TECHNICAL MEMORANDUM 003

MCMILLEN, LLC

To:	Nathan Higa, PacifiCorp	Project:	Lewis River Acclimation Ponds
From:	Derek Nelson	Cc:	Frank Shrier, PacifiCorp Mort McMillen, McMillen LLC File
Date:	June 24, 2011	Job No:	1039.06
Subject:	Acclimation Ponds – Construction, Operations, and Potential Maintenance Issues		

1.0 INTRODUCTION

McMillen, LLC (McMillen) is submitting this technical memorandum to accompany the Lewis River Acclimation Ponds design. This memorandum outlines the construction sequence, operations of each acclimation pond facility, and the potential maintenance issues related to each facility.

Operation of the Muddy River and Clear Creek acclimation pond facilities will occur from late April through the end of June pending snow levels each year. Crab Creek acclimation facility will be operated in September after Labor Day into October. The acclimation pond facilities will be operated for a total of six weeks with an additional one week of start up at the beginning and one week of shutdown at the end. The discussion in the subsequent paragraphs for Crab Creek, Clear Creek and the Muddy River correspond with the design drawings and specifications.

1.1 Acclimation Pond Design

Design criteria for the acclimation ponds were provided by PacifiCorp and Washington Department of Fish and Wildlife (WDFW). The acclimation ponds design criterion is for a 1.2 cubic foot per second (cfs) flow rate and a rearing volume of 13.2 fish per cubic foot. The design capacities of each of the acclimation sites are illustrated in Table 1.

Table 1: Acclimation Pond Capacities

Pond Site	Approx Volume (cft)	Max # Fish	Flow (cfs)
Crab Creek	2500	33,000	1.2*
Clear Creek	6800	89,760	1.2
Muddy River	9500	125,400	1.2

*Dependent upon Crab Creek flows and subsurface flow from Lewis River

Crab Creek flows have been determined and vary from approximately 0.2 to 1 cfs during the acclimation period. Lewis River subsurface flow will supplement the Crab Creek flows for the pond.

Acclimation channel flow is controlled by the intake and outlet structures. The water flow will be controlled by stop logs located in the outlet structure of each acclimation channel. The Muddy River channel will have flow control at the entrance to the water supply pipeline with a canal gate. The Clear Creek intake structure design incorporates stop log slots behind the screens to aid in controlling flow into the acclimation channel depending on Clear Creek flows. The Muddy River and Clear Creek acclimation channels each have a general cross sectional area of flow greater than 12 square feet. The area and 1.2 cfs flow equates to less than a 0.1 foot per second flow velocity through the acclimation channels.

2.0 CRAB CREEK

The Crab Creek Site is located on USFS Road 90 near the bridge located approximately one mile downstream from the Lower Falls Recreation Site. Crab Creek enters the Lewis River on the south bank approximately 100 ft upstream from the bridge. A small pond will be excavated at the confluence of Crab Creek and the Lewis River for acclimation of the juvenile Chinook salmon. Water supply for the pond will be from Crab Creek flows and supplemented by subsurface infiltration from the Lewis River. The perimeter of the pond will be comprised of large boulders partially covered with the natural cobbles and gravels excavated from the pond. An outlet will be comprised of boulders with a fine mesh net/seine covering the outlet during acclimation.

2.1 Construction

The following is a potential sequence of construction activities to install the Crab Creek acclimation pond facility. Construction is estimated to take 4 to 8 weeks during the months of July through August.

1. Mobilize equipment and materials to the site.
2. Install all sediment and erosion control BMPs.
3. Install the site access road to the site or provide crane to lower equipment into site.
4. Install cofferdam.
5. Excavate the pond at the confluence of Crab Creek and Lewis River stockpiling the material to be utilized in the pond berm.
6. Place large boulders around the pond perimeter. Create outlet from boulders. Install rootwads.
7. Place excavated gravel and sand material around and between the large boulders. Compact as possible the excavated materials around the boulders constructing a small berm.
8. Remove cofferdam
9. Grade and vegetate disturbed areas as required and reinstall removed vegetation from site access road installation.
10. Remove sediment and erosion control BMPs and seed areas disturbed by BMPs.
11. De-mobilize from the site.

Construction shall minimize disturbance to the existing vegetation along the Lewis River. All disturbed areas will be re-vegetated with a Gifford Pinchot National Forest approved seed mix, fertilizer, and mulch.

The following equipment or similar is anticipated to be used during construction of the Crab Creek Acclimation Pond facility:

1. John Deere 135 track excavator.
2. 10-wheel dump truck for hauling materials to and away from site.
3. Vibratory plate compactor for excavator.

2.2 Operations

Seasonal Start-up

After Labor Day weekend, operations personnel will mobilize to the site. The startup maintenance is anticipated to take approximately one week and will follow these steps:

1. Verify pond boulders are secure and equipment is not required to clean pond.
2. Manually clean the pond of excess debris.
3. Clear the outlet area and install the exclusion net.
4. Verify over the week that sufficient flow and depth are maintained in the pond.

The startup procedures will require manual hand labor and potentially a small excavator dependent upon deposition in the pond.

Daily Operations

Once the pond has been cleaned and the net installed, the fish transport vehicles will deliver the juvenile spring Chinook to the site and release them into the pond via flexible release pipe from the bridge. The following procedures are recommended once fish are in the pond on a daily basis:

1. Travel to the site in a standard pickup with maintenance equipment.
2. Feed the fish.
3. Maintain the outlet.
4. Verify sufficient water flow and depth is maintained in the pond.
5. Data collection of water temperatures, turbidity, flows, and mortality counts.

End of Season Shut Down

Upon completion of the six week fish acclimation period, the fish will be released into the Lewis River. The exclusion net will be removed. The fish will be allowed to leave volitionally through the outlet over a one week period. At the end of this period the fish will be manually crowded to the outlet into the Lewis River with a seine.

2.3 Maintenance and Operation Issues

The Crab Creek site major concern is maintaining the pond during high flows. **The pond will become inundated by high flows in the Lewis River.** Deposits of sand and gravel will require annual maintenance to maintain the required depth of the acclimation pond. During high runoff years, the boulders may become dislodged requiring re-construction prior to the acclimation period. The potential exists that the entire pond would need to be completely re-constructed after a major run-off event in the Lewis River.

Predation of the fish by otters and birds is a concern at this site. With the limited cover provided by the root wads, predation may be high.

The acclimation pond will be located upstream of the Forest Service bridge in view of the general public. Vandalism is a concern at this site. The exclusion netting may be removed by vandals. Utilizing a dark colored net will help in camouflaging the outlet.

3.0 CLEAR CREEK

The Clear Creek Site is located on USFS Road 9300 near the bridge approximately 1.5 miles upstream of the confluence with Muddy River. The Clear Creek site provides an opportunity for a 350 foot acclimation channel located on the right bank looking downstream from the bridge and will not adversely affect the bridge abutment. The bridge constrains Clear Creek in this location and aids in providing a consistent sweeping flow across the entrance to the new acclimation channel. The acclimation channel will be constructed in an existing side channel and provide a constant grade to an outfall back into Clear Creek. A screened surface intake structure will be placed at the head of the acclimation channel. An outlet structure will be placed near the downstream end of the channel to provide water level control and prevent juvenile escapement. At the end of the acclimation period, the control in the outlet structure will be removed and the fish released into Clear Creek.

3.1 Construction

The following is a potential sequence of construction activities to install the Clear Creek acclimation pond facility. Construction is estimated to take 8 to 12 weeks during the months of July through October.

1. Precast the concrete intake and outlet structures prior to any in-stream work off-site.
2. Mobilize equipment and materials to the site.
3. Install all sediment and erosion control BMPs.
4. Install coffer dam for intake excavation and installation.
5. Excavate for the inlet structure and install the inlet structure.
6. Install diversion boulders.
7. Place all stop logs into the inlet structure to prevent water flow into the channel.
8. Remove the cofferdam.

9. Excavate the acclimation channel using an excavator salvaging 3” to 6” cobbles for the acclimation channel substrate. Place all remaining excavated materials into the dike area to divert water to the newly constructed acclimation channel. Remove all excess material.
10. Install acclimation channel substrate, large woody debris, and boulders.
11. Excavate for the outlet structure.
12. Install the outlet structures complete with screens and stop logs.
13. Grade and vegetate disturbed areas
14. Initiate flow through the acclimation channel.
15. Remove and dispose any trapped sediment at sediment and erosion control BMPs.
16. Remove sediment and erosion control BMPs and seed areas disturbed by BMPs.

Construction shall minimize disturbance to the existing vegetation along the acclimation channel. Small shrubs and trees in the acclimation channel area shall be salvaged for re-planting along disturbed slopes. All disturbed areas will be re-vegetated with a Gifford Pinchot National Forest approved seed mix, fertilizer, and mulch.

The following equipment or similar is anticipated to be used during construction of the Clear Creek acclimation pond facility:

1. John Deere 120D excavator for acclimation channel construction.
2. Skid steer for acclimation channel construction.
3. Small backhoe CAT 416 for loading/unloading truck near roadway.
4. 10-wheel dump truck for hauling materials to and away from site.

3.2 Operations

<u>Seasonal Start-up</u>
When the snow level recedes sufficiently to access the site, operations personnel will begin mobilizing the screens and stop logs to the acclimation channel. The installation and flow testing is anticipated to take approximately one week and includes:

1. Cleaning the intake and outlet structures of debris.
2. Installing the intake screen and trash rack.
3. Installing the outlet stop logs and screen.
4. Inspection of the side channel.
5. Verify the water supply to provide flow through the channel.
6. Once the channel is filled, pull the stop logs and screens in the outlet structure to provide a flushing flow to remove as much floating debris as possible.
7. Replace the outlet screens and stop logs.
8. Establish the flow through the acclimation channel by measuring the flow over the outlet structure stop logs.
9. Maintain the flow through the channel for a minimum of 48 hours prior to planting fish.

No motorized equipment will be required to service the channel, intake, or outlet.

Daily Operations

Once the site is prepared, fish transport vehicles will deliver the juvenile spring Chinook to the site and release them into the channel via a flexible release pipe from the paved road. The following procedures are recommended on a daily basis:

1. Feed the fish.
2. Maintain the intake structure by removing debris.
3. Maintain the outlet structure by removing debris.
4. Pull the screens and clean with a brush.
5. Data collection of water temperatures, turbidity, flows, and mortality counts.
6. Inspect the channel for debris or obstructions that may preclude fish from using any part of the channel.

No motorized equipment will be required for daily operations of the channel, intake, or outlet.

End of Season Shut Down

At the end of the acclimation period, the fish will be released into Clear Creek. Initially the fish will be allowed to leave volitionally over the stop logs over a one to two week period. At the end of this period the stop logs are to be removed flushing the remaining juveniles to Clear Creek.

An optional release procedure would be to connect a short section of HDPE pipe to the outlet structure stop log with the pipe thimble. The pipe then could be routed to the creek to ensure the fish do not get stranded from the outlet to Clear Creek. The screens and stop logs will then be removed and taken off-site for cleaning and storage.

No motorized equipment will be required for shut down of the channel, intake, or outlet.

3.3 Maintenance and Operation Issues

A major concern for the Clear Creek site is maintaining the water supply to the acclimation channel. The acclimation period from mid April to mid June occurs during times when high runoff may deposit large amounts of debris and sediment at the intake significantly blocking the screens. A significant effort will be required to keep the screens clean.

Also during this period, freezing may occur that could constrict or diminish the water flow to the channel. During the acclimation period, weather extremes may occur limiting access to the Clear Creek site for maintenance of the water supply and feeding.

Predation is a concern for the acclimation channel due to the large number of fish in a confined area. Large woody debris and boulders will be placed in the channel to provide the juvenile Chinook escapement opportunities.

Any event that diminishes flow to the acclimation channel will require the immediate release of the juvenile Chinook to Clear Creek. Some of the potential major maintenance activities that may be required at the site include:

1. Excavating and repairing intake utilizing a John Deere 160 size excavator or similar.
2. Excavation of major deposition from flooding of Clear Creek with John Deere 120 size excavator or similar.
3. Re-grading of the acclimation channel.

4.0 MUDDY RIVER

The Muddy River Site is located on USFS Road 25 near the bridge located approximately 5 miles upstream from the confluence with the Lewis River. The site is located next to a day use recreation area just north of the bridge providing paved access to the site. The site will consist of an infiltration gallery approximately 1,700 ft upstream from the Muddy River bridge. A 1000 foot pipeline will extend into the left bank (north bank) along the Muddy River to a water control structure located in the upland. The water control structure will provide flow control through a valve for the pipeline and discharging into a screened outlet before entering the acclimation channel. The 650 foot acclimation channel will be constructed in an existing channel that collects spring seepage. The channel will be graded to provide a continuous flow to the outlet. The outlet structure will be used for level control and juvenile escapement control.

4.1 Construction

The following is a potential sequence of construction activities to install the Muddy River acclimation pond facility.

1. Precast the concrete water supply control structure, water supply discharge structure and the outlet structure off-site prior to any in-stream work.
2. Mobilize equipment and materials to the site
3. Install all sediment and erosion control BMPs.
4. Install cofferdam in Muddy River for infiltration gallery installation.
5. Excavate the infiltration gallery area and pipeline to the water supply control structure.
6. Install the infiltration gallery piping and water supply control structure and backfill.
7. Remove the cofferdam.
8. Clear vegetation and excavate the acclimation channel and place substrate, woody debris and boulders within the channel.
9. Excavate for the outlet structure and water supply pipe discharge structure.
10. Install the outlet and pipe discharge structure.
11. Excavate and install water supply pipeline and water supply control structure.
12. Provide back flush of the infiltration gallery with the portable pump.
13. Conduct tests to verify proper flow delivered through the channel for 48 hours.
14. Grade and vegetate disturbed areas.
15. Remove and dispose any trapped sediment at sediment and erosion control BMPs.
16. Remove sediment and erosion control BMPs and seed areas disturbed by BMPs.

Construction shall minimize disturbance to the existing vegetation along the acclimation channel and pipeline alignment. Small shrubs and trees at the acclimation channel area shall be salvaged as possible for re-planting along disturbed slopes. All disturbed areas shall be re-vegetated with a Gifford Pinchot National Forest approved seed mix, fertilizer, and mulch.

The following equipment or similar is anticipated to be used during construction of the Muddy River acclimation pond facility:

1. CAT 330 or 350 excavator for acclimation channel construction, pipeline excavation and infiltration gallery excavation.
2. Skid steer for acclimation channel construction.
3. Small backhoe CAT 416 for loading unloading truck near site access.
4. 10-wheel dump truck for hauling materials to and away from site.

4.2 Operations

Seasonal Start-up

When the snow level recedes sufficiently to access the site, operations personnel will begin mobilizing the screens and stop logs to the acclimation channel. The installation and flow testing is anticipated to take approximately one week and includes:

1. Cleaning the outlet structure and the water supply pipe outlet structure of debris.
2. Cleaning of the water control structure.
3. Maintenance and exercising the gate and butterfly valves.
4. Back flush the infiltration gallery area using a portable motorized pump. Back flush each of the 8 back flush pipes for 15 minutes.
5. Installing the outlet stop logs and screen. Installing the water supply pipe discharge structure screens and trash rack.
6. Inspection of the side channel.
7. Turn on the water supply to provide flow through the channel.
8. Once the channel is filled, pull the stop logs and screens in the outlet structure to provide a flushing flow to remove as much floating debris as possible.
9. Replace the outlet screens and stop logs.
10. Establish the flow through the acclimation channel by measuring the flow over the outlet structure stop logs.
11. Maintain the flow through the channel for a minimum of 48 hours.

A four wheeler and a trailer may be required to transport the gas powered portable pump to the water supply control structure along the pipeline alignment.

Daily Operations

Once the site is prepared, the fish transport vehicles will deliver the juvenile spring Chinook to the site and release them into the channel via a flexible release pipe from the paved parking area. The following procedures are recommended on a daily basis:

1. Feed the fish.
2. Maintain the intake structure by removing debris.
3. Maintain the outlet structure by removing debris.
4. Maintain the pipe outlet structure including screens and trash rack by removing debris and ice.
5. Pull the screens and clean with a brush.
6. Data collection of water temperatures, turbidity, flows, and mortality counts.
7. Inspect the channel for debris or obstructions that may preclude fish from using any part of the channel.

On a weekly basis, the infiltration gallery should be back flushed to ensure proper flows are maintained through the water supply pipe. A four wheeler and a trailer may be required to transport the engine powered portable pump to the water supply control structure. The frequency of back flush activities may be reduced if the water supply flows are maintained.

End of Season Shut Down

Upon completion of the acclimation period, the fish will be released to the Muddy River. A 50 foot to 200 foot section of HDPE pipe will be connected to the pipe outlet stop log within the outlet structure. The pipe will be extended to discharge directly into the Muddy River. The slide gate will be pulled at the pipe outlet stop log and the fish will be released. The screens and stop logs will then be removed and taken off site for cleaning and storage. The lids for each structure will be closed and locked.

4.3 Maintenance and Operation Issues

The Muddy River has changed course in recent years that could cause issues with the acclimation site. This movement and high bed load will cause problems for an infiltration gallery and the outlet location. If the channel converts back to the channel location from 2006 on the far right bank looking downstream, then the proposed infiltration gallery site will not function. The current proposed intake location is adjacent to a highly unstable bank potentially leaving the pipeline and water control structure exposed to damage.

The outlet location for the acclimation channel is located on the left bank (north bank) and just upstream of the bridge. The possibility of a runoff event depositing gravel and sediment that will block off the outfall is high. Fish release would need to be timed to insure connectivity between the acclimation channel and the Muddy River.

An additional concern is maintaining the water supply to the acclimation channel. Potentially the infiltration gallery may become blocked during high runoff and sediment events. **Due to the high bed load movement, the likelihood of the infiltration gallery becoming plugged is high**. Major maintenance will be required if the infiltration gallery becomes blocked and could become a yearly activity.

Also during this period, freezing may also occur that could constrict or diminish the water flow to the channel. During the acclimation period, weather extremes may occur limiting access to the Muddy River site for maintenance of the water supply and feeding.

Predation is a concern for the acclimation channel due to the large number of fish in a confined area. Large woody debris and boulders will be placed in the channel to provide the juvenile Chinook escapement opportunities.

Beaver activity has occurred in the proposed acclimation channel area that could become a major maintenance activity to support proper flows through the channel if dams are constructed in the channel.

Vandalism is a concern at this site due to the proximity of the day use site. Maintenance activities to camouflage or obscure the concrete structures will aid in deterring vandalism.

Any major event that diminishes flow to the acclimation channel will require the immediate release of the juvenile Chinook to the Muddy River. Some of the potential major maintenance activities that may be required at the site include:

1. Excavating and repairing infiltration gallery, pipeline, or structures utilizing CAT 330 size excavator or similar.
2. Re-grading of the acclimation channel using a skid steer.