JUVENILE FISH FACILITY

Facility Description

McNary Dam has elaborate structures and facilities to ensure the safe downstream passage of juvenile salmonids and juvenile lamprey. Trash racks keep most debris from entering the "intacts" (entrances) of McNary's 14 turbines. When clean, trash racks help to keep fish passing in good condition. Each turbine unit has three gatewell slots with associated fish screens. The fish enter the turbine intact, and extended length submersible bar screens (ESBS's) divert them into each gatewell slot. Vertical barrier screens (VBS's) in each gatewell slot then keep the fish from entering the turbine.

Each gatewell slot has two orifices. Usually only one is open. The fish pass through these twelve-inch orifices to the juvenile collection channel. McNary usually operates with 42 open orifices. The juvenile collection channel flow runs from north to south. The dewatering structure and associated equipment are at the southern end of the powerhouse. Here there are the two side-dewatering valves, which regulate the channel elevation. This changes with the orifice flow volume associated with turbine operation and forebay elevation changes.

Three floor dewatering valves remove excess water. Staff normally set these at the 60 percent open position. Excess water from the all these valves goes to the southern ice and trash sluiceway, the dewatering pit and the 48-inch facility supply line. This line supplies the Juvenile Fish Facility (JFF), which collects and holds the fish for transport.

Water from the dewatering pit helps provide attraction flow for the north adult powerhouse entrances. Bar screens in the side and on the floor of the channel retain fish and remove the excess water. The side, rectangular and transition brushes clean the screens.

A programmable logic controller (PLC) controls the side dewatering valves, brushes and juvenile channel elevation. In the transition area, the channel funnels down to the full flow transport flume, where the fish exit. The transport flume takes the fish to the separator in the JFF. Just upstream from the separator is the primary bypass gate. In the spring and fall, this gate bypasses fish directly to the river.

The separator sorts the fish by size, with the small smolts exiting down the A flume and the larger smolts (e.g., steelhead) going down the B flume. Staff release adult salmonids and other miscellaneous fish into the separator's "return to river" line. The separator building is where technicians record fish counts, monitor the separator and perform other duties.

Downstream of the separator, in the A and B flumes, are the primary Passive Integrated Transponder (PIT) tag gates (used to bypass most PIT tagged fish), sample gates used for smolt monitoring, and secondary PIT tag gates used for PIT tag studies, secondary bypass or transport. When open, these secondary gates return the fish to the river down ten-inch diameter bypass lines, typically in the spring. When closed, they route the smolts to the raceways for summer transport collection.

McNary has eight raceways, four of which can be used for trucking. There are also two sample raceways. From the raceways, crews can off-load the fish onto barges at the dock or onto trucks at the bay. Transport starts with barging and ends with trucking, as fish numbers drop.

The sample and PIT tag systems each have two count tanks with associated equipment and two holding tanks. The "A" and "B" sides each have a set. Inside the JFF building is the wet lab, where contractors examine the sample. The full flow flume, adult return line and all facility lines all have PIT tag detectors and associated equipment.

PIT tag detection equipment is throughout the facility, while the sample timer and operating system are in the JFF building. PIT tag monitoring equipment is also in the JFF building[g1]. The 48-inch line from the collection channel feeds the head box, water add-ins and separator up well. The head box supplies water to the rest of the transport facility. All flow is gravity fed.

Facility Modifications (Maintenance and Improvements)

In order to enhance system performance over previous seasons, during the winter of 2010-2011 project personnel:

1. Conducted scheduled, preventative maintenance at the juvenile channel and the JFF;
2. Installed proximity switches and replaced transducers on ESBS's;
3. Began or continued rehabilitation of ESBS's and VBS's;
4. Covered the upper emergency bypass juvenile channel drain with a solid plate to reduce entrapment during channel de-watering;
5. Installed safety net anchors above the upper emergency bypass channel drop off;
6. Installed an air shut-off valve in the air line to the 48 inch supply line valve;
7. Rehabilitated the PIT tag and sample gates;
8. Installed new raceway weir boards;
9. Began installation of new spillway gate controls;
10. Continued installation of spillway controls;
11. Installed lighting for the channel phone booth;
12. Installed an uninterrupted power supply and alarm for the juvenile channel's PLC;

13. Installed a PLC for the air burst system;

14. Repaired a leak in the main flume upstream of the separator;

15. Installed a new wind sock at the JFF;

16. Installed a hoist system for the east raceway bank;

17. Began constructing new raceway tailscreens that will pass juvenile lamprey;

18. Removed US Geological Survey equipment from the facility;

19. Repaired a failed gasket in the A side secondary bypass gate; and

20. Began construction of a new, $10.2 million bypass outfall.

We will discuss additional maintenance issues in the remaining text of this report.

Operations and Maintenance

Bypass and Transport Operations

On March 21, for a short time, staff turned on the facility emergency water supply to check for freeze breaks. Staff also tested all [g2][g3]sample, bypass and PIT tag gates. Staff found no problems with any of these. On March 27, primary bypass began. On March 31, for approximately eight hours, staff dewatered the juvenile channel to examine the rectangular screen cleaning brush. On April 11, for 8.5 hours, staff closed the orifices and pooled the channel so that crews could replace the rectangular brush's drive motor. During the pooling, staff rescued 50 juvenile lamprey and 50 steelhead smolts. Staff lost one clipped yearling Chinook and three clipped steelhead smolts.

On April 11, with the ESBS installation already underway, staff initiated spring bypass season, with alternating days of primary and secondary bypass. Daily data collection started at 07:00 hours. April 12 was the first day of secondary bypass. Both bypass methods allow for PIT tag detection. Primary bypass reduces fish passage through the system. Secondary bypass allows for smolt monitoring and studies. The system only activates sample gates during secondary bypass.

Power outages forced primary bypass, outside the alternating schedule, on the following dates:

1. On April 18, twice for a total of 55 minutes;

2. On May 16, (extended) for 45 minutes;

3. On June 13, (extended) for 45 minutes; and

4. On June 22, for 45 minutes. This outage also affected the juvenile channel. All gates were off.

Also, we went into primary bypass:

1. On May 3, for 5 minutes for a tour; and

2. On June 12, twice during a ten minute span for technician training. Both times all gates were off.

During secondary bypass, ice block checks three times a day (for unknown blockages in the bypass lines) revealed and removed small debris wads from the A and B "return to river" lines, two and five times respectively. Also, ice checks of the adult return to river line this season revealed no problems. High tailwater elevations in June and July obstructed the view as the blocks exited the pipes.

On July 20 at 1200, staff began collection for transport, with all PIT and sample gates operational. Collection for transport allows for PIT tag diversion and smolt monitoring. This season, water balloon checks of the PIT tag release lines revealed no obstructions. We will describe barging and/or trucking of fish later in this report.

On September 2, staff switched to primary bypass for six minutes due to a debris blockage at a PIT tag detector in the A flume. Staff lost twenty-one non-clipped sub-yearling Chinook. Staff left on the gates [g4]for the sample and PIT tags. From September 8 at 1400 to September 17 at 0700, staff initiated primary bypass because heavy debris loads in the system and in the forebay endangered the facility and the fish. Staff turned all gates off.

On September 13, while attempting to remove the forebay debris, small debris obstructed the inclined floor screen. Staff closed all the orifices and drains and pooled the channel so that the air burst system and screen cleaning devices could clean this screen and the side screen. On September 30 at 0700, transport season concluded with the beginning of fall bypass season. Again, staff turned off all gates.

During fall primary bypass season, PIT tag detection only occurs in the full flow flume. Also for the fall season, technicians monitored the collection channel on all shifts.

On November 18, staff switched the system to emergency bypass due to failure of the rectangular screen cleaning device. Once in emergency bypass, the system had to remain there due to the dewatering of Station Service Unit 01. This unit supplies the water to fill the channel's dewatering chamber and flush the transport pipe. Without this water supply, staff cannot re-water the channel without impinging fish on the inclined floor screen.

During the switch to emergency bypass, staff used a fire hose, which uses river water, to flush the transport pipe. Staff used the SeaSnake camera to verify that staff had successfully removed all the fish from the flume. Also, staff needed to pool the channel

before completing the switch, as debris again obstructed the inclined floor screen, and the air burst system could only clean the screen while staff pooled the water. Finally, electricians replaced a fuse in one of the floor valves. There is no PIT tag detection during emergency bypass.

On December 21, after crews raised the ESBS's, staff closed the channel orifices. Staff sent to the river one adult Chinook, six adult coho and approximately 75 adult steelhead. Staff also rescued approximately 20 sub-yearling Chinook. Staff lost five sub-yearling Chinook and one non-clipped steelhead smolt. Staff did not observe any lamprey adults or juveniles.

This year power outages affected both the channel and the facility. These outages were due to work in the powerhouse. This is the first year that power outages occurred in the collection channel during the season. On April 18, staff switched the system to primary bypass twice due to a power outage that affected both the facility and the channel. The first diversion was for the power outage. The second was for the collection channel, as the water elevation fluctuated after we restarted the side dewatering valves.

On April 19, another power outage occurred on a scheduled primary bypass day. This day, staff monitored and manually adjusted the channel after the outage to reduce the severity of the channel fluctuations. On May 16, staff lost 30 minutes of sampling due to two outages totaling 44 minutes, which delayed the start of secondary bypass for 45 minutes and later for about 30 minutes. On June 13, a possible power outage delayed the start of secondary bypass for 45 minutes. It later caused a 12 minute outage with 37 minutes of sample lost.

On June 22, staff switched to primary bypass 45 minutes early due to high flows caused by a power outage in the channel. The side dewater valves stabilized themselves in about 30 minutes. Later that day, during a second outage, a technician monitoring the channel reduced the fluctuations by manually restarting the side dewatering valves. Two outages totaling 21 minutes on December 6 had no ill effect on the facility.

Twice in September the station service air briefly tripped off line with no adverse effect in the collection channel or at the transportation facility.

Turbine and Spill Operations

The one percent hard criteria for unit operation ran from April 1 to October 31, inclusive. On two recorded occasions in June an individual unit ran outside the constraint for less than 10 minutes for testing after crews completed unit maintenance. On July 17, all units briefly ran outside the criteria due to a programming issue. Slight variances occurred during the season, but staff did not record any long term violation of the criteria. On 12 occasions operators reduced unit loads to the lower end of one percent criteria, due to high VBS differentials, for a total of 13 days.

During the soft one percent criterion in November and December, units ran outside the constraint due to the dive contract installation of study equipment, for ESBS removal and at BPA's request. Debris caused high VBS differential readings. Operators reduced loads for six units for nine days until crews could clean the VBS's.

North powerhouse loading for temperature abatement did not occur this year. Crews monitored temperatures from June 15 to August 31, inclusively. Based on the data generated, on August 26 to 31, operators changed unit priority so that units 2, 4, 8 and 11 would be first off/last on.

Operators spilled in excess of powerhouse capacity from January 18 to April 10, with only three days without spill. On April 10 at 0001, the spring spill program began. Crews installed TSW's at bays 19 and 20. For the spring, operators normally plan to spill 40 percent of flow. However, due to high flows in excess of powerhouse capacity, they spilled 40 to 71 percent of total flow during the spring program.

On May 23, spill gate 1 experienced excessive vibration. Operators closed the spill bay and crews removed the gate from service. The bottom seal on the gate had failed. Until June 13, crews attached the TSW to the crane stationed at bay 20. Crews finished repairs to gate 1 on July 21, and activated the crane to operate the gate on July 25. On June 2, crews completed two electrical repairs on spill gate 2.

On June 8 and 9, project personnel closed spill bays 18 to 22 to remove the TSW at bay 19. They kept bay 20 closed until June 13, when they removed the second TSW. TSW removal coincides with the projected start of sub-yearling Chinook out migration. On November 7 and 8, crews removed the TSW's from the project for rehabilitation.

On June 20, the summer spill program began, with operators spilling 50 percent of total flow. Due to flow in excess of powerhouse capacity, they spilled 50 to 68 percent of total flow for the summer. From July 21 to August 16, during the barge transport season, operators closed and reopened the spillway every other day so that the fish tug and barge could travel safely to and from the fish facility dock. On September 1, at 0002, the spill program concluded.

During the spring and summer spill seasons, all changes followed the Fish Passage Plan. With the spillway closed, crews began hoist maintenance.

During the winter, on three days, operators spilled 15 to 35 kcfs due to flows in excess of powerhouse capacity. On five days, operators conducted slight spill for gate testing after crews completed upgrades on controls. For one day, slight spill occurred for testing the diesel backup system.

On September 6, 13, 15, 16, 21 and on October 25, operators spilled to remove forebay debris. On the first three occasions, they opened bays 20 to 22 one to three hours and spilled 15 to 77 kcfs. They also rotated units off and on to try to help remove the debris, with no success. From September 13 to October 25, bay 20 had a split leaf configuration.

On September 16, 21 and October 25, operators opened bay 20 for 18 feet in order to spill the debris, after a tug with log boom deposited the debris north of the spill bay. For those dates, operators opened the bay nine, four and three times, respectively. On September 16, operators also used slight unit rotation to move debris.

Forebay Debris and Trash Racks

The floating debris mostly consisted of tumbleweeds and woody material, with man-made objects mixed in. Also, in summer, Eurasian milfoil increased in volume. The debris load was light to heavy moderate from March to May, depending on windstorms along with spill, flow changes and project operations, which moved the debris throughout the forebay. Trash rack cleaning in early May, when the TSW's were in place, removed and moved the debris to the spill flow resulting in light debris loads. By the end of July, the debris load increased to moderate with half of it floating at the spillway. Again, weather and project operations affected debris movement.

After the spill program concluded on September 1, the debris load quickly increased to heavy with debris along the shores, the powerhouse and the spill dam. On September 6, 13 and 15, attempts to remove the debris with night spill, a tug along with spill, and spill with a southwest wind had little effect due to the powerhouse flow. On September 16, 21 and October 25, crews used a tug to move the debris north of spill bay 20. Once the tug had cleared the area, operators opened the bay and successfully spilled the debris.

On September 16, the tug with log boom made nine trips in four hours, removing 75 percent of the debris. On the next two occasions it removed seven loads of debris in 2.5 hours. During these operations, operators used the pier nose air burst system to help move the debris from the powerhouse face. Also at this time, the resource maintenance crew removed debris from the Oregon shore. After this work, the debris remained light for the rest of the year.

When debris loads were fairly heavy, they affected both juvenile and adult facilities. We will discuss the adult facilities in a separate report.

High flows and debris along with storms are generally not an issue in the winter maintenance season. However, in January, trash rack debris began adversely affecting unit 1's operation. On February 1, the intake deck crane returned to service after completion of maintenance. Differentials at units 1 and 3 through 5 measured three to ten feet, with unit 1 being the highest. On February 2, crews twice attempted to clean the racks at 1A slot. On February 3, crews cleaned the racks at 1A, 1B and 1C slots. Operators used the pier nose air burst system to help move the debris.

On February 4, crews cleaned units 3 and 4. On February 4, they cleaned unit 4 again. On February 6, they cleaned units 1, 4 and 5. On February 7, crews cleaned unit 1 for a third time. Other units appear not to be affected by the debris, which mostly consisted of tumbleweeds. This cleaning removed 71 ten-yard truck loads of debris. In the debris, staff counted approximately 1000 juvenile lamprey mortalities in the trash rack debris. Most of

the lamprey appeared to come from the lower sections of the trash racks.

On February 14, crews cleaned units 1 to 6. There is no record of debris removed or mortality. On February 23 to 26, crews removed 15.5 ten-yard truck loads of debris from the trash racks at units 1 and 4. We noted no lampreys.

During the season, staff monitored trash rack differentials daily. The project also plans to monitor differentials in the coming winter. In March, high differential readings ranged from 2.0 to 6.3 feet. On March 21 to 24, at units 1, 3, 5 and 9 to 14, crews removed 42 ten-yard loads of debris. Staff recorded twenty juvenile lamprey mortalities. Late in the month, high differentials measured from 1.9 to 5.2 feet. On March 28, 29 and 31, crews removed 27.5 ten-yard truck loads of debris from units 3 through 6 and 8. Staff counted zero mortalities. At this point, crews had cleaned all operating units. After March, there were no high differential readings. From April 25 to 27, crews cleaned all units' trash racks, removing 25 ten-yard truck loads. Staff saw no mortalities.

From May 18 to 21, crews cleaned all units, removing 20.5 ten-yard truck loads. Staff noted only one juvenile lamprey mortality. On June 3, 4 and 11, crews cleaned all units, removing 18 ten-yard truck loads of debris. On June 13, operators briefly removed unit 4 from service in order to "burp" debris from the unit's trash racks. From June 27 to 28, crews cleaned the racks at units 1 to 9, removing five ten-yard truck loads of debris. When the crane was at 9B slot, the hoist brake failed, damaging the hoist system. Staff expect the hoist to return to service by March 8, 2012. Fortunately, trash rack differentials remained low and staff did not observe any apparent harm to fish. This year crews mostly removed tumbleweeds, woody debris and man-made materials.

Gatewells

Staff observed no debris accumulations this year. Crews removed some light woody debris during the season, especially with trash rack cleaning, as debris would inadvertently enter the slots. Crews removed a slight amount of large woody debris from 4B and 4C slots. They removed a large container lid from 2C slot.

On February 7, crews removed oil from 13C slot. At the start of the season, crews removed a slight amount of residual fish screen oil from five gatewell slots. During the year, they used absorbent pads to remove a slight amount of oil from 11 slots, usually while the unit was out of service.

From July 13 to 14, crews removed hydraulic fluid from 6B slot. This fluid had bled from Station Service Unit 01, which also required cleaning. During the spill, the crews closed the orifices at unit 6. They had already closed the emergency water that feeds off the station service unit. On September 12, a hydraulic line for 6B slot's headgate leaked five gallons of fluid into the slot. Crews closed the orifice for two days until they removed the fluid. On October 17 and 20, respectively, after closing the orifices, crews removed hydraulic fluid from 13A and 6C slots.

From June 30 to October 11, crews dewatered the 1B slot because the headgate would not seal. Before dewatering 1B slot, fish crews salvaged 100 sub-yearling Chinook smolts. Crews used the emergency bulkhead for this part of the unit outage. On August 31, crews reinstalled the headgate. On October 11, they pumped water from 1A slot to 1B slot, refilling the slot in order to remove the bulkhead. For this work, from October 8 to 11, they covered slot 1A slot.

Staff noticed no blue/green algae in the gatewell slots this year. Finally, fish crews examined gatewell slots daily, after any orifice blockage or inadvertent closure, along with any other events we discussed in other sections of this report.

Extended-Length Submersible Bar Screens

This season marked the fifteenth year with a full complement of ESBS's in place in all 14 units (42 screens, 3 per unit). From May 3 to November 27, fish crews conducted underwater camera inspections. They skipped seven inspection dates due to other project operations on the intake deck. The purpose of the inspections is to look for the proper range of ESBS brush mechanism operation.

On July 5, the screen at 5C slot, which was in bypass mode, was found with the brush mechanism not functional, as a coupler had failed. Since June 21, the screen had low motor amp readings. On July 19 the screen in 9C slot, which had been in bypass, failed due to a faulty coupler. Staff last examined the screen on May 24, with no indication of the failure. On November 14, the screen in 5B slot, which had been in bypass mode, failed again due to a coupler. Staff had last inspected the screen on October 4, with no indication of a problem. These failed screens had fine debris and milfoil on them, but staff only found one impinged juvenile lamprey, and staff indentified no other problems.

Fish crews examined the ESBS's at units 1, 7 and 10 two, three and one times, respectively, due to the units being out of service long term. They examined all other units' ESBS's four to five times. On three occasions, they could not examine a screen due to storage of a spare fish screen in the slot. However, they examined the screen at a later date after riggers removed the spare screen. When crews raised the screens in December, none showed any problems. During camera inspections, staff did not observe significant smolt mortalities in the gatewell slots.

During winter maintenance, electricians converted more screens to proximity switches with the brush bar timing program, which will eliminate the need for transducers. About 50 percent of McNary's ESBS's now have proximity switches. For the third year, in order to possibly improve juvenile lamprey survival for an early spring outmigration peak and yet have minimal impact on juvenile salmonid passage, crews installed ESBS's in early April instead of late March. On April 5 crews installed screens at units 1 through 6 and 8. On April 11 to 13, they installed ESBS's at units 9 to 13. On April 15, they installed the screens at unit 14. By April 15, they switched the screens at unit 2, which was out of service, to other units. On May 25, they installed ESBS's in the unit. On May 26 crews installed screens at unit 7, which was out of service.

With the success of the last three years, in an effort to reduce mechanical wear on the fish screens, the brush cycle time for all units remained at 60 minutes. Camera inspections during the year confirmed that the screens remained clean with this setting. The cycle timing, along with installation of proximity switches, seems to have reduced ESBS failures and repairs.

In April, with start up, crews repaired three ESBS's in place. They resolved electrical issues on three screens and replaced five failed screens. Operators reset two alarms with no other problems. Electricians placed one screen in transducer bypass mode. These problems were electrical issues or brush drive chain problems along with coupler failure. These failures resulted in an increased rate of ESBS rehabilitation. Crews rotated screens from the intake deck to the yard and back throughout the year. Rehabilitation included the spare ESBS's.

In May, crews switched two screens to bypass and repaired electrical problems on two others. The screen at 3B slot was in bypass from May 14 to December, when crews raised it. In June crews switched two screens to bypass mode. At unit 7, crews replaced a failed a PLC module. On June 30, crews removed the screen at 1B slot for bulkhead installation. Due to the unit being out of service, they will not replace the screen until next spring. On July 5 they replaced the ESBS in 5C slot, which had been in bypass mode since May 25.

On July 9, crews removed the screen at 10B slot and installed it at 13A slot. They did not replace this ESBS because unit 10 was out of service. The screen at 13A failed the day before and received electrical work before the crew replaced it. Later that day, crews switched the screen to bypass mode, where it remained until it was they raised it in December. On July 20, crews replaced the screen in 9C slot, which had been in bypass mode since April 12, as mentioned above.

On July 21, the screen in 2A slot that had been in bypass mode since June 14 failed due to an electrical cable issue, which electricians resolved. They removed the screen from bypass mode. On July 23, due to a coupler failure, crews removed from service the ESBS in 2B slot, which had been in bypass since June 16 due to a coupler failure. On July 25 they replaced the screen with the ESBS from 1A slot. Next spring they will install a screen at slot 1A.

In August and September, two ESBS's received electrical work, and crews switched one to bypass mode. On October 7, crews switched the screens at 11A and 11B slots to bypass mode after returning the unit to service. On October 13, they also switched the screen in 11C to bypass. On October 27, the screen at 13B slot failed and electricians switched it to bypass mode the next day. On November 1, they switched the screen in 2A to bypass. All five screens remained in bypass until crews raised them in December.

On November 2 and 3, crews raised the remaining screens at units 1 and 10 for the season. On November 14, the screen in 5B slot, which had been in bypass mode since September 15, failed and crews replaced it. Six days later, electricians adjusted the screen's brush mechanism. A week later, the proximity switch failed on the screen and electricians placed

it in bypass mode until crews could raise it. On November 15, the screen at 13C slot failed and crews replaced it.

For the year, there were problems associated with transducer failures, gearbox or motor issues, brush drive or coupler issues and electrical or programming. Most fish screen failures, especially those repairs that required raising the ESBS's and/or replacing fish screens, forced unit outages. Staff noted no significant fish loses during ESBS's issues. During the first week of December, crews raised the screens at unit 7 because the unit was out of service. From December 16 to 19, they raised all remaining ESBS's. Maintenance began as soon as crews raised each screen.

Vertical Barrier Screens

VBS monitoring corresponds with ESBS's installation, which we discussed above. During the season, impinged debris on the VBS's continued to be a problem with crews cleaning all screens at least once. They cleaned the screen at 3A slot 34 times. On April 20, crews cleaned the first VBS. Daily monitoring of head differentials across the VBS's resulted in crews cleaning these screens on 516 occasions this season compared to 274 times in 2010. Crews cleaned VBS's on 92 days, with December 15 being the last day they cleaned a screen. Project operations, river flows and weather patterns affect the debris dispersal across the powerhouse. For the spring bypass season, transport season and fall bypass season, crews cleaned the screens 192, 220 and 104 times, respectively.

Criteria for cleaning of the screens is 1.5 feet or more of differential, at which time operators reduce the unit loading to the lower end of the one percent peak efficiency curve (approximately 43 megawatts) until crews can pull the screen and wash it with a fire hose. Operators sometimes operated the units were at reduced load, which we cover in the Turbine and Spill Operations section above. Reducing the load also allows debris to slough off the screen. Unless adult and juvenile shad or debris abundance presents a hazard to the fish, crews dip smolts from the gatewell slots prior to pulling the VBS's, to prevent fish from exiting back through the turbine unit.

In order to reduce debris in the collection channel, crews cleaned screens while staff closed the orifices at the slot, and used adjacent orifices to maintain channel elevation. Also during VBS cleaning, staff operated the collection channel screen cleaners and the rectangular screen's air bubbler system more often to keep the channel's dewatering screens clean.

For the year, on 157 occasions, screens had differentials at 1.5 feet or above. Staff count only once screens with multiple readings out of criteria, before crews clean them. Twenty four of the high readings occurred when the unit was at 70 to 80 megawatts during the soft one percent criterion in November and December. For three screens, operators allowed the debris to slough off, or reduced the load until crews could clean the screens at a later date. Crews immediately cleaned all other screens that were out of criteria or at a later date with the units at reduced load. On one occasion crews cleaned the wrong screen, then cleaned the out of criteria screen the next day.

The other 359 VBS cleanings for the year were done as a preventative measure with 22 screens done on November 4 before a dive contract would raise the unit loads to over 70 megawatts. In April, six of these cleanings occurred for VBS inspection. During cleaning, crews examined the VBS mesh and replaced the retaining clips as required, along with documenting any problems.

During the year, crews replaced seventeen VBS's with rehabilitated screens or with screens from units 1, 9 and 10, which were out of service. Crews later replaced the VBS's from the out of service units, with only 1C slot missing a screen, which they will replace in late January, 2012 before the unit is operational. During most of the year, crews used units 1 and 10's slots to shuffle torn and rehabilitated screens to and from the intake deck. Maintenance scheduled 10 to 12 screens for rehabilitation this year, but accelerated rehabilitation due to the number of torn screens found during cleaning.

The prototype bar screen VBS's remain at 4B and 4C slots. Due to the weight of the screens, they were more difficult for the maintenance crew to lift than standard VBS's. They cleaned these screens in 4B and 4C slots seven and three times, respectively. They generally cleaned these screens one or two times a year. In comparison, they cleaned the standard screens at 3A, 4A and 5A slots 34, 28 and 24 times, respectively.

Staff counted thirty juvenile lamprey mortalities in the VBS mesh in April. Staff noted no other significant lamprey or smolt losses.

Orifices and Collection Channel

On March 17, fish personnel observed heavy spalling on the floor of the juvenile channel. After 17 winters, repetitive freezing and toughing had peeled, in a random pattern, about 1/16 inch of concrete cream from the channel floor. The amount of spalling was enough to concern the project, and crews used fire hoses to remove it on March 21 and 22.

After completion of winter maintenance, on March 27, crews opened the orifices and the system came on line. On March 31, crews dewatered the system for about eight hours and placed it out of service for examination of the rectangular screen cleaning device. On April 11, for 8.5 hours, crews pooled the channel with systems off to repair the rectangular brush. They used the north orifice at 1A slot to keep the channel elevation stable.

On May 5, NMFS reassembled the 6B orifice trap so that the project could use the orifice in case of an emergency. On September 13, after an attempt to remove forebay debris, crews pooled the channel for about three hours, closing orifices and drains and turning off the systems in order to clean the side and inclined floor screens with the air burst system and brush mechanisms. On November 18, crews switched the system to emergency bypass to clean and repair the rectangular mechanism. On December 21, crews closed all orifices to conclude the year and begin winter maintenance.

From March 27 to May 27, crews opened 40 to 43 orifices, depending on forebay elevation. On March 27 and 30, trash rack debris also affected the flow from the orifices at

units 4 and 5. At this time, generally, crews opened 41 to 42 orifices. After May 27, after slightly adjusting the floor valves, crews operated 42 orifices for the remainder of the season, except for three days in October when they used 41 orifices due to forebay elevations slightly above 340.0 feet. When going below the 42 orifice count, crews would close orifices at units that were not in service.

Nineteen orifice blockages occurred this year. The first was on April 5 and the last was on November 24. At 3B south orifice, crews closed the flow for two days before clearing and reopening the orifice. Crews opened the north orifice during this closure. They cleared the remaining obstructions as soon as they found them, by cycling the orifice and using the air back flush system. Staff noted no harm to fish in any blockages. Finally, seven of these blockages occurred at 6B north orifice. The trap is on 6B south orifice. On April 28, crews "burped" unit 6 with no debris seen. On May 2, a camera inspection of unit 4 and 6's orifices revealed nothing. Two of 6B's blockages came after the camera inspection with the final blockage occurring on May 13.

On seven occasions, staff removed ESBS ropes from the orifice inflows. On one occasion, staff removed an old antenna wire from an orifice outflow. Twice staff found orifices closed, at units with ESBS's not yet installed, for eight and 11 hours, respectively. On April 29, staff found the orifice at 6A slot closed for approximately eight hours or less. In all cases, staff noted no harm to fish and a biologist reviewed orifice cycling protocols with the staff.

From June 30 to October 13, staff closed the 1B slot orifice due to the bulkhead in that slot. From July 13 to 14, they closed all orifices at unit 6 due to a hydraulic fluid leak. From September 12 to 14, they closed the orifice for 6B slot due to a hydraulic leak. On October 17 to 20, staff closed the orifice at 13A slot due to a hydraulic fluid spill. Finally, on October 20, staff closed the orifice at 6C slot due to a hydraulic leak. In all cases, operators placed the unit out of service and staff opened adjacent orifices.

On September 16, 21 and October 25, staff briefly closed units 1 to 6 for forebay debris removal, to keep debris from entering the collection channel, and opened make up orifices at units 7 to 11.

From September 15 to November 16, with unit 1 out of service, staff closed the orifices at times in a variety of arrangements due to ESBS storage, headgate cleaning and work at 1B slot. Staff always opened makeup orifices at a nearby unit. Orifice adjustments at times resulted in brief high/low water alarms, which staff quickly reset.

Crews conducted scheduled maintenance on the orifice operators, oil reservoirs and valves during the maintenance season. Staff promptly replaced orifice attraction lights. Crews will address moisture in the orifice air supply during winter maintenance.

During the spring and fall bypass seasons, the technicians constantly monitored the collection channel when primary or emergency bypass was occurring until they went on furlough in December. During secondary bypass and transport season, staff monitored the

channel on day shift with spot checks at night when required. They also monitored the channel during VBS and trash rack cleaning, forebay debris removal, power outages, hydraulic leaks, failure of screen cleaner devices and failure of air burst systems along with other problems described in this report.

Adult fish continue to jump at the orifice jets. However, none were lost this year.

Primary Dewatering Structure

The system was operational and in automatic mode from March 27 to November 18, except for interruptions described in the Bypass and Transport section, which includes power outages along with what is discussed here. Problems are listed in Table 1.

Operators took Service Station Unit 1 out of service for maintenance from early October until early December. It provides water for flushing the main flume from the juvenile fish channel, and to fill the dewatering chamber below the inclined floor screen.

Table 1. Primary Dewatering Structure Problems

Date	Event	Resolution	RTS Date
Rectangular Screen Cleaning Brush			
3/27/11	Brush timing alarm	Adjusted limit switch.	3/27/11
3/28/11	Brush timing alarm, found faulty drive motor.	Replaced. In the meantime, techs operated the air burst system 24/7	4/11/11
3/28/11	Brush pressure switch found on.	Turned off.	3/28/11
5/25/11	Brush timing alarm: debris.	Debris cleared	5/25/11
6/7/11	Ditto.	Debris in scissor arm cleared	6/7/11
7/1/11	Ditto.	Debris cleared.	7/1/11
9/8/11	Ditto.	Ditto.	9/8/11
9/13/11	Ditto.	Channel pooled, screen cleaned.	9/13/11
9/15/11	Ditto.	Alarm reset. Brush restarted: Woody debris removed:	9/15/11 9/16/11
9/16/11	Faulty setting on limit switch.	Adjusted limit switch so rectangular brush would rise to its proper parking position.	9/16/11
11/16/11	Rectangular brush failed.		
11/19/11	Examination of rect. brush showed key for the brake.clutch required replacement.	Replaced key.	11/20/11
11/20/11	Rect. brush missing first 2 rows of screen panels when sweeping.	Readjusted.	11/21/11
Side Screen Cleaning Brush			

3/27/11	Brush became operational.	Winter maintenance completed.	3/27/11
3/31/11	Brush turned off for channel dewatering.	Restarted	3/31/11?
4/6/11	Brush stalled on debris, alarmed.	Debris dislodged; brush reset.	4/6/11
5/6/11	Ditto.	Ditto.	5/6/11
8/6/11	Ditto.	Ditto.	8/6/11
9/13/11	Ditto.	Ditto.	9/13/11
11/18/11	Removed from service.	Channel switched to emergency bypass.	11/18/11
Transition Screen Cleaning Brush			
3/27/11	Brush returned to service.	Winter maintenance completed.	3/27/11
3/28/11	Brush alarmed. Problem with station air supply?	Reset.	3/28/11
3/28/11?	Removed brush from service.	Returned to service.	4/11/11
5/3/11	Brush timing alarm.	Cleared debris.	5/3/11
9/13/11	Brush operated as needed during removal of forebay debris.	Device put in reserve.	9/13/11
11/2/11	Brush timing alarm.	Cleared debris.	11/2/11
11/8/11	Ditto, due to a leak in the air line affecting the latch pin's operation. Water also noted in oil reservoir.	Taken out of service for winter maintenance.	

The channel's water elevation meter and PLC were in use from March 27 to November 18. The elevation meter had no problems this year. High/low water alarms always occur with the start up and shutdown of the orifices when flow is over the dewatering structure. Brief alarms also occurred at times when managing orifices. On April 18, 19 and June 22, power outages resulted in water alarms as the side dewatering valves searched after resumption of power, causing water fluctuations. The September 13 debris incident also caused water alarms. On November 7, a sudden change in unit loads caused a brief water alarm.

The no problems with the PLC occurred this season. However, after the power outages, on June 30, crews installed an uninterrupted power supply for the PLC and later added an alarm. We describe screen cleaning mechanism alarms in Table 1. Staff monitored the channel throughout the year, when possible, to back up to the alarm system. In fact, the technicians had a later furlough date for the third season in a row, so they were available to monitor the channel into December.

During the winter, crews maintained the side screen dewatering valves. From March 27 to November 18, both side dewatering valves were operational in automatic mode with no problems to report. On March 31, April 11 and September 13, staff needed to operate the valves manually for the issues described in the Bypass and Transport Operations Section.

Also, as mentioned above, on April 18, 19 and June 22, power outages interrupted the valves, causing water fluctuations. Orifice usage and project operations also briefly affected the functioning of the valves, causing them to search in order to reestablish channel elevation which at times could result in water alarms.

Staff used the main floor de-watering valves from March 27 to November 18. On March 31, April 11 and September 13, staff closed the valves for the operations previously described. On May 27, staff slightly adjusted the valves to reduce the number of orifices required, and to improve the operating range of the side dewatering valves. When switching to emergency bypass on November 18, crews replaced a fuse on one floor valve. There were no other problems to report for the year as power outages did not affect these valves.

From March 27 to November 18, the rectangular screen air burst system worked well on station service air. On March 31 and April 11, the system was out of service for the channel work previously noted. Power outages did not affect the system. On September 13 and November 18, staff used the system to clear the inclined floor screen of debris. They used the system frequently when the rectangular screen cleaning device was out of service. On September 22, staff noted that the sequencer was not automatically running zone 4 in the transition screen area. The sequence was out of order, as it skipped the other zones at times.

On October 3 and 4, crews replaced the sequencer with a PLC, which returned the air burst system back to normal operation. When the system was faulty, staff operated the rectangular mechanism more often while technicians monitored the channel. On November 21, crews rewired the master switch for the system after staff discovered that the air was running even with the switch off. The system's cycle time remained at one zone every ten minutes. Also, crews serviced the backup compressor before and during the season. During problems and operations discussed in this report, the air bubbling system was instrumental in keeping the rectangular and transition screens clean.

Separator

The separator was functional during secondary bypass and collection for transport as described in the Bypass and Transport Section. On March 31, April 11 and September 13, staff briefly dewatered the separator. The separator is five feet wide. The smaller smolt A section is 13 feet long while the larger smolt B section is nine feet long. The spacing between the A separator bars is approximately 11/16 inch while the spacing between the B bars is approximately 1 and 5/16 inch. After peak steelhead smolt out migration and with the beginning of adult shad fallbacks, staff install PVC pipe over the B bars to help exclude shad from the sample tank and raceways. Juvenile steelhead can still exit. The A side bars gradually slope up going downstream with the water depth going from approximately six to three inches. The B bars are approximately two inches below the downstream end of the A bars.

The B-side water depth starts at approximately five inches and drops to three inches at the adult release gate. Flow into the separator depends on collection channel changes and debris blockage on the perforated plate just upstream of the separator. High flows were generally due to debris on the perforated plate, which technicians cleaned. During the spill program and other project operations, including spill closure for fish tug and barge crossings along with juvenile channel adjustments, the separator can experience fairly severe fluctuations. Channel power outages also affect separator flow. As staff described in the Bypass and Transport Operations section, power outages at the facility also affect operations.

Staff regularly improved the separator up well flow by tapping and back flushing the screens. The end of the spill program had no significant effect on separator debris loads. However, from September 8 to 17, the system had to be in primary bypass due to excessive debris loads. Other debris issues, as described elsewhere in this report, affect the separator and the facility when operational. The separator exits had very few debris blockages, which staff generally removed quite easily with no apparent harm to fish. Otherwise, the flow exiting the separator was quite stable. The technicians monitored and addressed all issues at the separator. This year staff did not observe any apparent adverse effect on fish in the separator area.

In early April, while in primary bypass, staff lost 17 juvenile lampreys on the perforated plate. On August 3 and September 20 staff released an unclipped bull trout and an unclipped pink salmon from the separator, respectively. On September 22, after staff removed the forebay debris, there was an increase in smolt passage. Possibly the fish were using the debris for cover.

At the transport facility staff removed algae all year as long as staff watered up the facility. With fall primary bypass season, the system remained watered up to help avoid frozen pipes, so staff only performed light maintenance until November 18, when full emergency bypass began. At this time, with the separator and transport facility dewatered, crews completed winterization and began maintenance. On November 21, staff cleared a frost drain.

The only significant fish loss that occurred at the facility was on September 2, as described in the Bypass and Transport Operations Section. Staff quickly removed other debris blockages downstream of the separator, with no fish loss. On April 13, while bypassing the sample raceway, a floor mat inadvertently went down the release line. Staff checked the line with ice blocks and noted no harm to fish. We also mention blockages of the bypass lines in the Bypass Section.

From September 1 to 8, heavy debris loads in the raceways made truck loading difficult. For the year, facility mortality records were within normal ranges except on July 21 and 22, when the mortality rate was slightly above six percent. No reason could be found at the facility for this rate. Finally, the smolt monitoring staff had no significant losses this year.

On March 21, staff turned off the emergency facility water supply from the service unit to provide water to check for any breakage that might have occurred overwinter. Staff found no problems.

The smolt monitoring staff maintained temperature probes on project from June 15 to August 31. They published results in a separate report.

Sample System and PIT Tag System

On March 21, staff tested the sample and PIT tag systems and found no problems while the emergency facility water supply was on. On April 12, staff prepared both systems for the upcoming year, as we outline below.

The sampling and pre-anesthetic systems worked well all year. On April 12, at 0700, staff turned on the sample gates for the first day of secondary bypass. Every morning during spring bypass season staff turned the gates off and on, to be operational during secondary bypass. We discuss this in the Bypass and Transport Operations Section. Also, for the year, staff changed the sample rates with the beginning of the data day at 0700. The power outages on April 18, May 16, June 13 and 22 resulted in approximately three hours of sampling loss with the gates closed. After each power outage, staff double-checked the sample timer and found no problems. On July 11, September 1 and 22, monitoring staff decreased the sample rate due to increased smolt numbers.

On July 20 at 1200, with the start of transport season, staff left the gates on continually, except when problems occurred as outlined in this report. During transport, when going to 20 percent, staff operated the PIT tag gates to override the sample gates. Due to the low numbers of smolts, the override probably had very little effect on the sample or the diversion of PIT tagged fish. On August 1, crews replaced a broken gear on the B side sample tank crowding device. On September 8 to 17, the gates were off, due to primary bypass for debris. On September 24 staff turned off one of the B side fish counters for 19 hours. Due to low fish numbers this had no ill affect. On September 30, at 0700, staff shut down the sample system for the year with the conclusion of transport. The primary PIT tag detection/deflection system (A and B gates) worked well this year.

Throughout the spring bypass and transport seasons, crews tested and adjusted the gates. During the scheduled work, staff immediately released any stray fish that entered the system. After a system check on March 21 and April 12, along with pre-season preparations, during the spring bypass season, staff turned off these slide gates. With the gates off, all PIT tagged fish were still detected in the full flow flume during primary bypass and at the facility, including the return to river lines during secondary bypass, so we lost no data. We prefer these bypass routes over the smaller PIT tag release lines.

During the spring season, with the gates off, no problems mentioned in the Bypass and Transport Section before July 20 had any effect on this system. There was no override of the sample gates while set at 20 percent or higher. On June 27, the A side PIT tag system became operational for a Columbia River Intertribal Fish Commission (CRITFC) study. This study concluded on July 20 at 1200 with the start of transport season when the full PIT

tag system became operational.

On July 27, staff removed a debris blockage from the A side release line. The tank on this side had been draining slowly for about one day. Staff noted no harm to fish. The only interruption in the gates operation occurred from September 8 to 17 due to primary bypass for debris. When in use, a water balloon test of the system's release lines, which occurred daily to weekly, revealed no problems. On September 30 at 0700, with the start of fall primary bypass season, staff turned off both PIT tag slide gates for the year.

Staff did not use the secondary pit tag detection/diversion system this year as no study required it. This system uses the secondary bypass gates as PIT tag slide gates (C gate is on the A side and D gate is on the B side). These gates received no preseason adjustments and were left off except as described here. On April 12 at 0700, staff briefly turned on, and left open, the gates to return secondary bypass to the river for the spring season. When transport season began at 1200 on July 20, staff momentarily turned on and closed the gates, diverting all fish to the raceways. During the fall bypass season, staff deactivated and closed the gates. No other events affected them.

Barge and Truck Loading Operations

In July staff prepared for barge transport. On July 20, at 1200, we initiated collection and on July 21, we loaded the first barge of the season at McNary. Generally, the tug and barge come over to the facility at approximately 0630 each morning. Operators briefly close the spillway while the tug and barge pass below it. At times, having southern units out of service made it difficult for the tug to leave the facility. Staff switched raceways every day to reduce stress on fish. Staff barged every other day, with the last trip occurring on August 16. There were 14 barge trips from McNary this year.

On July 25, staff loaded the barge at 1600 due to the engine on the tug having failed earlier in the day. They released the fish in a timely manner. On the July 28 return trip the tug engine failed again and the barge hit the east navigation lock wing wall. The contractor had to change fuel filters on the tug and they removed the barge from service for repairs. There were no other issues with barging operations.

On August 2, water temperatures became a concern and daily transport began with the first truck leaving the facility on August 3. Staff trucked every other day (on the non-barging days). When staff ended barge loading, after August 17, they continued truck transport on an every other day basis. For barge and truck seasons, due to low fish numbers, staff loaded both A and B side fish into the same raceway at a given time.

On August 3, an unexpected quick stop at a freeway construction site resulted in the loss of 15 sub-yearling Chinook on the pavement due to hatches that were closed but not sealed. Staff sealed these small hatches on the trailer the next day. Also, staff noted that the flush pump at the release site required repair and the truck needed a new battery. Staff quickly addressed these issues. From August 8 to 11, crews repaired leaks in the truck loading line at the facility. Also, at this time, crews at the Bonneville release location repaired the

trailer drain and the release pipe along with the connector.

On August 15, crews repaired the drain hose at the McNary facility. On August 17, they repaired one of the fish trailer hatches. On August 19, the air conditioning for both trucks at McNary went out. The contractor later resolved the issue. On August 23, issues with the facility drain hose and the credit card delayed the return trip by one hour. District personnel addressed the credit problem immediately. On August 25 and 29, our drivers noted several smolts lost in the release line at Bonneville. District reminded all projects to flush the fish properly. From September 2 to 9, staff commenced daily trucking due to high debris loads at McNary. On September 4, the citizens' band radio (CB) antenna was lost off the truck but staff recovered it.

On September 9, staff found that the release line at Bonneville was missing a gasket. Due to primary bypass for heavy debris loads, the next truck trip was September 18 with every other day loading resuming. This year, three times the trailer's indicator lights malfunctioned. Staff maintained these and other failed items while the system was in primary bypass. On September 18, the gasket at the release site was still missing. Staff resolved the issue immediately. Also, that day, the left CB antenna fell off again and staff could not retrieve it. On September 23, staff made an extra trip due to high smolt numbers. On September 30, the last truck left for a total of 30 truck trips for the season.

We discuss other issues with the facility during transport season elsewhere in this report. At least, juvenile shad were not an issue this year.

Avian Predation

The water cannon sprinkler was operational at the bypass' outfalls from March 27 to November 18 with outages on March 31, April 11 and September 13 due to issues in the collection channel, along with facility power outages previously described in this report. On March 27, the sprinkler jammed but staff cleared it the next day. On June 21, a bird wire jammed the sprinkler. Staff removed the wire the next day with no damage to it or the cannon. On November 16, the sprinkler jammed on debris or ice and staff cleared it the next day. The sprinkler protects smolts during primary and secondary bypass along with PIT tagged fish we bypass during the transport season. During the fall bypass season, the main hazing technique used was the water cannon. Technicians turned the cannon off and on each day so it was operational during daylight hours.

From April 1 to July 16, Agricultural Department personnel hazed predatory birds at the bypass outfalls daily, except for two days in May when one of the employees had surgery. Federal law did not allow hazing of pelicans or lethal removal of other species.

Based on casual observations, staff concluded that gulls, cormorants, pelicans, grebes and bald eagles over winter in the general area of the project.

Daily bird counts ran from March 27 to September 29 for the tailwater area, including the bypass outfalls, powerhouse and spill basin. The spill program ran from April 10 to

September 1, though operators spilled in excess of powerhouse capacity most of the proceeding winter. The counts were usually done twice daily, in the morning and evening. Technicians or biologists performed the counts from the separator building using binoculars. Staff reported the week's highest daily counts for each species from the tailwater area with the bypass' outfall counts, while combining the spill and powerhouse flows. Evening counts were generally higher due to the hazing personnel being off duty.

When spilling, staff observed most of the birds feeding or roosting in the spill basin. All species moved freely between the powerhouse and spill basin, however pelicans preferred calmer water, while gulls and terns preferred the spill. Staff observed pelicans along the navigation lock wing wall, possibly feeding on adult shad. With the conclusion of spill, more birds, especially gulls, moved to the powerhouse flow to feed. At times staff observed night herons roosting on the facility barge dock. In September, staff occasionally observed juvenile ospreys. Also, in September, gull and cormorant counts were fairly high, which might indicate that they are feeding on juvenile shad. Table 2 reflects the observations made for the tailwater area. Other than the start/stop dates, dates in Table 2 are for the start of the data week.

Table 2. Predatory Bird Tailwater Counts.

Species	First Observation	Spring Bypass Peak Date/Number	Transport Peak Date/Number	Last Observaation
Gull	March 27	May 20 - 266	July 22 - 133	September 29
Pelican	April 8	July 8 - 58	July 22 - 18	August 12
Cormorant	March 27	July 8 - 30	Sept. 23 - 59	September 29
Tern	May 27	July 15 - 40	July 22 - 14	August 5

After the conclusion of counting, staff continued to observe gulls and cormorants into December, with gulls roosting or feeding and cormorants mostly roosting. In November and December, respectively, mergansers and pelicans arrived with both preferring the north edge to the powerhouse flow.

In April, staff observed an occasional gull or pelican at the bypass' outfall. Countable numbers began in May and are reflected in Table 3. This table's data is similar to Table 2. When hazing personnel were not on duty, gulls, terns and pelicans numbers were higher at the bypass' outfalls. Bird numbers fluctuated during the spring bypass season. Once transport began, staff only occasionally observed birds near the outfalls. In August, staff briefly observed cormorants by the bypass' outfalls. From June to August, staff also observed pelicans by the separator adult return line. We assume they were feeding on adult shad.

Table 3. Predatory Bird Bypass' Outfall Counts.

Species	First Observation	Spring Bypass Peak Date/Number	Transport Peak Date/Number	Last Observation
Gull	April 8	May 6 - 17	NA	July 22
Pelican	April 8	May 27 - 14	NA	August 12
Tern	May 13	Jun. 3, Jun. 24, Jul. 8 - 3	NA	July 22

During the remainder of the counting season, even with primary bypass for forebay debris in September, staff did not observe any birds at the bypass outfalls. During casual observations after the season, staff occasionally observed gulls, cormorants and mergansers feeding at the outfalls. After the switch to emergency bypass, staff also observed these species at this outfall to the end of the year. However, this outfall is at the northern edge of the powerhouse flow, which may have also attracted the birds. We assume that juvenile shad had become the focus of the birds, and that bird numbers fluctuated with juvenile shad out migration.

For the forebay area, from March 1 to December 31, fisheries staff counted birds with the unaided eye once daily while conducting gatewell observations, usually in the morning. From there they cannot see the roosting rocks by the Washington boat dock. During other inspections, staff sometimes observed large numbers for pelicans, gulls or cormorants at that location. A few grebes may have overwintered at the project. Again, staff reported the week's highest daily count per species. The results of these observations are in Table 4, with data recorded similar to Tables 2 and 3. When no data is recorded, staff only observed the species occasionally.

Most of the gulls that staff observed were juveniles feeding on the floating forebay debris. At times during the year, staff noticed groups of gulls, cormorants or grebes outside the normal counting zone. For example, in June, grebes were also not near the navigation lock. Occasionally, staff observed blue and night herons along with a solitary loon. From mid-August to the end of September, staff observed no grebes. From mid-August to December, staff did not observe any pelicans. Finally, staff occasionally observed kingfishers during the year.

Table 4. Predatory Bird Forebay Counts.

Species	First Observation	Spring Bypass Peak Date/Number	Transport Peak Date/Number	Fall Peak Date/Number	Last Observation
Grebe	April 1	Apr. 29 - 107	NA	NA	Dec. 31
Gull	April 1	July 15 - 4	July 22 - 60	NA	Dec. 31
Pelican	April 22	NA	NA	NA	Dec. 31
Cormorant	April 8	April 15 - 2	NA	NA	Dec. 31
Tern	April 29	June 3 - 9	NA	NA	August 12
Osprey	April 8	NA	NA	NA	September 9

Grebe observations and counts are difficult due to their behavior, the various locations they appeared and system operations. There is no accurate way to count grebes. Grebes passed to the gatewell slots from late April to late June, reflecting somewhat the patterns seen in the forebay. Staff observed two grebes in mid-October.

This year, staff estimate that 75 grebes entered the gatewell slots, which is fairly typical. They removed 34 grebes from the slots, including 28 on June 15 and 16. The remaining 41 grebes passed to the collection channel. These birds all passed out of the system. Staff released seven of them from the separator and the other grebes passed during primary bypass. Grebe patterns in the channel reflect those seen in the gatewell slots.

Cooling Water Strainers

In January and July, staff did not examine cooling water strainers. For February, about 105 of the juvenile lamprey mortalities appeared as if they may have expired before the trash rack debris cleaning on February 2 to 7. For April, one of the lampreys was an ammocete. One live smolt was a clipped steelhead. In May, the three dead smolts were unclipped sockeye. In June, the lost smolts were eleven unclipped and eleven clipped sub-yearling Chinook. In August, the lost smolts were three clipped and one unclipped sub-yearling Chinook. In November, staff removed 749 juvenile shad mortalities. In December, staff removed 468 juvenile shad and 150 juvenile perch. All the perch came from unit 14. These last two months may explain predatory bird activity at that time. Table 5 lists cooling water strainer counts.

Table 5. Cooling Water Strainer Results

Date	Lamprey Dead	Lamprey Alive	Smolts Dead	Smolts Alive
January	No inspection.			
February 9	139	27	0	0
Mar. 8 to 10, 28	57	0	0	0
April 13	54	128	0	1
May 16 to 17	14	3	3	0
June 21	45	5	22	0
July	No inspection.			
August 2	9	1	4	0
September 14	0	0	0	0
October 27	0	0	0	0
November 22	0	0	0	0
December 20	0	0	0	0

Recommendations

1. Rehabilitate orifice traps and free up orifices. Also, the 6B trap has no fish outlet.
2. Reinstall unit 4 forebay debris shield and replace three steel bulkheads with concrete.
3. Install drier to remove water from channel orifice air line.
4. Move 48 inch supply valve outside were it would be accessible.
5. Fix channel stairwell lighting.
6. Reinstall second hoist on channel trolley.
7. Automate channel floor valves.
8. Motorize facility emergency water supply valves.
9. Install new GBT pipe.
10. For safety, install raceway escape ladders at east raceway bank.

11. Install new water supply actuators for raceways 5 and 9 west.
12. Install new porosity unit perforated plate.
13. Repaint facility.
14. Extend west raceway drain for juvenile lamprey passage.
15. Install new shop doors.
16. Install new facility heating and cooling system.
17. Monitor trash rack differentials during the winter.
18. Extend the hazing season.