



MEMORANDUM

Oregon Department of Fish and Wildlife

Date: January 18, 2019

To: Oregon Fish and Wildlife Commission

From: Greg Apke, ODFW Statewide Fish Passage Program Coordinator
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Subject: DRAFT Net Benefit Analysis - Scoggins Dam Fish Passage Waiver –
No. W-02-0032

The U.S. Bureau of Reclamation (Reclamation) and Clean Water Services (CWS) have jointly submitted an application to Oregon Department of Fish and Wildlife (Department) requesting a fish passage waiver for a proposed new dam on Scoggins Creek, a tributary to the upper Tualatin River near Forest Grove in Washington County. The Tualatin Basin Dam Safety and Water Supply Joint Project (Joint Project) proposes to construct a new dam approximately 2.90 river miles downstream of the existing Scoggins Dam and provide alternative fish passage mitigation in lieu of not providing fish passage at the new dam.

The existing dam on Scoggins Creek impounds Henry Hagg Lake (Hagg Lake) (Figure 1). The purpose of the proposed project is to meet projected Washington County municipal, industrial and environmental water supply demands through 2050. To accomplish this, the project proponents propose to construct a new dam downstream of the existing Hagg Lake Dam which will enlarge the existing impoundment to 112,000 acre-feet (Figure 2) and will more than double the size of the existing water storage facility on Scoggins Creek. Scoggins Dam is a central component of Washington County's water supply and a major regional asset and has been identified as a high priority for the Governor's Metro Regional Solutions Team.

As permissible in Oregon Revised Statutes (ORS) 509.585(7), fish passage waivers can be granted if alternatives to providing passage through mitigation provides net benefits greater than if passage were provided at the waiver site. The purpose of this Net Benefit Analysis, as required in ORS 509.585, is to evaluate the project proposal and determine if the alternatives to providing fish passage at the new project provides a net benefit. Net Benefit, defined in ORS 509.580(7) means "an increase in the overall, in-proximity habitat quality or quantity that is biologically likely to lead to an increased number of native migratory fish after a development action and any subsequent mitigation measures have been completed". The Department has reviewed the fish passage waiver request, completed this Net Benefit Analysis, and we conclude the mitigation actions, in lieu of not providing fish passage at the new dam on Scoggins Creek, does provide a net benefit to Native Migratory Fish (NMF). The Department therefore recommends the Oregon Fish and Wildlife Commission (OFWC) approve this fish passage waiver request.

Project Description

Scoggins Dam and Henry Hagg Lake were authorized by Congress in 1966 to provide water supply for irrigation, municipal, and industrial uses, flood control, recreation, water quality and conservation and development of fish and wildlife resources. The dam is owned by Reclamation and managed by the Tualatin Valley Irrigation District (TVID) under contract with Reclamation. Clean Water Services (CWS) is the fish passage waiver project lead agency, providing project management and public involvement oversight; as the owner of Scoggins Dam, the Reclamation supports the District's application for a fish passage waiver from the Department. Scoggins Dam is the central component of Washington County's water supply and is a major regional asset. Water from Henry Hagg Lake supports more than 250,000 jobs, provides drinking water for nearly 400,000 residents, irrigates 17,000 acres of cropland, and sustains water quality in the Tualatin River to protect fish and wildlife habitat.

A 2005 Tualatin Basin Water Supply Feasibility Study determined the water supply provided by Scoggins Dam and Henry Hagg Lake is not sufficient to address the projected municipal, industrial, agricultural, and environmental demands through 2050. The original concept for increasing water capacity involved raising the height of the existing Scoggins Dam by up to 40 feet to meet 50-year water supply needs for the region. Since the development of the dam raise concept and issuance of a previous fish passage waiver (Waiver Agreement No. W-04-0005) in 2005 by the OFWC, seismic studies have revealed potential dam instability in the event of a large earthquake. Seismic concerns associated with the existing dam and resources required to meet updated Reclamation seismic standards have resulted in analyses of additional dam safety and water storage alternatives associated with the Joint Project. These alternatives include:

- Option 1 – Modify the existing Scoggins Dam to address seismic stability with no increase in water supply,
- Option 2 – Increase the seismic stability of the existing Scoggins Dam and raise the dam to accommodate increasing the existing water surface elevation 17 feet to provide additional water supply, and
- Option 3 – Construct a new dam on Scoggins Creek downstream of the existing Scoggins Dam, and the existing Scoggins Dam may be notched and remain in place or otherwise modified to allow hydraulic connectivity between the existing and newly constructed downstream reservoir. The new dam (herein described as the Option 3 Dam) would result in new areas of inundation that would be hydrologically connected to Henry Hagg Lake, but the existing area of inundation for Henry Hagg Lake would essentially remain the same (see Figure 2).

Selection of the preferred option is expected to occur in 2021 after an Environmental Impact Statement has been drafted and published. CWS has requested the fish passage waiver/mitigation process in advance of the selection of the preferred option so that the proposed mitigation actions may be implemented, and their associated ecological benefits can be realized, as soon as possible. As such, this net benefit analysis addresses only implementation of Option 3, as the implementation of Option 1 is not expected to result in a fish passage trigger, and the OFWC previously determined in 2005 that the fish passage impacts associated with Option 2 were adequately addressed by the existing Waiver Agreement (W-04-0005).

Proposed Fish Passage Mitigation Actions

In lieu of not providing fish passage associated with the new dam on Scoggins Creek, the Applicants propose the following fish passage mitigation actions. These include:

- Permanent removal of the Balm Grove Dam on Gales Creek, an in-proximity tributary stream to the Tualatin River that will provide NMF a Net Benefit in stream habitat miles and meet multiple species life history needs in the basin, identified in figure 1.
- Retrofit the existing pool & weir fish ladder at the Lake Oswego Corporation diversion dam (formerly known as the Oregon Iron and Steel Dam) with a new vertical slot fish ladder configuration on the lower Tualatin River (RM 3.8) to significantly improve upstream passage conditions for all NMF in the subbasin identified in figure 1, and
- Transfer a .09 cfs water right associated with Balm Grove Dam to an in-stream ecological use which will ensure this water remains as in-stream natural flow in Gales Creek.

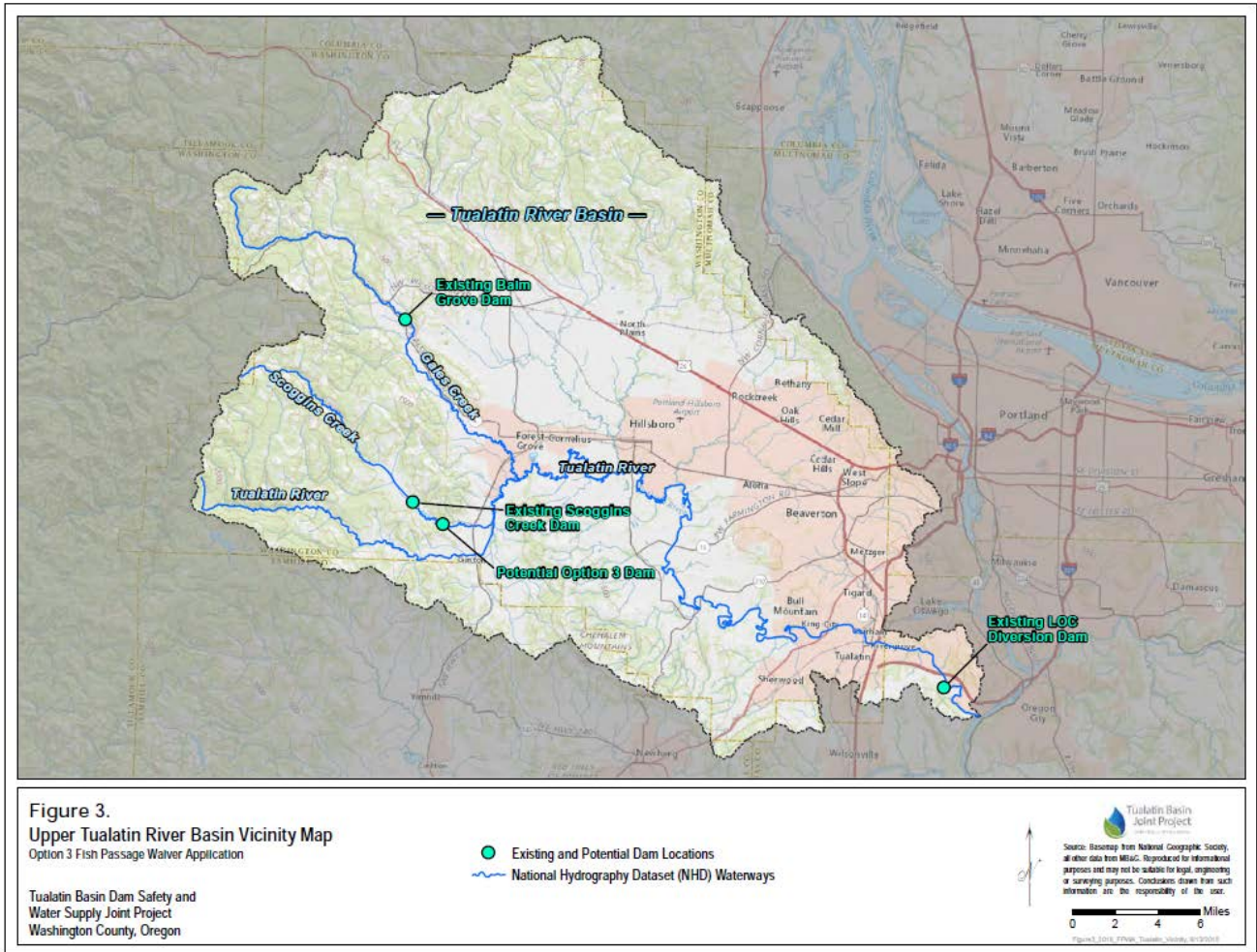


Figure 1. Upper Tualatin River Basin Map showing the project component locations.

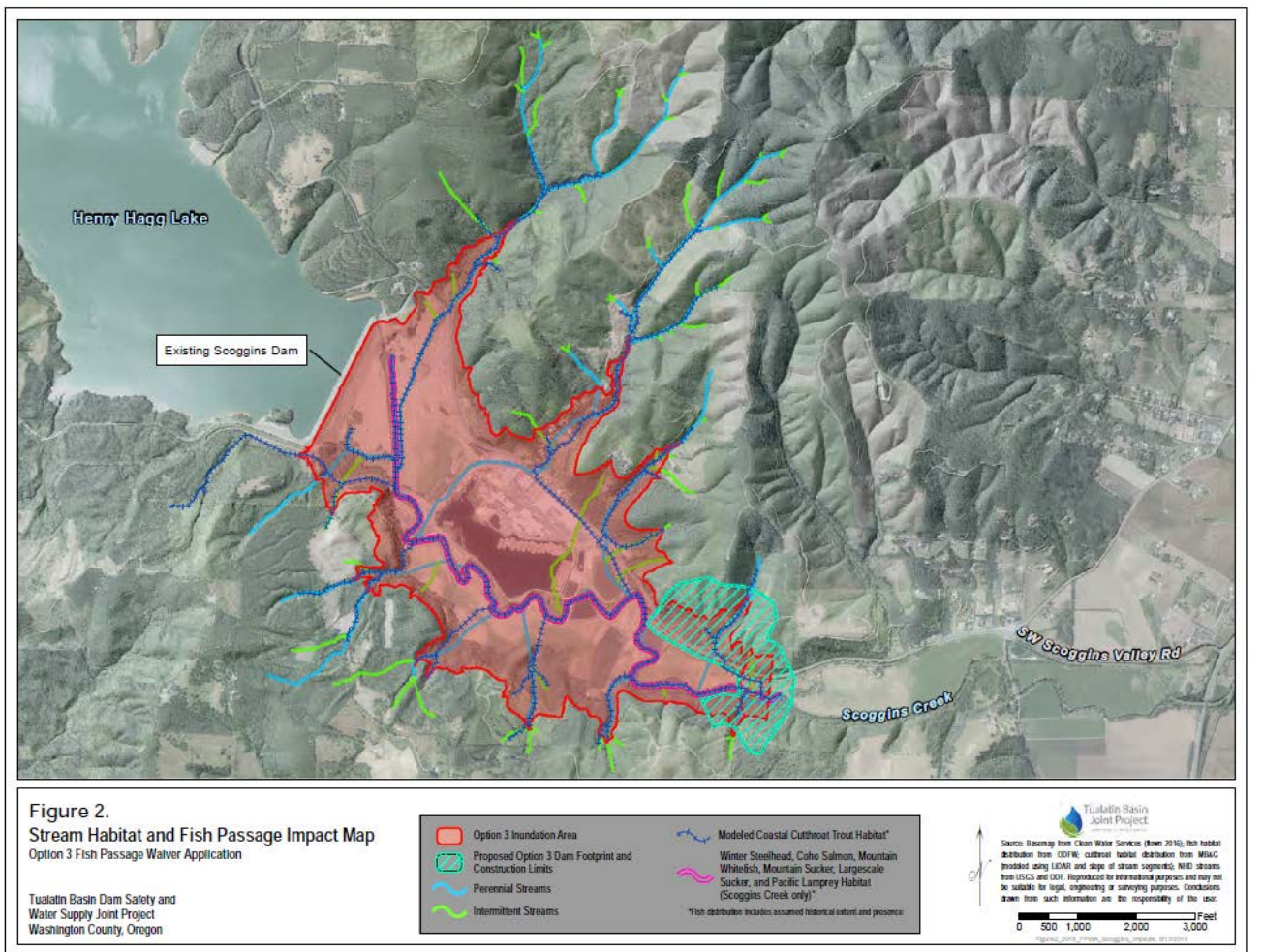


Figure 2. Option 3 Dam site location downstream from the existing Henry Hagg Lake. Red area identifies the proposed inundation zone create by the new dam.

The following information in this Net Benefit Analysis provides:

- policy context of fish passage and fish passage waiver requests,
- a description of the existing site conditions in Scoggins Creek proximal to the existing and proposed new dam,
- a description of NMF and life history types present in the Tualatin River sub-basin, and comparative fish use of both the waiver site (dam) in Scoggins Creek and the proposed mitigation locations (mitigation sites),
- a description of the proposed mitigation actions at each site, and
- the Department’s Net Benefit Analysis assessment, conclusion and staff recommendation of how the proposed mitigation actions will benefit NMF production and distribution in the Tualatin River sub-basin greater than if fish passage is provided at the new dam.

Policy Context of Fish Passage and Fish Passage Waiver Requests

The proposed action to construct a new dam at RM 2.75 on lower Scoggins Creek invokes the state’s fish passage policy and requires the Applicants address fish passage. Under the state’s fish passage policy, there are three fundamental approaches to address fish passage. These include providing fish passage, or seek a fish passage waiver or an exemption. As proposed under Option 3, the Applicants seek a fish passage wavier associated with the new dam. The project proposes to construct a new dam built 2.89

miles downstream of the existing Scoggins Dam which is located at approximately River Mile 5.60 on Scoggins Creek. Artificial obstructions (AO) are defined in law as any dam, diversion, culvert or other human-made device placed in the waters of this state that precludes or prevents the migration of native migratory fish. The state's fish passage statutes (509.580 through 509.910) and corresponding administrative rules (635-412-0005 through 0040) requires fish passage be addressed prior to the construction of a new dam, a fundamental change in permit status associated with an existing dam, or abandonment of an existing dam. ORS 509.585(7) provides waiver alternatives to addressing fish passage if alternatives to fish passage provides a net benefit to NMF. Waiver decisions shall be granted if there is a net benefit associated with mitigation alternatives greater than the proposed artificial obstruction with passage. Net benefit analyses for fish passage waivers shall evaluate conditions that exist at the time of the fish passage trigger event for which fish passage is required. Only the OFWC can authorize fish passage waivers where more than one mile of NMF habitat exists for which a waiver requested.

Approximately 18.50 perennial and intermittent stream miles occur in the Option 3 impact/inundation area (Figure 2). This estimate includes Scoggins Creek and all of its tributaries within the Scoggins Creek subbasin between the Option 3 Dam downstream spillway location and the existing Scoggins Dam spillway pool. Construction of the Option 3 Dam and the resulting reservoir would inundate and result in a loss of approximately 9.90 miles of stream miles. Of this total, 2.89 stream miles are associated with the mainstem of Scoggins Creek, and 7.01 stream miles are associated with several small, unnamed Scoggins Creek tributaries in the impact/inundation area. Approximately 8.60 tributary stream miles (intermittent and perennial) would remain upstream of the inundated area. As such, approximately 54% of the existing stream network in the Option 3 impact area would be lost due to inundation from the new dam.

The existing Scoggins Creek Dam is a complete fish passage barrier to all native migratory fish species and is located 2.89 river miles immediately upstream of the location of the proposed new dam. This site context, given the conditions that exist at the time of the new fish passage project, obligates the applicants to mitigate for the NMF habitat lost access to 2.89 miles of the mainstem Scoggins Creek reach immediately upstream of the new dam and 6.37 miles of associated tributary streams between the proposed new dam extending upstream to the existing Scoggins Dam that presently inhabit coastal cutthroat trout. Based on a fish habitat assessment conducted by Mason, Bruce & Gerard Inc., on behalf of the Applicants, confirmed by the Department and described in the Fish Passage Waiver Application, a maximum of 9.26 linear miles of stream habitat will be lost to contiguous NMF access by the new dam proposed on Scoggins Creek. The NMF species composition of this habitat includes coastal cutthroat trout, coho salmon, steelhead trout, large scale and mountain suckers, mountain whitefish and Pacific lamprey. Of the 9.26 miles of total habitat lost to access by NMF from the construction of the new dam, 2.89 miles of mainstem Scoggins Creek habitat would be lost to coho salmon, steelhead trout, large scale and mountain suckers, mountain whitefish and Pacific lamprey. Coastal cutthroat trout presently occupy the 2.89 miles of mainstem Scoggins Creek habitat between the proposed action and the existing dam. An additional 6.37 miles of tributary habitat which drains into the mainstem Scoggins Creek between the proposed dam and the exiting dam is presently occupied by cutthroat trout, but continuous habitat connection will be lost as a result of the new dam. Coastal cutthroat trout presently occupy Hagg Lake and some of the tributaries flowing into the lake, but the new proposal will disconnect contiguous upstream and downstream access to an additional 9.26 miles of total stream habitat as a result of the new dam (see Table 1).

Table 1. NMF Habitat Impacts Based on GIS Analysis from Proposed New Dam on Scoggins Creek.

Species	Habitat Lost (Stream Miles)
Winter steelhead	2.89
Coho salmon	2.89
Pacific lamprey	2.89
Mountain whitefish	2.89
Mountain sucker	2.89
Largescale sucker	2.89
Coastal cutthroat trout	9.26*

* Value includes 2.89 stream miles of the Scoggins Creek mainstem and confluent tributaries that flow into Scoggins Creek situated above the proposed new dam and the existing dam.

This lost habitat includes the area under the footprint of the new dam, plus the inundated section of Scoggins Creek and associated fish bearing tributaries. It is important to note that conservatively there are approximately an additional 43.0 miles of fair to good coastal cutthroat trout fish habitat above the existing Scoggins Dam. The applicant/owner are not legally obligated or required to mitigate for this habitat given that no fish passage trigger event will occur at the existing dam. It is also worth noting that the proposed mitigation to remove Balm Grove Dam on Gales Creek effectively mitigates for the cumulative miles of stream habitat lost between the new dam and Scoggins Dam (9.26 miles), plus those miles of habitat upstream of the existing Scoggins Dam (43 miles). The information supporting the determination that no trigger will occur at the existing Scoggins Dam as part of the Applicant’s action is principled on the following details:

- Scoggins Dam will not be “abandoned”, but will remain in place and maybe “notched” or modified in a manner that both connects the two impoundments and allows for more efficient management of stored water,
- Notching or modifications of the existing dam will fall below the 30% structural volume trigger threshold, and
- There will be no fundamental change in the water right(s) associated with the existing dam.

Given this information, and consistency with the state’s fish passage rules and regulations, there is no legal requirement at this time to mitigate for the lost NMF access to habitat above the existing dam on Scoggins Creek. The only legal requirement for this action, as required by ORS 509.585(7), is the requirement to mitigate for the lost habitat access of NMF from the new dam to the existing dam on Scoggins Creek.

Existing Site Conditions on Scoggins Creek

Stream Habitat Characteristics:

Scoggins Creek is a tributary of the Tualatin River in Washington County. The basin area is 45 square miles. The creek’s headwaters are on the east slopes of the Oregon Coast Range, an area zoned primarily for forest management. There are multiple fish bearing tributary streams of low to moderate gradient that converge above the existing Scoggins Dam and form Henry Hagg Lake (Hagg Lake), a 54,600 acre-foot water supply and recreational-use reservoir. Downstream of the existing dam, Scoggins Creek meanders out across low-gradient agricultural land, ultimately connecting with the Tualatin River approximately 5.7 miles below the dam, south and east of Forest Grove. Fish habitat in the lower reach of Scoggins Creek has been impacted and modified over many years by a variety of land use practices, including dam operations, flow management, agriculture, and forest practices. There are only intermittent pockets of spawning gravel dispersed downstream of the dam, with most substrate consisting of clay and soft sediment, or exposed sandstone bedrock. Large wood is almost non-existent in Scoggins Creek below the dam, further affecting habitat function for NMF.

The existing Scoggins Dam is a 151-foot high earthen structure built in 1976 to provide for irrigation, industrial, and municipal water needs to a rapidly growing population. The water supply also serves to improve water quality in the Tualatin River for fish, wildlife and ecological processes. Hagg Lake is part of the Reclamation's Tualatin Project and co-managed by Washington County Parks for a broad range of recreational uses by a diverse and large regional population. These include fishing, boating, picnicking, biking and hiking. However, most visitor-use days are associated with angling. The Department stocks the lake annually with 85,000 rainbow trout. Hagg Lake is also very popular destination for warmwater game fish anglers, including smallmouth bass, largemouth bass, crappie, yellow perch, and catfish. All warmwater game fish self-reproduce in the reservoir. State records for smallmouth bass and brown bullhead catfish were caught in Hagg Lake.

Upstream of the existing Scoggins Dam and Henry Hagg Lake, there is fair to good fish habitat in the Scoggins Creek subbasin, including several tributaries; Sain, Tanner and Wall Creeks. The land in this part of the watershed is primarily under private forest management, with some public land present. Random stream habitat surveys conducted by the Department in this area indicate that stream function has been altered largely by historic timber harvest practices, including large wood removal efforts. Though these practices have diminished habitat complexity, pool formation and gravel retention, these processes are being restored through improved Forest Practice Rules and stream restoration projects under the Department and the Department of Forestry direction. Water quality and quantity in this reach of Scoggins Creek can also be limited during summer by reduced flows, common in west-side Willamette Valley tributaries. It is estimated that there is approximately 43.0 miles of available habitat upstream of the existing Scoggins Creek Dam for resident and fluvial cutthroat trout with much fewer miles available for other species like steelhead, coho salmon, Pacific lamprey, catostomids (large scale and mountain suckers) and mountain whitefish.

Native Migratory Fish:

NMF use of Scoggins Creek prior to Scoggins Dam in 1971 included winter steelhead, coho salmon, cutthroat trout, Pacific lamprey, mountain whitefish, large scale sucker and mountain sucker. Northern pike minnow are also native to the Tualatin River, but typically remain in the lower mainstem reach of the watershed. Anecdotal information shows that coho and spring chinook salmon were also present intermittently, but little is known about historic distribution and abundance of these populations during pre-dam periods. Each NMF species has different life history needs, and distribution in Scoggins Creek is varied. A summary of the linear extent of habitat that will be inaccessible to NMF as a direct result of the proposed action is found in Table 1.

Winter steelhead are anadromous and native to the Tualatin River subbasin, and historically spawned and reared in Scoggins Creek in the higher gradient reaches and tributaries upstream of the existing dam. Based on tributary size, winter steelhead would have used the mainstem of Scoggins Creek above the dam-site, and the lower reaches of Sain and Tanner Creek, two of the more prominent tributary streams that empty into Hagg Lake. Habitat quality is considered poor for winter steelhead in the 2.89 mile reach affected by the project proposal. The stream channel in this reach is highly incised, and has very low amounts of spawning gravel and habitat complexity. The reach is believed to have always served more as a migratory corridor for winter steelhead.

Natural production status, abundance and distribution of the steelhead population prior to the construction of the dam in the early 1970s is unknown. In addition, steelhead returns to Scoggins Dam were minimal during trap-and-haul operations over the first few years after the dam was built, an indication of presence but low abundance in Scoggins Creek. Based on a Willamette River radio tracking study conducted in 2013 (Jepson et. al. 2014) an estimated 8% of the winter steelhead escapement above Willamette Falls return to the Tualatin River, however, there is no recent information to quantify returns of steelhead specifically to lower Scoggins Creek. It is believed that most winter steelhead that migrate into the Tualatin River return to streams with higher habitat quality, including Gales Creek, the upper Tualatin River and the Dairy Creek system (mostly East Fork Dairy Creek) to

spawn and rear (ODFW 1992; Bio-Surveys, LLC 2015). The Department concludes that winter steelhead habitat exists in the 2.89 mile reach between the existing Scoggins Dam and the new proposed dam (Table 1).

Pacific lamprey are anadromous and native to the Tualatin River watershed, including Scoggins Creek. However, their current status and distribution in the Scoggins Creek subbasin and Tualatin watershed is unknown. Pacific lamprey prefer low-gradient and medium to larger size streams to spawn and rear in (Scott and Crossman 1979). Prior to the construction of Scoggins Dam, historic Pacific lamprey spawning and rearing habitat existed in Scoggins Creek upstream of the existing dam and Hagg Lake, and in the lower reaches of Sain and Tanner Creeks. Pacific lamprey also require large patches of soft sediments to rear in for 5 to 7 years before smolting and outmigrating to the ocean. This type of soft-sediment habitat is present throughout the 5-mile reach of Scoggins Creek below the dam, which includes the 2.89 miles of stream that will be inundated when the new dam is built.

Based on professional knowledge of the watershed and Pacific lamprey life history needs, if passage is not provided at the new Scoggins Dam, The Department estimates that about 2.89 miles of habitat will be lost for migratory and rearing purposes (Table 1). The 5.6 mile reach below the existing Scoggins Dam has very little if any spawning habitat.

Coho salmon were not historically native to the Willamette River above Willamette Falls at the time of pioneer settlement, as it is theorized that a combination of low autumn flows and minimal back flooding by the Columbia River in fall made ascent of the waterfall by migrating fish impossible during that time of year. Fish Passage at Willamette Falls was vastly improved with the installation of a state-of-the-art fish ladder in the early 1970s, and since the early 2000s natural production of coho salmon above Willamette Falls has increased. Though for many years the Department released large numbers of hatchery coho above Willamette Falls, including the Tualatin River, no hatchery coho have been released above the falls since 1998. The coho population returning to the Tualatin River have been supported almost entirely by natural production for the past 20 years (ODFW Willamette Falls Fish Passage Data). Naturally produced coho salmon are now observe annually in several Tualatin River tributary streams including Scoggins Creek below the dam. For this reason, these fish are being considered in the Net Benefit Analysis.

Coho salmon typically prefer lower gradient streams, small to medium sized, to spawn and rear. They will spawn in mainstem reaches like the Tualatin River, but will move into smaller tributary streams if rain elevates flow. While ODFW GIS data do not show historic use of coho upstream of the existing Scoggins Valley dam, we believe, based on tributary size, physical observations of the habitat and best professional judgement, coho salmon would have spawned in the mainstem of Scoggins Creek above the existing dam-site, and the lower reaches of Sain, Tanner and Wall Creeks, three tributary streams that empty into Hagg Lake.

Natural production status, abundance and distribution of the population prior to the construction of the dam in the early 1970s is unknown. Prior to dam construction, most coho returning to the Tualatin River would have originated from large hatchery releases in the basin between the late 1950s and the late 1990s. Since 2006, The Department surveyors have observed coho spawning each year in a quarter mile reach below Scoggins Dam. Natural production of coho in the reach, however, is minimized by lack of quality spawning gravel due to retention of substrate behind Scoggins Dam. Based on a Willamette River radio tracking study conducted by The Department in 2009, an estimated 35% of the coho salmon escapement above Willamette Falls return to the Tualatin River. Coho salmon typically return to streams with higher habitat quality, including Gales Creek, the upper Tualatin River near Cherry Grove, and the Dairy Creek system (mostly East Fork Dairy Creek) to spawn and rear (Bio-Surveys, LLC. 2015). The Department concludes that coho salmon habitat exists in stream reaches above Scoggins Dam, and in the 2.89 mile reach between the existing Scoggins Dam and the new proposed dam (Table 1).

Coastal Cutthroat trout are native to the Tualatin River Watershed, and are well distributed in the Scoggins Creek subbasin. Coastal cutthroat trout exhibit a diverse life history and adapt to a variety of habitat types. These fish are present as resident and fluvial forms, both downstream of Scoggins Dam, and in most tributary streams above Hagg Lake, including Scoggins Creek, Sain Creek, Tanner Creek and Wall Creek. Presence absence surveys conducted for timber harvest purposes shows that cutthroat trout are present in most headwater streams in the Scoggins Creek subbasin.

Similar to other salmonids, the habitat quality in the 2.89 mile reach affected by the Option 3 dam is considered only fair to poor for cutthroat trout. The stream channel in this reach is highly incised, and has very low amounts of spawning gravel and habitat complexity. The reach is believed to serve more as a migratory corridor for Coastal cutthroat trout. In addition to the 2.89 miles of mainstem tributary habitat, an additional 6.37 miles of tributary habitat is presently available for these species and will be made inaccessible to coastal cutthroat trout populations in the Tualatin River system downstream of the new dam. Approximately 3.05 miles of current and/or historic coastal cutthroat trout habitat occurs upstream of the inundation area and would remain accessible to these species. However, access to the tributaries outside of the inundation area would be limited to the coastal cutthroat trout population between the proposed project and the existing Scoggins Dam. Therefore, for the purpose of the Net Benefit Analysis, a sum-total of 9.26 miles of Coastal cutthroat trout habitat exists in the reach between the new proposed dam and the existing Scoggins Dam (Table 1), and will be lost to production if passage is not provided.

Mountain whitefish, mountain sucker and large scale sucker are native to the Tualatin River subbasin and are in Scoggins Creek, both upstream and downstream of the existing dam. All three species prefer lower gradient reaches of mainstem streams and larger tributaries for most of the year to forage (Scott and Crossman 1979). However, all three species also migrate, often in large numbers, to upstream spawning areas and are capable of ascending higher gradient sections of stream in order to reach preferred lower gradient spawning sections of stream.

The habitat quality in the 2.89 mile reach affected by the Option 3 Dam is considered poor for natural production and rearing of large scale and mountain suckers and mountain whitefish. Spawning substrate for these fish is nearly non-existent in the reach, and the area also lacks cobble and small boulder substrate, important for growing algae and periphyton, an essential food source. The reach between Scoggins Dam and the proposed Option 3 Dam is believed to serve more as a migratory corridor for these fish. For the purpose of the Net Benefit Analysis, a sum-total of 2.89 miles of stream habitat exist in the reach between the new proposed dam and the existing Scoggins Dam (Table 1), and will be lost to production if passage is not provided.

Spring Chinook salmon are native to the Willamette River and many of its tributaries above Willamette Falls. These fish are federally listed under the ESA as Threatened. Spring chinook prefer Cascade Mountain river systems driven by snowmelt and higher summer flows than what is provided in west-side Willamette Valley streams like the Tualatin River. Even so, spring chinook have been observed on occasion in low numbers in many of the west-side tributaries, including the Tualatin River, and potentially Scoggins Creek as well. However, due to intermittent presence, The Department does not consider spring chinook to be a NMF population in the Tualatin subbasin, (ODFW 1992), so these fish are not considered in this assessment.

Proposed Mitigation Actions

Permanent Removal of Balm Grove Dam at RM 13 in Gales Creek

In 2016, CWS purchased the property that contains the Balm Grove Dam and the riparian/floodplain area adjacent to the dam on the southwest side of the Gales Creek. The project proposes to permanently remove Balm Grove Dam during the 2019 in-water work window. In addition to removal of this dam and its ancillary features, the Applicants intend to restore the reach of Gales Creek that has been affected by

the dam, and restore the CWS-owned riparian and floodplain areas at the dam site as part of the Joint Project mitigation. Specifically, the CWS will restore approximately 1,200 linear feet (2.5 acres) of the Gales Creek channel in the vicinity of the dam. The restoration will involve the placement of large wood, habitat boulders, and channel grading to promote aquatic habitat complexity, functional fluvial conditions, and the maintenance of NMF passage and habitat through the site. Approximately 12 acres of the creek's floodplain will be planted with riparian and upland vegetation native to the region during fall 2019/winter 2020.

Gales Creek is a large and significant tributary of the Tualatin River subbasin and in-proximity to Scoggins Creek, the location of the proposed Option 3 Dam or Waiver Site. The basin area is 78 square miles. As with Scoggins Creek, Gales Creek's headwaters originate in the east slopes of the Oregon coast range and, near its midpoint just downstream of the Balm Grove Dam, flows across lower gradient agricultural land in the upper Tualatin Valley, before connecting with the Tualatin River east of Forest Grove.

Stream habitat in the upper Gales Creek watershed, above Balm Grove Dam, is considered good to very good based on surveys conducted by The Department and the 2015 Rapid Bio Assessment (Bio-Surveys LLC. 2015). Gales Creek is listed as Critical Habitat by the National Marine Fisheries Service for Endangered Species Act (ESA) listed winter steelhead (Threatened), and several of the more productive miles of stream and associated tributaries are on land managed by the Tillamook State Forest. Gales Creek and a small portion of the upper Tualatin River are the only stream reaches in the Tualatin River basin designated as Critical Habitat for winter steelhead. For over 20 years, Gales Creek has been the focus of stream habitat restoration projects by the Department, the Tualatin River Watershed Council, BLM, and the Department of Forestry among others. Large wood placement projects have been completed in about 4 miles of stream, all in key areas of the subbasin where habitat and water quality are considered high. Additionally, several culverts have been removed across the subbasin to improve access for NMF. The Gales Creek subbasin hosts many miles of diverse habitats, from low gradient meander channels with complex habitats in Beaver Creek, to higher gradient stream reaches in the North and South forks, Low Divide Creek and others.

Balm Grove Dam is a three-foot high concrete dam located at approximately RM 13 on Gales Creek near the small community of Gales Creek in Washington County. The dam was originally built to provide recreational activities during summer months, in conjunction with a small private campground, playground, tavern, and store. These ventures were mostly abandoned in the 1990s, and subsequently the land and buildings fell into disrepair. CWS purchased the land and the associated dam and water rights in 2016 with the purpose of removing it to improve fish passage and fulfill the mitigation obligation for waiving fish passage at the proposed Option 3 Dam.

The dam is comprised of a low concrete sill with provisions for flashboards to impound water in summer. It also has retaining walls extending upstream on both banks. The dam is approximately 50-feet long and has a hydraulic vertical height of nearly 3 feet depending on stream flow conditions. Flashboards were typically installed in summer to impound the stream for recreation. These flashboards added to the total height and impassability of NMF above the dam. No functional fish passage facilities were constructed. The dam has always been recognized as a full upstream fish passage barrier to all juvenile winter steelhead, juvenile coho salmon, all mountain whitefish, and both adult and juvenile mountain and large scale suckers, and all coastal cutthroat trout. It is presently considered a partial barrier to adult winter steelhead and adult coho salmon, depending on flow conditions, stream hydraulics, and jump height at the dam during migration runs, which varies seasonally as flow conditions vary. The water depth of the jump pool can also be diminished by substrate aggradation, and there is a 20 foot wide concrete apron above the dam that increases flow velocity or sheet flow depending on river gage height. It is also considered to be a full barrier to both brook and Pacific lamprey due to hydraulics and the 90 degree angular nature of the top of the concrete dam. The USFWS conducted a lamprey study in Gales Creek (USFWS 2015) and confirmed that Pacific lamprey ammocoetes were present below the dam but not

above it. Other reports confirm that the Balm Grove Dam is a significant fish passage issue in the Gales Creek watershed (ODFW 1992, Bio-Surveys, LLC. 2015).

NMF species composition in Gales Creek is the same as those in Scoggins Creek and the proposed project site. Winter steelhead, cutthroat trout, Pacific lamprey, largescale large scale and mountain suckers, and mountain whitefish are present. Coho salmon, now fully naturalized to the Tualatin River subbasin, are also present in Gales Creek and its many tributaries up and downstream of the dam. Warmwater species are present in Gales Creek, but generally don't migrate too far upstream from the confluence with the Tualatin River.

As with lower Scoggins Creek, Gales Creek below Balm Grove Dam has some water quality limitations. This is important, as the Balm Grove Dam limits upstream fish migration to better habitat, particularly in summer when juvenile salmonids desire to migrate upstream in search of cooler more oxygenated water. Due to basin size, Gales Creek has greater summer flows and better water quality than Scoggins Creek, and therefore is more likely to support anadromous steelhead, coho and Pacific lamprey. Most of Gales Creek above the dam is on forested land with private and public ownership. The stream reach above Balm Grove Dam is composed of diverse fish habitats, including excellent coho spawning and rearing habitat in the Beaver Creek sub-watershed, and very good to excellent winter steelhead habitat in upper Gales Creek (Bio Surveys LLC 2015).

Providing passage at this dam is currently listed as a basin priority by the Department, as found in both the 1992 Tualatin Subbasin Fish Management Plan and the Department's 2013 Statewide Fish Passage Priority Barrier List. This action has also been recommended in a number of other plans, including The Department's 1990 Tualatin River Salmon and Steelhead Production Plan, the Gales Creek Watershed Assessment Project, the Tualatin River Watershed Action Plan, and the 2014 Tualatin River Rapid Bio Assessment. Also, in coordination with the Department, much of Gales Creek has been identified by the Oregon Department of State Lands as "Essential Indigenous Anadromous Salmonid Habitat". This includes approximately 23 miles of stream above Balm Grove Dam, all of which is included in the stream distance which would be immediately accessible if passage were provided at Balm Grove Dam.

Large scale sucker, mountain sucker, coastal cutthroat trout, and mountain whitefish would also benefit with the removal of Balm Grove Dam. In spring, these fish all make fairly long spawning migrations from lower Gales Creek upstream to preferred spawning habitat. Large numbers of these fish have been observed "stacking" up below this barrier. These species of fish are not good jumpers so cannot pass this impediment. Based on a modeling effort conducted by MB&G in the 2018 Waiver Application for this project, it was determined that 5.9 miles of relatively low-gradient sucker and whitefish habitat exists immediately upstream of the dam that would provide good habitat for these fish if the dam were removed (Table 2). The Department concurs with this assessment based on the literature, knowledge of the Gales Creek watershed and its habitat from surveys, and an understanding of these species' life history needs and distribution in west-side Willamette Valley streams.

Lake Oswego Diversion Dam and Ladder modification (Tualatin River)

The Tualatin River is a large low-gradient tributary to the Willamette River with a watershed area of about 718 square miles. The Lake Oswego Corporation (LOC) Diversion Dam is a low-head concrete dam located at approximately river mile 3.8 in the lower river (Figure 1) and is approximately 62.4 river miles downstream of the proposed dam on Scoggins Creek. The dam is occasionally used to divert water into Lake Oswego to maintain lake level for both recreational use and hydropower when water need cannot be met by other tributary streams that enter the lake directly. A traditional pool-weir fish ladder was installed on the dam as mitigation for the original construction of Scoggins Dam in 1971, and is managed by the Department in agreement with LOC. This fishway does not function efficiently for fish passage at the wide range of flows in this reach of the river and is recognized as a partial barrier to adults and juvenile NMF. The Department considers it a full barrier to mountain whitefish, mountain sucker and large scale sucker, and a partial barrier to cutthroat trout, winter steelhead, coho salmon and Pacific

lamprey. At high stream flows the dam creates a velocity barrier and hydraulic situation that is believed to be impassable for all fish until flows drop to more favorable levels. Stream flows in this reach of the watershed slowly recede, and it often takes a week or more for stream flows to drop enough for the fish ladder to be functional. The following information is important to better understand the issues with fish passage associated with the existing conditions at the pool and weir fish ladder. These include:

- weir boards (within the fishway) can sometimes completely fail, separate or split, which reduces flow over the crest of the weirs, creating impassible conditions and extreme jump heights for migrating fish,
- jump heights at each weir may often exceed one foot differentials, which exceeds juvenile salmonid passage criteria (6 inches),
- excessive water velocities and turbulence exists in the fishway, particularly at moderate to higher flows in the Tualatin River. These conditions preclude upstream passage through the fishway,
- dynamic river flow conditions require frequent dam-board adjustment, a major workload and safety consideration for Department staff,
- logs and floating debris can accumulate at the upstream exit of the ladder, which impedes laminar flow, restricts upstream fish passage, requires chronic cleaning, and is significant workload and safety consideration for Department staff,
- attraction flows at the ladder's downstream entrance are considered to be poor, due in part to the length and shape of the dam, the small size of the fish ladder, the large amount of flow in the river and the river's mid-stream thalweg location, and
- streamflows in the mainstem Tualatin River can drastically fluctuate, particularly during spawning migrations in fall, winter and spring, which affects hydrology and jump heights in each of the fishway pool of the ladder.

Operating and maintaining this ladder has become a Department staff workload and safety issue because of the frequent debris cleaning and dam-board adjustment that is required to keep the facility operational. It requires frequent visits and maintenance during critical times of the year when fish are migrating, making for impractical staffing demands within the Department's Willamette Watershed District.

Although fish can pass downstream over the dam, upstream passage, even with the existing fish ladder, is problematic. Most juvenile salmonids are unable to find the fishway due to poor attraction flows and those that are successful in locating the fishway entrance are unable to move upstream through the ladder, given the excessive jump heights and excessive water velocities and turbulence. Most adult salmonids and Pacific lamprey, are believed to be delayed trying to locate the ladder. If migrating fish cannot find the ladder, they may be inclined to attempt to jump over the dam itself, which can cause injury to these fish. Given the low attraction flows from the ladder relative to the volumes of water flowing over the dam, operational adjustment constraints, and the other issues noted above, it is likely that a high proportion of the adult NMF seeking passage at this site are delayed, potentially for long periods of time.

The action at this location includes a retrofit of the existing pool and weir fishway configuration to a vertical slot fishway configuration. The Department engineering and fish passage program staff have worked collaboratively with engineering staff from CWS and have determined, given the configuration of the existing fishway concrete walls, that there are limited opportunities to improve conditions at this location. Ideally, complete abandonment and reconstruction of a more appropriately sized fishway at this diversion dam would occur. Alternatively, complete abandonment and permanent removal of the diversion dam would be best for fish passage, but these alternatives are not viable solutions given the purpose and need of the diversion structure. It was decided that a retrofit and conversion of the existing fishway from a pool and weir to a vertical slot fishway configuration would maximize fish passible conditions at this location. In addition to conversion to a vertical slot fishway, which will make the fishway more functional at a variety of flows, opportunities exist to help improve attraction flow at the

fishway entrance. Using the existing sluice pipe that runs parallel and adjacent to the fishway, significant attraction flows and a flow diffusing grate will improve the ability of all NMF to find the fish entrance and traverse upstream through the new vertical slot weir configuration.

This new fishway configuration, coupled with the conversion of the sluice pipe to functionally perform as a new auxiliary water supply system to help attract fish to the ladder entrance, will significantly improve conditions for all upstream migrating NMF, including both juvenile and adult life stages. These fish passage improvement retrofits will particularly improve upstream fish passage conditions for native sucker species as these fish do not jump over a traditional pool and weir fishway configuration, which presently exists. The Department believes these retrofits, while not the perfect solution at this site, will improve upstream migration conditions for NMF and at a variety of flow conditions in the mainstem Tualatin River, particularly those native fish that migrate through the Tualatin River up to the upper basin proximal to Gales Creek where Balm Grove Dam is proposed to be permanent removed.

In addition to the fishway improvements described above, a new log-boom and trash rack will be constructed and installed at the fishway exit (upstream terminus of fishway). The existing fishway has a long history of floating debris, particularly logs and other debris that congregate and collect at the fishway exit and accumulate within the fishway exit and fishway pools. This debris can compromise the ability of migrating native fish to migrate upstream, often causing delay or even prevent fish from migrating upstream through the fishway at times when debris accumulates. CWS will coordinate with the Department for log-boom maintenance to assure the log boom has regular and frequent maintenance in conjunction with the owners of the LOC Diversion Dam with the common goal of keeping the new fishway retrofits more functional for which they are designed to improve upstream migration through the fishway.

Balm Grove Dam Storage Water Right Conversion to Instream Water Right in Gales Creek

The CWS intends to file a transfer of use application a 0.09 cubic feet/second (cfs) irrigation water right in Gales Creek to in-stream, ecological uses upon The Department's approval of the waiver request. The irrigation water right and an 8 acre-foot water storage right are associated with the parcel the CWS purchased in 2016 and Balm Grove Dam, respectively. While transition of the water right to in-stream use is expected to result in a small benefit to NMF and enhance the proposed Joint Project fish passage mitigation, quantification of the exact net benefit to NMF from this action is impossible. Nonetheless, this action clearly further enhances and strengthens the mitigation proposal and potential overall net benefit to NMF.

Net Benefit Analysis

The primary purpose and a fundamental tenant of the Department's fish passage waiver net benefit analysis, as required in ORS 509.585(7), is to evaluate the project and make recommendation to the OFWC as to whether or not the proposed alternative mitigation actions, in lieu of not providing passage as part of the proposed project, results in a net benefit to NMF greater than if passage was provided at the new proposed dam, defined in ORS 509.580(7). As permissible in the state's fish passage statutes, the OFWC shall waive the requirement for fish passage if the OFWC determines that the alternatives to fish passage proposed by the person owning or operating the artificial obstruction (dam) provide a net benefit to NMF. Net benefit to NMF is determined by comparing the benefit that would occur if the new Scoggins Creek Dam had fish passage to the benefit to NMF that would occur at the proposed alternatives (mitigation) to fish passage. Alternatives to fish passage must result in a benefit to fish greater than that provided by the artificial obstruction (dam) with fish passage. The net benefit to fish shall be determined based upon conditions that exist at the time of comparison.

Table 1 previously describes and summarizes the quantity of habitat that will become inaccessible to NMF if fish passage is not provided by the project, as proposed. The Department and the project team members have worked collaboratively and agree that these habitat impacts are accurately quantified.

The NMF benefits associated with the permanent removing Balm Grove Dam are significant and are summarized below in Table 2. The methods for determining these habitat estimates are thoroughly described in the fish passage waiver application. These methods were developed collaboratively with the Department staff and we are in agreement that these habitat measurements are accurate. Also described in the fish passage waiver application and used in this Net Benefit Analysis, it is important to identify that Balm Grove Dam is not a complete upstream fish passage barrier to all migrating native fish. Since Balm Grove Dam is not a complete barrier to all NMF, the habitat mitigation credit is weighted or reduced commensurate to the degree to which NMF can voluntarily pass upstream of this dam. The product of the weighting factor and the habitat extent that would be accessible to NMF, when applied to the extent of habitat made accessible upstream of Balm Grove Dam after permanent removal, identifies the amount of species and life stage specific habitat credit available from the proposed fish passage mitigation action at Balm Grove Dam. NMF that are completely blocked by Balm Grove Dam (all juvenile NMF, adult cutthroat trout, adult lamprey, adult large scale and mountain suckers, and adult mountain white fish) receive 100% of the credit made available through the dam removal action. The weighting factor applies to the NMF species that the dam presents a partial barrier (adult steelhead and coho salmon). The species specific benefits, including the weighted factor habitat are summarized below (Table 2).

Table 2. Estimated NMF Habitat Upstream of Balm Grove Dam.

NMF Species	Life Stage	Available Upstream Habitat	Weighted Available Upstream Habitat*
Coho salmon	Adult	25.51 miles	17.09 miles
Coho salmon	Juvenile	25.51 miles	N/A
Steelhead	Adult	28.90 miles	19.36 miles
Steelhead	Juvenile	28.90 miles	N/A
Coastal cutthroat trout	All	106.11 miles	N/A
Pacific lamprey	All	25.51 miles	N/A
Mountain whitefish	All	5.90 miles	N/A
Mountain sucker	All	5.90 miles	N/A
Largescale sucker	All	5.90 miles	N/A

*As determined by application of WDFW's (2009) passability metrics.

Bold font indicates the amount of habitat credit that will be made available from the proposed mitigation action (Balm Grove Dam Removal).

Table 3 (below) identifies the total species specific habitat impacts (miles) from the proposed project at the waiver site (new dam on Scoggins Creek) and the proposed mitigation site at Balm Grove Dam. This table compares the impacts associated with the loss of habitat access at the proposed new dam on Scoggins Creek to the benefits associated with Balm Grove Dam removal and the habitat extent that will become accessible in Gales Creek.

Table 3. Comparison of NMF stream habitat miles lost in Scoggins Creek under the Option 3 Dam proposal and the miles of stream habitat gained through mitigation with the permanent removal of the Balm Grove Dam on Gales Creek.

Species Native Migratory Fish Species for the Net Benefit Analysis	Scoggins Creek Fish habitat miles between new dam site upstream to Scoggins Dam (Lost Access)	Gales Creek Fish habitat miles upstream of Balm Grove Dam once removed (Gained Access)	Net Habitat Gain to NMF as a result of the Mitigation Actions (Net Benefit)
Coho Salmon Adults	2.89 miles	17.09 miles	14.20 miles
Coho Salmon Juveniles	2.89 miles	25.51 miles	22.62 miles
Winter Steelhead Adults	2.89 miles	19.36 miles	16.47 miles
Winter Steelhead Juveniles	2.89 miles	28.90 miles	26.01 miles
Coastal Cutthroat Trout (All)	9.26 miles	106.11 miles	96.58 miles
Pacific Lamprey (All)	2.89 miles	25.51 miles	22.62 miles
Mountain Whitefish (All)	2.89 miles	5.90 miles	3.01 miles
Mountain Sucker (All)	2.89 miles	5.90 miles	3.01 miles
Largescale Sucker (All)	2.89 miles	5.90 miles	3.01 miles

In addition to the direct habitat that will be made accessible above Balm Grove Dam through its permanent removal on Gales Creek, and the other two mitigation alternatives (fishway improvements at the LOC Diversion Dam on the mainstem Tualatin River and the water right conversion in Gales Creek for in-stream use), we believe these fish passage alternative actions clearly demonstrate appreciable net benefits to NMF. The LOC Diversion Dam fishway improvements and the benefits from the water right conversion to in-stream ecological use are very difficult for the Department to quantify, but we are certain these two actions absolutely compliment the Balm Grove Dam removal project mitigation proposal. Improving fish passage conditions at the LOC Diversion Dam, situated downstream at river mile 3.80 on the lower Tualatin River, will enhance the NMF net benefits provided by removal of Balm Grove Dam given the location of the LOC Diversion Dam in the lower Tualatin Basin and that all anadromous fish in the Tualatin Basin have to pass the diversion dam during upstream spawning migrations and rearing out-migrations. The fish ladder and attraction-flow improvements increase the capability of NMF to more effectively pass through the dam site during migrations, net benefits will be provided, which will enhance the overall benefit of Balm Grove Dam removal. Fish passage improvements at the LOC Diversion Dam will decrease swimming and jumping stress on the migrating native fish, decrease potential predation and disease transmission by minimizing time NMF congregate at the diversion dam, and decrease NMF exposure to poor water quality conditions (*e.g.*, low flows and high water temperatures) while NMF wait for more ideal upstream passage conditions. The aquatic habitat upstream of the LOC Diversion Dam functions as a 20-mile-long, relatively stagnant reservoir that is a noted area of poor water quality (DEQ 2012). Therefore, if NMF expend less energy passing the LOC Diversion Dam due to ladder improvements, they would be less susceptible to the adverse effects of the poor water quality upstream of the dam. Similarly, the proposed modifications to the LOC Diversion Dam by replacing the pool/weir fish ladder configuration with a more effective vertical slot retrofit configuration to the fish ladder, and improving attraction flow to the fishway entrance, will improve NMF access to the entire Tualatin River subbasin for winter steelhead, cutthroat trout, Pacific lamprey, coho salmon, suckers and mountain whitefish.

The Department’s Net Benefit Analysis determines that providing the proposed mitigation at Balm Grove Dam, fish passage improvements to the LOC Diversion Dam fishway and the permanent conversion of 0.09 cfs to in-stream ecological use will provide a net benefit for native migratory fish over providing passage at the new Option 3 Dam on Scoggins Creek. We base these findings on the following facts and analysis:

- Scoggins Creek and Gales Creek are both tributary streams to the upper Tualatin River, are “in-proximity” to each other and share similar stream habitat characteristics including basin size, gradient, geomorphology, land use patterns, and fish population assemblages.
- If fish passage were provided at the new Option 3 dam on Scoggins Creek, NMF could move upstream and into tributary streams above Hagg Lake to spawn. A significant proportion of juveniles produced by spawning winter steelhead, coho salmon and Pacific lamprey would migrate downstream into the lake to rear or to depart the system on their way to the ocean. These fish would fall prey to a robust warmwater fish population, and potentially to thousands of stocked hatchery rainbow trout, as well. Pacific lamprey ammocoetes are particularly vulnerable to largemouth and smallmouth bass predation.
- Gales Creek and its tributaries above Balm Grove Dam support many more miles of viable native migratory fish habitat than Scoggins Creek above Henry Hagg Lake.
- As indicated in the Joint Project Waiver Application, the mitigation work on Gales Creek and the lower Tualatin River would be conducted several years prior to the point when passage would be provided at Scoggins Dam, thus providing a “time” benefit for native migratory fish production in the basin. The 2019 implementation schedule for the Balm Grove Dam removal (advance mitigation where NMF will realize effects from dam removal this summer) will provide significant benefits and in advance of the proposed schedule to construct the new dam on Scoggins Creek.
- Providing volitional passage at the proposed Scoggins Dam might negatively impact downstream native migratory fish populations through the increased opportunity of downstream passage for non-native warmwater fish and rainbow trout.
- A greater amount of stream habitat miles for all native migratory fish and their respective life histories exists above Balm Grove Dam than above Scoggins Dam. This is true for either those stream miles lost to production above the proposed Option 3 Dam or inclusive of all miles above the existing Scoggins Dam and above Hagg Lake.
- Providing improved passage at the Lake Oswego Corporation Diversion Dam and ladder will improve basin-wide access and connectivity for all native migratory fish, and will reduce maintenance needs. This will allow The Department staff more time to address other fish and habitat management issues for native migratory fish in the North Willamette Fish District.

Conclusion and Department Recommendation

The Department concludes through this benefit analysis that there is a Net Benefit to all NMF associated with the three fish passage mitigation alternatives in exchange for not providing fish passage at a proposed new dam on Scoggins Creek. Therefore we recommend that the OFWC approve the fish passage waiver request.

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