the fall. It was noted that the digital governor work is continuing across the project and the air gap issue is becoming a problem for more units at PH2. FPOM learned more about the process for getting sturgeon out of the PH2 draft tubes. **ACTION: Hausmann will put together a MOC with all of the details so FPOM can evaluate the risk to fish and make a recommendation.** Fredricks recommended trying other ways to move sturgeon out of the draft tube.
- 4.2.4. BON Unit 12 outage. There is an oil leak in Unit 12 so the Unit 16 tail logs will go to Unit 12. Fredricks noted that having Unit 12 out of service will be worse for the B2CC operation. Hausmann agreed and said that is why it was originally scheduled for digital governor replacement in the winter but the oil leak has caused the schedule to shift.
- 4.2.5. BON LED testing. Hausmann reported this is a follow up on the JDA testing. Hausmann said they were going to test in a dewatered gatewell but would like to use a watered up gatewell. Hausmann said that he can't find an underwater light meter to borrow. Fredricks said Rerecich has mentioned this at NWP FFDRWG and that he might be able to get an underwater meter. Hausmann said PNNL has most of the equipment but not the readout. **Fredricks said go ahead and do the test in the dry. He also said just replace with in-kind for now, but know that the lighting may change in the future.** Hausmann said they would do the test in Unit 12.
- A. Lorz asked for an update on Unit 11 at the July FPOM. He also requested a bid from Wasco County PUD.
- 4.2.6. BON JMF separator bar monitoring. NWP is in the process of developing contract for 24 hour separator bar monitoring. Martinson asked if it would be a small business set aside. Mackey and Klatte reported that the process has just started and we have no information beyond the fact that the contract will include separator bar monitoring only.
- 4.2.7. TDA Shad Fishery. Cordie reported that this appears to be a hook and line effort to get bait for their sturgeon broodstock program. Hausmann said Whiteaker has been collecting shad for Yakama Nation at the AFF. **FPOM agreed that they could get their shad from the AFF.**

4.3. Research/FFDRWG updates. Approval letters, permits, etc located at www.nwd-wc.usace.army.mil/tmt/documents/FPOM/2010/NWP%20Research/Research.html

- 4.3.1. BON TRD. The TRD was not as successful as anticipated and further testing will not occur.
- 4.3.2. AFF modifications.
- A. WDFW tank configuration memo. Stephenson provided a handout. She explained there are several groups tagging fish in the AFF this year. Space limitations may create potential conflicts between the groups. She also noted the recent information that the most recent operation the University of Idaho experimented with where the beam was harnessed to the guardrail doesn't meet

OSHA requirements and that WDFW is looking into purchasing a davit crane to install to transfer fish from the anesthetic to the transport tank. Fredricks said the concern is moving fish from the anesthetic tank to a recovery tank. He noted that the previous WDFW studies didn't include that extra handling so this may confound the study results. Hausmann noted that there have been changes since Fredricks was in the lab and that the plan is not to carry the fish up the stairs as Fredricks observed. **Conder asked if this will be the final year of WDFW's study. Stephenson said this is the final year for this study.**

*University of Idaho provided the following info. Looking at our specific tagging schedule:
By 01 AUG UI should have completed all Chinook and sockeye tagging and be only tagging steelhead.*

UI will be operating in the AFF typically 7 d/ week tagging adult salmonids. If we are behind schedule on steelhead due to temperature closures in AFF then the numbers presented below will be adjusted to "make up" for fish untagged during temperature shutdown. We will increase our daily take accordingly to get caught up once water temps allow for safe handling again (be advised).

*Throughout August (01-31), UI will need 5-10 steelhead per day.
Beginning Sept 01 we start sampling late run steelhead in addition to baseline steelhead effort ----- daily take 01-15 Sept; avg ~19-20 steelhead per day daily take 16-30 Sept; avg ~9 per day daily take 01-15 Oct; avg 5 or less per day*

We expect to wrap up tagging on or about 15 October barring difficulties or late runs or undetermined factors beyond our control. We will tag until run diminishes or our tagging/research goals are met.

We are willing to work with WDFW folks (and have made several changes in our tagging practices, set up, and operations to help allow them the opportunity to accomplish their goals as well) and I feel confident that we can do a good team effort in general. However, UI wishes that it be known that we must place the UI/USACE goals in for-front of other efforts being conducted in the AFF and as such will request that we have access to and are able to tag the first steelhead that are available during a tagging day until we meet that day's particular tagging goals.

RE: Possible sharing of hauling tanks: UI has no issues with this and welcomes the opportunities that may in fact allow us to get our fish as well as theirs back to the river sooner than later. As long as we(UI) are comfortable with the release strategy, the protocol, and other issues related to our study design and efforts then we are certainly willing to try this out. In case of using separate hauling tanks, there should be opportunity and ability to load more than one tank at one time so that if release goals differ, we can each accommodate specific needs. This has been done in the past during studies with multiple release sites within a day but with fish being tagged for each release site occurring simultaneously.

UI would like to make it clear that the trailer usage will be prioritized on completing UI/USACE research efforts.

I don't know the specifics of WDFW tagging goals, but I know they are hoping to get a lot of fish out the door. With UI tagging also, WDFW should expect to be able to tag less than they have in the past with the same effort and time available in the lab. Allowable tagging time available will not change, and with UI priority on some species, it ultimately stands that some handling numbers are going to be reduced. I don't know how or if this will ultimately affect the study design of WDFW research. That is up to them to decide, if they wish to proceed with "hope for the best" and expect to still get a good but likely reduced sample (compared to previous years), or abandon, that I can't say. But I am optimistic that they should be able to still achieve good results with reduced tagging effort available.

*Hope this information is useful and clear.
Steve*

In addition- Bissel provided some photos and video (posted to the FPOM website) and the following details.

Attached are a couple of pictures and a second email to come (due to size limits) of a quick video taken yesterday from the proposed sampling configuration in the AFF. After discussing the issue with the project safety office, a couple of concerns arose which will require adjustments to the proposed setup to accommodate WDFW from sampling. As discussed on the May 21st AFF meeting, we would ask that a davit crane be installed in lieu of hoisting fish via the picking beam. The safety concern is that this is technically working under a load and in OSHA violation. Along with that issue, tethering support straps to a hand rail is not allowed either.

As these changes are in the benefit of WDFW, the purchase of a davit crane should be the responsibility of WDFW. Project support for the installation of such davit crane could however be arranged. If you have any comments or concerns please let me know.

Update: 19 June 2013-

After getting the OK from FPOM, there has been some new info regarding the placement of the holding tank on the upper level for sampling in the AFF. U of I had a fish jump out of the tank that ended up going out the double doors and landing in the parking lot. While this isn't a common occurrence, such escapes from the tank do occur and with the tank placed on the upper level, the consequences are greater. Gary Fredricks has expressed concern and that has prompted this e-mail so we can come to a decision. Failure to allow the upper placement will potentially have significant impact to U of I and could be a deal breaker for WDFW.

This is a an effort to re-initiate the discussion so we can give both groups guidance. U of I is currently using the upper level tank placement for their sampling efforts.

Thanks. Ben

- 4.3.3.** NWW Hydrofoil in the B2CC. Hausmann reported that the contracting didn't get completed as quickly as hoped so Jack Sands would like to move the test to March 2014. Fredricks said the schedule (attached) doesn't make sense. Hevlin and Fredricks discussed the sense of the proposed study. Mackey asked if the original intent was to do the test at the B2CC because of timing needed for a prototype at LWG, why does this still need to be conducted at BON, given the delays. Hevlin and Fredricks explained that there is less risk to fish if the test is conducted at the B2CC rather than at LWG. **ACTION: A detailed discussion of the new study plan needs to be added to the NWW FFDRWG or a special meeting needs to be set up.** Lorz chimed in that the fish risks really need to be discussed as well. Hevlin and Lorz debated this a wee bit more before FPOM moved on to the next agenda item.
- 4.3.4.** LWG 14" orifice/overflow weir evaluation update. Trachtenbarg provided an update. He said the steelhead and yearling Chinook tagging are complete. Sub-yearling tagging is about halfway completed. The data is still very preliminary but appears to show some trends between the three groups. On 9 June, a lid was left open on a recovery tank and 98 sub-yearling leapt to their death. A summary of data will be available for lamprey data later this week or early next week, with a follow up lamprey call. Bettin asked how many 14" openings could be used and still operate the channel. Trachtenbarg said up to two. Hevlin asked how long until the sub-yearling tagging is complete. Trachtenbarg said tagging and testing will be finished by 30 June. Lamprey testing is complete. Adults will be part of the second year study.
- 4.3.5.** IHR adult fish trap update. Setter reported there is a problem with the jib crane, which lifts the device. The trap appears to be fine. Fredricks said there is to be no more talk of putting this at MCN. Setter said she has not heard of additional research that may be proposed. Fredricks and Conder said they haven't heard that but it may

related to the MCN talk. Setter noted she has tried to get NWW FFDRWG to use the MOCs similar to NWP FFDRWG and FPOM. The fish trap will remain an update. Pinney called in later and reported the fish info is sent to FPC for distribution and all appears to work relatively well.

- 4.4. RCC update.** Wright reported that late June/early July flows may be around 35kcfs, thus triggering pulling the TSW at LGS. Conder asked why this occurs. Bettin, Setter, and Lorz provided some background as to why the TSW creates problems for adult passage. Hevlin believed the issue was related to unit operation and fish transport barges. Lorz said the unit operation was a problem at LMN. Lorz then said he believed the problem may be more of a problem for juveniles rather than adults. At this point, Lorz and Hevlin decided the performance testing should be put off a little so we could get the data about juvenile impacts.

Project	Previous day average (kcfs)	5 day forecast (kcfs)	10 day forecast (kcfs)
LWG	63	48	41
MCN	240	221	214
BON	249	232	226

- 4.5. Pinniped update.** Stansell reported there are three sea lions upstream but activity downstream has concluded. Stansell requested a moment from Conder and Fredricks about the BiOp.

4.6. Lamprey updates.

4.6.1. BON WS lamprey structure. Tackley provided the following written info. *I will be drafting up a DRAFT coordination form on this work, then will work with the team to fill in the details on anticipated operations required to accommodate the construction. At this point, some of the key factors are:*

- *The Corps team is very concerned about rod failure, which could result in the flume actually falling into the tailrace. Fatigue analysis details forthcoming, but we have to do this work this year (can't delay until winter 2014-15).*
- *The rod failure fix is still in the design process (INCA Tetra Tech, with NWP review).*
- *Once the design is done, then Fowler's contract will be amended to do the install.*
- *We won't have a detailed construction schedule until later in the summer/fall.*

Due to this combination of factors, the Corps needs to use a CONSERVATIVE approach with respect to projecting the operations required to accommodate construction. We will minimize fish and hydropower impacts to the extent possible and details on operations may be amended as the construction schedule is developed. I suggest regular 30-min FPOM calls (every 2 weeks, perhaps) so we can relay details as the emerge. However, we will likely be requesting something along the lines of:

- *Floating plant operation in the tailrace to support dive work and suspension of the flume during repairs*
- *B2 outage from Oct 15-Nov 9 for dive safety (team needs to weigh in on potential nighttime unit ops)*
- *DSM outage from Oct 15-Nov 9*
- *If B2 units are OOS (as suggested above), then may not need B2CC operation for downstream passage (adults, juveniles)*
- *If B2 units have partial operation (nighttime), then we need to operate the B2CC*
- *Continue operation of WA Shore Ladder throughout the construction period, but with NDE and NUE closed (bulkheads in place). North powerhouse FOG gates 14, 15, 17 and 18 closed*
- *Crane work within 50 ft of the operating fishway throughout the construction period and perhaps through November (conservative)*
- *May need to increase spillway attraction flows to Cascades Island and Bradford B-Branch fishway entrances to mitigate for partial operation of WA Shore Ladder and lack of B2 attraction*

I spoke with Gary Fredricks this morning and he was very understanding of the situation and indicated that the above ops seemed reasonable under the circumstances. He reiterated that we can't impact much-needed maintenance on Bradford Island Ladder. More to come...Sean

- 4.6.2. Lamprey are using the WS lamprey structure but having difficulty at the end.
 - 4.6.3. BONCILPS mods. Hausmann reported that the pumps are the only thing left to install. The system is not operating until the pumps can be installed.
 - 4.6.4. Lamprey strainer reports. Wills asked about the counts at LGS. Setter explained how the strainers work and what happens when a unit is turned off. Hevlin asked if there has been any thought of trapping lamprey and diverting them in the cooling water strainer system. Fone said NWW is looking at screening the cooling water intake instead of providing a collection point.
 - 4.6.5. JDA-S Lamprey collection protocols. Zyndol reported that the jib crane hasn't been installed and it won't be until August. JDA proposes lifting the collector box with a mobile crane. Zyndol stated this new trap should be considered an improvement over the old traps. He said JDA Fisheries installed the trap last week to allow it to "cure". Zyndol said as far as he is concerned, JDA Fisheries is ready to assist beginning next week, however the mobile crane support is only available Monday through Thursday. Zyndol said the installation was quiet and with little vibration. He doesn't anticipate any negative impact to fish passage with the operation of the lamprey trap. Stansell added that he was informed the tribes wouldn't be starting trapping until July. Zyndol noted that the Tribes will be hauling fish the same day as collecting the fish from the trap; they will not be holding lamprey at the SMF. Fredricks said he would still like to take a look at the set up, when the jib crane is installed. Fredricks asked if a hand crank could be used instead of the mobile crane. Zyndol said they are still looking into other options since JDA Maintenance has other work to do. The hold up on the jib crane is a contract/contractor issue. Zorich wanted some clarification on upper temperature limits for lamprey. FPOM felt the temperature criteria at JDA-S would be more of a lamprey criteria rather than a salmonid criteria. **ACTION: A. Jackson has been asked to write up some justification and bring it back to FPOM. Zorich will continue to do a literature search for some guidance as will the rest of FPOM.**
- 4.7. Avian.
- 4.7.1. NWW lethal take of gulls at dams update. No update.
- 4.8. BPA updates. Bettin said some of the RAS may be cancelled at TDA.
- 4.9. Critical Spare parts lists. Fone had no update on the framework for organizing the list.
- 4.9.1. Bettin asked if there has been any push to get the bearings and bushings ordered. There wasn't any response to that question.
5. **Diel passage at ladders.** Cordie discussed the diel passage for each species. He would like to see it incorporated into the FPP to help guide decision-making when looking at fish impacts and timing of maintenance. Fredricks agreed. The information was in a report UI did for Clugston a number of years ago, but it was forgotten. The goal with including it in the FPP would be to make sure it isn't forgotten. Fredricks would like to see the original data so people could design graphs they need. **ACTION: Wright will take the lead on figuring out where to insert the information into the FPP.**
6. **Weekly reports.** Lorz requested additional information such as debris loading and drawdown results or have Project Fisheries call in to TMT. Upon hearing that the reports will be about a week outdated, Lorz suggested he could keep making up stuff (also known as best professional judgment) at TMT. Hausmann offered to provide a debris report to the appropriate TMT representative the morning of TMT. **ACTION: Hausmann will send weekly updated on debris to Benner and Baus prior to TMT.**

7. **Coordination/Notification forms (need concurrence).**
 - 7.1. 13LWG08 – Transformer Bushing Replacement. Bettin asked if they looked at overlapping this outage with the double testing outage. Fone said they tried but BPA crews were not available. Bettin said he would like to go back and explain the impacts to the crew and see if they can rearrange their time. **FPOM agreed with this MOC, with the understanding that if BPA can provide a crew during the double testing outage, this outage would be scheduled to occur at that time instead.**
 - 7.2. 13LWG09 – JDA Screen Testing. Setter explained the MOC. Hevlin suggested doing the test but not going so far as saying the screens could be moved anywhere. He said there may be a need to collect more data next spring. Setter agreed. Fredricks asked about the differences between the screens. Setter said the JDA screens have been modified to have the same opening as the LWG screens. The JDA screens are more lamprey friendly. Conder asked about the sampling and confidence intervals. Setter said the tests were just gatewell dipping data. Hevlin said since it is just a comparison between gatewells they don't need 100 fish; 35 should be sufficient. Setter said that would be great to have to handle fewer fish. Fredricks agreed. **ACTION: Setter will send an email to FPOM when the Project starts the gatewell dipping. FPOM concurred with this MOC.**
 - 7.3. 13LWG10 - AWS Pump #1 Test. **FPOM concurred.**
8. **Fish Passage Plan:** Final 2013 FPP has been posted to the website: <http://www.nwd-wc.usace.army.mil/tmt/documents/fpp/2013/index.html>.
 - 8.1. 14BON001. **BPA- will follow NWD policy lead. NOAA, CRITFC, IDFG, WDFW, Colville, ODFW, USFWS all support the change form.**
 - 8.2. Fredricks suggested including a calendar of dates when specific actions are scheduled to occur.
9. **Task Group Updates.**
 - 9.1. Sea Lion task group. New group. Need to establish chair and team members. Chaired by Stansell. Team members include: Fredricks, Conder, J. Skidmore, Hausmann, Mackey, Whiteaker, VanderLeeuw, Cordie.
 - 9.2. Avian task group. Chaired by NWW. Team members include: Cordie, Dugger, Fone, Fredricks, Hausmann, Madson, Setter, Skidmore, Trachtenbarg, Zorich, Zyndol. NWW will hold a meeting in the next few months.
 - 9.3. BON VBS task group. (Hausmann). This group is now disbanded. Team members include Baus, Bettin, Fredricks, Hausmann, Lorz, Mackey, Rerecich, and Wills.
 - 9.4. AFF mods (Rerecich). Modifications are not complete so task group will continue.
 - 9.5. Sturgeon task group (Van der Leeuw or Hausmann). This group has now disbanded.
 - 9.6. Fish counting task group (Setter). Team members include Fredricks, Klatte, Mackey, Setter, Tackley, and Wills. Setter pulled together existing needs and gave that to Klatte. A meeting will be tentatively scheduled for after the August FPOM. Setter suggested there may be a place for video counting at some projects. The team can look at all of the options.
 - 9.7. BON unit operating range (Lorz). This team has now disbanded. Team members include Baus, Benner, Bettin, Chockley, Conder, Cooper, Fredricks, Hausmann, Hevlin, Lorz, Mackey, Meyer, Tackley, Rerecich, Wills.
10. MCN sampling with no transport. Setter asked FPOM to consider reducing the sampling to about 8 hours every other day rather than a 24 hour sample day. Fredricks agreed and said the hours should be when fish are passing. This change would help reduce fish holding, cut costs, etc. Setter will coordinate with PSMFC, WDFW and the Project. Fredricks did note that the index could be compromised since that is an expansion of the collection numbers. He said it would still be possible

but the index would just be a new index. FPAC could provide input as to the importance of the index.
ACTION: NWW will put together a proposal for the Region to consider. Wills said he would take the issue to FPAC as well.

11. Calendar items/ next FPOM agenda items. (Check the CY13 on the website)



State of Washington
Department of Fish and Wildlife
2108 Grand Blvd. Vancouver WA 98661 (360) 696-6211

To: U.S. Army Corps of Engineers, Bonneville Dam Fisheries; FPOM
From: Washington Dept. of Fish and Wildlife, Ann Stephenson, Eric Kinne
Subject: 2013 AFF fish tank location and transfer of fish
Date: June 10, 2013

In 2013, three researchers will be using the Bonneville Adult Fish Facility (AFF) during the same time frame from mid-August through October: the Washington Dept. of Fish and Wildlife (WDFW), the Columbia River Intertribal Fisheries Commission (CRITFC) and the University of Idaho (U of I).

The U of I will be tagging steelhead during this time frame and WDFW will be tagging fall Chinook (both Tules and upriver Brights), coho and steelhead. Both groups can use the same transport tanks at the same time to relocate fish downstream since the release point(s) are the same. WDFW can provide an additional fish tank so there would be no delay in the transfer of fish downstream back into the river.

CRITFC's activities occur at the east end of the AFF so they have no current overlapping need for space with the other researchers. The U of I is currently set up on the north-east end of the facility. In 2011 and 2012, the WDFW worked up fish in the small anesthetic tank off of an additional side flume which also exits towards the north-east end of the building. WDFW plans to use this flume again in 2013, starting August 12. With limited space for equipment and personnel in 2013, WDFW, with the U of I, propose moving the fish transport tank from the floor of the AFF up one level, onto the concrete slab above, parallel to the large exit doors. The tank, with water and fish weighs approximately 4800 pounds. The project's structural crew has determined that is it sound to locate the tank at this location, plus there is adequate egress space for people to pass on the walkway with the tank there. Moving the transport tank to this location would allow adequate space for all groups to work up fish on the main floor of the AFF. Also, at this location, the tank is never suspended over the researchers, reducing the amount of risk to personnel.

The U of I experimented with the tank in the upper level at the end of May. (See Figure 1. The tank location is where the beam with the hardhat is.) They used a "sanctuary net bag" to transfer the fish from their anesthetic tank into the transport tank. Fish would be moved from both agencies anesthetic tanks into the transport tank with the use of such a fish tube or bag. U of I will also be experimenting with moving the fish from the anesthetic tank to the transport tank with the bag on a pulley, attached to the beam on the crane, to move the fish efficiently from one tank to the other (Figure 2). Minimal time is required to move the fish from one tank to the other using this method when the tank is located above the main floor.

WDFW and U of I request that this be forwarded to the Fish Passage Operation and Maintenance Team for approval at the June 2013 meeting.

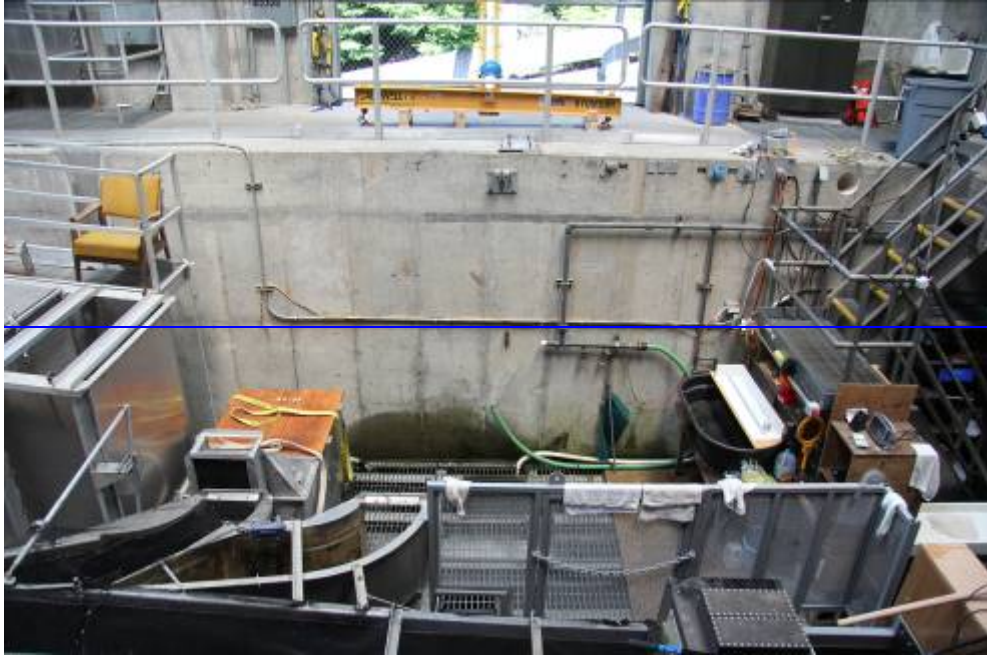


Figure 1. Bonneville Dam Adult Fish Facility



Figure 2. Fish net attached to pulley on beam.

Bonneville Corner Collector PIT Tag Monitoring Test – Entrance Hydrofoils
Professional Services Contract Proposed Schedule

Action	Approximate Dates
Award	July 1 2013
Pre-work coordination meeting	July 8-12, 2013
TASK 1	
Determine compatibility and/or interference issues between an unshielded system similar to the hydrofoil concept system and existing B2CC PIT-tag detection system.	July 2013
TASK 2	
Evaluate the physical performance of the prototype forebay PIT-tag detection concept in the lab.	July 2013
Complete and submit a feasibility report of results for Task 1 and 2.	August 31 2013
TASK 3	
Design, fabricate, and evaluate in the lab a prototype forebay PIT-tag detection system that uses the multiple hydrofoil antennas.	September 2013- January 2014
TASK 4	
Install monitoring equipment (i.e. hydroacoustic equipment or DIDSON camera) to evaluate the horizontal and vertical passage distribution of fish entering the B2CC.	February 2014
TASK 5	
Install the prototype forebay PIT-tag detection system infrastructure (i.e. transceivers and power supplies) that was designed in Task 3 to detect PIT-tagged fish entering the B2CC.	February 2014
TASK 6	
Evaluate the horizontal and vertical distribution of smolts passing into the B2CC using an appropriate technology with the corner collector operating and the prototype forebay PIT-tag detection system installed.	March 1-April 7, 2014
TASK 7	
Evaluate the physical performance of the prototype forebay PIT-tag detection system in the field with the B2CC operational.	March 1-April 7, 2014
TASK 8	
Evaluate the horizontal and vertical distribution of smolts passing into the B2CC using an appropriate technology with the corner collector operating and the prototype forebay PIT-tag detection system not installed.	April 9-May 10, 2014
Remove monitoring equipment and prototype forebay PIT-tag detection system.	September 2014
TASK 9	
Analyze, and compare the horizontal and vertical distribution of smolts passing into the B2CC collected under Task 6 and 8 to determine if the prototype forebay PIT-tag system affects passage into the B2CC.	May 11-July 1, 2014
TASK 10	
Prepare reports and present study findings. (Task 1 and 2)	August-December 2013
Prepare reports and present study findings. (Task 3 through 8)	August-December 2014
Preliminary Report Due	October 1, 2014
Final Report Due	December 15, 2014

Memorandums of Coordination



COORDINATION TITLE - 13 LWG 08 T2, B-phase neutral bushing replacement_MOC

COORDINATION DATE - 05 June 2013

PROJECT - Lower Granite Dam

RESPONSE DATE – 13 June 2013 (FPOM Meeting)

Description of the problem – The Bonneville Power Administration (BPA) plans to replace the B-phase neutral bushing on transformer T2 which insulates electrical ground from the other circuits. This current bushing is leaking oil, and the continued loss of this insulating oil increases the risk of electrical failure resulting in equipment damage and possible oil spill.

Type of outage required – Continuous powerhouse outage from August 26, 2013 (0600 Hours) to August 28, 2013 (2300 Hours).

Impact on facility operation – Powerhouse will not be producing any power other than station service, and nearly all river flow will be diverted through the spillway. Juvenile Fish Facility collection for transport will be reduced. Turbine attraction flow to ladder entrances will be lost. Turbine unit 5 will be operating in station service mode to maintain internal power needs.

Dates of impacts/repairs –Length of time for repairs –From August 26, 2013 (0600 Hours) to August 28, 2013 (2300 Hours). This work coincides with the work and outages necessary for replacement of the Lower Granite Powerhouse roof (See See FPOM MOC 13LWG003 - approved 5/9/13), available on the FPOM website (click [here](#)). Under MOC 13LWG003, outage times on these dates are currently scheduled to take place from 0930 – 2300 Hours daily. This new coordination will make the outage continuous on these dates.

Expected impacts on fish passage – Normal operations will continue at the juvenile fish facility. The number of fish collected for transport will be reduced and more juvenile subyearling Chinook will remain in river than usual. However, far more than 90% of all juvenile fish passage will already have taken place before the planned start of this work. See chart below for specific details by species groups.

Adult passage will likely be delayed due to less turbine operation attraction water flow near the fishway entrances. The fish pumps will continue to operate and normal fishway entrances attraction flow would continue. The outage is scheduled prior to the expected start of the adult steehead run in September and after the peak of Spring and Summer Adult Chinook passage. See the chart below for addition detail by species groups.

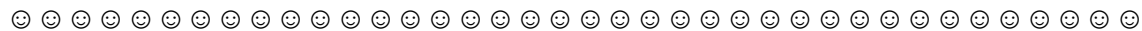
Fish Passage Migration Timing at Lower Granite Dam 2003 - 2012

<u>Juvenile Fish Passage</u>		<u>90% Passage</u>		<u>Adult Fish Peak Passage Dates</u>	
Yearling Chinook				Spring Chinook	
	Median	16-May			Earliest 26-Apr
	Earliest	10-May			Latest 17-Jun
	Latest	21-May		Summer Chinook	
Subyearling Chinook					Earliest 18-Jun
	Median	13-Jul			Latest 17-Jul
	Earliest	17-Jul		Fall Chinook	
	Latest	28-Jul			Earliest 5-Sep
Unclipped Steelhead					Latest 6-Oct
	Median	25-May		Steelhead	
	Earliest	20-May			Earliest 1-Sep
	Latest	5-Jun			Latest 16-Oct
Clipped Steelhead				Sockeye	
	Median	25-May			Earliest 1-Jul
	Earliest	20-May			Latest 19-Jul
	Latest	5-Jun		Lamprey	
Coho					Earliest 18-Jul
	Median	30-May			Latest 25-Jul
	Earliest	17-May			
	Latest	5-Jul			
Sockeye					
	Median	2-Jun			
	Earliest	21-May			
	Latest	19-Jun			

Fish Passage Migration Timing at Lower Granite Dam 2003 - 2012					
Juvenile Fish Passage		90% Passage		Adult Fish Peak Passage Dates	
Yearling Chinook			Spring Chinook		
	Median		16-May		Earliest 26-Apr
	Earliest		10-May		Latest 17-Jun
	Latest		21-May	Summer Chinook	
Subyearling Chinook			Earliest 18-Jun		
	Median		13-Jul		Latest 17-Jul
	Earliest		17-Jul	Fall Chinook	
	Latest		28-Jul		Earliest 5-Sep
Unclipped Steelhead			Latest 6-Oct		
	Median		25-May	Steelhead	
	Earliest		20-May		Earliest 1-Sep
	Latest		5-Jun		Latest 16-Oct
Clipped Steelhead			Sockeye		
	Median		25-May		Earliest 1-Jul
	Earliest		20-May		Latest 19-Jul
	Latest		5-Jun	Lamprey	
Coho			Earliest 18-Jul		
	Median		30-May		Latest 25-Jul
	Earliest		17-May		
	Latest		5-Jul		
Sockeye					
	Median		2-Jun		
	Earliest		21-May		
	Latest		19-Jun		

Comments from agencies

Final results



COORDINATION TITLE: Additional Testing of John Day Fish Screens at Lower Granite Project

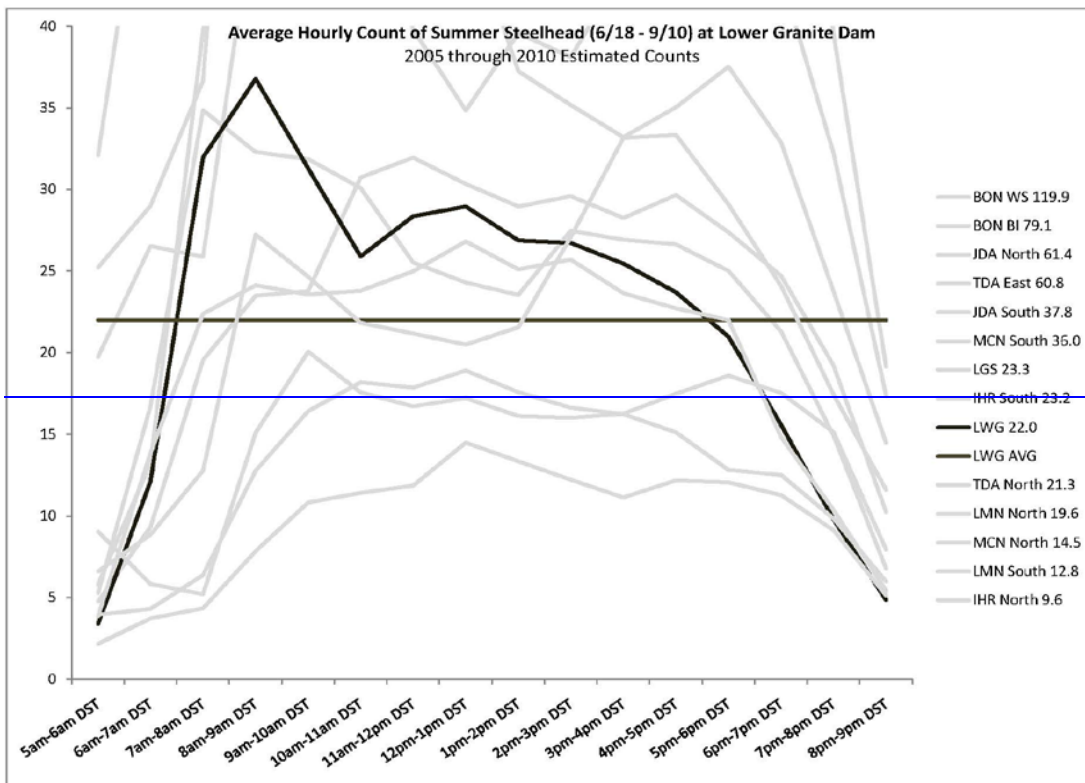
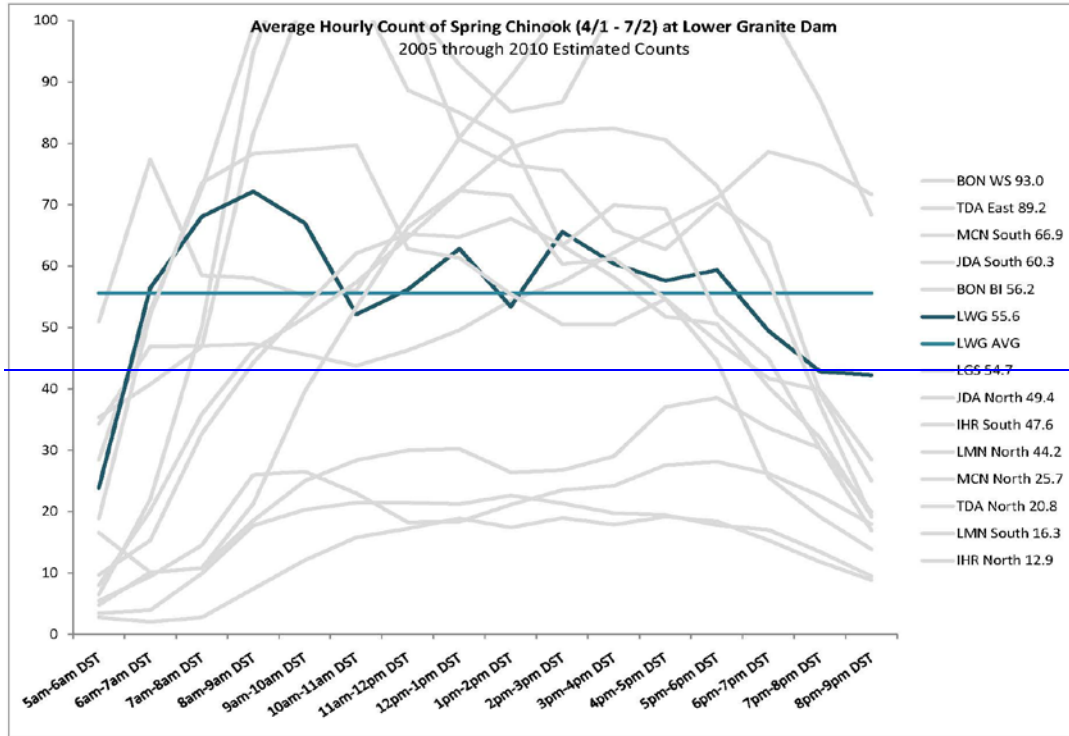
COORDINATION DATE: June 6, 2013

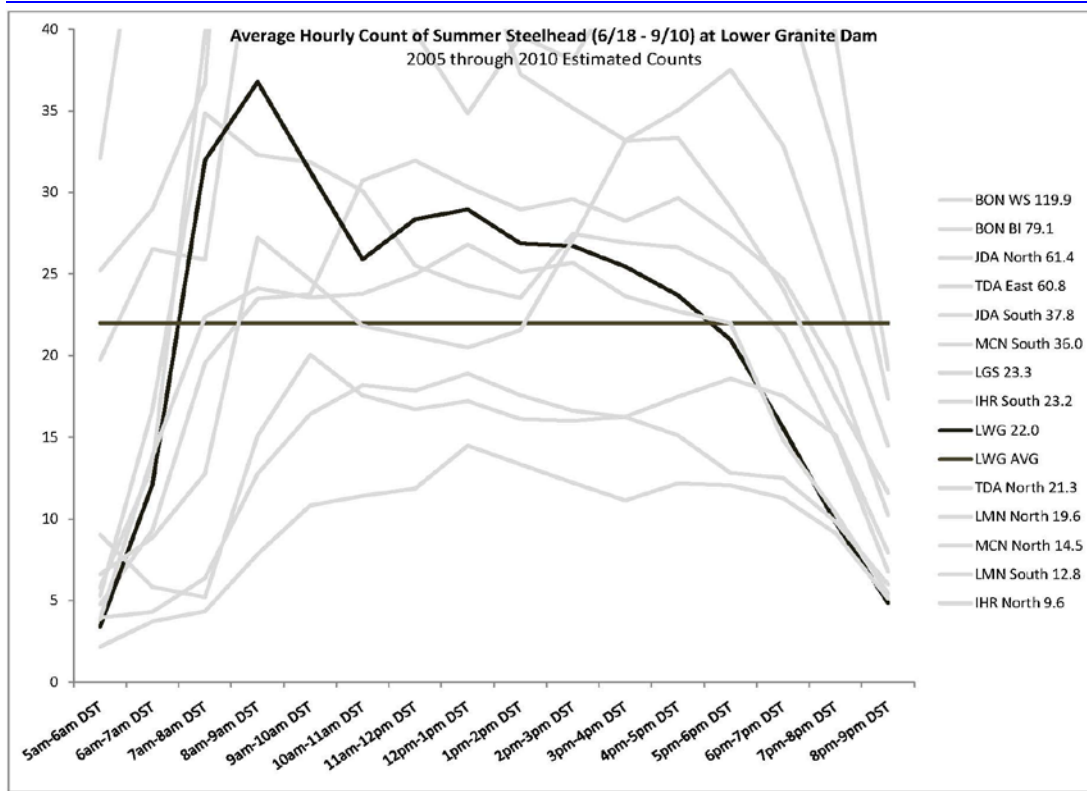
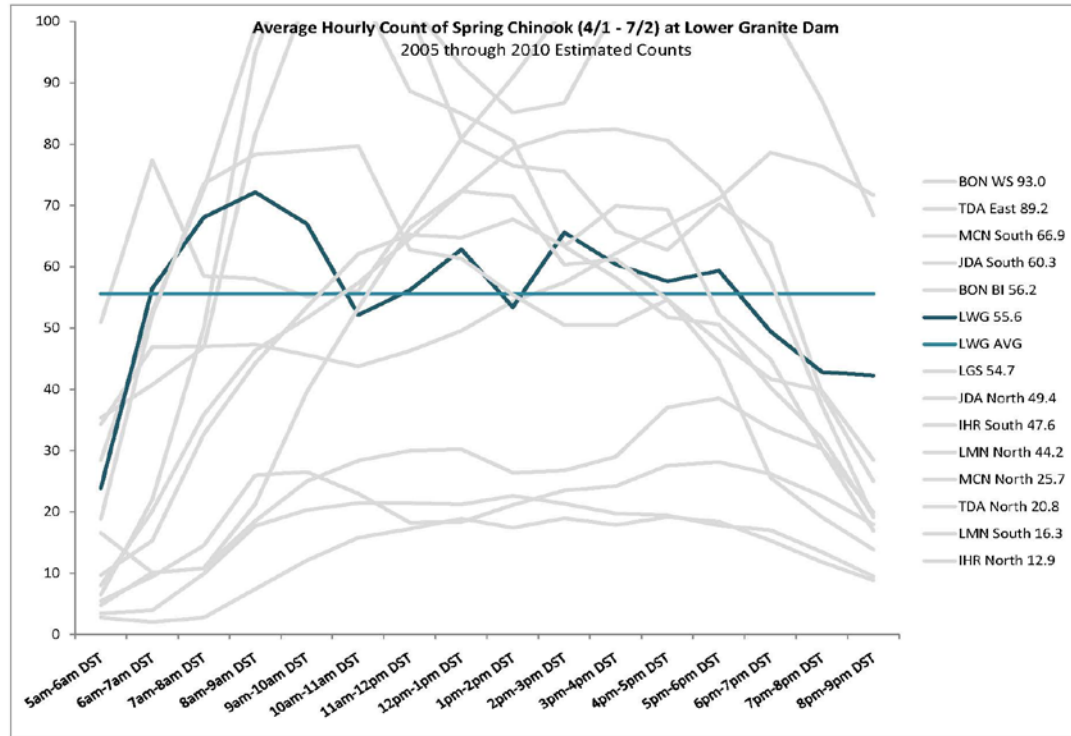
PROJECT: Lower Granite

RESPONSE DATE: June 13, 2013

Description of the problem: The Lower Granite Project received extended length submersible bar screens (ESBSs) from John Day Dam as replacements for production fish screens damaged during the 2012 fish season. Modifications (see attachment) have been done to make the replacement screens function in a similar manner to the production ESBSs presently in long term use. Due to possible fish passage impacts associated with the replacement screens, a test screen was placed in gatewell slot 6C. After running the unit continuously, the unit was shut down and gatewell orifices in all three unit slots (6A, 6B, and 6C) were closed to trap the guided fish. Each gatewell slot was then dipped and fish were examined for descaling by PSMFC smolt monitoring biologists. The results (see attachments) indicated that there was no more descaling in slot 6C with the modified test screen than in the other two slots with the standard production screens.

ladder has taken place (see fish passage graph). Currently, over 400 spring Chinook are passing through the ladder each day. Adult steelhead passage through the ladder is presently in the single digits.





Comments from agencies:

Final results:



FPP Change Forms



Change Request Number: 14BON001 Table BON-16 Add Mid-Range

Date Submitted: 3/29/2013

Project: BON

Requester Name, Agency: FPOM BON Ops Task Group

Location of Change - FPP Project and Section:

BON sections 5.2 and 5.3 (Turbine Unit Operations and Maintenance), and Table BON-16 (PH2 turbine 1% range)

Proposed Changes:

5. TURBINE UNIT OPERATION AND MAINTENANCE

5.1. Powerhouse priority is detailed in **Table BON-14**. When splitting flows, as directed in section **2.1.2**, the top two available priority units for PH1 will be operated first followed by normal unit priority at PH2. If there is a need for more units, and all available units at PH2 are in operation, proceed with the normal unit priority for PH1.

5.2. November 1 through March 31. All turbine units will operate *as a soft constraint* within $\pm 1\%$ of peak efficiency (within upper and lower limits of the 1% range) as shown in **Tables BON-15 (PH1) and BON-16 (PH2)** for project heads of 35-70 feet. See **BPA Load Shaping Guidelines (Appendix C)** for further information on turbine operations within and outside of the 1% range.

5.3. April 1 through October 31. Except as defined below in section **5.3.1**, all turbine units will operate *as a hard constraint* within $\pm 1\%$ of peak efficiency (within upper and lower limits of the 1% range) as shown in **Tables BON-15 (PH1) and BON-16 (PH2)**.

5.3.1. April 10 through August 31. During the spring and summer spill seasons when the project is spilling in accordance with the Fish Operations Plan (FOP, see **Appendix E**), turbine units will operate in the following priority order to pass increasing flow:

1. Operate PH2 units within the 1% mid-range (**Table BON-16**);
2. Then, operate PH1 units up to the 1% upper limit (**Table BON-15**);
3. Then, operate PH1 units up to Best Operating Point (BOP; **Table BON-15**);
4. **From April 10 through June 20 (spring spill season)**, additional flow above what can be passed in steps 1-3 will be passed in one of the two following ways, as directed by Project Fisheries based on monitoring of juvenile and adult spring Chinook passage and collection data:
 - a. If the adult trigger is met (adult counts exceed juvenile collection counts for two consecutive days), then operate PH2 up to the 1% upper limit in the following unit priority order: 18, 17, 16, 15, 14, 13, 12, 11 until adult counts drop below juvenile counts for 3 consecutive days.

- b. If the adult trigger is *not* met (adult counts are less than juvenile collection counts for two consecutive days), then increase spill to pass the additional flow.

- 5. **From June 21 through August 31 (summer spill season)**, additional flow above what can be passed in steps 1-3 will be passed by operating PH2 up to the 1% upper limit.

5.4. The project turbine unit maintenance schedules will be reviewed by Project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for winter maintenance periods, or when there are low numbers of fish passing the project.

Existing Language For Section 5:

5. TURBINE UNIT OPERATION AND MAINTENANCE

5.1. Powerhouse priority is detailed in **Table BON-14**. When splitting flows, as directed in section 2.1.2, the top two available priority units for PH1 will be operated first followed by normal unit priority at PH2. If there is a need for more units, and all available units at PH2 are in operation, proceed with the normal unit priority for PH1.

5.2. Turbine units at PH1 will operate within 1% of best efficiency and within cavitation limits at various head ranges as shown in **Table BON-15**.

5.2.1. Turbine units at PH2 will operate at the mid to lower 1% range (unless total dissolved gas waivers are exceeded in the tailrace) of best efficiency and within cavitation limits at various head ranges as shown in **Table BON-16**.

5.3. Turbines will be operated within $\pm 1\%$ of best turbine efficiency from April 1 through October 31 (as specified in the BPA load shaping guidelines), except as outlined in **Appendix C**.

5.4. The project turbine unit maintenance schedules will be reviewed by Project and Operations Division biologists for fish impacts. If possible, maintenance of priority units will be scheduled for winter maintenance periods, or when there are low numbers of fish passing the project.

Justification for Change:

FPOM requested adding PH2 1% mid-range columns since PH2 may be limited to mid-range operation. See Memo to FPOM from Bonneville Turbine task group for justification.

Comments from others:

See FPC memo

9 May 2013 FPOM: 14BON001 Lorz provided the change form and supporting documentation. Wright asked if steps 1-3 could just be accepted now. Lorz and Fredricks said this is a package deal. Lorz said going to BOP at PH1 is a contentious issue with some in the Region and they feel the spill is an acceptable trade-off. Baus and Wright would like to avoid the TMT SOR process but FPOM isn't quite willing to accommodate that request by parsing out sections of the change form. There is some fear of kicking the trigger issue down the road and this needs to be dealt with sooner rather than later. CRITFC, NOAA, USFWS support the change form. IDFG was absent. ODFW supported it at the last meeting, but no rep was at the May FPOM. BPA and USACE need to take this back to their chain of command. Aside from the fact that this couldn't be accepted today, Bettin suggested this is a good time to present this. Fredricks said this is probably the more documented decision FPOM has made and it will likely be

included in the 2014 BiOp. ACTION: FPOM will take the change form to their respective agencies and bring their a position back to the June FPOM meeting.

22 May 2013 TMT: IDFG (Kiefer), WDFW (Morrill), and ODFW (Kruger and Van Dyke) agreed with the change form.

13 June 2013 FPOM. 14BON001. BPA- will follow NWD policy lead. NOAA, CRITFC, IDFG, WDFW, Colville, ODFW, USFWS all support the change form.

Record of Final Action: This document has been elevated to NWD and the other Regional policy offices.

Table BON-16. Bonneville Dam Powerhouse Two Turbine Units 11-18 (with and without STSs) Output (MW) and Discharge (cfs) at the Upper, Mid-Range and Lower Limits of the 1% of Peak Efficiency Operating Range.

Head (feet)	Powerhouse Two (units 11-18)											
	1% Limits With STS						1% Limits Without STS					
	Lower Limit		Mid-Range 13K - 15K		Upper Limit		Lower Limit		Mid-Range 13K - 15K		Upper Limit	
	(MW)	(cfs)	(MW)	(MW)	(MW)	(cfs)	(MW)	(cfs)	(MW)	(MW)	(MW)	(cfs)
35	27.6	11,259	31.9	36.8	44.3	18,068	28.2	11,444	32.1	37.0	45.1	18,277
36	28.5	11,271	32.9	37.9	45.8	18,097	29.2	11,455	33.1	38.2	46.6	18,306
37	29.4	11,279	33.9	39.1	47.3	18,121	30.1	11,464	34.1	39.4	48.1	18,331
38	30.3	11,284	34.9	40.3	48.8	18,139	31.0	11,470	35.2	40.6	49.7	18,350
39	31.3	11,287	36.0	41.6	50.3	18,153	32.0	11,473	36.3	41.8	51.2	18,364
40	32.2	11,288	37.1	42.8	51.8	18,162	32.9	11,474	37.3	43.0	52.7	18,374
41	33.0	11,259	38.1	44.0	53.3	18,197	33.7	11,445	38.3	44.2	54.3	18,409
42	33.8	11,230	39.1	45.2	54.9	18,228	34.6	11,415	39.4	45.4	55.8	18,441
43	34.6	11,201	40.2	46.3	56.4	18,255	35.4	11,386	40.4	46.6	57.4	18,468
44	35.4	11,172	41.2	47.5	57.9	18,278	36.2	11,357	41.4	47.8	58.9	18,493
45	36.2	11,144	42.2	48.7	59.4	18,299	37.0	11,328	42.5	49.0	60.5	18,514
46	37.0	11,139	43.2	49.8	61.0	18,366	37.9	11,324	43.5	50.2	62.1	18,581
47	37.8	11,135	44.2	51.0	61.9	18,200	38.7	11,319	44.5	51.3	63.0	18,415
48	38.7	11,129	45.2	52.1	62.7	18,040	39.6	11,314	45.5	52.5	63.8	18,255
49	39.5	11,124	46.2	53.3	63.5	17,887	40.4	11,308	46.5	53.6	64.7	18,101
50	40.3	11,118	47.2	54.4	67.5	18,598	41.3	11,303	47.5	54.8	68.7	18,817
51	41.3	11,154	48.1	55.5	69.8	18,850	42.2	11,339	48.4	55.9	71.1	19,072
52	42.3	11,187	49.1	56.7	72.1	19,091	43.2	11,373	49.4	57.0	73.4	19,316
53	43.2	11,219	50.1	57.8	74.5	19,323	44.2	11,405	50.4	58.1	75.8	19,551
54	44.2	11,249	51.0	58.8	76.5	19,536	45.2	11,436	51.3	59.2	76.5	19,431
55	45.2	11,278	52.1	60.1	76.5	19,115	46.2	11,466	52.4	60.5	76.5	18,975
56	46.4	11,343	53.2	61.3	76.5	18,718	47.4	11,531	53.5	61.7	76.5	18,581
57	47.6	11,404	54.2	62.6	76.5	18,336	48.6	11,593	54.6	63.0	76.5	18,202
58	48.8	11,461	55.4	63.9	76.5	17,967	49.9	11,652	55.7	64.3	76.5	17,836
59	50.0	11,515	56.5	65.1	76.5	17,611	51.1	11,707	56.8	65.6	76.5	17,483
60	51.2	11,567	57.6	66.4	76.5	17,267	52.3	11,760	57.9	66.8	76.5	17,142
61	51.8	11,532	58.5	67.5	76.5	16,978	53.0	11,724	58.9	67.9	76.5	16,857
62	52.5	11,498	59.5	68.6	76.5	16,699	53.7	11,690	59.8	69.1	76.5	16,582
63	53.1	11,466	60.4	69.7	76.5	16,428	54.3	11,657	60.8	70.1	76.5	16,315
64	53.7	11,434	61.3	70.7	76.5	16,166	55.0	11,625	61.7	71.2	76.5	16,056
65	54.4	11,405	62.3	71.8	76.5	15,912	55.6	11,595	62.6	72.3	76.5	15,806
66	55.4	11,448	63.2	72.9	76.5	15,671	56.7	11,639	63.6	73.4	76.5	15,570
67	56.5	11,490	64.2	74.0	76.5	15,437	57.8	11,682	64.6	74.5	76.5	15,341
68	57.5	11,532	65.1	75.1	76.5	15,210	58.9	11,724	65.5	75.6	76.5	15,119
69	58.6	11,571	66.1	76.3	76.5	14,990	59.9	11,764	66.5	76.5	76.5	14,903
70	59.6	11,610	67.0	77.3	76.5	14,775	61.0	11,803	32.1	37.0	76.5	14,693

* Table based on data provided by HDC, January 2001 (Table BON-16 revised 2006).