

Oregon Department of Transportation Culvert Repair Programmatic Agreement Pilot Project Final Report 2018-2022

Final ODFW Report



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Background

Under the 2018 Oregon Department of Transportation (ODOT) Culvert Repair Programmatic Agreement (CRPA) Pilot Project, the Oregon Department of Fish and Wildlife (ODFW) is required to complete a written report that includes the effects of the culvert repairs under the agreement and the fish passage improvements implemented with the Fish Passage Compensations Funds. This report describes these actions. This agreement applies to ODOT owned and operated culverts only.

The CRPA agreement allowed ODOT to make site-specific short-term repairs to aging culverts in a cost-effective manner, while providing a net benefit to native migratory fish (NMF) over the status quo by improving fish passage at each site repaired. As part of the agreement, ODOT paid \$2 million into the Fish Passage Conservation Fund, an ODFW managed account that was used to fund high priority fish passage projects off the State highway system to offset delayed full criteria fish passage at the culvert repair sites. ODOT provided an additional \$500,000 due to the number of projects completed under the agreement. In this agreement, ODOT also provided funds for two ODFW/ODOT Fish Passage Liaison Positions for the duration of the agreement. ODOT additionally dedicated \$4.2 million per year to providing full fish passage at high priority fish passage sites on the Oregon highway system regardless of the condition of the infrastructure.

The 2018 CRPA Pilot Project, signed on 1/19/2018, is the second CRPA agreement ODFW has entered into with ODOT. The first agreement, signed 10/10/2014, had the following criteria:

- 1) Culverts must be located west of the Cascades and outside of the ODFW North Coast Watershed District,
- 2) Culvert repairs intended to provide (up to) an additional 25 years of culvert life,
- 3) Repaired culverts must include fish passage improvements, and
- 4) Culverts cannot be identified as a high priority for fish passage as determined by ODFW.

Due to the success of the first CRPA, changes were made to the 2018 CRPA Pilot Project. The 2018 CRPA Pilot Project removed the location restrictions and could be applied to ODOT owned culverts statewide. High priority projects were also allowed but must include all feasible fish passage improvements.

The CRPA includes several key goals and sideboards for ODOT to conduct the culvert repair pilot program. The goals of the CRPA include:

- a) Provide improved fish passage conditions at each culvert repair site.
- b) Address statewide fish passage priority barriers using the \$2.5 million fish passage fund in the most expeditious and efficient way practical.
- c) Improve state highway infrastructure conditions at each culvert repair site to address public safety.
- d) Generate information on the costs, impacts, efficiency, and effectiveness of the CRPA project approach.
- e) Develop a work plan to further identify resources and gather information on fish presence and barriers.

Culvert Repair Programmatic Agreement Pilot Project Repair Sites

2018 CRPA Pilot Project Repair Sites

Map 1. Locations of CRPA Projects in 2018

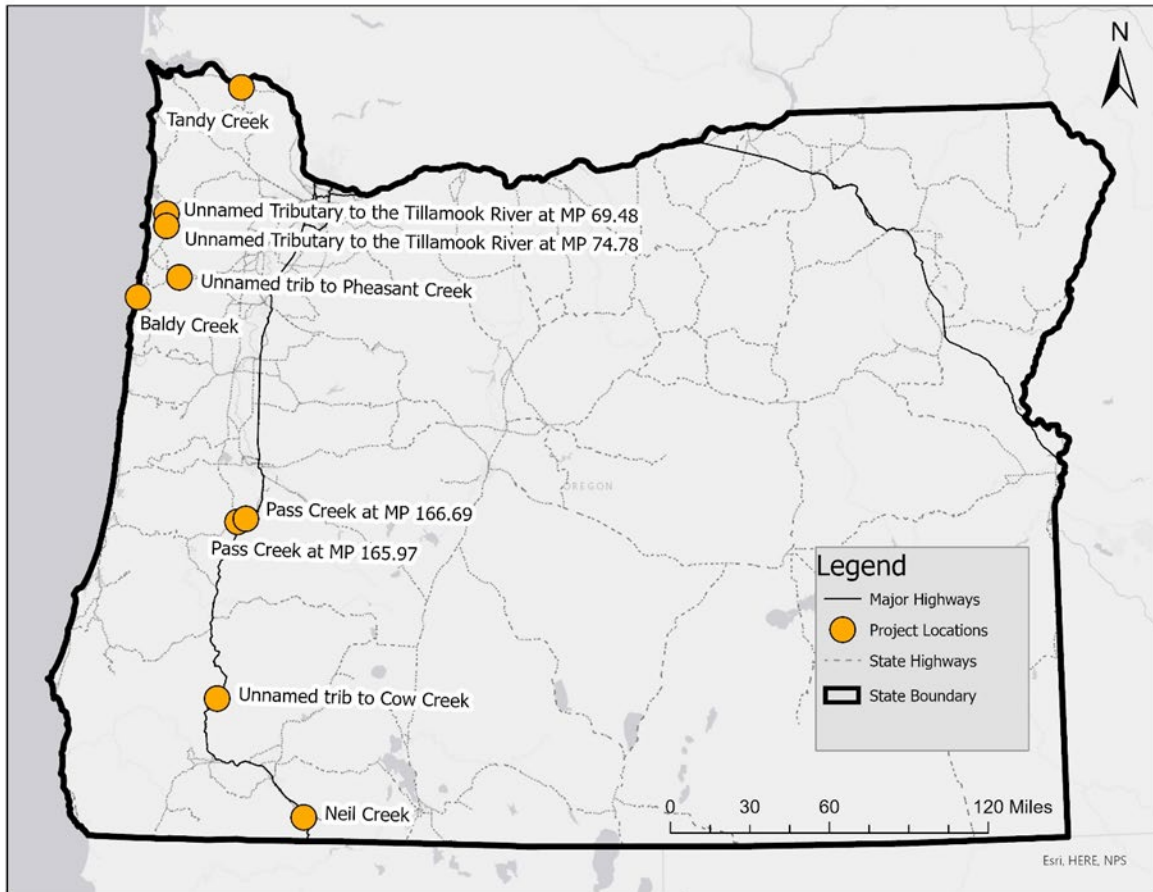


Table 1. Fish Passage Improvements and Native Migratory Species Present

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Pacific Lamprey
Trib. to Pheasant Creek	OR-18, 16.03	8.90	Offset Side Weirs	Present		Present	

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Pacific Lamprey
Neil Creek	I-5, 10.42	4.89	Fish Rocks	Present	Present and ESA Listed	Present	
Pass Creek	I-5, 165.79	3.67	Fish Blocks and Downstream Weir	Present	Present and ESA Listed	Present	
Pass Creek	I-5, 166.69	0.20	Plastic Baffles	Present			
Trib. to Cow Creek	I-5, 84.91	0.20	Baffles	Present			Present
Trib. to Tillamook River	US 101, 69.48	1.79	Fish Rocks	Present	Present and ESA Listed	Present	
Trib. to Tillamook River	US 101, 74.78	0.27	Fish Rocks	Present			
Tandy Creek	US 30, 65.46	0.65	Fish Rocks	Present	Present		Present
Baldy Creek	US 101, 116.35	2.62	Downstream Boulder Weir	Present	Present and ESA Listed		Present

OR 18 MP 16.03 Unnamed Tributary to Pheasant Creek Culvert Repair

Completed September 2018, Figure 1.

Pre-treatment Fish Passage Condition

This culvert drains an unnamed tributary to Pheasant Creek, a tributary to the Little Nestucca River. The tributary passes under OR 18, approximately 5.5 miles west of the city of Grand Ronde in Polk County, Oregon.

This 80-foot long culvert is a 36" diameter corrugated metal pipe (CMP), passing a stream with an estimated active channel width of 14 feet. The culvert's structural condition was considered poor, due to severe settlement and open joint issues. If left untreated, these issues could allow water to escape the culvert and erode the soil arch under the roadway, ultimately leaving the highway unsupported and unsafe. Hydraulic calculations show flow conditions at the culvert had velocities of 2.44 fps and flow depths as low as 1.5 inches (flows ranging between 5 percent and 95 percent of the daily exceedance

stream discharge). This flow exceeded the ODFW fish passage criteria of 2 fps. Species using the habitat upstream of the culvert include cutthroat trout and possibly pacific lamprey. The culvert was a partial velocity barrier to these species, potentially blocking or delaying access to approximately 0.2 miles of habitat.

Post-treatment Fish Passage Condition

The degraded culvert was repaired with a cast-in-place pipe liner that sealed the joints and alleviated the settlement issues, keeping the water flowing inside the culvert. Fish passage was improved with the addition of staggered one-piece polymer baffles with rounded edges. These baffles were placed to decrease the velocities within the culvert and offer ample hydraulic variation for NMF. The rounded edges of the baffles were an important fish passage detail due to the possibility of adult Pacific lamprey in the system. Post-treatment conditions were estimated to have velocities of 1.03 fps and flow depths of 6.7 inches, thus improving access to the approximate 0.2 miles of upstream habitat.

Figure 1: Unnamed Tributary to Pheasant Creek Culvert Repair Before and After

Description: Two images, the first displays water running through the culvert pre-repair. The second shows water running through the culvert post-repair.



I-5 MP 10.36 Neil Creek Culvert Repair

Completed September 2018, Neil Creek was approved under the 2015-2017 CRPA Figure 2.

Pre-treatment Fish Passage Condition

Neil Creek is a tributary to Bear Creek in the Rogue River Watershed and is located approximately 2.7 miles south of Ashland in Jackson County. The Neil Creek culvert crosses under Interstate 5 at mile point

10.36. Neil Creek is a perennial stream with an upstream drainage basin of 10.4 square miles. The basin has approximately 8.9 miles of habitat upstream of I-5 for cutthroat trout, steelhead, and rainbow trout.

This concrete box culvert is 435 feet long, eight feet wide, and eight feet tall. The culvert's condition prior to repair was poor due to invert degradation. Invert degradation allows water to saturate the soil surrounding the culvert. It also erodes away the soil beneath the culvert and can lead to settling. If left untreated, these issues can lead to the roadway becoming unsupported and unsafe. The hydraulic conditions within the culvert presented numerous issues, including passage barriers of increased jump heights over the old concrete weirs and high velocities during high flow.

Post-treatment Fish Passage Condition

The culvert invert and concrete weirs were repaired, amending the invert degradation issue. The repair of the concrete weirs improved fish passage. These lowered the velocity in the culvert and allowed for variation of hydraulic conditions through the culvert to improve NMF passage conditions to the potential 8.9 miles of habitat upstream.

Figure 2: Neil Creek Culvert Repair Before and After

Description: Two images, the first is the pre-repair view inside the concrete box culvert with old weirs on the invert. The second image is inside of the concrete box culvert post-repair with water running through it.



I-5 MP 165.97 Pass Creek Culvert Repair

Completed September 2018, Figure 3.

Pre-treatment Fish Passage Condition

This culvert conveys Pass Creek under I-5 approximately 7.7 miles south-west of Cottage Grove in Douglas County, Oregon. Pass Creek is a tributary to Elk Creek in the Umpqua River basin.

The 12-foot diameter CMP is 284 feet long and drains an area of 5.27 square miles. The culvert's surveyed condition was considered poor due to corrosion and a missing section of the invert. If left untreated, this could become a potential hazard to the traveling public due to water saturating and

destabilizing the surrounding soil arch and roadbed, leading to settlement of the culvert that could leave the roadway unsupported.

The stream has an estimated active channel width of 15 feet. Water velocities during high flow conditions and shallow water depths during low flow conditions created a partial barrier for the upstream movement of fish through the culvert. Cutthroat trout, steelhead, rainbow trout, and ESA listed coho salmon were potentially blocked or delayed from accessing the approximately 4.89 miles of upstream habitat due to these conditions.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert treatment. This allowed for the degraded invert condition to be restored, keeping the water inside the barrel. Installing an 18-inch pre-cast concrete fish blocks at 10-foot intervals through the pipe improved fish passage. These blocks slow water velocities during high flow events, increase flow depth during low flow conditions, and create flow complexity within the culvert. The resulting conditions improve fish passage and increase access to the 4.89 miles of upstream habitat.

Figure 3: Pass Creek Culvert Repair Before and After

Description: Two images, the first shows the outlet end of the culvert pre-repair with water running through it. The second image shows the outlet of the culvert post-repair with water running through it.



I-5 MP 166.69 Pass Creek Culvert Repair

Completed August 2018, Figure 4.

Pre-treatment Fish Passage Condition

This culvert conveys Pass Creek under I-5 approximately 6.0 miles south-west of Cottage Grove in Douglas County, Oregon. Pass Creek is a tributary to Elk Creek in the Umpqua River basin. This culvert is an 8-foot circular CMP and is 234 feet long. In this location, Pass creek has an estimated active channel width of 15 feet. The culvert was considered to be in critical condition, mainly due to invert damage, water piping (water flowing on and around the outside or damaged sections of the pipe), and some end

treatment issues that, if left untreated, could allow water to saturate the soil surrounding the culvert. This could cause the culvert to settle and the soil to erode, ultimately leaving the roadway unsupported.

Fish passage issues included high velocities during high water events, shallow depths during low flow events, and a small perch at the culvert outlet. These passage issues potentially prevented or delayed access for cutthroat trout, coho salmon, steelhead, and rainbow trout to the 3.67 miles of available upstream habitat.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert. This restored the invert integrity, resolved the water piping issues, and improved the end treatment to help keep the water flowing through the culvert and not around it and in the surrounding soil. Installing 10- inch pre-cast concrete fish blocks at 5-foot intervals throughout the culvert improved fish passage. The fish blocks increase flow depths during low flow, create eddies and flow complexities within the culvert, and reduce velocities during high flow. A weir was constructed downstream of the culvert outlet to increase the outlet pool elevation and reduce the 6-inch perch, allowing for improved access to the 3.67 miles of habitat upstream.

Amendment (Summer 2019)

Post-construction monitoring of the project documented that the specified rocks in the downstream weir were undersized, was not embedded into the channel, and not fully sealed, allowing water to flow through the rocks rather than maintaining surface flow. The following winter, a high water event displaced the rocks of the weir. Although subsequent high flow events recruited natural streambed material in the proximity of the original weir location, the ultimate backwater condition at the culvert outlet does not improve fish passage to the extent designed. Monitoring of the project continues to see how the natural recruitment of sediment will ultimately backwater the site. If the site does not backwater to the extent designed, a modification will be made during the applicable IWWP.

Figure 4: Pass Creek Culvert Repair Before and After

Description: Two images, the first shows the outlet end of the culvert pre-repair with water running through it. The second image shows the inside of the outlet of the culvert post-repair with water running through it.



Note on Pass Creek Culverts

These two projects on Pass Creek are part of a series of culvert improvements done along a two-mile stretch of I-5. A culvert at mile point 165.9 was repaired under the CRPA in 2017. The two culverts repaired in 2018 were at mile points 165.97 and 166.69. Additionally, two culverts are planned for 2019 and 2020 at mile points 167.04 and 167.17, respectively. Pass Creek flows south along I-5. Therefore, the increasing mile points correspond to movement upstream in the Pass Creek watershed. The amount of habitat above each culvert is reported in each CRPA report.

I-5 MP 84.91 Unnamed Tributary to Cow Creek Culvert Repair

Completed August 2018, Figure 5.

Pre-treatment Fish Passage Condition

This culvert passes an unnamed tributary at approximately 14 miles south of Canyonville, Oregon, leading into Cow Creek within the Umpqua River basin.

The culvert is an arch culvert 244 feet long and 36 tall and 54 inches wide with an estimated active channel width of six feet. The culvert was in critical condition due to severe distortion creating a structural blockage of the pipe and open joints. These issues, if left untreated, could compromise the safety of the roadway due to the surrounding soil arch eroding away through the open joints caused by the distortion, ultimately leaving the above roadway unsupported.

The intermittent tributary goes dry during the summer low flow period but provides refuge for cutthroat trout during winter higher flows. ODFW predicts the velocity through the culvert to be over 2 fps during much of the high flow season and would prevent or impede passage upstream. There are 0.2 miles of upstream habitat for cutthroat trout that was possibly inaccessible due to these conditions.

Post-treatment Fish Passage Condition

This critical condition culvert was repaired with a cured in place pipe liner, which realigned the distortion, closed the joints, and allowed for removal of the structural blockage. Through this repair, the surrounding soil arch is no longer exposed to the flowing water and, in turn, at risk of erosion. Installation of plastic baffles to provide hydraulic complexity and flow variations through the culvert improved fish passage. This aims to slow the water velocity during higher flow periods and improves access to the upstream 0.2 miles of high water refuge habitat.

Figure 5: Unnamed Tributary to Cow Creek Culvert Repair Before and After

Description: Two images, the first looks at the end of an arch culvert pre-construction, grass growing along the top, and thin layer of sediment in the bottom. The second image is post-repair, looks at the end of the arch culvert, it is surrounded by rock with baffles installed inside.



OR 101 MP 69.48 Unnamed Tributary to the Tillamook River Culvert Repair

Completed September 2018, Figure 6.

Pre-treatment Fish Passage Condition

The culvert passes an unnamed tributary that leads to the Tillamook River in Tillamook County, approximately 3.5 miles south of Tillamook, Oregon.

This tributary drains an area of 0.67 square miles and flows into the Tillamook River just downstream from the culvert. Water through the culvert is backwatered from the Tillamook River during high flows. Although flow in the tributary is low during the summer months, it provides refuge habitat during moderate and high flows.

The corrugated metal culvert is five feet wide and 98 feet long, with an estimated 11-foot wide active channel width. It was considered to be in critical condition due to a rusted invert condition. If left untreated, the soil below the culvert could erode allowing the culvert to settle into that open space. Ultimately then allowing water to flow around the culvert, saturating and eroding the above soil and roadbed to leave the roadway unsupported.

The velocity within the culvert at high flow was modeled to be 4.44 fps with a flow depth of 3.9 inches. This flow exceeds the ODFW fish passage criteria of 2 fps. Species using the tributary include cutthroat trout, ESA listed coho salmon, steelhead, and rainbow trout, with a potential 1.74 miles of habitat upstream.

Post-treatment Fish Passage Condition

An invert pave was used to repair the culvert, allowing the bottom of the culvert to be resurfaced and hold the water inside the culvert. Adding 20-inch fish rocks to create flow variations and to slow water velocities improved fish passage. The modeled water velocity after construction was 1.77 fps at a depth of 7.3 inches. This lowered velocity and increased hydraulic variation within the culvert, improving access to the 1.74 miles of habitat upstream for juvenile rearing of salmon and steelhead and spawning and rearing for coastal cutthroat trout.

Figure 6: Unnamed Tributary to the Tillamook River Culvert Repair

Description: Two images, the first is the inside of the culvert pre-repair. The second is inside the culvert post-repair. Here we can clearly see concrete on the invert and fish rocks installed.



OR 101 MP 74.78 Unnamed Tributary to the Tillamook River Culvert Repair

Completed September 2018, Figure 7.

Pre-treatment Fish Passage Condition

This culvert carries an unnamed tributary of the Tillamook River in the Tillamook basin, located approximately nine miles south of the city of Tillamook within Tillamook County.

The culvert is an elliptical corrugated metal pipe six and a half feet in height, five feet in width, and 140 feet in length. Its condition was critical due to a severely corroded invert that could potentially, if left untreated, allow water to saturate the surrounding soil arch and roadbed. If allowed to worsen, this could then lead to settlement of the pipe and erosion of the soil, ultimately leaving the roadway unsupported. The estimated active channel width is 10 feet.

The tributary contains cutthroat trout, with a potential 0.27 miles of habitat located upstream of the culvert. One of the most pressing fish passage was velocity and depth, measured at 3.78 fps with flow depths of four inches.

Post-treatment Fish Passage Condition

The culvert was repaired with an invert pave. This resurfaced the culvert's invert, lowering the previous concern of saturation, erosion, and the lack of support for the roadway. Installation of 24-inch fish rocks improved fish passage at this culvert. These provided hydraulic breaks and lowered water velocity to 1.5 fps at a flow depth of 7.5 inches. By reducing the velocity and increasing depths through the culvert and creating hydraulic variation within the culvert, there is improved passage to the 0.27 miles of upstream habitat.

Figure 7: Unnamed Tributary to the Tillamook River Culvert Repair

Description: Two images, the first is looking down at the mitered slope end treatment pre-repair. The second is looking down at the mitered slope end treatment post repair.



U.S. 30 MP 65.46 Tandy Creek Culvert Repair

Completed September 2018, Figure 8.

Pre-treatment Fish Passage Condition

Tandy Creek is a tributary of Westport Slough, which connects to the Columbia River. The culvert is located at mile point 65.46, approximately four miles west of Clatskanie, in Columbia County, Oregon. The Tandy Creek culvert is one of two culverts that drain a 1.62 square miles drainage area. The creek splits around an agricultural field and rejoins into one watershed just downstream of this culvert.

The active channel width of this section of Tandy Creek is approximately nine feet. The four foot wide, 90-foot long culvert is tidally influenced. Before the repair, the culvert was backwatered during high tide, but became perched at low tide with a 3.5-foot jump. The creek is home to cutthroat trout, coho salmon, and Pacific lamprey, additionally, all these species would benefit to improved access to the potential 2.62 miles of habitat upstream of the culvert. The culvert itself was in poor condition due to general barrel issues such as heavy corrosion, but also due to the presence of a bulge in the crown under the roadbed. This was concerning because if left untreated, the bulge could weaken and give way. The soil and roadbed compacted above the culvert could then erode away, leaving the above roadway unsupported.

Post-treatment Fish Passage Condition

Centrifugal cast concrete was used to line the entire pipe. This reinforced the whole structure of the culvert, including the crown bulge. A boulder weir was installed downstream to backwater the culvert outlet, addressing the fish passage barrier. This increased the depth by six inches during low tide, overall minimizing outlet's perch and decreasing the jump height. These repairs improve access to the 2.62 miles of upstream habitat, including over one mile of juvenile coho rearing habitat.

Amendment (Summer 2019)

The downstream weir did not seal enough to adequately backwater the culvert when it was installed initially. Adjustments were made in the following months with the installation of additional rocks and fine sediments into the weir. The result of the adaptive management work continues to be monitored to ensure the weir is functioning as designed.

Figure 8: Tandy Creek Culvert Repair Description: Two photos, the first shows the outlet end of the culvert recently dug out of the mud pre-repair, with water running through it. The second photo shows standing water at the post repaired outlet of the culvert.



U.S. 101 MP 116.35 Baldy Creek Culvert Repair

Completed September 2018, Figure 9.

Pre-treatment Fish Passage Condition

Baldy Creek is a direct tributary to the Pacific Ocean. The stream flows through the small town of Nelscott, north of Lincoln City, in Lincoln County, Oregon. Baldy Creek has a basin area of 0.69 square miles and a six-foot active channel width at the highway crossing. The 45-foot long, three and a half foot wide corrugated metal culvert is undersized for average flows. It presents a velocity barrier to cutthroat trout, with an average velocity of 5.01 fps. The culvert was in critical condition due to open joints, severe corrosion of the invert, and cracks in the metal. With time, these conditions could lead to the further collapse of the culvert, water outside the barrel, and the erosion through the open joints of the surrounding soil arch and roadbed, eventually leaving the roadway unsupported and unsafe. The culvert is partially blocking access to 0.65 miles of potential habitat.

Post-treatment Fish Passage Condition

The culvert was replaced with a centrifuge cast concrete pipe liner, which sealed the joints and the cracks and covered the degrading invert. Through these repairs, water is now staying within the culvert and lessened the pre-repair structural concerns. Along with the liner, 15-inch fish rocks were installed to provide hydraulic complexity in the culvert and slow water velocities. The estimated velocity in the culvert after treatment is 1.92 fps, which meets ODFW's requirements for fish passage for adults and juvenile NMF. By decreasing velocity and increasing depth there is now improved access for NMF to the 0.65 miles of upstream habitat.

Figure 9: Baldy Creek Culvert Repair

Description: Two images, the first shows water running through the inside of the culvert pre-repair. The second image shows water running through the culvert with fish rocks post-repair.



2019 CRPA Pilot Project Repair Sites

Map 2. 2019 Locations of CRPA Projects

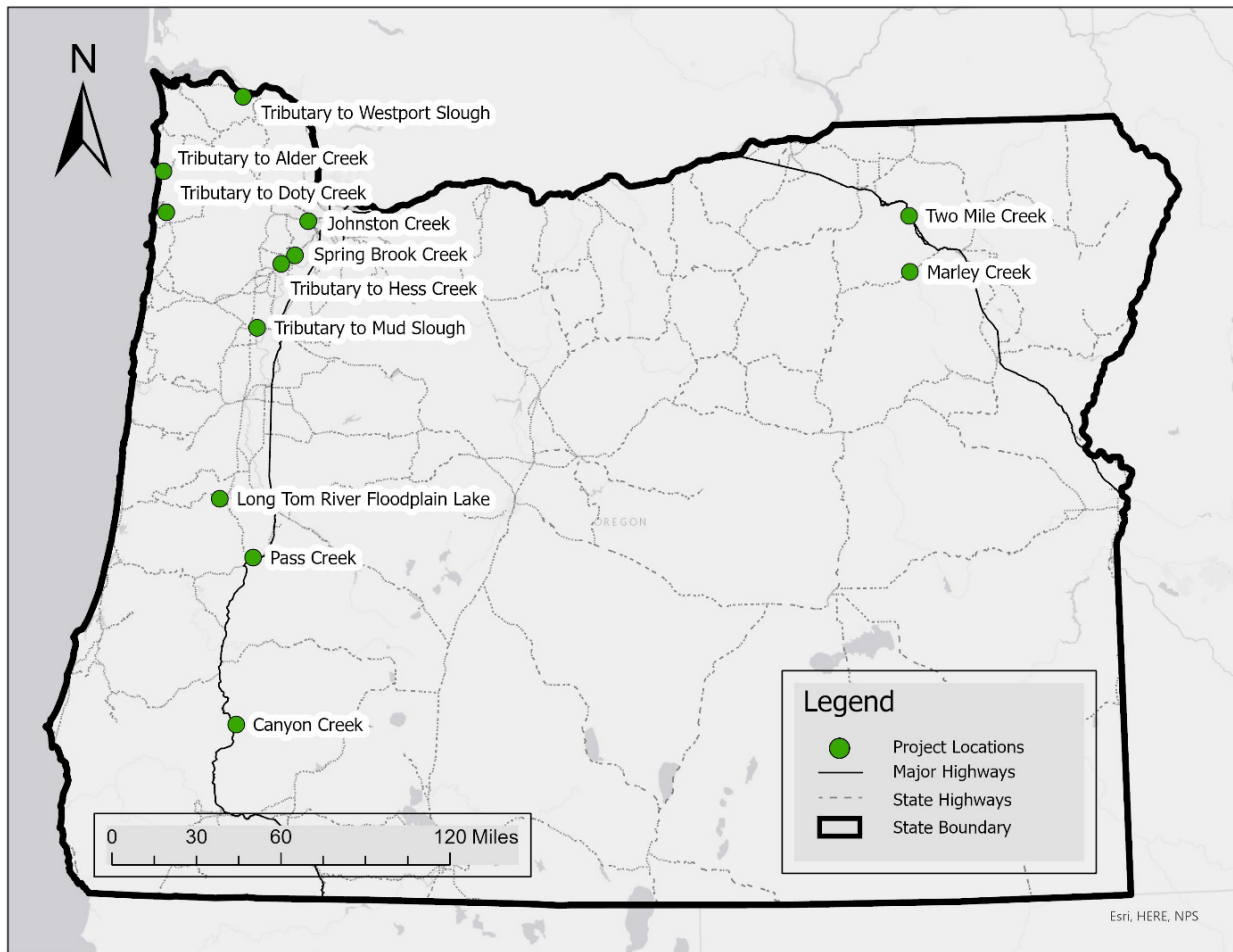


Table 2. Fish Passage Improvements Analysis

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Other NMF Species
Johnston Creek	OR 8, 4.97	4.92	Fish Rocks	Present		Present and ESA Listed	Pacific Lamprey
Unnamed Tributary to Mud Slough	OR 22, 18.48	5.05	Fish Rocks	Present			

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Other NMF Species
Unnamed Tributary to Westport Slough	US 30, 68.7	1.55 Acres	Boulder receiving pool	Present	Present	Present	Pacific Lamprey, chinook, chum, sockeye
Spring Brook Creek	OR 99W, 20.85	0.14	Replacing undersized downstream culvert	Present			Western Brook Lamprey
Unnamed Tributary to Hess Creek	OR 99W, 26.91	0.2	Boulder weir	Present			
Long Tom River Floodplain Lake	OR 126, 44.17	0.75	Fish Rocks	Present			
Unnamed Tributary to Doty Creek	US 101, 61.46	3.05	Fish Rocks	Present	Present and ESA Listed	Present	Chum – ESA Listed
Unnamed Tributary to Alder Creek	US 101, 44.43	6.9	Fish Rocks	Present	Present and ESA Listed	Present	
Canyon Creek	I-5, 95.07	15.15	Fish rocks and roughened channel	Present	Present and ESA Listed	Present	
Pass Creek	I-5, 167.04	3.5	Fish Rocks and roughened channel	Present	Present and ESA Listed	Present	Pacific Lamprey
Marley Creek	OR 244, 31.03	5.89	Baffles and roughened channel			Present and ESA Listed	Redband
Two Mile Creek	I-84, 236.31	1.96	Fish baffles			Present and ESA Listed	Redband Trout

OR 8 MP 4.97 Johnston Creek Culvert Repair

Completed October 2020, Figure 10.

Pre-treatment Fish Passage Condition

This culvert drains Johnston Creek, a tributary to Beaver Creek. Johnston Creek passes under OR 8, approximately 1.5 miles west of the city of Beaverton in Washington County, Oregon. These double barrel 80-foot long culverts are 11-foot diameter corrugated metal pipes (CMP). The two culverts are set at different elevations, with the Eastern most culvert carrying the low flow channel.

The structural conditions of these culverts was critical due to significant corrosion. The culverts were collapsing causing sagging and roadway cracking on the highway. A fatal accident occurred at this location due to a partial roadway collapse over the culverts. Significant repairs to the culverts would trigger Oregon's fish passage rules, and in August of 2018 ODOT declared these culverts an emergency and began the process of planning to address fish passage at this location under the CRPA. Internal cross-bracing to support the culverts was completed in the spring of 2019, with fish passage improvements and further repair work were implemented in 2020.

Hydraulic calculations showed flow conditions at the culvert had velocities over 2 fps and flow depths as low as 4 inches (flows ranging between 5 percent and 95 percent of the daily exceedance stream discharge). This flow exceeded the ODFW fish passage criteria of 2 fps. Species using the habitat upstream of the culvert include cutthroat trout, ESA listed steelhead/rainbow trout and pacific lamprey. The culvert was a partial velocity barrier to these species, potentially blocking or delaying access to approximately 4.95 miles of habitat, including a sizable beaver wetland complex.

Post-treatment Fish Passage Condition

The degraded culverts were repaired with an invert pave that sealed and reinforced the failing corrosion and returned structural integrity to the culverts. Fish passage was improved with the addition of fish rocks in lower culvert. The repair work was completed in 2019, and the fish passage improvements were completed in 2020. These fish rocks were placed in the east culvert to decrease the velocities within the culvert and offer ample hydraulic variation for NMF. Posttreatment conditions were estimated to have velocities approximately 2.1fps, down from over 3 fps and flow depths of over 7 inches, thus improving access to the approximate 4.95 miles of upstream habitat.

Figure 10: Johnston Creek Culvert Repair, Before and After

Description: Two images, the first displays the culvert pre-repair. The second shows the culvert post-repair before water was returned to the system.



OR 22 MP 18.48 Unnamed Tributary to Mud Slough Culvert Repair

Completed August 2019, Figure 11.

Pre-treatment Fish Passage Condition

This unnamed tributary to Mud Slough runs through heavily impacted agriculture land before passing under highway 22 approximately 2.5 miles east of Rickreal, Oregon. This tributary flows seasonally, going dry during the summer months, but transporting a 2-year peak flow of 59 feet³/s during the wet season. The aquatic habitat upstream of the culvert is suitable for seasonal use by cutthroat trout. The watershed drains an area of 1.78 square miles and contains 5.05 miles of potential habitat for cutthroat trout.

The 182-foot long, 5-foot diameter culvert is undersized for the 10-foot active channel width of the stream, and was a partial velocity barrier prior to treatment. The velocity of the culvert during high flows likely affected the ability of fish to migrate upstream during the time of year they would most likely utilize the habitat in the stream.

Although the culvert was rated in fair condition following initial inspections, subsequent inspection efforts determined that the amount of invert rusting was enough to warrant repair. Degradation of a culvert invert allows water to saturate the soil surrounding the culvert. It also erodes away the soil beneath the culvert and can lead to settling. If left untreated, these issues can lead to the roadway becoming unsupported and unsafe.

Post-treatment Fish Passage Condition

The rusting culvert was repaired by a Centrifugally Cast Concrete to amend structural issues caused by rust. Fish passage was improved by the addition of fish rocks to slow water velocity, increase hydraulic diversity, and better facilitate fish passage during high flows. The fish rocks lowered the velocity in the culvert and allowed for variation of hydraulic conditions through the culvert to improve NMF passage conditions to the potential 5.05 miles of habitat upstream.

Figure 11: Unnamed Tributary to Mud Slough Culvert Repair, Before and After
Description: Two images, the first is the pre-repair view inside the culvert. The second image is of fish rocks inside of the culvert post-repair with water running through it.



US 30 MP 68.7 Unnamed Tributary to Westport Slough

Completed September 2019, Figure 12.

Pre-treatment Fish Passage Condition

This culvert conveys flows from a wetland complex and tidal flows from Westport slough under US 30 approximately 7.29 miles west of Clatskanie in Columbia County, Oregon. Westport slough is a side channel in the floodplain of the Columbia River.

The 18 inch diameter CMP is 95 feet long and drains an area of 1.55 acres of habitat and floodplain. The culvert's surveyed condition was considered critical due to corrosion. If left untreated, this could become a potential hazard to the traveling public due to water saturating and destabilizing the surrounding soil arch and roadbed, leading to settlement of the culvert that could leave the roadway unsupported.

The area around the culvert is tidally influenced. The culvert was backwatered during high tides, however there was a 4-12 inch perch at low tides. The height of the perch was determined by the height of the tide. The perch created a jump height, preventing cutthroat from accessing upstream floodplain habitat during low tides.

Post-treatment Fish Passage Condition

Fish passage was improved at the outlet of the culvert by building two boulder receiving pools. The culvert was repaired with a CIPP liner. This allowed for the degraded invert condition to be restored, keeping the water inside the barrel. Installing two downstream u shaped boulder receiving pools improved fish passage. These pools slow velocities during outgoing tides, backwatering the culvert for longer durations, and reducing the perched condition of the culvert at low tide. The resulting conditions improve fish passage and increase access to the 1.55 acres of upstream habitat.

Post-construction monitoring at this site determined that the boulder receiving pools did not fully seal and backwater the culvert to the designed plans. Adaptive management in 2020 included resealing the weir with fine material to backwater the culvert to designed condition. The site will continue to be monitored to ensure the weir functions as intended.

Figure 12: Unnamed Tributary to Westport Slough Culvert Repair, Before and After

Description: Three images, the first shows the outlet end of the culvert pre-repair with water running through it, the culvert is perched ~4 inches. The second image shows the outlet of the culvert post-repair with water running through it, the perch at the outlet of the culvert has been improved. The third photo shows the conditions at the outlet following adaptive management work in 2020, where there is no longer a perch.



OR 99W MP 20.85 Spring Brook Creek Culvert Repair

Completed September 2019, Figure 13.

Pre-treatment Fish Passage Condition

This culvert conveys a tributary of Spring Brook Creek under highway 99 west approximately 1.28 miles east of Newberg in Yamhill County, Oregon. Spring Brook Creek is a tributary to the Willamette River.

The culvert drains an area of 0.21 square miles which is heavily influenced by spring fed runoff, there are 0.14 miles of fish habitat for cutthroat trout upstream of the culvert. The culvert is an arch culvert with a box culvert on both ends. The box culvert sections are 3-feet high by 4-feet wide and the entire culvert is 132 feet long. The transitions between the arch and the boxes on each end were not sealed. The culverts surveyed condition is fair. Roadway fill had begun to leak into the culvert. The culvert also fills with sediment and needs to be cleaned yearly. If left untreated this condition is potentially hazardous to the traveling public due to road destabilization which leaves the roadway unsupported.

Conditions at the ODOT culvert under highway 99 were not a barrier to fish passage. However, approximately 30 feet downstream from this culvert is a private road crossing. The culvert on this road crossing was a 3-foot diameter culvert, which was undersized and placed at a stream elevation that was not conducive to fish passage. Conditions at this lower culvert presented a passage barrier to cutthroat trout downstream from the ODOT culvert.

Post-treatment Fish Passage Condition

Under the CRPA agreement, if fish passage cannot be improved at the repair site, fish passage can be improved at the next barrier upstream or downstream of the culvert to be repaired. At this location, fish passage was improved by replacing the next culvert downstream. The 3-foot culvert was undersized, creating a velocity barrier to fish passage. ODOT designed and installed a new culvert meeting hydraulic criteria for fish passage. The new 6-foot diameter corrugated plastic pipe meets full fish passage requirements, and improves access for cutthroat trout to 0.14 miles of habitat.

The ODOT culvert is planned to be repaired by grouting the joints between the arch culvert and the box culverts. Additionally a CCCP liner will be installed through the culvert. As of the writing of this report, the repair work had not been completed at this location due to ODOT Region contracting capacity.

After installing the new culvert downstream of the ODOT culvert, it was found that the elevations of the new structure were higher than designed. The difference of designed versus constructed elevations was not significant, and did not create a fish passage issue. As the site was monitored over time, it was observed that the new structure has not settled. While providing fish passage, it is not helping to flush out the ODOT culvert as anticipated. The site continues to be monitored annually to ensure volitional fish passage is provided.

Figure 13: Spring Brook Creek Culvert Repair, Before and After

Description: Two images, the first shows the outlet end of the private culvert pre-replacement with water running through it. The second image shows the outlet of the culvert post replacement with water running through it.



OR 99W MP 26.91 Unnamed Tributary to Hess Creek Culvert Repair

Completed September 2019, Figure 14.

Pre-treatment Fish Passage Condition

This culvert conveys an unnamed tributary to Hess Creek under highway 99 west approximately 0.8 miles south-west of Dundee in Yamhill County, Oregon. Hess Creek is a tributary to the Willamette River. This culvert is a 2.5-foot circular CMP with concrete ends, and is 238 feet long. In this location, the tributary has an estimated active channel width of seven feet. The culvert was considered to be in critical condition due to rust in the CMP sections, and disjointed segments on the outlet section. The rusted sections of CMP can lead to water piping (water flowing on and around the outside or damaged sections of the pipe), that, if left untreated, could allow water to saturate the soil surrounding the culvert. This could cause the culvert to settle and the soil to erode, ultimately leaving the roadway unsupported. Fish passage issues included a small perch at the culvert outlet and high velocities due to the slope. This perched condition likely prevented or delayed access for cutthroat trout to the 0.20 miles of available upstream habitat.

Post-treatment Fish Passage Condition

Fish passage was improved by the addition of three downstream boulder weirs. These weirs backed water up at the outlet of the culvert and reduced the jump height for cutthroat migrating upstream.

Post treatment monitoring has shown that some of the weirs have not sealed as designed. While the culvert outlet continues to be backwatered, the loss of surface flows through the weirs have created increased jump heights over the weirs themselves. Work will be completed in 2021 to introduce more stream material to re-seal the weirs.

Figure 14: Unnamed Tributary to Hess Creek Culvert Repair, Before and After

Description: Two images, the first shows the outlet end of the culvert pre-repair illustrating the perched condition. The second image shows the outlet of the culvert post-repair with one downstream boulder weir. The boulder weir has backed up water and reduced the perched condition.



OR 126 MP 44.17 Long Tom River Floodplain Lake Culvert Repair

Completed August 2019, Figure 15.

Pre-treatment Fish Passage Condition

This culvert connects two parts of a wetland / lake that is segmented by highway OR 126. The culvert is a CMP arch inside of a concrete outer liner, and is 48 inches wide, 36 inches tall, and 119 feet long. The culvert was considered to be in fair to poor condition due to distortion, barrel damage and rust throughout its length.

These issues, if left untreated, could compromise the safety of the roadway due to the surrounding soil arch eroding away through the open joints caused by the distortion, ultimately leaving the above roadway unsupported.

The lake and floodplain habitat is used by cutthroat trout, and the ability of these species to navigate the culvert is primarily determined by lake and floodplain elevations. 0.75 miles of habitat exists on the upstream side of the highway. During periods of heavy rain, however; higher velocities resulting from differences in the floodplain and lake water surface elevations could lead to reduced fish passage at this location. In addition, shallow sheet flows can occur during low flow periods, reducing the window for fish to pass the culvert.

Post-treatment Fish Passage Condition

The rusting culvert was repaired with centrifugally cast concrete to increase the stability. Through this repair, the surrounding soil arch is no longer exposed to the flowing water and, in turn, at risk of erosion. The deteriorating rusted sections were sealed through this process, adding years of service life to the culvert.

Fish passage was improved by the addition of fish rocks to slow water velocities during high flows, and increase depth during lower flows to increase the amount of time that the culverts are passable.

Figure 15: Long Tom River Floodplain Lake Culvert Repair, Before and After

Description: Two images, the first looks at the end of an arch culvert pre-construction, where the culvert invert is showing signs of rust and deterioration. The second image is post-repair, and looks in the end of the arch culvert. The interior of the culvert shows new concrete around the perimeter, and fish rocks placed on the inlet.



OR 101 MP 61.46 Unnamed Tributary to Doty Creek Culvert Repair

Completed August 2019, Figure 16.

Pre-treatment Fish Passage Condition

This culvert carries an unnamed tributary of Doty creek under US 101 near Bay City. This CMP culvert is 54 inches wide, 36 inches tall, and 83 feet in length. The original inspection of the culvert rated it in good condition, however; subsequent survey documented a rusted invert and channel scour at the inlet and outlet ends. If left untreated, the soil below the culvert could erode allowing the culvert to settle into that open space. Ultimately then allowing water to flow around the culvert, saturating and eroding the above soil and roadbed to leave the roadway unsupported.

During periods of high flow, velocities through the crossing were observed to be high, creating a passage barrier for fish migrating upstream.

Native Migratory Fish species at this location include cutthroat trout, ESA Coho salmon, steelhead and rainbow trout, and chum salmon. 3.05 miles of habitat is available for these species upstream of US 101.

Post-treatment Fish Passage Condition

An invert pave was used to repair the culvert, allowing the bottom of the culvert to be resurfaced and hold the water inside the culvert. Fish passage was improved through the addition of fish rocks. These rocks create flow variations and slow water velocities to improve fish passage during high water events. In addition, the rocks consolidate low flows, creating more depth during low flow periods.

Post construction monitoring revealed a small, preexisting perch was slightly exacerbated at the outlet of the culvert due to the addition of the concrete invert liner. This raised the water surface elevation inside the culvert, exacerbating a jump for upstream migrating fish to enter the culvert. Adaptive management of the site was completed in 2021, where the concrete liner on the outlet section was ground down to reduce the perch. The site will continue to be monitored to ensure fish passage improvements function as intended.

Figure 16: Unnamed Tributary to Doty Creek Culvert Repair, Before and After

Description: Two images, the first is the inside of the culvert pre-repair. The second is inside the culvert post-repair. Here we can clearly see fish rocks installed.



OR 101 MP 44.43 Unnamed Tributary to Alder Creek Culvert Repair

Completed September 2019, Figure 17.

Pre-treatment Fish Passage Condition

Alder Creek crosses under US 101 near Nehalem, Oregon. At this location, there are two 72-inch diameter CMP culverts, set at different elevations. Both culverts are 76 feet long. During low flows, the creek is conveyed through the lower of the two culverts, and the second culvert is activated during moderate and high flows. The higher culvert was found to be in poor condition due to distortion, open joints, a rusted invert, and outlet scour. If left untreated, these conditions could allow water to saturate

the surrounding soil arch and roadbed. If allowed to worsen, this could then lead to settlement of the pipe and erosion of the soil, ultimately leaving the roadway unsupported.

Alder Creek contains cutthroat trout, ESA Coho salmon, and steelhead/rainbow trout, and has a potential of 6.9 miles of habitat located upstream of the culvert. One of the most pressing fish passage issues was velocity during moderate and high flow events.

Post-treatment Fish Passage Condition

The culvert was repaired with an invert pave. This resurfaced the culvert's invert, lowering the previous concern of saturation, erosion, filled the voids in the culvert, and addressed the lack of support for the roadway. Installation of fish rocks improved fish passage at this culvert. These provided hydraulic breaks and lowered water velocity. By reducing the velocity and increasing depths through the culvert, and creating hydraulic variation within the culvert, there is improved fish passage to the 6.9 miles of upstream habitat.

Figure 17: Unnamed Tributary to Alder Creek Culvert Repair, Before and After

Description: Two images, the first is looking inside the culvert pre-repair. The second is looking inside the culvert post-repair. We can see the paved invert of the culvert and installed fish rocks post-project.



I-5 MP 95.07 Canyon Creek Culvert Repair

Completed August 2019, Figure 18.

Pre-treatment Fish Passage Condition

Canyon Creek is a major tributary of the South Umpqua River, and is located near Canyonville, OR. This culvert repair was completed under an off ramp of Interstate 5 near milepost 95. The culvert is large CMP culvert that is 134 inches wide, 144 inches tall, and 113 feet long. The culvert was rated in poor condition due to invert degradation, general barrel damage, and outlet scour. Previously, the culvert had a paved invert installed as a repair, and the repair had degraded over time due to high rates of sediment load in the system.

The culvert had a significant (2') perch at the outlet, and high velocities during moderate and high flow events. In addition, shallow sheet flows were common during periods of low flow. Upstream of the crossing, there is approximately 15.15 miles of potential habitat available, however; more passage

barriers do exist upstream of the crossing. Cutthroat trout, Coho salmon, steelhead, Pacific lamprey, and rainbow trout all utilize Canyon Creek in this location.

Post-treatment Fish Passage Condition

To repair the culvert, a section of the old concrete invert was first removed. A rebar cage was constructed and installed in the bottom of the culvert, and new concrete invert liner was installed. To address the large jump at the culvert outlet, 140 feet of the downstream channel was reconstructed, backing water up to the culvert outlet. Fish passage was further improved by the addition of fish blocks in the barrel of the culvert which reduced high flow velocities, provided refuge locations, and increased low flow depths.

Figure 18: Canyon Creek Culvert Repair, Before and After

Description: Two photos, the first shows the outlet end of the culvert with water running through it, this clearly illustrates the perched condition of the culvert. The second photo shows standing water at the post-repaired outlet of the culvert, and fish blocks placed through the culvert.



I-5 MP 167.04 Pass Creek Culvert Repair

Completed September 2019 Figure 19.

Pre-treatment Fish Passage Condition

This culvert conveys Pass Creek under I-5 approximately 6.0 miles south-west of Cottage Grove in Douglas County, Oregon. Pass Creek is a tributary to Elk Creek in the Umpqua River basin. This culvert is an 8-foot circular CMP and is 214 feet long. In this location, Pass creek has an estimated active channel width of 15 feet. The culvert was considered to be in poor condition, mainly due to invert damage, water piping (water flowing on and around the outside or damaged sections of the pipe), and some end treatment issues that, if left untreated, could allow water to saturate the soil surrounding the culvert. This could cause the culvert to settle and the soil to erode, ultimately leaving the roadway unsupported.

Fish passage issues included a one foot perch at the culvert outlet, high velocities during high water events, and shallow depths during low flow events. These passage issues prevented or delayed access for cutthroat trout, Coho salmon, steelhead, and rainbow trout to the 3.5 miles of available upstream habitat.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert. This restored the invert integrity, resolved the water piping issues, and improved the end treatment to help keep the water flowing through the culvert and not around it and in the surrounding soil. A roughened riffle was installed downstream of the culvert to backwater the culvert outlet, alleviating the jump height. Installing fish rocks at 5-foot intervals throughout the culvert improved fish passage. The fish rocks increase flow depths during low flow, create eddies and flow complexities within the culvert, and reduce velocities during high flow.

Figure 19: Pass Creek Culvert Repair, Before and After

Description: Two images, the first shows the outlet of the culvert and a perch creating a jump height pre-repair. The second image shows water running through the culvert backwatered with no jump height post-repair.



Note on Pass Creek Culverts

This project on Pass Creek is part of a series of culvert improvements done along a two-mile stretch of I-5. In 2017, a culvert at mile point 165.9 was repaired under the CRPA. Two culverts were repaired under the agreement in 2018, and were located at mile points 165.97 and 166.69. In 2019, the project at mile point 167.04 was completed, and another project is planned at mile point 167.17 in 2020. Pass Creek flows south along I-5. Therefore, the increasing mile points correspond to movement upstream in the Pass Creek watershed. The amount of habitat above each culvert is reported in each CRPA report.

OR 244 MP 31.03 Marley Creek Culvert Repair

Completed October 2019, Figure 20.

Pre-treatment Fish Passage Condition

This project is located under Hwy 244 on Marley Creek, near Starkey, Oregon. It was one of the first projects in the Eastern side of the state completed under the CRPA agreement. As a high priority fish passage barrier, significant work was completed to improve passage conditions through the culvert.

The CMP is a 130' long 78" diameter culvert. The culvert was found to be in poor condition due to rusted invert, distortion, and separation. With time, these conditions could lead to collapse of the culvert, water outside the barrel, and the erosion through the open joints of the surrounding soil arch and roadbed, eventually leaving the roadway unsupported and unsafe.

The culvert had two major fish passage issues; a large perch at the outlet, and high velocity in the crossing during moderate and high flows. ESA listed summer steelhead and redband trout were the focal NMF species for this location, and 5.89 miles of potential habitat is available upstream of the culvert.

Post-treatment Fish Passage Condition

The culvert was repaired with a centrifugal cast concrete liner, which sealed the joints and the cracks and covered the degrading invert. Through these repairs, water is now staying within the culvert and lessened the pre-repair structural concerns. Along with the liner, rounded corner baffles were installed to provide hydraulic complexity in the culvert and slow water velocities. These baffles also consolidate flows during low flow periods, adding depth to help facilitate fish passage.

In addition, a large portion of the downstream stream channel was rebuilt to backwater the culvert outlet. A roughened channel was installed for 150 feet downstream to meet the gradient required to eliminate the jump into the culvert.

The project experienced a 50-year flow event in the winter following completion, and post project monitoring found loss of surface flows due to voids in the newly constructed stream channel downstream of the culvert. Additional fine sediment was added to the project in the summer of 2020, and the project is currently being monitored to ensure fish passage conditions are maintained.

Figure 20: Marley Creek Culvert Repair, Before and After

Description: Two images, the first shows water running through the perched culvert pre-repair. The second image shows water backwatered to the culvert outlet with alternating baffles post repair.



I-84 MP 236.31 Two Mile Creek Culvert Repair

Completed September 2019, Figure 21.

Pre-treatment Fish Passage Condition

This culvert carries Two Mile Creek under Interstate 84 near Meacham, Oregon. This CMP culvert is 72 inches in diameter, and 258 feet long. The culvert was ranked as fair condition following initial survey,

however; the inlet portion of the culvert collapsed in the winter of 2019. Further inspection at that time revealed a rusted invert, separation, and general barrel damage. With time, these conditions could lead to the further collapse of the culvert, water outside the barrel, and the erosion through the open joints of the surrounding soil arch and roadbed, eventually leaving the roadway unsupported and unsafe.

1.96 miles of habitat is available upstream of the culvert, and ESA listed summer steelhead and redband trout are present in Two Mile Creek at this location.

Post-treatment Fish Passage Condition

The culvert was repaired with a concrete invert pave, which sealed the joints and the cracks and covered the degrading invert. Through these repairs, water is now staying within the culvert and lessened the pre-repair structural concerns. Along with the liner, corner baffles were installed to provide hydraulic complexity in the culvert and slow water velocities. By decreasing velocity and increasing depth there is now improved access for NMF to the 1.96 miles of upstream habitat.

Figure 21: Two Mile Creek Culvert Repair, Before and After

Description: Two images, the first shows water running inside of the culvert pre-repair. The second image shows the paved invert of the culvert with corner baffles post-repair.



2020 CRPA Repair Sites

Map 3. Locations of the 2020 CRPA Projects

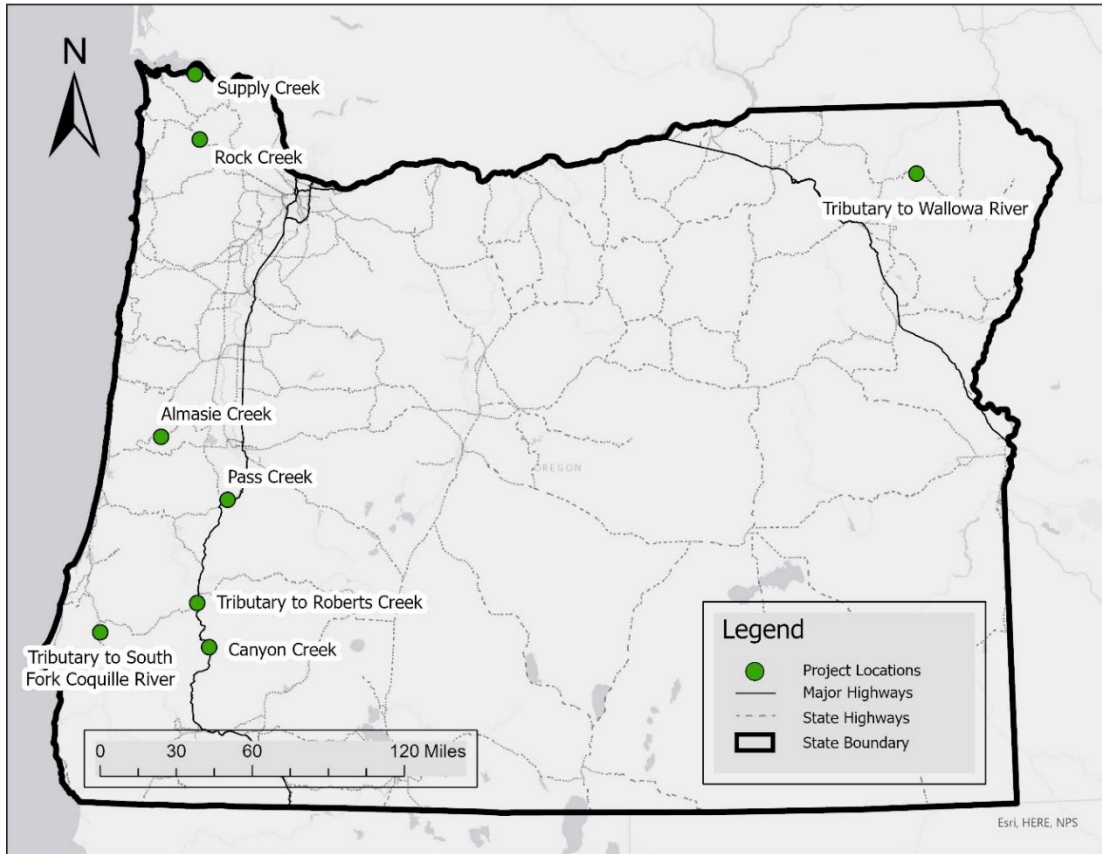


Table 3. Fish Passage Improvements Analysis

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Other NMF Species
Unnamed Tributary to Roberts Creek	I-5, 119.88	0.7	Baffles	Present			
Pass Creek	I-5, 167.17	1.96	Fish Blocks	Present	Present and ESA Listed	Present	Lamprey
Canyon Creek	I-5, 96.82	13.14	Fish Blocks	Present	Present and ESA Listed	Present	

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Other NMF Species
Unnamed Tributary to Willowa River	OR 82, 39.47	0.55	Concrete weirs			Present	Redband Trout and Pacific Lamprey
Rock Creek	US 26, 27.85	6.48	Baffles and Downstream roughened riffle	Present	Present And ESA Listed	Present	Pacific and Western Brook Lamprey
Supply Creek	US 30, 79.72	3.66	Boulder Weirs and Corner Baffles	Present	Present and ESA Listed	Present	Pacific Lamprey
Almasie Creek	OR 36, 16.41	2.01	Fish Rocks	Present	Present and ESA Listed	Present	Chinook Salmon, Lamprey
Unnamed Tributary to South Fork Coquille River	OR 542, 8.73	0.87	Flexible Baffles and Channel Rebuild	Present	Present and ESA Listed		

I-5 MP 119.88 Unnamed Tributary to Roberts Creek Culvert Repair

Completed August 2020, Figure 22.

Pre-treatment Fish Passage Condition

This 251-foot long, 96" diameter culvert drains an unnamed tributary to Roberts Creek, a tributary to the South Umpqua River. The tributary passes under I-5, approximately 3 miles south of Roseburg in Douglas County, Oregon.

The culvert's structural condition was deteriorating due to barrel and invert damage, and in need of repair. The active channel width at the site was estimated at 12 feet. Hydraulic calculations determined that during 5% daily exceedance flows (high fish passage design flow) the culvert had velocities of 4.90 fps, and depth at the outlet was 2-5/8 inches at the 95% daily exceedance flows (low fish passage design

flow). This compares to an ODFW fish passage design criteria maximum velocity of 2 fps at high fish passage design flow, and a minimum water depth of 6 inches at low fish passage design flow.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert treatment and staggered fish baffles were placed every 15 feet to decrease velocity and create hydraulic variation. Hydraulic calculations estimated a post-treatment high fish passage design flow velocity of 4.01 fps, and a low fish passage design depth of 3 inches. The reduction in velocity and increase in depth improved access to approximately 0.7 miles of potential habitat for cutthroat trout.

Figure 22: Unnamed Tributary to Roberts Creek Before and After

Description: Two images, the first displays water running through the culvert pre-repair. The second shows water running through the culvert post-repair.



I-5 MP 167.17 Pass Creek Culvert Repair

Completed August 2020, Figure 23.

Pre-treatment Fish Passage Condition

This 204-foot long, 96" diameter culvert conveys Pass Creek under I-5 approximately 8 miles southwest of Cottage Grove in Douglas County, Oregon. Pass Creek is a tributary to Elk Creek in the Umpqua River basin.

The culvert's structural condition was deteriorating due to distortion, barrel damage, and invert damage, and in need of repair. The active channel width at the site was estimated at 15 feet. The culvert

was determined to have shallow depths during periods of low flow, creating a partial fish passage barrier.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert and staggered fish blocks were placed every 5 feet to increase flow depths and create hydraulic shadow. The increased water depth and addition of hydraulic shadow improved access to approximately 1.96 miles of potential habitat for cutthroat trout and steelhead/rainbow trout.

Figure 23: Pass Creek Culvert Repair Before and After

Description: Two images, the first is the pre-repair view looking inside the culvert from the outlet end. The second image is looking inside the culvert post-repair from the inlet end.



Note on Pass Creek Culverts

This project on Pass Creek is part of a series of culvert improvements done along a two-mile stretch of I-5. Culverts at mile points 165.90, 165.79, 166.69, and 167.04 were repaired under the CRPA in 2017, 2018, 2018, and 2019; respectively. Pass Creek flows south along I-5. Therefore, the increasing mile points correspond to movement upstream in the Pass Creek watershed. The amount of potential habitat above individual culverts is reported in each CRPA report, and the amount of potential habitat above the furthest downstream culvert repaired under the CRPA (MP 165.90) is 4.89 miles.

I-5 MP 96.82 Canyon Creek Culvert Repair

Completed September 2020, Figure 24.

Pre-treatment Fish Passage Condition

This 348-foot long, 120x240" closed bottom arched culvert conveys Canyon Creek under I-5 approximately 1.6 miles south of Canyonville in Douglas County, Oregon. Canyon Creek is a tributary to the South Umpqua River.

The culvert's paved bottom was severely deteriorated and had several voids, causing water to flow under the culvert. The active channel width at the site was estimated at 25 feet. Pre and post project hydraulic calculations of velocity and depth were not determined for this culvert. Moderate and high

velocities were observed during winter months. To improve fish passage, the project proposed to reduce velocity during moderate and high flows and retain a V-shaped notch in the bottom of the culvert for fish movement during low summer flows.

Post-treatment Fish Passage Condition

Concrete repairs were made to the culvert invert and staggered fish blocks were placed every 10 feet on river left inside the culvert to decrease velocity and maintain the existing low flow notch. The decreased velocity and low flow channel improved access to approximately 13.14 miles of habitat for cutthroat trout, federally listed coho salmon, and steelhead/rainbow trout.

Figure 24: Canyon Creek Culvert Repair Before and After

Description: Two images, the first shows the outlet end of the culvert pre-repair with water running through it. The second image shows the outlet end of the culvert post-repair with water running through it and fish blocks.



OR 82 MP 39.47 Unnamed Tributary to Wallowa River Culvert Repair

Completed August 2020, Figure 25.

Pre-treatment Fish Passage Condition

This 86-foot long, 63x87" closed bottom arched culvert drains an unnamed tributary to the Wallowa River. The tributary passes under OR 82, approximately 7 miles northwest of Wallowa in Wallowa County, Oregon.

The culvert was partially filled with larger rock material and its invert was rusted through in multiple spots, resulting in the culvert being impassable during low flow conditions. Hydraulic calculations determined that high fish passage design flow conditions at the culvert had velocities of 4.38 fps and had less than two inches of depth during low fish passage design flow levels.

Post-treatment Fish Passage Condition

The rock and gravel material were removed from the culvert and a sprayed on concrete liner was used to repair the invert. Eight-inch-high weirs placed every 12 feet were installed to decrease high flow velocity and increase low flow depths. Hydraulic calculations estimated a post-treatment design high

flow velocity of 3.12 fps and design low flow depth exceeding 8 inches. The decreased velocity and increased depth improved access to approximately 0.55 miles of habitat for steelhead/rainbow trout, redband trout, and Pacific lamprey.

Figure 25: Unnamed Tributary to Wallowa River Culvert Repair Before and After

Description: Two images, the first shows the outlet end of the culvert pre-repair with water running through it and accumulated large cobbles. The second image shows the outlet end of the culvert post-repair with water running through it and concrete weirs.



US 26 MP 27.85 Rock Creek Culvert Repair

Completed August 2020, Figure 26.

Pre-treatment Fish Passage Condition

This 166-foot long, 96" diameter culvert conveys Rock Creek under US 26 approximately 37 miles southeast of Seaside in Clatsop County, Oregon. Rock Creek is a tributary to the Nehalem River. The culvert was in critical condition, with large voids from a rusted invert leading to the piping of water under the culvert. Hydraulic calculations determined that during periods of high fish passage design flows, the culvert had velocities up to 5.77 fps. During periods of low fish passage design flow, models estimated less than three inches of water depth in the culvert. Also, the culvert outlet was perched at low flow, and a trash rack not meeting fish passage design criteria was present upstream of the culvert.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert and six baffles were placed every 25 feet to reduce velocities inside the culvert. An existing riffle was treated with additional boulders at the tail of the outlet pool to create additional roughness and reduce the perch during low flow. Hydraulic calculations estimated a post-treatment velocity of 1.65 fps during high fish passage design flows, and depths of over 2 ½ feet during low fish passage design flow. The decreased velocity, increased depth, and reduced perch improved access to approximately 6.48 miles of habitat for cutthroat trout, federally listed coho salmon, steelhead/rainbow trout, and lamprey.

Post-project monitoring showed that the designed backwater resulting from placement of boulders downstream of the outlet did not function to the degree intended. In 2021, additional material was added to the riffle, and additional backwater at the outlet was observed during low flow.

In addition, a beaver dam was constructed on the first baffle in the inlet of the culvert during Spring of 2021. This resulted in a large backwater of the channels upstream of the culvert and had potential to saturate the road fill prism. Due to safety concerns of potential highway failure resulting from saturation, the beaver dam was removed in the summer of 2021. The dam was subsequently re-built and removed again before winter of 2021. To address the issue long term, a beaver deceiver and or beaver dam analogue are being designed for installation in the 2022 in water work window. Staff from both agencies will continue to monitor this site at frequent intervals to monitor beaver activity and fish passage conditions.

Figure 26: Rock Creek Culvert Repair Before and After

Description: Two images, the first image shows the perched outlet of the culvert pre-repair with water running through it. The second image shows the unperched outlet of the culvert post-repair with water running through it.



US 30 MP 79.72 Supply Creek Culvert Repair

Completed September 2020, Figure 27.

Pre-treatment Fish Passage Condition

This 275-foot long, 84" diameter culvert conveys Supply Creek under US 30 approximately 2.3 miles west of Knappa in Clatsop County, Oregon. Supply Creek is a tributary to Gnat Creek.

The culvert had severe barrel and invert damage, was a fish passage velocity barrier, and had a perched outlet. The active channel width at the site was estimated at 17 feet. Hydraulic calculations determined that during periods of high fish passage design flow, the culvert outlet had velocities of 6.74 fps, and during periods of low fish passage design flow, had less than three inches of depth. Also, the culvert inlet was partially plugged with rock and other debris.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert, eight baffles were placed every 30 feet to reduce velocities inside the culvert, a roughened riffle was constructed upstream of the culvert to increase depth, and boulder weirs were constructed downstream of the culvert to reduce the outlet perch. Hydraulic calculations estimated a post-treatment high fish passage design flow velocity of 6.43 fps, and low fish passage design flow depths of nearly 4 inches. The decreased velocity and increased depth improved access to approximately 3.66 miles of habitat for cutthroat trout, federally listed coho salmon, steelhead/rainbow trout, and lamprey.

Post project monitoring showed some settlement and scour in the roughened riffle upstream of the culvert. In 2021, boulders were added to the channel segment to provide hydraulic shadow, and to increase channel roughness. In addition, a tree fell across the culvert outlet during winter of 2020, creating a large jump for upstream migrating fish. The tree was removed, and the site continues to be monitored by staff from both agencies to ensure passage conditions continue to function as intended.

Figure 27: Supply Creek Culvert Repair Before and After

Description: Two images, the first shows the culvert outlet pre-repair with water running through it. The second displays the culvert outlet post-repair with water running through it and the constructed rock weir with water running over it.



OR 36 MP 16.41 Almasie Creek Culvert Repair

Completed August 2020, Figure 28.

Pre-treatment Fish Passage Condition

Two 60-foot long, 72" diameter culverts drain Almasie Creek under OR 36 approximately 16.4 miles northeast of Mapleton in Lane County, Oregon. Almasie Creek is a tributary to Lake Creek in the Siuslaw River Basin.

The culverts had voids and damage in the inverts and were velocity barriers at high flows. The active channel width at the site was estimated at 15 feet. Hydraulic calculations were not

determined for these culverts, but velocity during 5% exceedance flows along with depth during 95% exceedance flows were targeted for fish passage improvement.

Post-treatment Fish Passage Condition

The culverts were repaired with a 6-inch paved invert and fish rocks were installed to reduce velocities inside the culverts. The decreased velocities and increased depths improved access to approximately 2.01 miles of habitat for cutthroat trout, federally listed coho salmon, steelhead/rainbow trout, and Chinook salmon.

Figure 28: Almasie Creek Culvert Repair Before and After

Description: Two images, the first shows the inlet end of the culverts pre-repair with water running through them. The second image shows the inlet end of the culverts post-repair with water running through them and fish rocks.



OR 542 MP 8.73 Unnamed Tributary to South Fork Coquille River Culvert Repair

Completed August 2020, Figure 29.

Pre-treatment Fish Passage Condition

This 48-foot long, 36" diameter culvert drains an unnamed tributary to the South Fork Coquille River. The tributary passes under OR 542, approximately 9 miles north of Powers in Coos County, Oregon. The culvert was in critical condition due to voids, channel scour, and barrel damage, and in need of repair. The active channel width at the site was estimated at 5 feet. Hydraulic calculations determined that during high fish passage design flow the culvert had a velocity of 4.9 fps. During low fish passage design flow, the culvert had an estimated 12" perch at the culvert outlet.

Post-treatment Fish Passage Condition

The culvert was repaired with a cured-in-place pipe-liner and flexible baffles were placed every 10 feet to reduce velocities inside the culvert. A 105-foot section of stream immediately downstream of the culvert was rebuilt to eliminate the 12" perch. Hydraulic calculations were not estimated for post-treatment conditions. However, the decreased velocity and elimination of the perch improved access to approximately 0.87 miles of habitat for cutthroat trout and federally listed coho salmon.

Figure 29: Unnamed Tributary to South Fork Coquille River Culvert Repair Before and After

Description: Two photos, the first shows the pre-repair outlet end of the culvert with water present in the outlet pool and irrigation pipe running through the culvert. The second photo shows the post-repair outlet end of the culvert with water present in the outlet pool and irrigation pipe removed from the culvert.



2021 Culvert Repair Projects

Map 4. Locations of the 2021 CRPA Projects

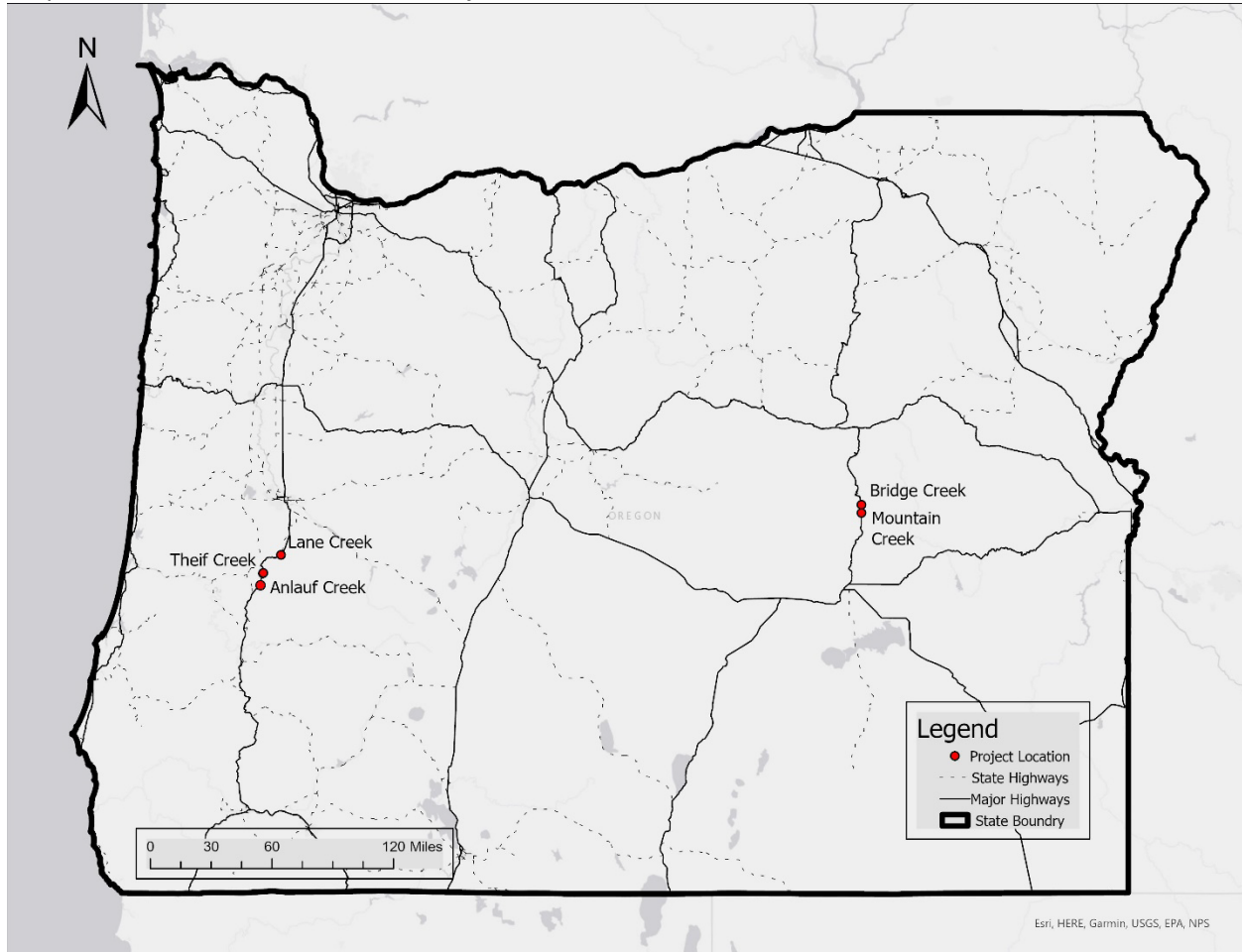


Table 4. Fish Passage Approval Analysis

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Other NMF Species
Lane Creek	I-5, 171.47	2.90	Baffles	Present			Pacific Lamprey
Anlauf Creek	I-5, 159.29	0.26	Baffles	Present	Present and ESA Listed	Present	Pacific Lamprey

Stream Name	Hwy and MP	Maximum Potential NMF Habitat Miles	Passage Improvement	Cutthroat Trout	Coho Salmon	Steelhead/Rainbow Trout	Other NMF Species
Thief Creek	I-5, 159.17	3.73	Baffles and root wads	Present	Present and ESA Listed	Present	Pacific Lamprey
Bridge Creek	US 395, 35.83	8.42	Baffles and Blocks				Redband Trout
Mountain Creek	US 395, 38.91	4.03	Baffles and Blocks				Redband Trout

I-5 MP 171.47 Lane Creek Culvert Repair

Completed August 2021, Figure 30.

Pre-treatment Fish Passage Condition

This 310-foot long, 72" diameter culvert drains Lane Creek, a tributary to Martin Creek in the Willamette River Basin. The tributary passes under I-5, approximately 3 miles southwest of Cottage Grove in Lane County, Oregon.

The culvert's structural condition was deteriorating due to barrel and invert corrosion, and in need of repair. Hydraulic calculations determined that during 5% daily exceedance flows (high fish passage design flow) the culvert had velocities of 6.34 fps and during 95% daily exceedance flows (low fish passage design flow) a depth of 1-1/4 inches. This compares to an ODFW fish passage design criteria maximum velocity of 2 fps at high fish passage design flow, and a minimum water depth of 6 inches at low fish passage design flow.

Post-treatment Fish Passage Condition

The culvert was repaired with a 4-inch paved invert treatment and baffles were placed every 21 feet to decrease velocity and increase depth. Hydraulic calculations estimated a post-treatment high fish passage design flow velocity of 4.67 fps. The baffles also helped to concentrate low flows, and increased the water depth throughout the culvert. The reduction in velocity improved access to approximately 2.90 miles of potential habitat for cutthroat trout and Pacific lamprey.

Figure 30: Lane Creek Before and After

Description: Two images, the first displays the culvert pre-repair from the outlet end with a small quantity of standing water. The second shows the culvert post-repair from the outlet end with water flowing over a baffle.



I-5 MP 159.29 Anlauf Creek

Completed August 2021, Figure 31.

Pre-treatment Fish Passage Condition

This 182-foot long, 72" diameter culvert conveys Anlauf Creek under I-5 approximately 12 miles southwest of Cottage Grove in Douglas County, Oregon. Anlauf Creek is a tributary to Thief Creek in the Umpqua River basin.

The culvert's structural condition was deteriorating due to barrel and invert corrosion, and abrasion was present. Velocity during high fish passage design flow and depth during low fish passage design flow were targeted for fish passage improvement.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert and seven baffles were installed to reduce velocity and increase flow depths. The fish passage treatment improved access to approximately 0.26 miles of potential habitat for cutthroat trout, federally listed coho salmon, steelhead, and Pacific lamprey.

Figure 31: Anlauf Creek Culvert Repair Before and After

Description: Two images, the first is pre-repair looking inside the culvert from the inlet end with water running through it. The second is post-repair looking inside the culvert from the inlet end with water running through it.



I-5 MP 159.17 Thief Creek Culvert Repair

Completed August 2021, Figure 32.

Pre-treatment Fish Passage Condition

This 120-foot long, 84" diameter culvert conveys Thief Creek under an onramp to I-5 approximately 12 miles southwest of Cottage Grove in Douglas County, Oregon. Thief Creek is a tributary to Elk Creek in the Umpqua River basin.

The culvert's structural condition was deteriorating due to barrel and invert corrosion, abrasion was present, and there was debris buildup. Velocity during high fish passage design flow and depth during low fish passage design flow were targeted for fish passage improvement.

Post-treatment Fish Passage Condition

The culvert was repaired with a 6-inch paved invert, debris was cleared, nine baffles were installed to reduce velocity and increase flow depths, and a root wad was added upstream of the culvert to increase habitat complexity. The fish passage treatment improved access to approximately 3.73 miles of potential habitat for cutthroat trout, federally listed coho salmon, steelhead, and Pacific lamprey.

Figure 32: Thief Creek Culvert Repair Before and After

Description: Two images, the first shows inside the culvert from the inlet end pre-repair with water running through it. The second displays inside the culvert from the outlet end post-repair with water running through it.



US 395 MP 35.83 Bridge Creek Culvert Repair

Completed October 2021, Figure 33.

Pre-treatment Fish Passage Condition

Three 63-foot long, 48" diameter culverts convey Bridge Creek under US 395 approximately 11 miles south of Seneca in Grant County, Oregon. Bridge Creek is a tributary to the Silvies River.

The structural condition of the culverts was compromised due to separated joints. Velocity during high fish passage design flow, and depth during low fish passage design flow were targeted for fish passage improvement.

Post-treatment Fish Passage Condition

Rock and gravel material was removed and a cured-in-place pipe-liner was used to repair the culvert. Ten corner baffles were placed in the north culvert and 28 fish blocks were installed in each of the other two culverts to reduce velocities and increase flow depths. The decreased velocity, increased flow depth, and elimination of outlet perch improved access to approximately 8.42 miles of habitat for redband trout.

Figure 33: Bridge Creek Culvert Repair Before and After

Description: Three images, the first shows inside a culvert pre-repair with a separated joint and accumulated sediment. The second shows inside a culvert post-repair with fish blocks and the third shows inside a culvert post-repair with fish baffles.



US 395 MP 38.91 Mountain Creek Culvert Repair

Completed October 2021, Figure 34.

Pre-treatment Fish Passage Condition

Two 65-foot long, 48" diameter culverts convey Mountain Creek under US 395 approximately 14 miles south of Seneca in Grant County, Oregon. Mountain Creek is a tributary to the Silvies River.

The inlet ends of the culverts were tipped up and damaged, there was sediment accumulation inside the culverts, and the structural condition of the culverts was compromised due to several open joints. In addition, the outlet ends were tipped up, there were separated joints in the first section, and the culverts were perched, creating a jump height. Depth during low fish passage design flow and outlet jump height were targeted for fish passage improvement.

Post-treatment Fish Passage Condition

The accumulated sediment was removed, the culvert end sections were removed, grade was reset to eliminate the outlet perch and a spray applied pipe liner was used to repair the culvert. Ten corner baffles were placed in the north culvert and 30 fish blocks were installed in the south culvert to increase flow depth. The decreased velocity, increased flow depth, and elimination of outlet perch improved access to approximately 4.03 miles of habitat for redband trout.

Figure 34: Mountain Creek Culvert Repair Before and After

Description: Three images, the first shows the perched culvert outlets pre-repair. The second shows inside a culvert post-repair with fish blocks and the third shows inside a culvert post-repair with fish baffles.



2022 Culvert Repair Projects

Map 5. Locations of the 2022 CRPA Projects.

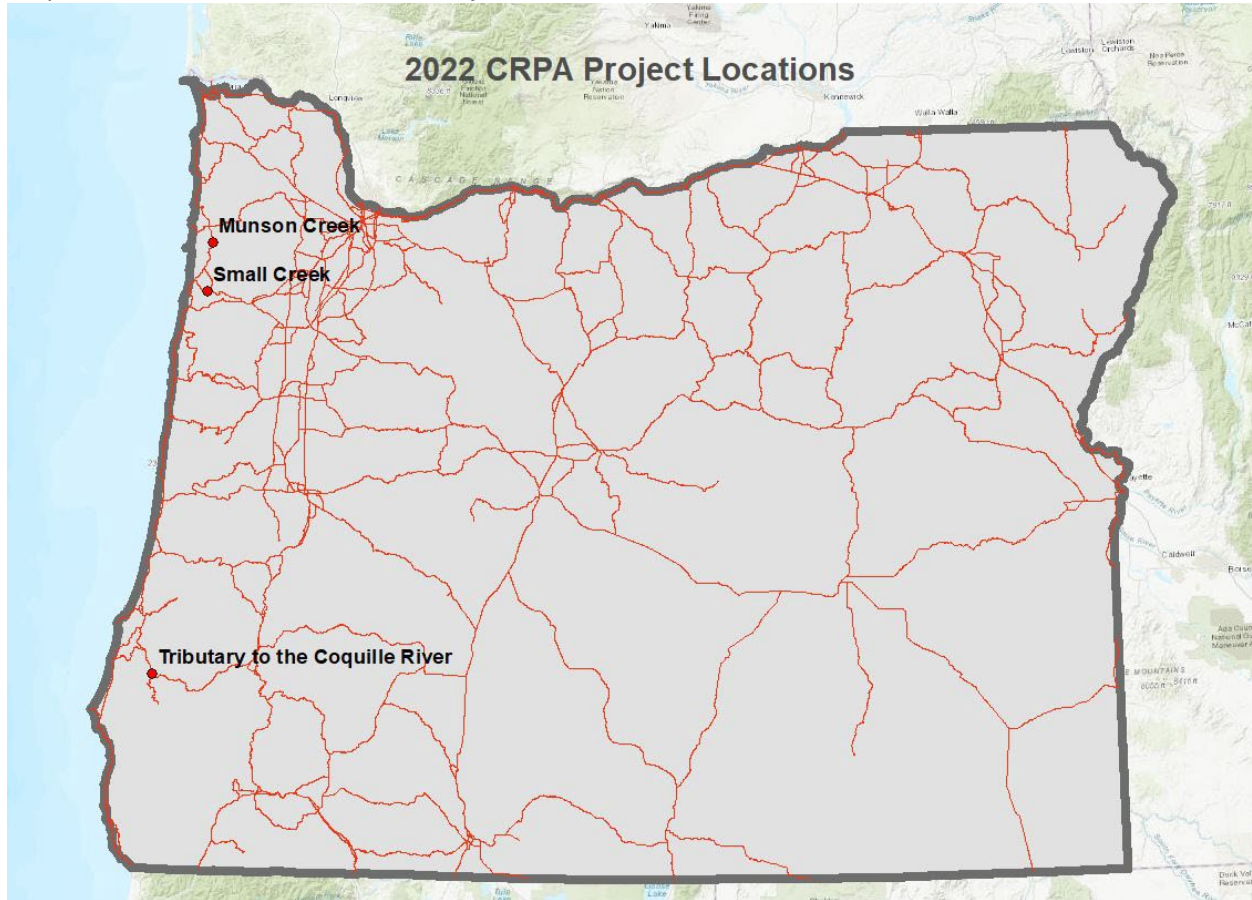


Table 5. 2022 CRPA Projects Fish Passage Analysis

Stream Name	HWY and MP	Maximum Potential NMF Habitat	Passage Improvement	Cutthroat Trout	Steelhead	Coho	Fall Chinook	Pacific Lamprey
Small Creek	OR130 MP 7.4	0.93	Roughened riffle, baffles	Present	Present	Present and ESA Listed	Present	Present
Munson Creek	OR101 MP 72.42	4.73	Roughened riffle, baffles	Present	Present	Present and ESA Listed	Present	Present
Unnamed Tributary	OR 42 MP 22.35	0.56	Fish Rocks	Present				

OR130 MP 7.4 Small Creek

Completed October 2021, Figure 35.

Pre-treatment Fish Passage Conditions

This culvert on OR130 MP 7.4 conveys, Small Creek, a tributary of the Little Nestucca River in Tillamook County, Oregon. Small Creek has an estimated active channel of 10' and the current culvert is 54' long and 4' in diameter. The culvert has an 18" drop on the outlet near the confluence with the Little Nestucca River causing significant passage issues and a complete barrier for Pacific lamprey. The culvert shows signs of barrel damage and is in need of repair.

Post-treatment Fish Passage Condition

The culvert was repaired by paving the invert to cover the scour. Fish passage improvements include a roughened riffle to the culvert to eliminate the jump cement rounded corner baffles to reduce velocities and increase the depth in the culvert.

These fish passage improvements will provide easier access for coastal cutthroat, winter steelhead, Pacific lamprey and coho salmon to access 0.93 miles of native migratory fish habitat.

Figure 35: Small Creek Repair, Before and After

The first picture shows the perched culvert with no jump pool. The second picture shows the repair but using a roughened riffle to allow fish to swim through the culvert. The culvert also had weirs installed to increase the depth and reduce velocities.



OR101 MP 72.42 Munson Creek

Completed October 2021, Figure 36.

Pre-treatment Fish Passage Conditions

Munson Creek is a tributary of the Tillamook River south of Tillamook, Oregon in Tillamook County. The 12'X6' concrete box culvert is 57' long and is perched 1' above the outlet pool creating a partial barrier to many native migratory fish and a complete barrier for lamprey. At low flows, shallow sheet flow further causes passage issues.

The box culvert has exposed rebar and concrete wear from scour on the floor and needed repairs. Some small sections of the walls have some erosion as well. The active channel width is estimated to be 17'.

Post-treatment Fish Passage Condition

The repair including repaving of the invert of the culvert and covering erosion scour and exposed rebar. To address the perch, a 70' roughened channel was built up to the culvert invert, eliminating the jump. Weirs were placed in the culvert to reduce the velocities and increase the depth. The weirs are rounded to allow for lamprey migration. Improved passage here will provide easier access to 4.73 miles of habitat for coast cutthroat trout, Pacific lamprey, winter steelhead, coho and fall Chinook.

Figure 36 Munson Creek Repair, Before and After

The first pictures shows the pre-project conditions, with shallow sheet flow through the culver and a perched outlet. The second picture shows the roughened riffle to address the perch and a notched weir to address the depth in the culvert.



OR42 MP 22.35 Unnamed Tributary of the South Fork Coquille River

Completed October 2021, Figure 37.

Pre-treatment Fish Passage Condition

The 152' long 4' diameter corrugated metal culvert at OR42 MP 22.35 conveys an unnamed tributary of the South Fork Coquille River near Myrtle Point, Oregon.

The culvert is deteriorating and has vertical and horizontal alignment breaks. The active channel width is estimated at 7' and the stream is a seasonal stream but provides coastal cutthroat trout habitat when it is flowing. The undersized culvert has velocity issues for fish passage at higher flows.

Post-treatment Fish Passage Condition

The structural condition of the culvert was addressed by installing a CIPP liner. Fish blocks were installed in the culvert to increase depth, increase hydraulic complexity and reduce velocities. The passage improvements will improve passage for coastal cutthroat trout to 0.56 miles of additional habitat in the unnamed tributary above Highway 42.

Figure 37: Small Creek Repair, Before and After

The first picture is the outlet at low flow conditions. The second picture is after a CIPP liner was installed and the placed fish rocks.



ODFW Fish Passage Compensation Fund Projects

Under the CRPA, ODOT provides ODFW Conservation Funds to assist in removing high priority barriers off the state highway system. Under the 2018 CRPA, ODOT provided ODFW \$2 million dollars of Conservation Funds and an additional \$50,000 for each culvert past 40 culverts. During 2018-2022, ODOT provide \$2,500,000 into this fund. Three requests for proposals were completed under the 2018 CRPA agreement (2018, 2019 and 2021).

Once the request period was over, applications were provided to a review team consisting of an ODOT representative, ODFW Fish Screening and Passage Program Manager, the ODFW-ODOT Fish Passage Liaison, a ODFW Conservation Program representative and a member of the ODFW Fish Passage Task Force (made up of members of the public). This group met to discuss the applications to make recommendations to ODFW on which projects to select for funding.

Twenty-nine projects were approved for Conservation Funding under the 2018, 2019 and 2021 request for proposals. If all projects were completed this would have improved fish passage at 29 high priority barriers statewide to over 682 miles and 270 acres of tidal floodplain of native migratory fish habitat. Unfortunately, two projects were not completed due to landownership management changes (270 acres of habitat) and access issues and due to the Bootleg Fire (35 miles).

2018 Request for Proposals

ODFW completed a request for proposals in 2018 and approved nine projects for funding.

Map 6. The 2018 Conservation Fund Projects Awarded under the 2019 request for proposals.

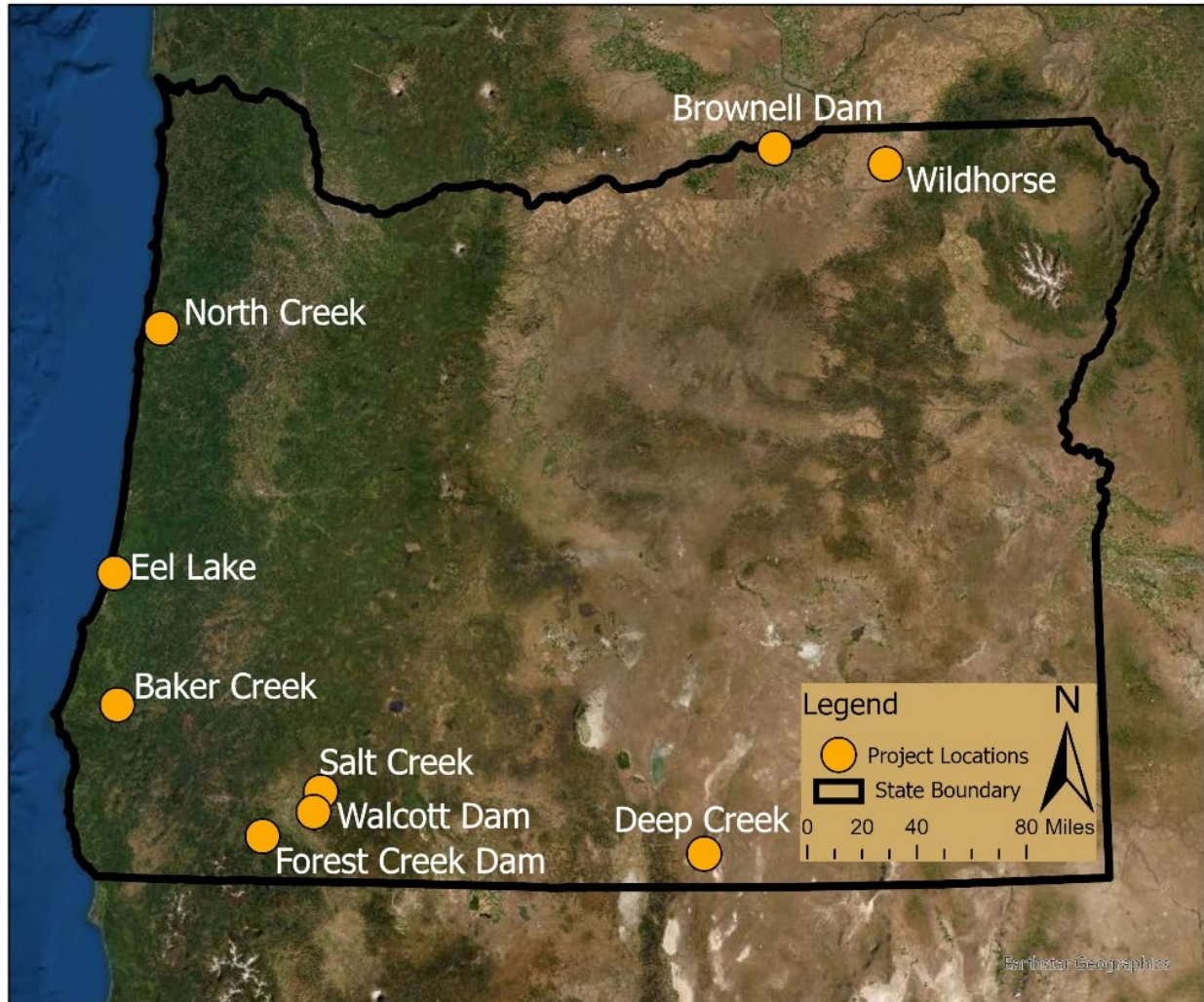


Table 6. Projects approved for funding under the 2018 request for proposals.

Project Name	<u>Actual</u> or Projected Completion Date	Habitat Access Provided to NMF (miles)	Project Cost	Funds Contributed by ODOT	County
Deep Creek	12/11/2019	3	\$504,120	\$50,000	Lake County
Baker Creek	11/1/2019	2	\$678,764	\$200,000	Coos County

Project Name	Actual or Projected Completion Date	Habitat Access Provided to NMF (miles)	Project Cost	Funds Contributed by ODOT	County
North Creek	10/17/2019	13	\$966,664	\$145,000	Lincoln County
Brownell Dam	8/2/2018	237	\$138,785	\$50,000	Umatilla County
Eel Lake	8/30/2019	4	\$47,314	\$10,000	Coos County
Forest Creek Dam	9/24/2019	6.4	\$177,043	\$113,375	Jackson County
Salt Creek	8/1/2018	7.5	\$85,121	\$17,000	Jackson County
Walcott Diversion	7/30/2019	25	\$268,043	\$100,000	Jackson County
Wildhorse Creek	11/4/2019	15.4	\$667,964	\$140,000	Umatilla County

Table 7. ODFW Compensation Fund Synopsis

Species	Deep Creek	Baker Creek	North Creek	Brownell Dam	Eel Lake*	Forest Creek Dam	Salt Creek	Walcott Diversion	Wildhorse Creek
Cutthroat Trout		✓	✓			✓	✓		✓
Coho Salmon		✓		✓		✓	✓	✓	✓
Redband Trout	✓			✓					
Steelhead/ Rainbow Trout		✓	✓	✓		✓	✓	✓	✓
Chinook Salmon		✓	✓	✓		✓	✓	✓	
Pacific Lamprey		✓	✓	✓	✓			✓	✓
Brook Lamprey					✓				
Klamath Smallscale Sucker								✓	
Warner Sucker	✓								

Deep Creek Town Diversion

The Deep Creek Town Diversion is located in the town of Adel in Lake County, Oregon. Fish Passage Conservation Funds helped remove the irrigation dam here which was a complete barrier to fish passage. The project replaced the existing weir and diversion, and a fish passable by-pass channel was constructed. The work completed here provides volitional fish passage for ESA listed Warner suckers, Warner Lakes redband trout, which is a State Sensitive species and other native fish.

Figure 38: Before and after restoration of fish passage at the Deep Creek Middle Diversion

218-4018-16051 Before and After Photos



Photo Point: Before #2
File Name: Pre Project Looking South.jpg
Photo Description: Across the Creek Looking South
Pre Project
Photo Date: 10/10/2017



Photo Point: After #2
File Name: Looking South Across Creek.JPG
Photo Description: Post Project Looking South
Photo Date: 12/18/2019

Baker Creek

The Baker Creek project removed a 12' by 250' long culvert that was perched 18' feet above the channel. This project was in Group 10 of the ODFW Statewide Fish Passage Priority list. A wooden fish ladder was installed in the past, but it wasn't very effective in getting fish into the culvert. Removing this barrier provided volitional fish passage to 2 miles of habitat. Baker Creek is an important cold water refugia in the South Fork Coquille River and many juvenile coho have been observed in Baker Creek below the culvert during summer and late fall months.

Figure 39: Baker Creek before (left) and after barrier removal (right).



North Creek

The North Creek project replaced a perched undersized 12' culvert with an 50' engineered arch culvert. The pre-project culvert was undersized creating velocity barriers, and along with the perch, very few adult salmonids were able to pass. North Creek is a tributary of Drift Creek in the Siletz basin. North Creek provides spawning habitat and cold water refugia rearing habitat. Restoring volitional fish at this site provides access to 13 miles of habitat for coastal resident and searun cutthroat trout, 5.4 miles of winter steelhead habitat, 3.4 miles of Coho habitat and some additional habitat for fall chinook. Pacific lamprey also occupy North Creek. Many adult fish have been observed above the culvert since its replacement.

Figure 40. North Creek before (left) and after (right) culvert replacement.



Brownell Dam

Brownell dam is located at river mile 2.5 on the Umatilla River and is the first barrier migrating fish encounter on their way upstream to spawning grounds. The dam was no longer in use and a notch was removed to improve passage in the past, but the structure still caused delay in passage and created greater predation for out-migrating fish. The dam has been removed, providing volitional fish passage for native migratory fish and reducing upstream delays at this structure.

Figure 41. Brownell Dam before (left) and after (right)



Eel Lake

The outlet of Eel Lake has a cement dam with an existing fish ladder that provides passage for anadromous salmonid species. Lamprey are not able to use the fish ladder. A lamprey ramp was installed to provide passage for Pacific lamprey to provide access to the lake and its tributaries. Providing passage here provides an additional four miles of high quality spawning habitat and the project is on the 2013 ODFW Fish Passage Priority List. This project had significant financial and maintenance contributions from the Coos, Lower Umpqua and Siuslaw tribes.

Figure 42: Eel Creek ladder, adult Pacific lamprey climbing



Forest Creek Dam

The Forest Creek Dam removal project removed a full channel spanning five foot tall dam on Forest Creek, a tributary of the Applegate River in Jackson County. This dam has created an impediment to fish passage for over thirty years. A roughened riffle replaced the dam providing volitional fish passage to four miles of coho habitat and 6.4 miles of steelhead habitat. The habitat above the dam is high intrinsic quality habitat.

Figure 43. Before and after



Salt Creek

Salt Creek is a tributary of Little Butte Creek near Eagle Point, Oregon and provides exceptional habitat for ESA listed coho salmon. This project removed two push up dams on Salt Creek which were in Group 9 of the 2013 Fish Passage Priority List. These push up dams were replaced by reprofiling existing irrigation ditches and retrofitting the existing fish screens and installing new head gates. This provided volitional fish passage to the lower 2.35 miles of Salt Creek.

Walcott Diversion

Walcott Dam was ranked 24 on the 2013 ODFW Statewide Fish Passage Priority List and is the uppermost barrier in Little Butte Creek in the Rogue Basin. This stop log dam, constructed in 1912, is a barrier to fish passage, particularly fall chinook, coho, winter steelhead, Klamath smallscale suckers and Pacific lamprey. A fish ladder was installed providing improved fish passage and access to 25 miles of the Little Butte Creek system.

Figure 44: Salt Creek before and after.



Wildhorse Creek

A channel spanning grade control structure in Athena, on Wildhorse Creek, tributary to the Umatilla River, completely blocked fish passage for native fish. To provide voluntary fish passage, the grade control structure was removed and a new bridge was installed at 3rd Street. Removing this barrier and restoring fish passage provides access to 15.4 miles of salmonid spawning and rearing habitat. This barrier was listed in the 2013 ODFW Statewide Fish Passage Priority List.

Figure 45: Wildhorse Creek after construction.



2019 Projects

Map 7. The 2019 Conservation Fund Projects Awarded under the 2019 request for proposals.



Table 8. Projects Approved for Funding Under the 2019 Request For Proposals

Site	Species									
	Cutthroat	Redband	Winter Steelhead	Summer Steelhead	Coho	Fall Chinook	Spring Chinook	Bull Trout	Pacific Lamprey	Other
Annie Creek		✓		*			*	✓		
Neskowin, Hawk and Butte Creeks	✓		✓		✓	✓			✓	Chum Salmon
Cedar Creek Hatchery	✓		✓	✓	✓	✓	✓		✓	Western Brook Lamprey
Fishhawk Lake	✓		✓		✓				✓	
Harboldt Dam	✓		✓	✓	✓	✓			✓	
North Fork Sprague Hydro		✓						✓		
Rudio Creek		✓		✓			✓			
Salt Creek	✓		✓	✓	✓	✓				
Seestrom										
Tidegates	✓		✓		✓	✓				
Starveout Diversion										Warner Redband Warner Sucker
Thomas Creek-Amsbaugh Diversion		✓								Modoc Sucker Pit Roach Goose Lake Sucker Goos Lake Tui Chub Goose Lake Lamprey
York-Breeden Dam	✓		✓		✓	✓			✓	Klamath Small Scale Sucker

Annie Creek

This project provided volitional fish passage at two irrigation diversion pushup dams on Annie Creek, a tributary to the Wood River in the Upper Klamath Basin. Both barriers were removed and a roughened riffle was constructed to provide volitional fish passage. Both diversions were combined and a new criteria fish screen was installed to prevent the entrainment of juvenile fish. Removing these barriers allows upstream and downstream volitional passage in the lower five miles of Annie Creek.

Figure 46. Annie Creek before and after.



Neskowin, Hawk and Butte Creeks

This project is located in Neskowin, Oregon and is in Group 8 of the ODFW Statewide Fish Passage Priority List. This project removed two 42" top hinged tidegates on two 5' culverts and replaced them

with a 32' bridge on Butte Creek. Providing passage at this location provides native migratory fish 1.7 access to an additional 1.7 miles of habitat for spawning and rearing on Butte Creek.

Figure 47. Butte Creek after removal of the tidegates.



Cedar Creek Hatchery

Cedar Creek Hatchery is approximately 1.5 miles east of Hebo and adjacent to Three Rivers, tributary to the Nestucca River. The hatchery, which was constructed in 1925, in order to meet hatchery and management goals used a hydraulically operated picket weir for collection of adult Chinook and Steelhead. This picket weir created a barrier to fish passage. The project removed the picket weir and replaced it with an Obermeyer weir which will only be operated during periods of hatchery fish collection. A new fishway was installed to provide juvenile and adult salmonid and lamprey passage as well as a new cylinder fish screen. This project provides improved access to 18 miles of habitat.

Figure 48: Cedar Creek before and after.



Fishhawk Lake

Fishhawk Lake Dam is located on Fishhawk Creek, a tributary to the Nehalem River and has a ladder that does not meet the state's fish passage standards. This project is on the 2018 ODFW Statewide Fish Passage Priority List. The project is replacing the existing ladder with a new ladder that meets State Fish Passage Criteria. Providing passage at this location will benefit coastal cutthroat, coho and steelhead.

Figure 49: The old fish ladder at Fishhawk Lake.



Harboldt Dam

This project removed the Harboldt Dam on Slate Creek and two unnamed dams on Welter Creek, both tributaries of the Applegate River in Josephine County. Harboldt Dam is listed at Group four on the ODFW Statewide Fish Passage Priority List. Additionally a new fish screen was installed to criteria to protect fish from entrainment into a water diversion. Removing these diversions provides volitional access to 15 miles of salmonid habitat.

Figure 50: Harboldt Dam before and after.



North Fork Sprague Hydro

This project would have improved passage and installed criteria fish screening at a hydroelectric facility at river mile 15 of the North Fork Sprague River. The project was pulled by the project proponent due to damage and accessibility issues due to the Bootleg fire.

Rudio Creek

This project removed an existing channel spanning passage barrier at river mile 5.61 on Rudio Creek, a tributary of the John Day River. A criteria fish screen was also installed. This provided 11.18 miles of access to important habitat for ESA listed summer steelhead, spring chinook and redband trout.

Figure 51: Rudio Creek before and after.



Salt Creek – C2 Cattle Company

This project removed two of Salt Creek's remaining five push up dams. New headgates and criteria fish screening were installed for the irrigation diversions. Salt Creek is a tributary of Little Butte Creek and provides habitat for steelhead, coho, Chinook and coastal cutthroat trout. Salt Creek maintains cold water temperatures over the summer months providing essential over summer rearing habitat for salmonids.

Figure 52: Salt Creek before and after.



Seestrom Tidegate

The Seestrom Tidegate project proposed to address three tidegates: remove one and replace two with side hinged tide gates with muted tidal regulators on Seestrom and Alder Creeks, tributaries to the Coquille River. Unfortunately, due to a change in ownership this project could not proceed and the project proponents removed their request for funds.

Starveout Diversion

The Starveout Diversion Project, listed in Group 10 of the Statewide Fish Passage Priority List, addresses a complete fish passage barrier at the Starveout dam by providing roughened channels to provide passage. This project is on Deep Creek and provides habitat for ESA listed Warner suckers and Warner Lakes redband trout. Deep Creek is a tributary of Crump Lake in Lake County.

Thomas Creek Amsbaugh Diversion

The Thomas Creek project, Group 8 on the Statewide Fish Passage Priority List, provides passage by providing a bypass channel around a diversion providing access to 35 miles of upstream native migratory fish habitat for Goose Lake redband trout, Goose Lake lamprey, Goose Lake sucker, Goose Lake tui chub, modoc sucker and pit roach. This project will re-establish opportunities for native fish to access cold water refugia during the warm summer months.

Figure 53: Thomas Creek before and after.



Lower Bridgeport - York-Breeden Dam

This project on Williams Creek, a tributary of Applegate River, will remove a push up dam that limits fish passage and install a new headgate and fish screen for the water diversion. Removing this barrier will improve access to 11.5 miles of Pacific lamprey habitat, 13.1 miles of Chinook habitat, 24 miles of ESA listed coho habitat, 36.2 miles of steelhead habitat and 62.5 miles of cutthroat trout habitat. This dam is on the 2018 Statewide Fish Passage Priority List.

Figure 54: York Breeden Dam before and after.



2021 Projects

Map 8: Locations of the 2021 request for proposals Compensation Fund Sites

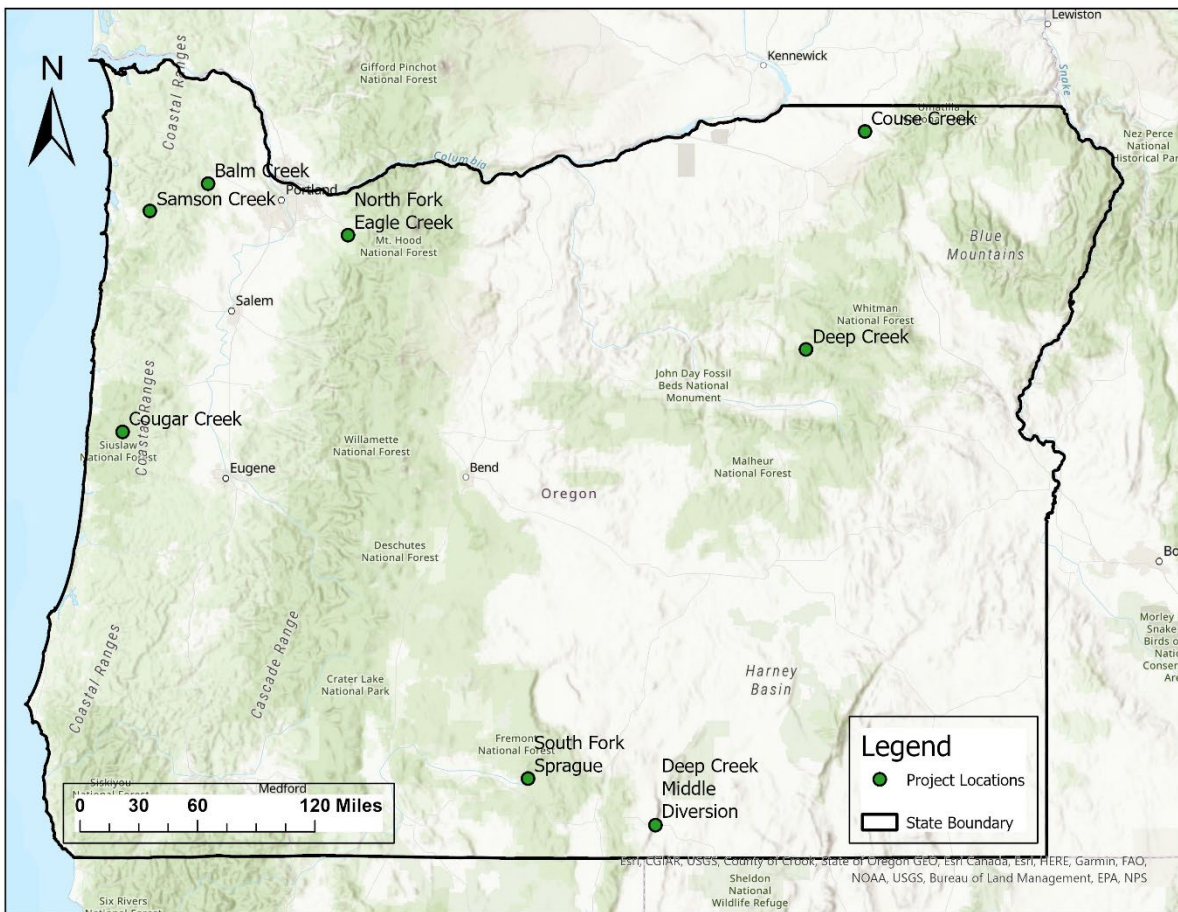


Table 9. Summary for the Compensation Fund sites selected during the 2021 request for proposals.

Project Name	Habitat Accessed by NMF (miles)	NMF Present	Project Expected Cost	Compensation Funds Awarded	County
North Fork Eagle Creek	8	Steelhead, coho, and Chinook	\$326,395	\$96,748	Clackamas
Deep Creek	3.2	Steelhead and redband trout	\$254,196	\$97,647	Grant
Deep Creek Middle Diversion	9.5	Warner sucker and redband trout	\$188,393	\$46,431	Lake
South Fork Sprague River	6	Redband and Bull trout	\$610,000	\$155,000	Lake
Cougar Creek	4+	Chinook, coho, steelhead, and cutthroat trout	\$848,288	\$100,000	Lincoln
Samson Creek	1.3	Chinook, coho, chum, steelhead, cutthroat trout, and Pacific Lamprey	\$809,185	\$150,137	Tillamook
Couse Creek	11	Steelhead, redband and bull trout	\$304,814	\$83,730	Umatilla
Balm Grove	87+	Steelhead, coho, Pacific lamprey, cutthroat trout, mountain whitefish, and largescale sucker	\$779,614	\$100,000	Washington

North Fork Eagle Creek

The North Fork Eagle Creek Project will restore full volitional fish passage to eight miles of high quality spawning and rearing habitat for ESA listed winter steelhead, coho and spring chinook. This project is listed in the ODFW Statewide Fish Passage Priority List. This 8' high channel spanning dam on has impaired passage since the 1970's. The project will also restore side channel connectivity at a second location nearby.

Figure 55: North Fork Eagle Creek Dam.



Deep Creek Middle Diversion

The Middle Diversion on Deep Creek, tributary to Crump Lake, has been operating for at least 100 years. This diversion impedes fish passage for Warner sucker and Warner Lakes redband trout. This project will remove the Middle Diversion weir. Three lower diversions on Deep Creek have already been addressed with 2 additional upstream barriers that will need future work. When passage is improved at all six diversions, 9.5 miles of habitat will be connected.

Figure 56: Deep Creek Middle Diversion.



South Fork Sprague River

This project proposed to improve fish passage at two culverts in the South Fork Sprague watershed on Leonard Creek and Brownworth Creeks. The project would have improved passage for bull trout redband trout. The project proponents withdrew this project after access issues became present after the Bootleg fire.

Cougar Creek

This project will replace an undersized and damaged culvert with a full spanning bridge on Cougar Creek, a tributary of Five Rivers in the Alsea basin. This project is in Group 11 of the Statewide Fish Passage Priority list. Providing improved passage at this location will allow access to four miles of upstream habitat for Chinook, Coho, steelhead, Pacific lamprey and cutthroat trout.

Figure 57: Cougar Creek Culvert



Couse Creek

Couse Creek is a tributary of the Walla Walla River near Milton Freewater. This project removed a 2 foot tall irrigation dam and installed a roughened riffle to provide passage. This project is on the 2019 Statewide Fish Passage Priority List in group 13. This was the last known barrier in the Couse watershed. Removing the dam provided volitional access to 11 miles of habitat for ESA listed steelhead and bull trout as well as redband and spring chinook.

Figure 58: Couse Creek before and after.



Balm Grove Dam

This project will remove the Balm Grove Dam on Gales Creek, a tributary of the Tualatin River. This channel spanning dam is in Group 4 of the ODFW 2019 Statewide Fish Passage Barrier List and providing full fish passage here improves access to 87 miles of native migratory fish habitat. The dam has been in place for almost 100 years. Instream habitat improvements were completed along with the dam removal.

Figure 59: Balm Grove before and after.



Analysis

The Culvert Repair Programmatic Agreement continues to be a useful tool for improving fish passage in existing culverts while extending the life of degrading and failing culverts on the statewide highways system. The benefit of the Conservation Fund continues to reestablish volitional fish passage at high priority fish passage barriers off the state highway system. Many of the fish passage barriers that get addressed through this funding are on the ODFW Statewide High Priority Fish Passage Barrier List.

There have been several lessons learned and issues identified during the execution of the 2018 CRPA agreement:

- Having dedicated project inspectors/managers on site during CRPA implementation would be very helpful in ensuring that the projects are built as designed and materials brought in are to the design specifications. Given the small nature of these projects compared to typical ODOT projects, they do not get dedicated project inspectors. Pre project meetings have been initiated under this agreement which has helped dialogue between the contractor and ODOT prior to construction.
- The timelines in the agreement continue to be difficult to meet. Getting the projects scoped, the repairs and fish passage improvements identified, having the correct forms and designs ready as described in the agreement has been difficult. As far as the efficacy of the agreement, this has not been an issue and ODOT and ODFW work closely to get these projects through review and approval quickly typically.
- The number of projects continues to be less than projected. ODFW is working with ODOT to increase communication with the ODOT Regions to increase the number of projects that get to approval. Certain Regions are more proactive than others on this task and hopefully the number projects will increase as this program gets more attention.

Given the improvements to fish passage at the repair sites, the increased viability of existing infrastructure before complete replacement, and the incredible amount of habitat with improved passage through the Conservation Fund, ODFW and ODOT have agreed that this is a beneficial

agreement and have worked on a new Programmatic Agreement that begins January 1, 2023. This agreement is a 10 year agreement that includes two payments of \$4.41 million of Fish Passage Conservation Funds. ODOT will provide additional Conservation Funds if the number of projects expected projects is exceeded over the duration of the agreement. Conservation costs have been increased from previous agreements to keep up with inflation. Additionally, projects with tidegates can be included in the new agreement if the tidegate is removed as part of the fish passage improvements.