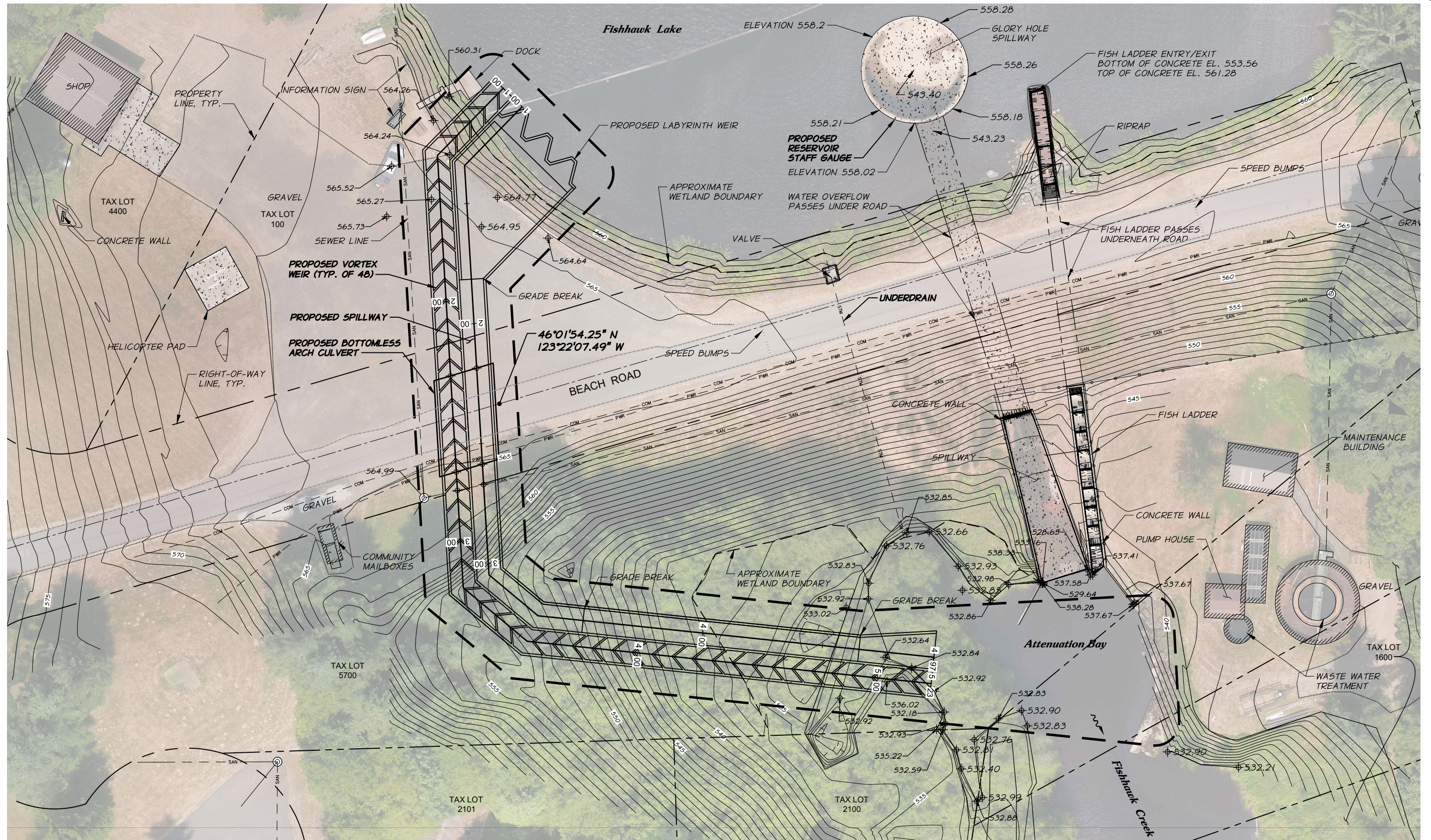
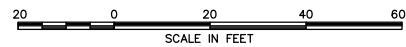


Q:\FishhawkLakeReserve&Community\1199-778\_FishPassageImprove\Drafting\1199-778-060F-101SPL\_GRANT.dwg\_Layout1\_6/5/2020 11:20 AM\_prichardson



LEGEND			
---	PROJECT AREA BOUNDARY	---	SAN SEWER
---	PROPERTY/RIGHT-OF-WAY	---	STM UNDERDRAIN
---	CONTOUR LINE	---	COM COMMUNICATIONS
+	SPOT ELEVATION	---	PWR POWER



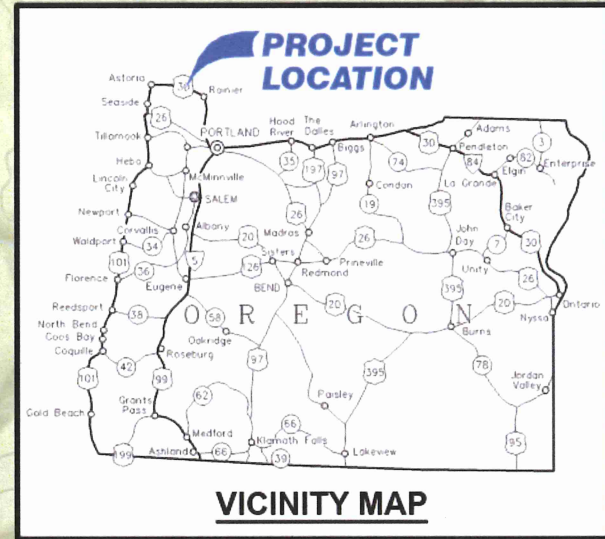
**ap** anderson  
perry  
& associates, inc.

**FISHHAWK LAKE RESERVE & COMMUNITY  
FISH PASSAGE IMPROVEMENTS  
OWRD WATER PROJECT GRANT**

**SITE PLAN**

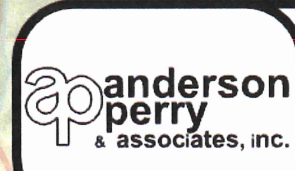
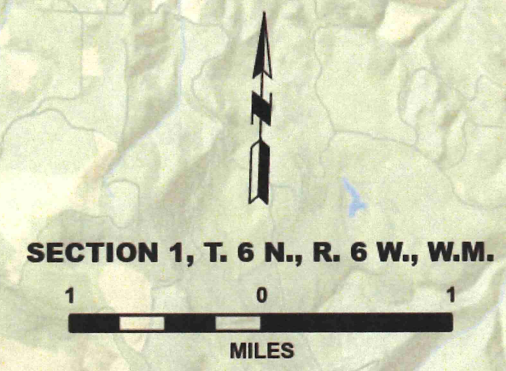
**FIGURE  
A**

\\LGSVR6\gis\projects\FishhawkLakeReserve\Community\1199-778\_FishPassage\1199-778\_FishPassage.aprx, 6/4/2020 2:51 PM, dchristman



**PROJECT LOCATION**  
 LAT 46° 01' 54.25" N  
 LON 123° 22' 07.49" W

**Fishhawk Lake**



**FISHHAWK LAKE RESERVE & COMMUNITY**  
 FISH PASSAGE IMPROVEMENTS  
 OWRD WATER PROJECT GRANT

**FIGURE B**

**LOCATION AND VICINITY MAPS**

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community.  
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



## Water Project Grants and Loans Landowner Agreement

*Instructions to Applicants: Work with landowners to complete this form for all properties on which the proposed project would occur. Submit this completed form as part of your grant/loan application. For questions contact [WRD\\_DL\\_waterprojects@oregon.gov](mailto:WRD_DL_waterprojects@oregon.gov).*

### Project and Applicant Information

Project Name: Fishhawk Lake Storage Protection Project

Funding Applicant: Fishhawk Lake Reserve and Community, Inc.

Co-Applicant (if applicable): \_\_\_\_\_

#### Funding Applicant Contact Information:

Name: Travis Duncalf

Phone Number: 971-235-0857

Email Address: Travis.Duncalf@fishhawklake.com

#### Co-Applicant Contact Information:

Name: \_\_\_\_\_

Phone Number: \_\_\_\_\_

Email Address: \_\_\_\_\_

### Landowner Information

Landowner(s) Name: Fishhawk Lake Reserve and Community, Inc.

Landowner Authorized Representative: Travis Duncalf

#### Landowner Contact Information (or Authorized Representative)

Address: 9997 Beach Drive

(required) Clatskanie, OR 97016

(optional) Phone Number: 503-755-2132

(optional) Email Address: travis.duncalf@fishhawklake.com

### Property Information

List each property owned by the above-mentioned Landowner on which the project would occur:

County	Tax map	Lot number
<u>Clatsop</u>	<u>60601DB (6N06W01DB)</u>	<u>5700, 1600</u>
<u>Clatsop</u>	<u>60601 (6N06W01)</u>	<u>100 (reservoir)</u>

### Landowner Acknowledgement

1. Fishhawk Lake Reserve and Community, Inc. is the legal owner(s) (the Landowner) of the above described property (the Property).
2. I am authorized to act on behalf of the Landowner.
3. I am aware of and agree to the above-mentioned proposed project and grant permission for the Applicant, and the Applicant's agents, to conduct the following activities on the Property. (List activities below)

a.
b.
c.
d.

4. I am aware that monitoring information related to the Project is a matter of public record.
5. I certify that the above-mentioned information is true and accurate, I am aware of and agree to the proposed work, and I am authorized to sign as the Landowner or Authorized Representative.

Signature of Landowner or Authorized Representative: \_\_\_\_\_

Date: May 26, 2020 Print Name: Travis Duncalf



## FISHHAWK LAKE RESERVE & COMMUNITY

9997 Beach Drive  
Birkenfeld, OR 97016

May 27, 2020

To Oregon Water Resources Department:

Fishhawk Lake Reserve and Community (FLRC) is committed to meeting the state and federal requirements necessary to protect Fishhawk Lake and the dam that stores water in this reservoir. Construction of a combined spillway and fish ladder is planned to occur in 2021-22. The combined spillway and fish ladder will meet Oregon Water Resources Department's ½ probable maximum flood requirements to ensure the integrity of the dam structure. This upgrade will ensure the dam does not overtop, as it nearly did in 2007, and avoid a catastrophic failure of the dam structure. The new fish ladder, which is necessitated by construction of the spillway, will also improve conditions for fish migration and survival, especially for Oregon Coast Coho Salmon ESU juveniles, Pacific Lamprey, and other cold-water species. The new combined spillway and fish ladder have a unique design that we hope will become a model for other outdated dams in Oregon and across the country.

At the annual meeting of the FLRC membership in August 2017, the community recognized the importance of the project and approved moving forward with the preliminary engineering for the spillway and fish ladder project. This project is currently estimated to cost \$3,583,123.00. FLRC intends to apply to the Oregon Watershed Enhancement Board (OWEB) on July 27, 2020 for a Restoration Grant of \$300,000, and to the Bureau of Land Management (BLM), Fisheries and Aquatic Resource Management Funding Opportunity No. L20AS00037 for \$300,000 on June 16, 2020. Each of these projects will request funds for the combined spillway and fish ladder based on the ecological benefits, including habitat restoration and fish passage, that will occur as a result of the improved combined spillway and fish ladder designs.

In November 2019, FLRC signed an assistance agreement with ODFW/ODOT for a grant award of \$105,238 to complete the road construction required for the combined spillway and fish ladder. According to ODFW, the ODFW/ODOT funds are "currently allocated for the project, pending a grant agreement for reimbursement of expenses contingent of full fish passage being addressed." The official grant agreement dedicating the funds to the Fishhawk Lake fish ladder project is contingent on the entire project and barrier being upgraded to meet full fish passage and obtaining an ODFW fish passage approval (ODFW communication, 5/28/2020).

FLRC is also looking for other funding opportunities for which this project qualifies. Should it be unable to obtain grant or other funding of the 25% match required, FLRC will look to finance the balance (which will be paid back over time by member assessments) or assess its members directly, depending on the amount required. It is presently paying for the Design Review and Approval (Task 1) and the Project Permitting and Approvals (Task 2) using membership assessments and capital reserves, and is committed to providing match funds of \$190,543 toward these tasks.

On behalf of the FLRC, I urge approval of this application, a positive public-private partnership that achieves goals for the Upper Nehalem Watershed Council, the Oregon Coastal Coho Salmon Plan, the Oregon Plan for Salmon and Watersheds, the Nehalem River Coho Partnership, the State of Oregon Coho Business Plan, the NOAA Oregon Coast Coho Recovery Plan, the Oregon Water Resources Department dam safety program, and the Oregon Fish and Wildlife Department's fish passage program..

Thank you,

Travis Duncalf, President  
Fishhawk Lake Reserve & Community, Inc.



**City of Vernonia**  
1001 Bridge Street  
Vernonia, OR 97064  
[www.vernonia-or.gov](http://www.vernonia-or.gov)  
503-429-5291

April 10, 2018

To: Grant Request Review Board  
Re: Fishhawk Lake Project Solutions Committee

Grant Board Members,

It is my understanding that Fishhawk Lake Project Solutions Committee is applying for grant funding to help support the design and implementation of vital improvements to the Fishhawk Lake spillway infrastructure, as well as a new regulation approved fish ladder for the community, citizens, and the native species that inhabit the Fishhawk Watershed. On behalf of the City of Vernonia, we want to express our strong support to this grant request.

Since 1967 this community has been part of our greater community in the Nehalem Watershed. The flood events of 1996 and 2007 effected the Fishhawk Lake community and nearly caused catastrophic damage. The Fishhawk Lake Reserve and Community continues to be a local partner in the income base of Vernonia, using services and establishments in our town. We wish for this community to thrive long into the future and the proposed upgrades in the lake infrastructure are vital for the Fishhawk Lake Reserve and Community to continue to exist. Please communicate the City of Vernonia's strong support for this grant request to the appropriate parties.

Sincerely,

Josette M. Mitchell

City Administrator, City of Vernonia



**Clatsop County**  
Board of Commissioners

800 Exchange St., Suite 410  
Astoria, OR 97103  
(503) 325-1000 phone / (503) 325-8325 fax  
[www.co.clatsop.or.us](http://www.co.clatsop.or.us)

---

May 12, 2020

Oregon Water Resources  
Oregon Water Enhancement Board  
Bureau of Land Management

On behalf of the Clatsop County Board of Commissioners, we share our support for the Fishhawk Lake Reserve and Community, Inc. (FLRC), proposal to construct a new combined fish ladder and spillway. This project will restore seasonally variable flows, improve fish passage and connectivity to upstream and downstream habitat for threatened fish species such as Coho Salmon and for Pacific Lamprey, and will exceed State flood flow and dam safety requirements.

The proposed combined spillway/fish ladder is an innovative design that could inspire modifications of other spillways that create fish passage barriers. By restoring a more normal seasonally varied flow downstream, it will also augment the riverine conditions of Fishhawk Creek and enhance aquatic habitat.

This is a community initiated and led project that has been many years in the making. When accomplished, it will meet the goals of state and federal agencies and plans, including strategic goals of NOAA Fisheries, the Oregon Department of Fish and Wildlife, Oregon Water Resources Department, the Upper Nehalem Watershed Council as reflected in the Oregon Coastal Coho Recovery Plan, Oregon Coho Business Action Plan, and Upper Nehalem Watershed Council Strategic Plan.

We are enthusiastic in our support for the construction of a combined spillway and fish ladder at Fishhawk Lake dam.

Sincerely,

Kathleen Sullivan  
Chair, Clatsop County Board of Commissioners



**Clatsop Soil and Water Conservation District**  
750 Commercial Street, Room 207  
Astoria, OR 97103  
503-325-4571

*For Farms, Fish and Forestry.*

---

May 19, 2020

Re: Fishhawk Lake Reserve and Community, Inc. Fish Passage Improvements

To whom it may concern:

The Clatsop Soil and Water Conservation District established under ORS 568.210 in recognition of the ever-increasing demands on the renewable natural resources of the state and of the need to conserve, protect and develop such resources hereby supports the Fishhawk Lake Reserve and Community plans for fish passage improvement.

The Clatsop SWCD has worked with the Fishhawk Lake Reserve and Community for the last 50 years and was especially concerned about the impact of the major flood events of 1996 and 2007 on natural resource of this area. We support efforts to construct a combined fish ladder spillway which proposes to restore seasonally variable flows, improve fish passage and connectivity to upstream and downstream habitat for threatened fish species such as Coho Salmon and for Pacific Lamprey, and to exceed State flood flow and dam safety requirements; contributing to the fish habitat in the Fishhawk stream and the Nehalem Watershed.

The Clatsop SWCD is in support of FLRC implementing a structure that will meet state and federal regulatory requirements for dam safety and fish passage, restore seasonally variable flows and improve aquatic habitat.

The Fishhawk Lake Reserve and Community have our support.

Sincerely,

Clatsop SWCD  
Board of Directors



# Oregon

Kate Brown, Governor

## Department of Forestry

Astoria District  
92219 Highway 202  
Astoria, OR 97103  
(503) 325-5451  
Fax (503) 325-2756

May 15, 2020

Dr. C. Sue McCullough  
FLRC Board of Trustees  
9997 Beach Dr.  
Birkenfeld, OR 97016

Re: Fishhawk Lake Reserve and Community, Combined Spillway and Fish Ladder

To whom it may concern:

The Oregon Department of Forestry supports the application of the Fishhawk Lake Reserve and Community to upgrade the Fishhawk Lake dam to a combined spillway and fish ladder that will provide improved flood control, protect dam integrity, and improve and restore lake and stream habitat and passage for native fish species, including salmon, lamprey, and steelhead trout.

The planned improvements will remedy many existing conditions that are detrimental habitat needs of ESA threatened aquatic species including stream temperature and fish passage, as well as preventing a catastrophic overtopping of the dam which could impact homes and homeowners at Fishhawk Lake and the surrounding community.

Additionally, the proposed spillway/fish ladder is an innovative, unique design that could inspire modifications of other spillways that create fish passage barriers throughout the Pacific Northwest and United States. By restoring a more normal seasonally varied flow downstream, it will also augment the riverine conditions of Fishhawk Creek, and assist in creating better aquatic habitat. The design creates safer fish passage conditions, especially for juveniles, and exceeds dam safety requirements.

We urge funding of this project that will benefit the public through restoration and improvement of native habitat in the feeding streams, the lake, and downstream. These improvements will also help protect property and lives downstream.

Sincerely,

Ty Williams  
District Operations Coordinator - Astoria District  
Oregon Department of Forestry



# Oregon

Kate Brown, Governor

## Department of Fish and Wildlife

Northwest Region  
4907 3<sup>rd</sup> Street  
Tillamook, OR 97141  
(503) 842-2741  
Fax (503) 842-8385  
ODFW.com



May 19, 2020

Mr. Brett Moore  
Project Manager  
Anderson Perry and Associates  
1901 North Fir Street  
La Grande, Oregon 97850

**Subject:** Letter of Support for Fish Passage Improvements at Fishhawk Lake

Dear Mr. Moore:

The Oregon Department of Fish and Wildlife (ODFW) wishes to express its continued support for fish passage improvements at Fishhawk Lake dam. We are pleased to work with you on your proposed designs for a new fish ladder that meets ODFW fish passage requirements and a new spillway that allows safe passage for downstream migrating fish. As you know, the Fishhawk Creek basin is an important system for Oregon Coast coho salmon (Endangered Species Act – *Threatened*). With over 13.5 miles of habitat for coho salmon upstream of Fishhawk Lake dam, it is imperative that both upstream and downstream passage conditions do not cause delay or injury to migrating adults and juveniles. Other fish species in the basin including winter steelhead, coastal cutthroat trout, Pacific lamprey and brook lamprey will also benefit from proposed passage improvements.

We will continue to provide technical assistance as needed to ensure that the final design complies with our rules. Thanks for your continued coordination with ODFW.

Sincerely,

Chris Knutsen  
District Manager

**BETSY JOHNSON**

**State Senator**

Columbia, Clatsop, Portions of Tillamook,  
Washington, and Multnomah Counties



**OREGON STATE SENATE  
900 COURT ST NE  
SALEM, OR 97301**

May 15, 2020

To Whom it May Concern,

I am writing in support of Fishhawk Lake Reserve and Community, Inc. (FLRC), grant application which supports the construction of a new fish ladder and spillway for Fishhawk Lake dam.

FLRC and Fishhawk Lake are located in my legislative district. Fishhawk Lake is located on Fishhawk Creek, a tributary to the Nehalem River. The lake and community span Columbia and Clatsop Counties. The community is a small group of homeowners (about 250), about half of whom reside at Fishhawk Lake. The community is responsible to maintain and improve the dam constructed to create the lake in the late 1960s.

According to Oregon Water Resources Department Dam Safety Division, the Fishhawk Lake dam's spillway is undersized and in urgent need of improvement. The dam was nearly overtopped in the flood of 2007. The lack of spillway capacity caused severe flooding in the local community, endangering lives and causing extreme property damage. The Fishhawk Lake fish ladder is also extremely outdated. Built in the 1960's, the fish ladder does not meet any current fish passage criteria. Both of these issues are critical concerns. Fishhawk Lake and Fishhawk Creek are anchor habitat for species like the threatened Coho Salmon and culturally significant Pacific Lamprey.

This project is critical to improving fish passage with the new combined fish ladder/spillway designed specifically to improve the ability of Coho and Pacific Lamprey to pass up and downstream of the lake. The improved fish ladder will greatly enhance connectivity between over 34 miles of high value upstream habitat and existing downstream habitat for both of these species, as well as for Steelhead and Coastal Cutthroat Trout. The combined spillway and fish ladder also will help restore seasonally variable flows downstream which further assist in enhancing fish habitat. Fishhawk Creek is a designated anchor salmon habitat, a threatened species. Because of its importance to restoring coastal Coho, this project is supported by and part of the Upper Nehalem Watershed council strategic plan and the Nehalem River Coho Partnership strategic plan — plans developed with the input of state, federal and private community partners.

This project is critically important for the safety of the FLRC community and property owners downstream. According to the Oregon Water Resources Department, expanded spillway capacity is essential to improve the Fishhawk Lake dam's structural integrity and to prevent a catastrophic flood that could wipe out the community, its downstream neighbors and much of the downstream habitat.

FLRC is a vital part of the rural economy in my district. FLRC members contribute directly to the struggling local economies in Columbia County and Clatsop County.

I commend the community for its ongoing and recently renewed commitment to the long-term ecological health of Fishhawk Lake, Fishhawk Creek, and the species that inhabit both.

For nearly a decade, FLRC has worked with multiple state and federal agencies, the Upper Nehalem Watershed Council, and other partners to develop this project and to ensure it reflects values held by all Oregonians.

FLRC's proposed spillway/fish ladder is the type of community led, public-private partnership oriented solution that Oregonians value. FLRC's project will provide infrastructure that is essential to protect the community and will greatly enhance habitat for the fish species that inhabit and rely on Fishhawk Lake and Fishhawk Creek.

I support FLRC's efforts and urge you to do the same by helping to fund this critically important project.

Thank you,

A handwritten signature in blue ink, appearing to read "Betsy Johnson", with a stylized flourish at the end.

Betsy Johnson

Columbia County



# Board of Commissioners

230 Strand Street, Rm 331, St. Helens, Oregon 97051-2096  
\*Ph: 503-397-4322 \*Fax 503-397-7243

Commissioner Margaret Magruder  
Commissioner Henry Heimuller  
Commissioner Alex Tardif  
Jan Greenhalgh, Board Office Administrator  
Jacyn Normine, Board Office Specialist

[Margaret.magruder@co.columbia.or.us](mailto:Margaret.magruder@co.columbia.or.us)  
[Henry.heimuller@co.columbia.or.us](mailto:Henry.heimuller@co.columbia.or.us)  
[Alex.tardif@co.columbia.or.us](mailto:Alex.tardif@co.columbia.or.us)  
[Jan.greenhalgh@co.columbia.or.us](mailto:Jan.greenhalgh@co.columbia.or.us)  
[Jacyn.normine@co.columbia.or.us](mailto:Jacyn.normine@co.columbia.or.us)

February 26, 2018

Thomas W Rupers  
Solutions Team  
Fishhawk Lake Community & Reserve

Re: Fishhawk Lake Reserve and Community Water Control and Fish Habitat

The Columbia County Board of Commissioners support the application of the Fishhawk Lake Reserve and Community to upgrade the Fishhawk Lake dam in order to provide improved flood control, protect dam integrity, and improve and restore lake and stream habitat and passage for native fish species, including salmon, lamprey, and steelhead trout.


These improvements will bring this important recreational and residential area into compliance with current codes. It will improve lake habitat by lowering the percentage of silt and lowering lake temperatures to support improved fish and plant habitat. It will also improve downstream habitat and facilitate fish passage through the dam.

Five streams empty into Fishhawk Lake, providing spawning grounds for native fish species. This project will improve and support habitat that is important for reproduction of threatened species, such as salmon and lamprey.

We urge funding of this project that will benefit the public through restoration and improvement of native habitat in the feeding streams, the lake and downstream. Dam improvements will also help protect property and lives downstream.

BOARD OF COUNTY COMMISSIONERS  
FOR COLUMBIA COUNTY, OREGON

By:   
Margaret Magruder, Chair

By:   
Henry Heimuller, Commissioner

By:   
Alex Tardif, Commissioner



UPPER NEHALEM WATERSHED COUNCIL  
1201 Texas Ave. Suite A Vernonia, OR 97064  
(503) 396-2046 [maggie@nehalem.org](mailto:maggie@nehalem.org)

To Whom It May Concern:

The Upper Nehalem Watershed Council (UNWC) is an engaged partner with the Fishhawk Lake Reserve Community (FLRC) in our efforts to enhance natural conditions in the Fishhawk sub-basin of the Nehalem watershed. Currently FLIC is building support to improve the Fishhawk Lake dam infrastructure (built in the early 1960's) to meet current fish passage design and high and low flow spillway capacity design standards, and assure dam safety standards are met in order to avoid catastrophic dam failure during peak flow flood events.

UNWC has worked collaboratively with the Fishhawk Lake community for 20+ years in support of citizen efforts to understand ecological assets and factors limiting natural productivity, improve aquatic habitat in the lake, and to improve fish passage to tributaries entering the lake and through Fishhawk Lake Dam. The fish ladder and spillway improvement projects currently in the design process are in alignment with the Upper Nehalem Strategic Action Plan to improve the aquatic ecology of Fishhawk Creek. This project also aligns with restoration strategies and actions identified in the ODFW Oregon Coast Coho Recovery Plan, the NOAA Fisheries ESA Recovery Plan for Oregon Coast Coho Salmon and the Nehalem Strategic Action Plan for Native Coho Population Recovery. The combined fish ladder/spillway improvement project is a key component and necessary step for increasing lake water volume and dam spillway capacity, improving water quality (temperature/sediment impoundment reduction) in Fishhawk Lake and improve water quality and natural stream hydrology downstream of the dam in Fishhawk Creek.

UNWC is committed to working with the FLRC in order to secure the funding and permitting support needed to assure unconditional fish passage and increase the spillway capacity at the dam site. Please give their application for funding your utmost consideration.

Respectfully,

Maggie Peyton - UNWC  
Executive Director  
5-27-2020

# TECHNICAL MEMO

**To:** Fishhawk Lake Reserve and Community  
**From:** Brett Moore, P.E.  
**Subject:** Fishhawk Lake Reserve and Community - Fish Passage Improvements - Predesign Memo  
**Date:** May 26, 2020  
**Job/File No.** 1199-778-02 (w/encl.)



## **Background**

The Fishhawk Lake Dam is owned and operated by the Fishhawk Lake Reserve and Community (FLRC). In 2007, a flood event nearly overtopped the dam. The FLRC, the Oregon Water Resources Department Dam Safety Program (Dam Safety), and the Oregon Department of Fish and Wildlife have noted the need to improve the dam in multiple respects. Dam Safety has ranked the dam as a significant hazard dam and stated in multiple inspection reports that, "This dam cannot pass a major flood and is in an unsatisfactory and potentially unsafe condition." The July 16, 2018, Fishhawk Dam (F-23) Inspection Summary is included as Attachment A. In 2018, Dam Safety also recommended further inspection of the low-level conduit and installation of a slightly smaller conduit inside the existing pipe, when necessary. The FLRC contracted with McMillen, LLC, and, subsequently, Kleinschmidt Group, Inc., to prepare preliminary engineering reports to address the spillway capacity of the dam and possible fish passage improvements. Subsequent meetings were held with Dam Safety and fish passage agencies to review these preliminary engineering reports. FLRC also contracted to repair the low-level conduit (underdrain) during the 2019 in-water work period; however, this work was stopped before the repairs were completed.

The purpose of this Technical Memo is to identify the scope of work (SOW) of improvements to be completed, summarize the design criteria, and present a conceptual design based on the work completed to date. The Memo and conceptual design will then be presented to appropriate regulatory agencies for review and comment prior to preparing design documents for the improvements. At this time, the State of Oregon is requiring that contact with the state agencies be through its legal counsel. Review and comment with the regulatory agencies is anticipated to be ongoing throughout the design process, and additional details of the proposed improvements will be provided in the future design documents.

## **Scope of Work**

The primary purpose of the improvements is to provide sufficient spillway capacity to handle flood flows so as to prevent the dam from overtopping and minimize the associated risk of a catastrophic failure.

The existing drop drain (glory hole) spillway has limited capacity, so an additional spillway needs to be constructed. While pursuing installation of an additional spillway, consideration is given for providing fish passage that meets current criteria. The existing fish ladder does not meet current passage criteria for fish species present. Improvements to the fish passage facilities would improve conditions for steelhead, coastal cutthroat, coho salmon, Pacific lamprey, Chinook salmon, and other resident and migratory fish that use the reservoir, watershed, and stream for spawning, rearing, and residing. Improving fish passage would provide a substantial ecological benefit to the watershed and target species.

The existing low-level conduit (underdrain) through the dam is experiencing some leakage and age-related decay. In fall 2019, Dam Safety reported (through counsel) that it was unable to weigh in further on the urgency and timing of the underdrain repairs. Thereafter, FLRC contracted with SLR Consulting to evaluate the condition of the underdrain. During SLR's January 2020 inspection, SLR's dam safety engineer Tarik Hadj-Hamou, Ph.D., determined the underdrain is not an immediate concern for failure but does need to be rehabilitated. The corrugated steel pipeline needs to be lined, and the control gate needs to be replaced or refurbished.

Dam Safety also noted that the reservoir has accumulated a fair amount of sediment. It has been estimated that approximately one-half of the reservoir is now full of sediment. This sediment reduces the depth and volume of the reservoir, and the lack of volume reduces the reservoir's ability to attenuate peak flood flows. The shallow reservoir can also contribute to water quality concerns by increasing water temperatures. The sediments themselves can also contribute to water quality concerns, if they are full of nutrients that contribute to algae growth and subsequent decay. The algae decay can reduce dissolved oxygen in the water. Sediments should be removed from the reservoir while the reservoir is drawn down to repair the underdrain. Removing the sediments while the reservoir is drawn down would reduce potential harm to aquatic organisms that may be drawn into the equipment used by the currently permitted wet dredging operation. Although removing the sediments would benefit the reservoir, dam, watershed, and water quality, the SOW may be difficult to achieve in a timely fashion. This work should be pursued for implementation but considered secondary to the spillway, underdrain, and fish passage improvements.

There has been concern over the existing operation's need to rely on human operators to make appropriate and timely adjustments to reservoir levels and fish ladder weirs. The underdrain pipe's capacity to pass sufficient water to reduce reservoir levels quickly enough to attenuate anticipated flood flows in the reservoir is also a concern. Installation of a new spillway should eliminate the need to draw down the reservoir in anticipation of flood flows, as it will increase the spillway capacity to over one-half of the probable maximum flood (PMF). The new spillway will pass additional flows (approximately 2,000 cubic feet per second [cfs] more), while maintaining 3 feet of freeboard. In designing the new spillway, consideration should be given to operating these facilities when flood flows exceed one-half of the PMF, without overtopping the dam. This will allow the reservoir to be maintained at a set elevation for consistent operation of the new fish ladder. No adjustments to the fish ladder or pre-drawdown in anticipation of flood flows should be needed. This will also reduce or eliminate the removal of colder water in the reservoir when the underdrain is opened, and it will keep the reservoir levels consistently deeper, improving water quality in the reservoir. The amount of capacity above one-half of the PMF is to be determined but should be maximized as much as economically reasonable.

The SOW can then be summarized as primary and secondary improvements as follows:

### **Primary Improvements**

1. Construct a new spillway.
2. Construct a new fish ladder.
3. Rehabilitate the low-level conduit (underdrain) and gate.
4. Modify the drop drain to improve downstream fish passage.

### **Secondary Improvements**

1. Remove sediments deposited in the reservoir.
2. Increase the capacity of the spillway as allowable above the one-half PMF.

### ***Design Criteria***

Different design criteria apply to the spillway and fish ladder. No specific design criteria are noted for the underdrain or sediment removal.

### **Spillway**

Dam Safety has indicated that the spillway capacity of the dam needs to be increased to one-half of the PMF, which has been determined to be 5,262 cfs. The existing drop drain spillway passes 3,350 cfs. A new spillway needs to be constructed to pass an additional 1,912 cfs. These flows were taken from the McMillen report. The new spillway location was determined to be on the west side of the dam. Dam Safety has indicated that seismic concerns will be reduced if the spillway is constructed outside the dam fill area. The spillway will be designed in accordance with Oregon Administrative Rules (OAR) Chapter 690 Division 20.

### **Fish Passage**

The fish passage flows are 326 cfs at 5 percent exceedance and 5.4 cfs at 95 percent exceedance. These flows were taken from the McMillen report and confirmed by Anderson Perry & Associates, Inc. Fish passage would be accomplished by utilizing a vortex weir pool and chute-style fish ladder. An energy dissipation factor (EDF) of 4 will be used for upstream passage facilities with a maximum jump height of 6 inches. An EDF of 15 is proposed for new downstream passage improvements for the new spillway weir. Resting pools will be periodically provided along the fish ladder. The National Marine Fisheries Service fish passage criteria, "Technical White Paper: Practical Guidelines for Incorporating Adult Pacific Lamprey Passage at Fishways" and fish passage criteria published in OAR 635-412-0035 will be used in the design.

The existing drop drain spillway has an approximately 15-foot vertical drop directly from the spillway entrance down to the invert. The invert of this spillway is constructed of rock and concrete. Fish plunging over the top of this spillway could be injured upon impact with the

concrete invert. The proposed design would not use this spillway during normal fish passage flows. A sloped impact surface into a shallow pool of water would be added.

The fish species of concern identified in the McMillen report are outlined on the following table:

<b>Common Name</b>	<b>Scientific Name</b>	<b>Adult Upstream Migration Period</b>	<b>Adult Downstream Migration Period</b>	<b>Juvenile Upstream Migration Period</b>	<b>Juvenile Downstream Migration Period</b>
Steelhead	<i>Oncorhynchus mykiss</i>	November through June	November through June	January through June	January through June
Coho salmon	<i>Oncorhynchus kisutch</i>	October through February	N/A	January through June	January through June
Coastal cutthroat trout	<i>Oncorhynchus clarkia</i>	Year-round	Year-round	Year-round	Year-round
Pacific lamprey	<i>Lampetra tridentata</i>	January through September	N/A	January through July	January through July

Additional species to be noted include summer and fall run Chinook salmon and other resident species.

**Conceptual Design**

**Spillway/Fish Ladder**

The conceptual design is shown on the attached figures (Attachment B) and includes a combined spillway/fish ladder. The basic concept is to provide a concrete spillway on the west side of the dam just outside the main dam fill area. A labyrinth weir set at Elevation 557.13 would control flow down the spillway. The labyrinth weir would be activated prior to the existing spillway being activated, as the existing spillway weir is set at Elevation 558.21. The new concrete spillway would be on an approximate 6 percent slope.

A new concrete vortex weir fish ladder would be constructed adjacent to the concrete spillway and would work in conjunction with the spillway during flood flows. The fish ladder would be activated at Elevation 556.38. The fish ladder would pass flows of approximately 8 cfs before water begins to flow over the spillway weir. Water flowing over the spillway weir would drop into a pool area to cushion the fall for fish going over the weir prior to proceeding down the spillway. The spillway would have a cross slope in the bottom to concentrate the lower flows going down the spillway for downstream fish passage. The fish ladder would pass approximately 67 cfs, while the spillway would pass 259 cfs, for a total of 326 cfs (5 percent exceedance). Therefore, at 5 percent exceedance, approximately 20 percent of the flows would pass down the ladder, and all flows would pass down the ladder at 95 percent exceedance.

The spillway would discharge into the existing attenuation bay, and the attenuation bay would be armored around the perimeter to prevent erosion from the additional high flows. The attenuation bay may also need to be enlarged for the additional flows, or the bottom portions of the new and existing concrete spillways may need to have energy dissipation features added to them. Additional survey information needs to be collected prior to designing this element. If added dissipation is needed, initial thoughts would be to install sections of a concrete ramp at the bottom of the spillway that would elevate part of the flow into the air. This would also create additional vortex eddies for the portions of the flows remaining on the spillway floor. This hydraulic turbulence would reduce the energy in the attenuation bay faster than the concrete ramps alone.

The fish ladder entrance would be on the west bank of the downstream channel and adjacent to the new spillway. The new spillway could act as an attractant for fish to the west bank and adjacent ladder. Fish would not need to pass through the turbulent flows to find the ladder.

#### **Existing Drop Drain Spillway**

Proposed improvements to the existing drop drain spillway will provide a sloped surface from near vertical to horizontal for plunging fish to use as a water slide, dampening the drop. This concept needs to be further developed through consultation with the agencies.

#### **County Road Crossing**

The spillway and fish ladder would cross under the County road. An arch culvert is proposed to be placed over the spillway and fish ladder. The road width will be determined with input from the County, but it is expected to include two lanes and a sidewalk.

#### **Utilities**

Currently, underground power, communication, and gravity sewer lines run across the area proposed for the new spillway. The power and communication cables would likely be routed over the spillway, but the gravity sewer pipeline would need to be routed through the walls of the spillway. This would allow continued gravity sewer flows and would not require a new sewer lift station. The preliminary elevation of the spillway and sewer pipeline indicates that the invert elevation of the pipeline would be close to the water surface elevation for spilling approximately 2,000 cfs. This means that the pipeline would be above the normal operating and design spillway water surface elevation, but there may be times when flood flows exceed one-half of the PMF and could impact this pipeline. For this reason, it is proposed to install this pipeline in a heavy steel casing pipe and to provide additional reinforcement at the concrete walls at each end where it penetrates. If water flowing down the spillway reaches the elevation of the pipe, it would impact the pipe and flow over it.

### **Low-Level Conduit (Underdrain)**

The 30-inch corrugated metal underdrain pipe that drains the reservoir has some leakage that is proposed to be repaired. The proposed repairs would be completed as required by Dam Safety. The pipe would be grouted at needed locations, and then a cured-in-place or slip-line pipe liner would be installed inside the pipe. The control gate would also be replaced.

### **Reservoir Sediment Removal**

It is proposed to remove approximately 300 acre-feet of sediment from the reservoir when the reservoir level is lowered to complete improvements to the existing underdrain, instead of wet dredging sediments while the reservoir is full. The dewatered depositional areas would be inspected for remaining aquatic species of concern. Once approved, the areas would be excavated using large earth-moving equipment, and this material would be deposited in approved upland areas. Finding appropriate upland areas and obtaining permits for removal of these large quantities may make this secondary work element difficult to implement with the primary improvements.

### **Operations**

The historic design maximum water surface elevation provided approximately 3 feet of freeboard on the dam, which provided a maximum water surface elevation of approximately 562.16. At this elevation, the drop drain spillway would pass approximately 3,350 cfs, and the new spillway would pass approximately 2,000 cfs. The existing fish ladder also provides a concrete-lined conduit through the upper section of the dam. McMillen reports that this ladder can have the stop logs installed to the elevation of the drop drain spillway and pass approximately 250 cfs at maximum water surface elevation. If the underdrain pipe is opened, it will pass approximately 108 cfs. The combined total would be approximately 5,671 cfs, which would exceed the minimum required one-half of the PMF flow of 5,262 cfs. Additionally, these improvements would provide a flood flow capacity that would eliminate the need to draw down the reservoir in anticipation of flood flows over one-half of the PMF due to the increased spillway capacity. As the reservoir levels would be maintained at the new fish ladder elevation, manual changes to the existing fish ladder would no longer be needed. This will provide for simpler operations of the dam facilities, as no seasonal adjustments would need to be made to the lake's water surface elevations.

Enclosures

BM/cw

**ATTACHMENT A**  
**Fishhawk Dam (F-23)**  
**Inspection Summary**



July 16, 2018

Jim Dahlquist  
Fishhawk Lake Homeowners Association  
9997 Beach Drive  
Birkenfield, OR 97016

**received**  
7/20/18  
*[Signature]*

**Re: Fishhawk Dam (F-23) – Inspection Summary**

This dam was inspected on March 26, 2018. I performed the inspection with dam safety Civil Engineer Tony Janicek and Watermaster Nikki Hendricks. Several people from the homeowners association were also there. You had organized a meeting of interested parties and agencies to discuss spillway capacity and fish passage. Status of the spillway and planned modifications were discussed during this inspection. The Water Resources Department conducts inspections to identify safety, maintenance or operational issues that may affect dam integrity. Dams are assigned a hazard rating based on downstream hazard to people and property, not on the condition of the dam. Fishhawk is classified as a significant hazard dam, inspected every 3 years.

**Summary:** Results of the inspection are summarized in the table below. Detail regarding the inspection can be found in the following photos and text. Where work is needed, additional information can also be found in the section below. Aspects of the dam not posing a dam safety concern are generally not discussed in this letter. **This dam cannot pass a major flood and is in an unsatisfactory and potentially unsafe condition.**

**Results of Inspection:**

Category	Inspected	Result
Access	<input checked="" type="checkbox"/>	Excellent
Reservoir	<input checked="" type="checkbox"/>	Maintenance
Spillway	<input checked="" type="checkbox"/>	Unsafe*
Conduit	<input checked="" type="checkbox"/>	Maintenance
Embankment	<input checked="" type="checkbox"/>	Adequate
Seepage/Leakage	<input checked="" type="checkbox"/>	Maintenance

\* Dam nearly overtopped in 2006

**Details:**

*Reservoir:* The reservoir level was 7.7 feet below the crest of the dam at the time of the inspection. The minimum freeboard was 5.5, which indicates no recent major storms at the dam, and would be reasonable if the spillway had sufficient capacity.

*Access:* There is a paved road across the dam, providing excellent access.

*Spillway: The small size of the spillway results in a **potentially unsafe condition**. Minimum freeboard in 2007 was 0.1 feet, and the dam barely survived that flood event.*



Interior overflow spillway – only spillway

Spillway capacity remains the major safety issue at this dam. The most serious issue with this dam remains the capacity to pass flood flows, which has not been resolved since the near overtopping of the dam in 2007. The dam is ***undersized for design flood as calculated in the engineers memorandum from George Robison dated September 16<sup>th</sup>, 2007.***

*Conduit and control:* The control for the conduit is a 30 inch diameter and it appears to be operational, with moderate deterioration.



30 inch diameter corrugated metal pipe conduit with seepage

*Seepage:* The only seepage observed was a 2-3 gallons per minute flow adjacent to the conduit. It is possible that this seepage is coming from leakage or flow next to or through that corrugated metal culvert.



# Dam Safety Inspection Form

State of Oregon  
Water Resources Department  
725 Summer Street NE, Suite A  
Salem, Oregon 97301-1271  
(503) 986-0900

Name of Dam: Fishhawk File #: F - 23  
 Height: 35 ft. Storage: 1650 ac. ft. Permit: R-3982 NID #: OR-00418  
**Significant Hazard Dam** Inspector(s): Mills, Janicek, Hendricks District: 1  
 Others on site: Vic Dykstra, Jeff Bush  
 Date: 3 / 26 / 2018 Temperature 40-50 F  Dry  Rain  Snow  Now  Recently  
 Prior Inspection Date: 2 / 12 / 2015 Issues from prior inspection: emergency spillway needed

*Rating Criteria: 5-Exemplary; 4-Adequate 3-Maintenance or minor repair needed*

**2-Serious repair needed; 1- Urgent dam safety issue – action now - Contact owner and dam safety directly**

General		Rating
Vehicle access	<input checked="" type="checkbox"/> All weather road <input type="checkbox"/> Dirt road <input type="checkbox"/> Cross country	4
Access Control	<input type="checkbox"/> Gate <input type="checkbox"/> Locked and secured <input type="checkbox"/> Fencing <input checked="" type="checkbox"/> Signage <input type="checkbox"/> Other _____	4
Detail:		

Reservoir	Pool level: <u>7.7</u> ft	Point of Reference: <u>Crest</u>	Rating
Minimum freeboard	Vertical distance from debris line to lowest place on crest <u>5.5*</u> ft.		2*
Condition	<input type="checkbox"/> Floating Debris/Trash <input checked="" type="checkbox"/> Log Boom <input type="checkbox"/> Unusual Conditions (see "Detail")		4
Detail:	*minimum freeboard was 0 in 2007		

Spillway	<input type="checkbox"/> Earth <input type="checkbox"/> Rock <input type="checkbox"/> Concrete <input checked="" type="checkbox"/> Other <small>Glory hole/overflow spillway</small>	Rating
Capacity	<input type="checkbox"/> Reduced by feature not on design <input type="checkbox"/> Sized for PMF: Y <input type="checkbox"/> N <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>	2*
Approach Channel	<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Trees/brush <input type="checkbox"/> Debris <input type="checkbox"/> Erosion	4-*
Control Section	<input checked="" type="checkbox"/> Concrete <input type="checkbox"/> Rock <input type="checkbox"/> Soil <input type="checkbox"/> Culvert <input type="checkbox"/> Unstable	4
Spillway dimensions	Width: _____ ft Depth: _____ ft Gradient: _____ <input type="checkbox"/> Survey Attached	-----
Flashboards/Gate	<input type="checkbox"/> None <input type="checkbox"/> In place <input type="checkbox"/> Operational <input type="checkbox"/> Deteriorated	-----
Discharge Channel	<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Trees/brush <input type="checkbox"/> Leakage <input type="checkbox"/> Headcutting ( _____ feet from spillway control section, depth _____ feet.)	4-
Stilling basin	<input type="checkbox"/> N/A <input checked="" type="checkbox"/> Functional <input checked="" type="checkbox"/> Minor Erosion <input type="checkbox"/> Severe Erosion/Undercutting	4
Aux. Spillway	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (use "Detail" below)	2*
Detail:	*Capacity - Needs to be sized for 1/2 PMF; *Approach Channel - fence around overflow; *Aux. Spillway - needed	

Seepage/Leakage		Rating
Serious conditions	<input type="checkbox"/> Leakage <input type="checkbox"/> Piping <input type="checkbox"/> Discolored water <input type="checkbox"/> Boils <input type="checkbox"/> Other <input checked="" type="checkbox"/> None	-----
Locations	<input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Center <input type="checkbox"/> Left <input type="checkbox"/> Right <input type="checkbox"/> Around pipe <input type="checkbox"/> On dam _____	4
Instrumentation & Monitoring	Instrumentation Type: <u>None</u> Condition: <u>NA</u> Monitoring Frequency: <u>NA</u> Access: <u>NA</u>	-----
Flow	<input type="checkbox"/> Wet vegetation <input type="checkbox"/> Spongy <input checked="" type="checkbox"/> Standing water <input checked="" type="checkbox"/> Flow <small>see below</small> _____ gpm	4-
Toe drains	<input checked="" type="checkbox"/> None <input type="checkbox"/> Working <input type="checkbox"/> Damaged <input type="checkbox"/> Buried <input type="checkbox"/> Other: _____	-----
Detail:	Flow of 12 gpm appears to be coming from the slope adjacent to the right abutment. Seepage around outlet conduit approx 2-3 gpm	

Conduit		Control: <input checked="" type="checkbox"/> Manual <input type="checkbox"/> Power <input type="checkbox"/> Other <input type="checkbox"/> Conduit Control missing	Rating
Inlet	<input checked="" type="checkbox"/> Submerged <input type="checkbox"/> Debris on Trash Rack <input type="checkbox"/> Deterioration		-----
Control/Stem	<input checked="" type="checkbox"/> Operable <input type="checkbox"/> Damaged <input type="checkbox"/> Missing <input type="checkbox"/> Inoperable <input type="checkbox"/> Unknown		4
Valve(s) cycling	<input type="checkbox"/> Frozen <input type="checkbox"/> Unknown <input type="checkbox"/> Past year <input checked="" type="checkbox"/> Frequent		4
Principal conduit	Diameter/Size: 30" Material CMP	Condition Unknown	3*
Primary outlet	<input type="checkbox"/> Overgrown <input checked="" type="checkbox"/> Clean <input type="checkbox"/> Pressurized <input type="checkbox"/> Leaking _____ gpm		4
Other outlet(s)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Type(s) _____ Diameter(s) _____		-----
Detail:	*Seep of 2-3 gpm around conduit on the right side. Conduit may need to be scoped but at the very least the seep should be monitored and a plan developed to line conduit.		

Structure of dam		<input checked="" type="checkbox"/> Earth <input type="checkbox"/> Rock <input type="checkbox"/> Concrete <input type="checkbox"/> Other:	Rating
Distress	<input type="checkbox"/> Cracks - offset _____ <input type="checkbox"/> Landslide(s) <input type="checkbox"/> Sinkhole(s) <input type="checkbox"/> Crest Settlement <input type="checkbox"/> Narrow crest <input type="checkbox"/> Wave erosion <input type="checkbox"/> Trampling <input type="checkbox"/> Surface erosion <input checked="" type="checkbox"/> None		4
Locations			-----
Other	Describe:		-----
Aux. dike (s)	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> over 5		-----
Seismic	Designed for EQ: _____	Liquifaction/deformation potential: _____ Priority for analysis <input type="checkbox"/>	-----
Animals	Type: None		Rating
Burrows	<input type="checkbox"/> Observed max diameter: _____ max depth: _____	<input type="checkbox"/> Trails <input checked="" type="checkbox"/> None	4
Locations			-----
Vegetation			Rating
Cover	<input checked="" type="checkbox"/> Low grass <input type="checkbox"/> high grass <input checked="" type="checkbox"/> brush <input type="checkbox"/> blackberries <input type="checkbox"/> small trees <input type="checkbox"/> large trees		4-*
Locations	Upstream Face	Downstream Face	4-
Impairs inspection	<input type="checkbox"/> toe seepage <input type="checkbox"/> conduit outlet <input type="checkbox"/> spillway <input type="checkbox"/> upstream face <input type="checkbox"/> downstream face		-----
Monitoring			Rating
Instrumentation & Monitoring	Instrumentation Type: None Monitoring Frequency: NA	Condition: NA Access: NA	-----
Detail:	*Vegetation - brush on upstream face and sedges on downstream face		

Expedited Re-inspection Needed:  Next Inspection Date: 2019 -Inspect in summer \_\_\_\_\_

**Other Issues or Additional Detail Needed:**

Expedited inspection for 2019 and needs to be inspected in the summer so that conduit and overflow can be inspected

---



---



---

**Recommendation(s):**

1. Construct an overflow spillway designed for the one-half Probable Maximum Flood (PMF). The spillway should have the capacity determined in the **technical memorandum from George Robison dated September 16<sup>th</sup>, 2007.**
2. Conduct a more detailed inspection of the low level conduit, and when necessary, install a slightly smaller conduit inside the existing pipe. Ensure the annular space between the conduits is effectively filled with grout or other sealant.

This inspection only evaluated the surface conditions of the dam. There was no inspection of the interior of the dam, its foundation, or any analyses of potential modes of failure. We use a standard inspection form, and a copy of the field inspection sheet for this dam is attached. Thanks again for meeting with us. Please let me know if you have any questions about this inspection. We look forward to future inspections of this dam.

Sincerely,

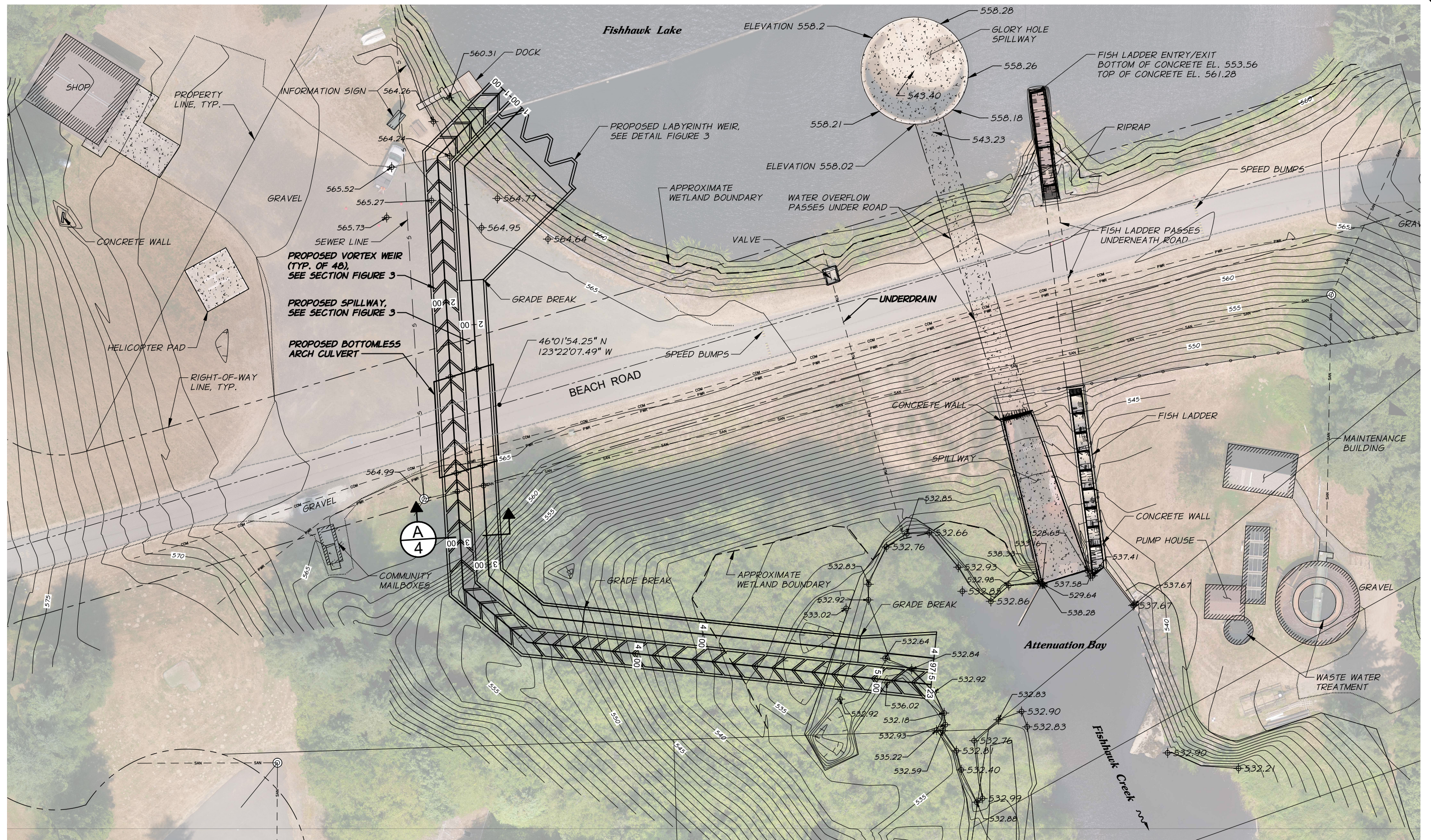


Keith Mills, P.E., State Engineer for Water Resources  
(503) 986-0840  
Cell (541) 706-0849

C: Nikki Hendricks, Watermaster District 1  
Dam Safety File F-23

**ATTACHMENT B**  
**Figures**

Q:\FishhawkLakeReserve&Community\1199-778\_FishPassageImprove\Drafting\1199-778-060F-101SPL.dwg, Layout1, 5/26/2020 3:24 PM, prichardson



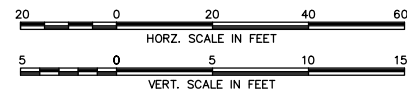
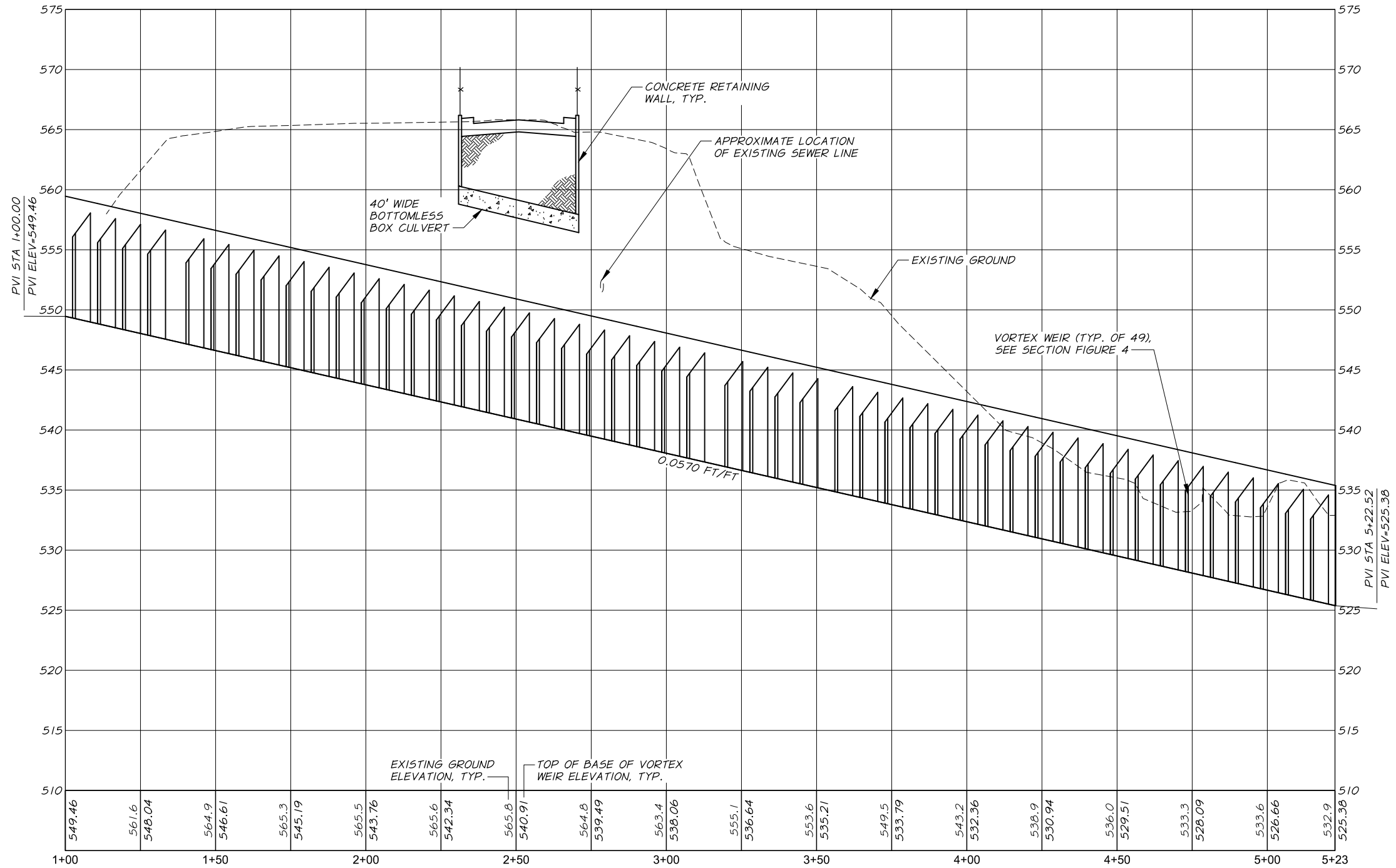
**FISHHAWK LAKE RESERVE & COMMUNITY  
FISH PASSAGE IMPROVEMENTS**

**SITE PLAN**

**FIGURE**

**1**

Q:\FishhawkLakeReserve&Community\1199-778\_FishPassageImprove\Drafting\1199-778-060F-20\PNP.dwg, Layout1, 5/26/2020 3:27 PM, prichardson

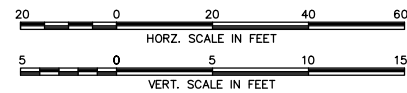
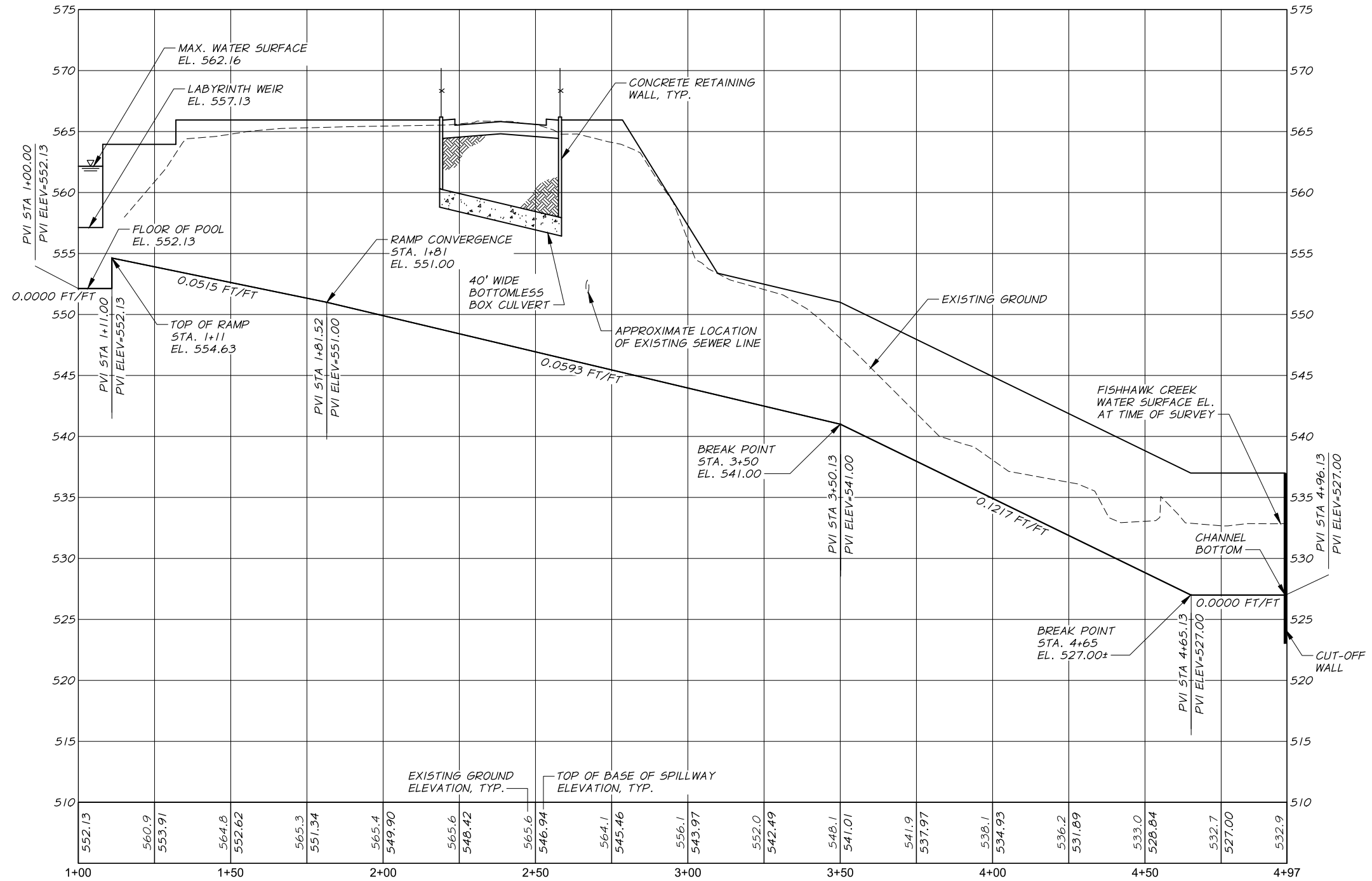


FISHHAWK LAKE RESERVE & COMMUNITY  
FISH PASSAGE IMPROVEMENTS

PROFILE - FISH LADDER

FIGURE

2





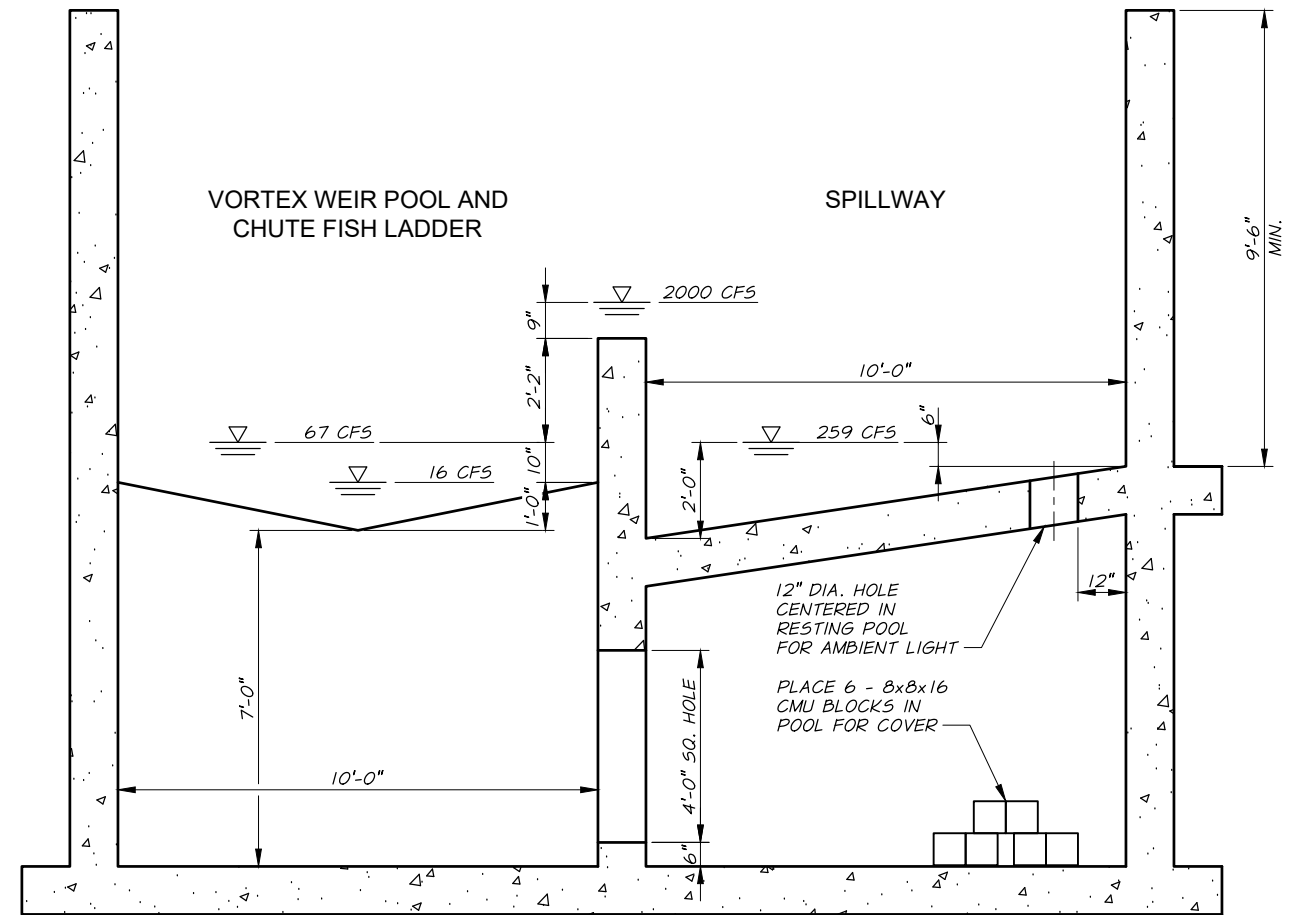
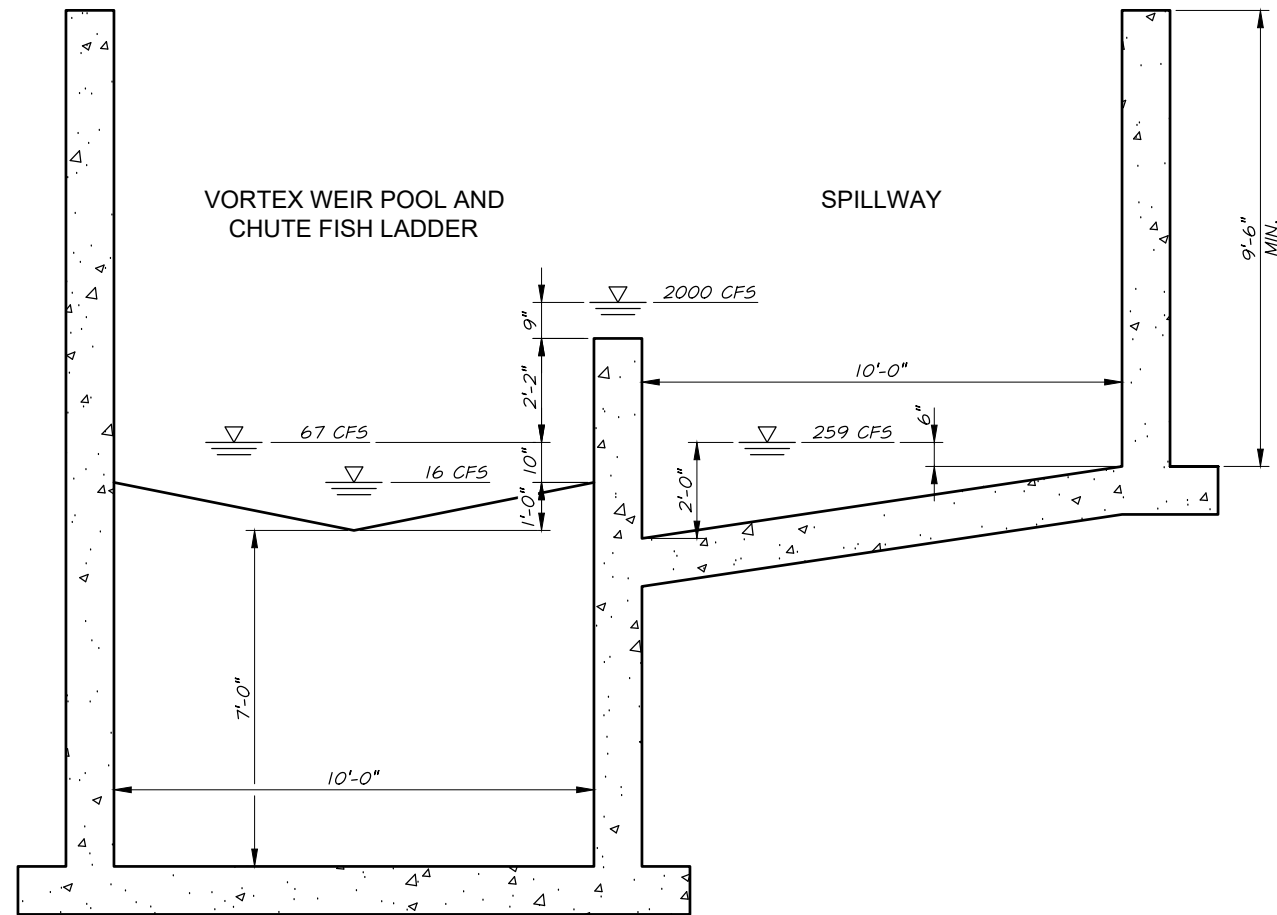
**anderson  
perry**  
& associates, inc.

**FISHHAWK LAKE RESERVE & COMMUNITY  
FISH PASSAGE IMPROVEMENTS**

**PROFILE - SPILLWAY**

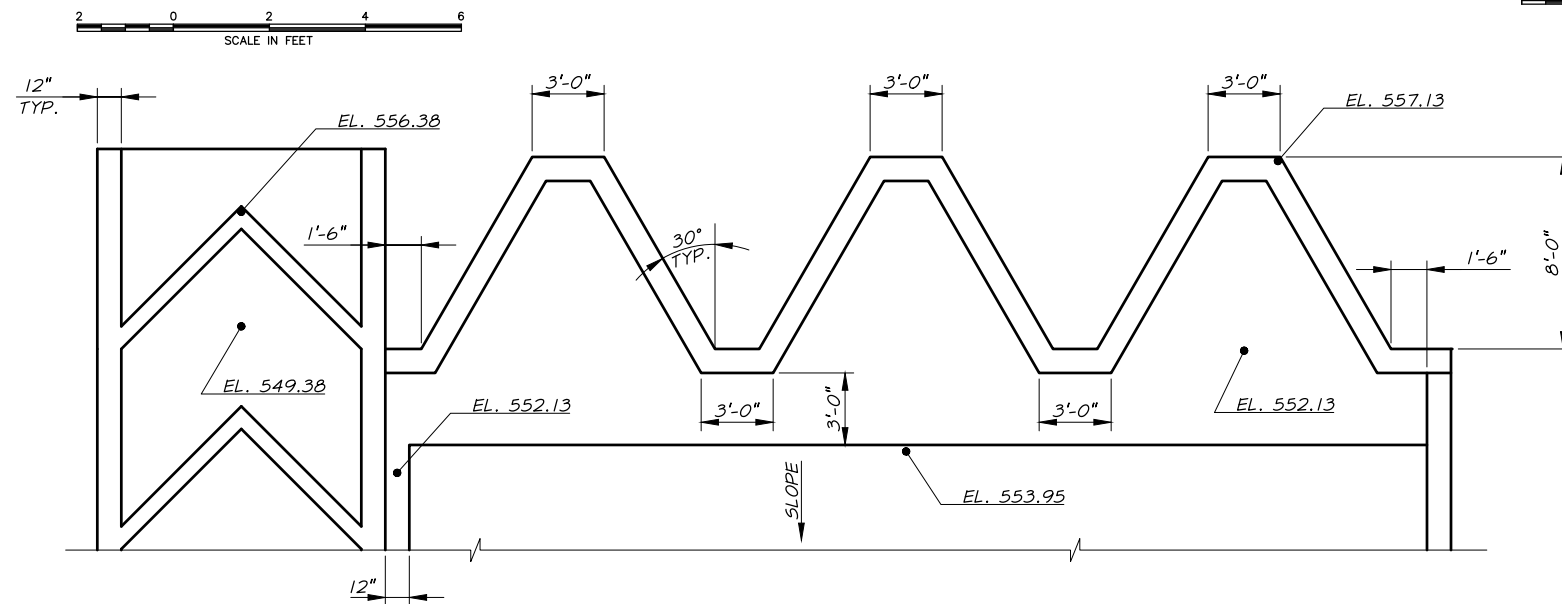
**FIGURE  
3**

Q:\FishhawkLakeReserve&Community\1199-778\_FishPassageImprove\Drafting\1199-778-060F-301SEC.dwg, Layout1, 5/26/2020 3:33 PM, prichardson



SECTION A  
1

RESTING POOL DETAIL



LABYRINTH WEIR DETAIL

SCALE IN FEET

SCALE IN FEET

SCALE IN FEET



FISHHAWK LAKE RESERVE & COMMUNITY  
FISH PASSAGE IMPROVEMENTS

SECTION AND DETAILS

FIGURE

4



July 16, 2018

Jim Dahlquist  
Fishhawk Lake Homeowners Association  
9997 Beach Drive  
Birkenfield, OR 97016

**received**  
7/20/18  
*[Signature]*

**Re: Fishhawk Dam (F-23) – Inspection Summary**

This dam was inspected on March 26, 2018. I performed the inspection with dam safety Civil Engineer Tony Janicek and Watermaster Nikki Hendricks. Several people from the homeowners association were also there. You had organized a meeting of interested parties and agencies to discuss spillway capacity and fish passage. Status of the spillway and planned modifications were discussed during this inspection. The Water Resources Department conducts inspections to identify safety, maintenance or operational issues that may affect dam integrity. Dams are assigned a hazard rating based on downstream hazard to people and property, not on the condition of the dam. Fishhawk is classified as a significant hazard dam, inspected every 3 years.

**Summary:** Results of the inspection are summarized in the table below. Detail regarding the inspection can be found in the following photos and text. Where work is needed, additional information can also be found in the section below. Aspects of the dam not posing a dam safety concern are generally not discussed in this letter. **This dam cannot pass a major flood and is in an unsatisfactory and potentially unsafe condition.**

**Results of Inspection:**

Category	Inspected	Result
Access	<input checked="" type="checkbox"/>	Excellent
Reservoir	<input checked="" type="checkbox"/>	Maintenance
Spillway	<input checked="" type="checkbox"/>	Unsafe*
Conduit	<input checked="" type="checkbox"/>	Maintenance
Embankment	<input checked="" type="checkbox"/>	Adequate
Seepage/Leakage	<input checked="" type="checkbox"/>	Maintenance

\* Dam nearly overtopped in 2006

**Details:**

*Reservoir:* The reservoir level was 7.7 feet below the crest of the dam at the time of the inspection. The minimum freeboard was 5.5, which indicates no recent major storms at the dam, and would be reasonable if the spillway had sufficient capacity.

*Access:* There is a paved road across the dam, providing excellent access.

*Spillway: The small size of the spillway results in a **potentially unsafe condition**. Minimum freeboard in 2007 was 0.1 feet, and the dam barely survived that flood event.*



Interior overflow spillway – only spillway

Spillway capacity remains the major safety issue at this dam. The most serious issue with this dam remains the capacity to pass flood flows, which has not been resolved since the near overtopping of the dam in 2007. The dam is ***undersized for design flood as calculated in the engineers memorandum from George Robison dated September 16<sup>th</sup>, 2007.***

*Conduit and control:* The control for the conduit is a 30 inch diameter and it appears to be operational, with moderate deterioration.



30 inch diameter corrugated metal pipe conduit with seepage

*Seepage:* The only seepage observed was a 2-3 gallons per minute flow adjacent to the conduit. It is possible that this seepage is coming from leakage or flow next to or through that corrugated metal culvert.



# Dam Safety Inspection Form

State of Oregon  
Water Resources Department  
725 Summer Street NE, Suite A  
Salem, Oregon 97301-1271  
(503) 986-0900

Name of Dam: Fishhawk File #: F - 23  
 Height: 35 ft. Storage: 1650 ac. ft. Permit: R-3982 NID #: OR-00418  
**Significant Hazard Dam** Inspector(s): Mills, Janicek, Hendricks District: 1  
 Others on site: Vic Dykstra, Jeff Bush  
 Date: 3 / 26 / 2018 Temperature 40-50 F  Dry  Rain  Snow  Now  Recently  
 Prior Inspection Date: 2 / 12 / 2015 Issues from prior inspection: emergency spillway needed

*Rating Criteria: 5-Exemplary; 4-Adequate 3-Maintenance or minor repair needed*

**2-Serious repair needed; 1- Urgent dam safety issue – action now - Contact owner and dam safety directly**

General		Rating
Vehicle access	<input checked="" type="checkbox"/> All weather road <input type="checkbox"/> Dirt road <input type="checkbox"/> Cross country	4
Access Control	<input type="checkbox"/> Gate <input type="checkbox"/> Locked and secured <input type="checkbox"/> Fencing <input checked="" type="checkbox"/> Signage <input type="checkbox"/> Other _____	4
Detail:		

Reservoir	Pool level: <u>7.7</u> ft	Point of Reference: <u>Crest</u>	Rating
Minimum freeboard	Vertical distance from debris line to lowest place on crest <u>5.5*</u> ft.		2*
Condition	<input type="checkbox"/> Floating Debris/Trash <input checked="" type="checkbox"/> Log Boom <input type="checkbox"/> Unusual Conditions (see "Detail")		4
Detail:	*minimum freeboard was 0 in 2007		

Spillway	<input type="checkbox"/> Earth <input type="checkbox"/> Rock <input type="checkbox"/> Concrete <input checked="" type="checkbox"/> Other <small>Glory hole/overflow spillway</small>	Rating
Capacity	<input type="checkbox"/> Reduced by feature not on design <input type="checkbox"/> Sized for PMF: Y <input type="checkbox"/> N <input checked="" type="checkbox"/> Unknown <input type="checkbox"/>	2*
Approach Channel	<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Trees/brush <input type="checkbox"/> Debris <input type="checkbox"/> Erosion	4-*
Control Section	<input checked="" type="checkbox"/> Concrete <input type="checkbox"/> Rock <input type="checkbox"/> Soil <input type="checkbox"/> Culvert <input type="checkbox"/> Unstable	4
Spillway dimensions	Width: _____ ft Depth: _____ ft Gradient: _____ <input type="checkbox"/> Survey Attached	-----
Flashboards/Gate	<input type="checkbox"/> None <input type="checkbox"/> In place <input type="checkbox"/> Operational <input type="checkbox"/> Deteriorated	-----
Discharge Channel	<input checked="" type="checkbox"/> Clear <input type="checkbox"/> Trees/brush <input type="checkbox"/> Leakage <input type="checkbox"/> Headcutting ( _____ feet from spillway control section, depth _____ feet.)	4-
Stilling basin	<input type="checkbox"/> N/A <input checked="" type="checkbox"/> Functional <input checked="" type="checkbox"/> Minor Erosion <input type="checkbox"/> Severe Erosion/Undercutting	4
Aux. Spillway	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No (use "Detail" below)	2*
Detail:	*Capacity - Needs to be sized for 1/2 PMF; *Approach Channel - fence around overflow; *Aux. Spillway - needed	

Seepage/Leakage		Rating
Serious conditions	<input type="checkbox"/> Leakage <input type="checkbox"/> Piping <input type="checkbox"/> Discolored water <input type="checkbox"/> Boils <input type="checkbox"/> Other <input checked="" type="checkbox"/> None	-----
Locations	<input checked="" type="checkbox"/> No evidence <input type="checkbox"/> Center <input type="checkbox"/> Left <input type="checkbox"/> Right <input type="checkbox"/> Around pipe <input type="checkbox"/> On dam _____	4
Instrumentation & Monitoring	Instrumentation Type: <u>None</u> Condition: <u>NA</u> Monitoring Frequency: <u>NA</u> Access: <u>NA</u>	-----
Flow	<input type="checkbox"/> Wet vegetation <input type="checkbox"/> Spongy <input checked="" type="checkbox"/> Standing water <input checked="" type="checkbox"/> Flow <small>see below</small> _____ gpm	4-
Toe drains	<input checked="" type="checkbox"/> None <input type="checkbox"/> Working <input type="checkbox"/> Damaged <input type="checkbox"/> Buried <input type="checkbox"/> Other: _____	-----
Detail:	Flow of 12 gpm appears to be coming from the slope adjacent to the right abutment. Seepage around outlet conduit approx 2-3 gpm	

Conduit		Control: <input checked="" type="checkbox"/> Manual <input type="checkbox"/> Power <input type="checkbox"/> Other <input type="checkbox"/> Conduit Control missing	Rating
Inlet	<input checked="" type="checkbox"/> Submerged <input type="checkbox"/> Debris on Trash Rack <input type="checkbox"/> Deterioration		-----
Control/Stem	<input checked="" type="checkbox"/> Operable <input type="checkbox"/> Damaged <input type="checkbox"/> Missing <input type="checkbox"/> Inoperable <input type="checkbox"/> Unknown		4
Valve(s) cycling	<input type="checkbox"/> Frozen <input type="checkbox"/> Unknown <input type="checkbox"/> Past year <input checked="" type="checkbox"/> Frequent		4
Principal conduit	Diameter/Size: 30" Material CMP	Condition Unknown	3*
Primary outlet	<input type="checkbox"/> Overgrown <input checked="" type="checkbox"/> Clean <input type="checkbox"/> Pressurized <input type="checkbox"/> Leaking _____ gpm		4
Other outlet(s)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Type(s) _____ Diameter(s) _____		-----
Detail:	*Seep of 2-3 gpm around conduit on the right side. Conduit may need to be scoped but at the very least the seep should be monitored and a plan developed to line conduit.		

Structure of dam		<input checked="" type="checkbox"/> Earth <input type="checkbox"/> Rock <input type="checkbox"/> Concrete <input type="checkbox"/> Other:	Rating
Distress	<input type="checkbox"/> Cracks - offset _____ <input type="checkbox"/> Landslide(s) <input type="checkbox"/> Sinkhole(s) <input type="checkbox"/> Crest Settlement <input type="checkbox"/> Narrow crest <input type="checkbox"/> Wave erosion <input type="checkbox"/> Trampling <input type="checkbox"/> Surface erosion <input checked="" type="checkbox"/> None		4
Locations			-----
Other	Describe:		-----
Aux. dike (s)	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> over 5		-----
Seismic	Designed for EQ: _____	Liquifaction/deformation potential: _____ Priority for analysis <input type="checkbox"/>	-----
Animals	Type: None		Rating
Burrows	<input type="checkbox"/> Observed	max diameter: _____ max depth: _____ <input type="checkbox"/> Trails <input checked="" type="checkbox"/> None	4
Locations			-----
Vegetation			Rating
Cover	<input checked="" type="checkbox"/> Low grass <input type="checkbox"/> high grass <input checked="" type="checkbox"/> brush <input type="checkbox"/> blackberries <input type="checkbox"/> small trees <input type="checkbox"/> large trees		4-*
Locations	Upstream Face	Downstream Face	4-
Impairs inspection	<input type="checkbox"/> toe seepage <input type="checkbox"/> conduit outlet <input type="checkbox"/> spillway <input type="checkbox"/> upstream face <input type="checkbox"/> downstream face		-----
Monitoring			Rating
Instrumentation & Monitoring	Instrumentation Type: None Monitoring Frequency: NA	Condition: NA Access: NA	-----
Detail:	*Vegetation - brush on upstream face and sedges on downstream face		

Expedited Re-inspection Needed:  Next Inspection Date: 2019 -Inspect in summer \_\_\_\_\_

**Other Issues or Additional Detail Needed:**

Expedited inspection for 2019 and needs to be inspected in the summer so that conduit and overflow can be inspected

---



---



---

**Recommendation(s):**

1. Construct an overflow spillway designed for the one-half Probable Maximum Flood (PMF). The spillway should have the capacity determined in the **technical memorandum from George Robison dated September 16<sup>th</sup>, 2007.**
2. Conduct a more detailed inspection of the low level conduit, and when necessary, install a slightly smaller conduit inside the existing pipe. Ensure the annular space between the conduits is effectively filled with grout or other sealant.

This inspection only evaluated the surface conditions of the dam. There was no inspection of the interior of the dam, its foundation, or any analyses of potential modes of failure. We use a standard inspection form, and a copy of the field inspection sheet for this dam is attached. Thanks again for meeting with us. Please let me know if you have any questions about this inspection. We look forward to future inspections of this dam.

Sincerely,



Keith Mills, P.E., State Engineer for Water Resources  
(503) 986-0840  
Cell (541) 706-0849

C: Nikki Hendricks, Watermaster District 1  
Dam Safety File F-23





# UPPER NEHALEM WATERSHED COUNCIL

## STRATEGIC ACTION PLAN 2019-2021

### OUR VISION

We hold the vision of a healthy watershed that contributes to a strong economic base and viable local communities.

### OUR MISSION

Our mission is to promote stewardship of the Upper Nehalem watershed and sustain watershed health.

### GOALS

**GOAL 1: Conserve, protect and restore native salmon populations while improving the overall health of the natural environment within the Nehalem River watershed. Focus on projects identified as priorities in the watershed data collected by the UNWC and other organizations. Continue to collect data as needed.**

**Objective 1.1: Nehalem Conservation Action Plan - Upper Nehalem Project Development:** Complete the task of gathering, translating to usable formats where necessary, organizing, and analyzing relevant data sets including LiDAR and the large assessments developed by various organizations and agencies. This information will be used to develop and execute projects that carry out NCAP strategies in the upper Nehalem at the fifth-field HUC level.

IN-PROGRESS = develop in-house GIS capabilities, and improve data management, storage and access systems/methods.

Objective 1.2: Nehalem Strategic Action Plan: Develop and implement high priority projects identified during the NSAP process with advisors from WSC, NOAA, ODFW, LNWC and consultant. In 2017 initiated the “pilot” Beaver Dam Analogue project with WSC, NOAA, NMFS, ODF and ODFW. Secured cost share funds from NOAA and the NFWF for summer 2018/19 implementation. Project will continue into 2019 phase ii augmentation stage and has the potential to complete the 10 year monitoring plan in 2028.

DONE = Summer 2018 27 BDA’s installed in Buster, Upper Rock Creek and the NF Lousignont. 15 LWD structures installed along the NF Lousignont. 5 LWD structures installed along Olsen Creek.

IN-PROGRESS = working with consultant in siting of 14 BDA augmentation sites for phase ii BDA pilot project along Buster Creek, upper Rock Creek and NF Lousignont Creeks. Hire contractor in spring 2019 for summer 2019 implementation.

IN-PROGRESS = working with consultant in siting of the next suite of salmon anchor habitat improvement projects along upper Fishhawk Creek, Deer Creek, Lousignont Creek and Walker Creek. Developing partnerships with OSU Blodgett Tract, Olympic Resource Management, ODF, ODFW and Small Woodlot Landowner for summer 2019 implementation. Develop scope of work with consultant winter 2019. Secure grant agreement with WSC/NOAA winter 2019. Secure contractor spring 2019 for summer 2019 implementation.

Promote the expansion of Beaver/Salmon Anchor Habitat protection and restoration projects with advisors and partners. Seek to elevate the public status of the North American Beaver Specie *Castor Canadensis* (Oregon State Animal) as a viable watershed recovery partner whose industrial nature is an essential element of ecosystem process geared to increase native salmon production.

Objective 1.3: Oak Ranch Creek: Replace fish passage barrier at MP 3.5 on Apiary Road in the Oak Ranch Creek sub-basin that will open 7 additional miles of the anchor habitat to salmon. Include salmon habitat improvements (LWD/BDA) to Oak and Archibald Creeks to the extent funding is available.

DONE = Summer 2016 14 LWD installed between RM 1.8 and 3.5 crossings.

DONE = Summer 2017 15 LWD structures installed long lowest mile of Archibald Creek.

DONE = Summer 2018 open bottom reinforced concrete arch installed w/stream simulation at RM 3.5.

IN-PROGRESS = completion and post status reporting required by OWEB 2019-23+.

Objective 1.4: Rock Creek: Carry out riparian plantings, large wood placements, off-channel habitat and Beaver Dam Analog creation. Partner with ODFW, DEQ, Columbia SWCD, and landowners Weyerhaeuser, Stimson and ODF. Follow prescriptions identified in the Rock Creek Limiting Factors Analysis.

DONE = 10 Beaver Dam Analogues installed along upper Rock Creek/Beaver Creek in summer 2018.

IN-PROGRESS = working with consultant and landowners in the development of summer 2019 BDA augmentation project. 5+ BDA to be installed in summer 2019.

Objective 1.5: Lousignont: Carry out large wood placements, off-channel habitat and Beaver Dam Analog creation. Partner with ODFW, and landowners Hyla Woods, Weyerhaeuser, and ODF. Follow prescriptions identified in NSAP.

DONE = 2018 NF 1 mile BDA/1mile LWD in summer 2018. 2 LWD at Hyla Woods and a riparian planting.

IN-PROGRESS = development of Summer 2019 <1 mile LWD along confluence reaches of Lousignont and NF Lousignont on Hauck Trust. 8+ LWD structures to be placed summer 2019.

Objective 1.6: Fishhawk Lake: Continue research and development of Fishhawk Lake dam retrofit for spillway/fish ladder. Continue water quality monitoring of turbidity/temp (up/downstream and in lake) w/volunteers.

IN-PROGRESS = Develop OWEB technical assistance application for fish ladder w/community in spring 2019. Develop design/build grant applications in spring 2020. Carry out riparian planting and salmon habitat improvements upstream and downstream and in and around the lake.

Objective 1.7: Deep Creek Passage and Habitat Improvement: Collaborate to develop fish passage and habitat improvement projects in the basin and seek cost share from OWEB for summer 2018/19 implementation.

DONE = Weyerhaeuser Lane and Calvin Creek crossings complete in summer 2018.

---

IN-PROGRESS = Develop next phase to capture remaining barriers and improve stream habitat in sync with Weyerhaeuser operations and grant opportunities.

IN-PROGRESS = Completion and post status reporting 2019 – 2025+.

Objective 1.8: Deer Creek - Salmon Anchor Habitat Establishment: Collaborate with Olympic Recourse Management to develop passage and habitat improvement projects along designated reaches.

IN-PROGRESS = Design phase winter spring 2019 - implement summer 2019.

Objective 1.9: Walker Creek - Salmon Anchor Habitat Improvement: Collaborate with Oregon Department of Forestry to develop habitat improvement projects along designated reaches.

IN-PROGRESS = Design phase winter spring 2019 - implement summer 2019.

Objective 1.10: Upper Fishhawk Creek: Collaborate with Oregon State University to develop habitat improvement projects along designated reaches.

IN-PROGRESS = Design phase winter spring 2019 - implement summer 2019.

Objective 1.11: Clear Creek - Salmon Passage and Anchor Habitat Improvement: Collaborate with Weyerhaeuser to develop passage and habitat improvement projects in designated reaches.

IN-PROGRESS = Design phase summer 2020 - implement summer 2021.

---

Objective 1.10: Tweedle Creek - Stream Corridor/Habitat Improvement: Collaborate with NSAP advisors (WSC/NOAA/ODFW/Consultants), permitting agencies (NOAA/NMFS/DSL/USACE/SHPO/Clatsop County and landowner (Carmichael) to develop engineer designs, secure cost share (OWEB small grant/NFWF/NOAA/ODFW) and implement project in the summer of 2020.

IN-PROGRESS = Design in review. Seeking cost share. Planning for summer 2020 implementation.

Objective 1:11: Nehalem East Fork: Investigate and develop a plan for restoring salmon habitat and passage on the East Fork of the Nehalem. Conduct feasibility analysis in 2020.

**Objective 1.12: Riparian Restoration (DEQ/ODA SIA/NNN):** Enlist 5 new landowners, plant 5000 trees on 15 acres, and re-vegetate 1000 feet of eroding stream bank annually. Seek additional cost share from OWEB Small Grant and volunteer support from SOLVE, BSA, VHS Forestry class, Landowners and community volunteers.

**Objective 1.13: Younger Riparian Restoration:** Complete Phase II report and submit to OWEB in winter 2019 and conduct plant establishment tasks in the summer/fall of 2019/20 in the riparian area of the Younger property around the confluence of Fishhawk Creek, Beaver Creek and along the Nehalem River. Report post status progress to OWEB in winter 2020.

**Objective 1.14: ODA Nehalem - Strategic Implementation Area:** Develop and implement high priority riparian restoration and water quality improvements projects in cooperation with identified landowners, Columbia SWCD, ODA and ODFW. Johnson and Armstrong riparian reforestation plant installation will be completed in the late spring of 2019. Project completion report will be submitted to OWEB in summer 2019. Plant establishment activities will continue until winter 2021. Columbia River Youth Conservation Corp and UNWC staff will conduct the plant establishment work.

**Objective 1.15: Nehalem Native Nursery:** continue to develop and expand the nursery operation and supply healthy plants for UNWC, NORP, VHS, fundraisers and private projects. Continue to strengthen integration of nursery operations with VHS students, faculty and mutual staff, and community volunteers. Employee 2 student interns for 10 weeks every summer to maintain nursery and upkeep greenhouse, outbuildings and grounds w/BLM RAC funds administered by Vernonia 47J. Develop new cost share partners/donors with 47J.

**Objective 1.16: Monitor - Water Quality - Temperature/Turbidity:** Continue to collect samples from designated sites through-out the Nehalem watershed as per DEQ standards. Process data, provide to DEQ/partners, and archive for future reference and use in watershed health and restoration analysis.

**Objective 1.17: Monitor Post Project Status**

- Pebble I - 5 crossings/19 LWD (complete 9-30-19)
- Pebble II - 46 LWD (complete 9-30-19)
- Beneke - 13 LWD (complete)
- Oak - upper crossing (ytbd)
- Oak - lower crossings/14 LWD (12-13-19/ complete 12-13-21)
- Rock Creek - 32 LWD (11-16-19/ complete 11-15-21)
- Lousignont - 15 LWD (complete 2019)
- Archibald - 14 LWD (complete 12-27-19)
- Younger I - 14 acre planting (OWEB post status report complete 2019)

- Younger II - 14 acre planting (planting complete 2019/OWEB post status report complete 2021)

## **GOAL 2: Promote community awareness, interest, and participation in our watershed health.**

**Objective 2.1: Online presence:** Update the UNWC website and the UNWC Facebook page. UNWC website rebuild in winter 2019 on Nehalem.org domain hosted by GoDaddy. Continue adding new content as it becomes available. Develop and infuse UNWC blog regularly.

**Objective 2.2: Local summer event:** Participate in at least one summer/fall community event such as the Friendship Jamboree and Salmon Fest, or sponsor a community wide picnic on the river, with project tours and/or native plant nursery tours.

**Objective 2.3: Educate the local community:** Submit an article on UNWC business, written by a board member/staff/consultant to the Vernonia Voice at least once a quarter.

**Objective 2.4: Educate local teachers and students:** Continue to work with VSD faculty on at least two joint projects involving hands-on activities in the watershed, community and/or nursery.

**Objective 2.5: Educate landowners:** Collaborate with NRCS to promote the pasture improvement project in the upper Nehalem river valley.

**Objective 2.6: Beaver:** Raise awareness of the value of incorporating Beaver in salmon restoration.

## **GOAL 3: Maintain and develop partnerships with schools, public agencies, businesses, timber interests, private landowners, and other organizations to carry out our mission.**

**Objective 3.1: Partnership with Vernonia School District/Native Plant Nursery:** Continue our work on the native plant nursery we established on the grounds of Vernonia School District in cooperation with BLM and the VSD. Continue to use the nursery to supply plants for restoration programs and to educate Vernonia students in nursery operations and restoration activities, as well as hands-on riparian planting projects with forestry class, temperature monitoring of upper Nehalem, Salmon Watch, and watershed health awareness activities.

**Objective 3.2: Partnerships with other watershed agencies:** Continue to work with Tillamook Estuary Partnership, Lower Nehalem Watershed Council, Northern Oregon Restoration Partnership, Lower Nehalem Community Trust, North Coast Land Conservancy, and other watershed groups to plan future partnerships and joint projects as viable opportunities arise.

**Objective 3.3: Wild Salmon Center:** Continue to participate in the Wild Salmon Center's development and finalization of the Nehalem Strategic Action Plan to promote funding for restoration of Coho salmon/Beaver anchor habitat to a broader funding community. Continue to engage stakeholders and natural resource agencies concerned in the process.

**Objective 3.4: Focused Investment Partnerships:** Explore and if feasible, participate in the development of a focused investment partnership for restoring Coho habitat in the North Coast Basin/Nehalem basin.

**Objective 3.5: Board Development:** Educate the Board on current and potential strategic partners by meeting with individuals and/or boards of Columbia County, Columbia SWCD, Clatsop SWCD, Tillamook SWCD, Tillamook Estuary Partnership, OWEB, and at least three other organizations whose mission concerns fish habitat and/or the health of rivers. Continue to engage stakeholders in UNWC activities and encourage identified representatives to participate at the core level by serving on the UNWC Board of Directors and/or strengthening restoration partnerships with stakeholder group. Continue to work together to identify core values and renew the UNWC mission of vision. Publish UNWC mission and vision on banners for public display at events and office entryway.

#### **GOAL 4: Sustain and improve a strategic, accountable, and transparent organization.**

**Objective 4.1: Financial Oversight:** Continue Board oversight of finances and projects through reports from the Board Treasurer, UNWC Bookkeeper and the UNWC Executive Director on at least a quarterly basis.

**Objective 4.2: Annual Audit:** Conduct an annual audit of all equipment over \$100.

**Objective 4.3: UNWC Policy and Procedures:** Monitor the use of the UNWC policies and procedures and revise as needed. Executive Director will conduct a biennial review of the policies and procedures and recommend updates to the UNWC Board of Directors for approval.

**Objective 4.4: UNWC Operational Plan:** Develop a written operational plan that encompasses the wide variety of activities and obligations UNWC is involved in daily, monthly, annually and biennially.

**Objective 4.4: Board recruitment:** Focus board recruitment efforts on identified stakeholders. Special focus on recruiting a faculty or student of Vernonia High School.

**Objective 4.5: Director's contract:** Review the Executive Director's contract and job description and revise as necessary. Conduct and annual review with UNWC Executive Director and UNWC Board of Directors.

**Objective 4.6: Policies and Procedures:** Review policies and procedures annually and update, as needed.

**Objective 4.7: Self-Evaluation:** Conduct biennial OWEB council self-evaluation, develop actions and report accordingly. Due early spring 2019 and 2021.

#### **GOAL 5: Explore/develop new sources of funding and volunteer support.**

**Objective 5.1: Online fundraising:** Explore the concept of raising money for specific projects through various "crowd-funding" websites.

**Objective 5.2: New funders:** Research and develop new funding sources including individual and group donors.

**Objective 5.3: Celebration/Fundraiser:** Recruit volunteers to assist staff and board in developing an UNWC 25-year accomplishment, family friendly, celebration at Camp Wilkerson to showcase Oak Ranch Creek projects, enjoy barbeque and live music, conduct silent action, camp... etc...

#### **GOAL 6: Develop a long range plan for the continuation of the Upper Nehalem Watershed Council.**

**Objective 6.1: 10-year plan:** Plan for the succession of the Executive Director and the continuation of the Upper Nehalem Watershed Council.

**Objective 6.2: Long Range Plan:** Work with stakeholders and community to develop a long range plan for the continuation of the Upper Nehalem Watershed Council beyond the 7<sup>th</sup> generation. Establish a relationship with the indigenous Nehalem Clatsop tribe based in Seaside.

**\*\*FINAL REVIEW DRAFT\*\***

**Strategic Action Plan for the Protection  
and Restoration of Nehalem River  
Coho Habitat**

*Nehalem River Coho Partnership*

*February 2020*

*This page left intentionally blank*

## Contributors and Acknowledgements

The “Strategic Action Plan for the Protection and Restoration of Nehalem River Coho Habitat” (SAP) was developed by the Nehalem River Coho Partnership (Nehalem Partnership), a team of dedicated resource managers and conservation professionals, representing the following agencies, organizations, and businesses:

- Columbia Soil and Water Conservation District (SWCD)
- Lower Nehalem Watershed Council (LNWC)
- National Oceanic and Atmospheric Administration (NOAA)
- Oregon Department of Environmental Quality (DEQ)
- Oregon Department of Fish and Wildlife (ODFW)
- Oregon Department of Forestry (ODF)
- Tillamook Estuaries Partnership (TEP)
- Upper Nehalem Watershed Council (UNWC)
- Weyerhaeuser

The Nehalem Partnership would like to thank the members of the Coast Coho Partnership (CCP), which includes the Oregon Watershed Enhancement Board (OWEB), ODFW, NOAA Fisheries, NOAA Restoration Center, National Fish and Wildlife Foundation (NFWF), and Wild Salmon Center (WSC), for their facilitation and technical support of the planning process. We would also like to acknowledge the critical contributions of several project consultants, including: Steve Trask and BioSurveys for sharing 30 years of experience in coast Coho population research and habitat restoration; PC Trask for producing the literature review and bibliography; TerrainWorks for generating the Netmap layers and conducting the initial spatial analyses; and Barbara Taylor and Rob Walton for their editorial support. Finally, we are grateful to The Nature Conservancy for their development of a Conservation Action Plan, which informed this SAP.

The Nehalem Partnership would also like to thank the funders of both the planning effort – OWEB, NOAA, and Oregon Community Foundation – and the first partners that stepped up to support this plan’s implementation, including NOAA, WSC, and NFWF.

## Acronyms

AQI	Aquatic Inventories Project
BMP	Best Management Practice
CAP	Conservation Action Plan
CCP	Coast Coho Partnership
CFS	Cubic Feet per Second
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FPA	Oregon Forest Practices Act
IP	Intrinsic Potential
KEA	Key Ecological Attribute
LNWC	Lower Nehalem Watershed Council
MDN	Marine Derived Nutrients
NFWF	National Fish and Wildlife Foundation
NGOs	Non-governmental Organizations
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRCS	National Resources Conservation Service
NWFSC	Northwest Fisheries Science Center
OC	Oregon Coast
ODA	Oregon Department of Agriculture
ODF	Oregon Department of Forestry
ODFW	Oregon Department of Fish and Wildlife
OWEB	Oregon Watershed Enhancement Board
RM	River Mile
SAP	Strategic Action Plan
SWCD	Soil and Water Conservation District
TEP	Tillamook Estuaries Partnership
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
UNWC	Upper Nehalem Watershed Council
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WSC	Wild Salmon Center

## Contents

Contributors and Acknowledgements .....	1
Acronyms .....	2
List of Figures .....	5
List of Tables .....	6
Executive Summary.....	7
1. Introduction: The Nehalem River Coho Partnership and the Purpose of this Plan .....	11
1.1 The Vision of a Healthy Coho Population.....	12
1.2 Why Coho? .....	13
1.3 Scope of this Strategic Action Plan.....	14
1.4 SAP Implementation Timeline: Long-Term Outcomes & Short-Term Goals.....	15
1.5 Implementing Partners .....	15
2. The Nehalem River Watershed .....	18
2.1 Geology and Physical Geography.....	19
2.2 Water Resources .....	21
2.3 Forest Resources .....	21
2.4 Biotic Systems .....	24
2.5 Human Settlement and Demographics.....	25
3. Nehalem Basin Coho and Habitats.....	28
3.1 Coho Salmon Life Cycle and Habitat Needs.....	28
3.2 Coho Salmon Population Abundance .....	29
3.3 Hatchery Production .....	30
3.4 Overview of Habitat Needs and Watershed Components.....	32
4. Development of the Nehalem River Strategic Action Plan .....	35
4.1 Visioning.....	35
4.2 Defining Terms .....	35
4.3 Determining Focal Areas .....	36
4.4 Determining Restoration Priorities by Focal Area .....	38
4.5 Identifying Anchor Habitats .....	38
4.6 Monitoring and Indicators .....	40
4.7 Estimating SAP and Project Costs .....	40

4.8	Community Outreach.....	40
5.	Impaired Watershed Processes and the Strategies to Restore Them ....	<b>Error! Bookmark not defined.</b>
5.1	Focal Areas: the High Ranked Sub-watersheds.....	<b>Error! Bookmark not defined.</b>
5.2	Habitat Stresses, Limiting Factors, and the Anchor Habitat Approach ..	<b>Error! Bookmark not defined.</b>
5.3	Strategies to Conserve Critical Coho Habitats in the Nehalem Watershed.....	<b>Error! Bookmark not defined.</b>
5.4	Priority Reaches by Restoration Strategy in the High Ranked Sub-watersheds .....	<b>Error! Bookmark not defined.</b>
6.	Project Implementation Plan: 2019 – 2023 .....	<b>Error! Bookmark not defined.</b>
7.	Evaluation and Adaptive Management.....	<b>Error! Bookmark not defined.</b>
7.1	The Monitoring Framework .....	<b>Error! Bookmark not defined.</b>
7.2	Data Gaps .....	<b>Error! Bookmark not defined.</b>
8.	Costs .....	<b>Error! Bookmark not defined.</b>
9.	Sustainability .....	<b>Error! Bookmark not defined.</b>
9.1	Updating the SAP .....	<b>Error! Bookmark not defined.</b>
	References .....	<b>Error! Bookmark not defined.</b>
	Appendices.....	<b>Error! Bookmark not defined.</b>

## List of Figures

- Figure 1-1 Habitat Restoration and Forest Road Maintenance Projects (1995 – 2018)
- Figure 2-1 The Nehalem River Watershed
- Figure 2-2 Geology of the Nehalem River Watershed
- Figure 2-3 Extent of fires collectively known as “The Tillamook Burn”
- Figure 2-4 Land Cover in the Nehalem River watershed
- Figure 2-5 Fish Distribution in the Nehalem River watershed
- Figure 2-6 Land Ownership in the Nehalem River watershed
- Figure 3-1 The Coho Salmon Life Cycle
- Figure 3-2 Recent Nehalem Coho Salmon Spawner Abundance Estimates
- Figure 3-3 Estimated Abundance of Hatchery Coho Spawners
- Figure 3-4 Habitat Components of a Watershed (placeholder for insert)
- Figure 4-1 Modeled Anchor Habitats in the Nehalem River Watershed
- Figure 5-1 High-ranked sub-watersheds in the Nehalem River Watershed
- Figure 5-2 Modeled anchor habitats in the SAP Focal Area
- Figure 5-3 Timber Stands with the Highest Potential to Deliver Large Wood into Identified Anchor Habitat Locations
- Figure 5-4 Modeled historic Stream Temperatures in the Nehalem River watershed
- Figure 5-5 Land Ownership and Stream Reaches with High Potential for Beaver Recruitment
- Figure 5-6 Loss of Historic Tidal Wetlands in the Nehalem Watershed
- Figure 5-7 Priority Reaches by Restoration Strategy in the North Fork Nehalem and Foley Creek Watersheds
- Figure 5-8 Priority Reaches by Restoration Strategy in the Humbug, Beneke, and Fishhawk Creek Watersheds
- Figure 5-9 Priority Reaches by Restoration Strategy in the Rock Creek Watershed
- Figure 5-10 Priority Reaches by Restoration Strategy in the Wolf and Lousignont Watersheds
- Figure 5-11 Priority Reaches by Restoration Strategy in the Salmonberry Watershed
- Figure 7-1 Locations of Current and Recommended Temperature Monitoring Probes
- Figure 7-2 Map of predicted stream temperatures in the Nehalem River watershed (2040)

## List of Tables

- Table 1-1 Core Implementing Partners
- Table 5-1 Acres of Forest Stands Recommended for Permanent Protection in the Nehalem River Watershed
- Table 7-1 Nehalem Monitoring Framework
- Table 8-1 Project Costs for Goal 1: Protect Standing Timber (2020-2024)
- Table 8-2 Project Costs for Goal 2: Large Wood in Streams (2020-2024)
- Table 8-3 Project Costs for Goal 3: Riparian Planting (2020-2024)
- Table 8-4 Project Costs for Goal 4: Beaver Recruitment (2020-2024)
- Table 8-5 Project Costs for Goal 5: Estuarine Reconnection (2020-2024)
- Table 8-6 Project Costs for Goal 6: Longitudinal Reconnection (2020-2024)
- Table 8-7 Total Project Costs (2020 – 2024)

## Executive Summary

Prior to European settlement an estimated quarter million coast Coho salmon (*Oncorhynchus kisutch*) returned to spawn in the Nehalem River watershed, representing the largest Coho run on the north coast. A century and a half after the initial influx of European settlers, who were drawn to the region's booming timber, fishing, and farming industries, watershed health has declined in the Nehalem basin. Critical watershed processes have been impaired by these and other land uses leading to the loss and degradation of the habitats that sustain Nehalem Coho and other Pacific Salmon species. A steady erosion in habitat quality and quantity throughout the 20<sup>th</sup> century – coupled with hatchery Coho production and unsustainable harvest rates – led to a crash in the Nehalem Coho population in the 1990s.

The Nehalem population bottomed out in 1995 when an estimated 525 wild fish returned to the watershed. An assessment completed by the Oregon Department of Fish and Wildlife a decade later determined that the Nehalem Coho population was no longer viable, primarily due to a lack of stream complexity necessary to support overwintering juveniles. Elevated water temperatures – especially in the mainstem Nehalem River – also limited the quality and quantity of summer rearing habitat.

The decline of Nehalem Coho – and, in fact, these limiting factors – largely mirrored trends coast-wide. As a result, the Oregon Coast (OC) Coho run – known as an “evolutionarily significant unit” (ESU) – was listed as “threatened” in 1998. While the last twenty years have witnessed an improvement in OC Coho abundance, the species remains listed due to concerns among federal managers that OC Coho habitat is insufficiently protected, and ongoing monitoring has not revealed improving trends in watershed health throughout the ESU. Uncertainties relating to climate change exacerbate these concerns.

Two plans resulted from the federal ESA listing: a state plan, the “Oregon Coast Coho Conservation Plan,” published in March, 2007, and a federal plan, the “Final ESA Recovery Plan for Oregon Coast Coho Salmon,” published by the National Marine Fisheries Service in December, 2016. These state and federal plans describe conservation and recovery goals for the ESU, as well as broad strategies to restore the ESU and its populations to the point where ESA protection is no longer necessary. This Strategic Action Plan (SAP) advances these by identifying the specific locations where habitat protection and restoration will have the greatest benefit to watershed function and coho production.

The process to develop this SAP began in 2015 when partners working to restore the Nehalem basin convened to: 1) determine the specific locations where protection and restoration strategies should be targeted to promote watershed function and increase habitat productivity over the long term, and 2) coordinate project implementation and leverage funding in the short

term. To develop the plan, the partners enlisted the support of the Coast Coho Partnership, a team of public and private agencies and organizations working to accelerate Coast Coho recovery. This SAP represents one of three pilot plans facilitated by Wild Salmon Center and the Coast Coho Partnership.

In addition to the federal ESA listing, the Nehalem Partnership focuses on Coho recovery for three reasons. First, Coho salmon are considered a “keystone” species, which numerous other plant and animal species rely on for their survival during some part of their life cycle. Second, Coho spend over a year in freshwater, making them an excellent indicator of the health of a watershed year-round. Third, because they spend a full year in freshwater, they occupy a range of habitats utilized by other salmonids. Consequently, the protection and restoration of Coho habitats (and the watershed processes that generate them) often directly benefit other salmonid species.

The Nehalem Coho salmon population is one of 21 independent populations that comprise the Oregon Coast (OC) Coho Salmon ESU. While important variations exist to the “standard” Coho life history, generally young OC Coho salmon spend roughly eighteen months in freshwater before migrating to the sea. During this freshwater residency, they rely heavily on instream pools and off-channel habitats that are connected to mainstem and tributary channels. These off-channel habitats include alcoves, beaver ponds, side channels, and tidal and freshwater wetlands. In addition to providing food resources, these habitats generate clean, cool water in the summer, and serve as refuge areas from high velocity flows in winter.

The watershed processes that produce and maintain these habitats have undergone significant changes since European settlement of the region began in the mid-19<sup>th</sup> century. The resource extraction economy that fueled settlement of the region has altered the ‘key ecological attributes’ (KEAs) of the watershed that are essential to the production of high-quality Coho habitats. The modified KEAs that most severely limit Coho production include: reduced tributary habitat complexity, reduced lateral connectivity between channels and floodplains, reduced riparian (streamside) function, reduced beaver ponds, and impaired water quality in the Nehalem’s tributaries and mainstem (most notably elevated summer temperatures and sedimentation.)

The Nehalem Partnership approached SAP development guided by a vision of healthy ecological, economic, and social conditions in the Nehalem basin that ensure a sustainable future for native Coho salmon through highly connected, functional, and productive landscapes. Through implementation of this SAP, local partners hope to achieve two long term outcomes:

- 1) Protect and restore summer, winter, and incubation habitats sufficient to produce a detectable change in Coho productivity in high priority 6<sup>th</sup> field watersheds, and promote the long-term viability of the Nehalem Coho population.
- 2) Protect and restore watershed processes to ensure sufficient habitat diversity for the expression of multiple life-history strategies within the Nehalem Coho population.

To achieve these outcomes, the SAP emphasizes the restoration of critical Coho habitats by repairing the watershed processes that generate and maintain them. This process-based approach relies heavily on an anchor habitat strategy, which seeks to identify, protect, and restore the stream reaches most capable of supporting Coho across the full spectrum of their freshwater residency, including egg incubation, rearing, smolting, and spawning. The primary strategies presented in this plan to conserve anchor habitats (and other critical habitats) include: protecting selected old growth timber stands to promote large woody debris (LWD) delivery to anchors; installing LWD and recruiting dam building beavers to promote instream complexity and floodplain interaction in and around anchor habitats; enhancing riparian function; and reconnecting tidal wetlands

The SAP recognizes 17 sub-watersheds as “focal areas.” These watersheds were selected using a stronghold approach, which evaluated the potential for on the ground intervention to restore watershed function and boost habitat productivity. Additionally, the process also considered the degree to which each sub-watershed is capable of supporting unique life-history strategies. Focal areas selected include: the Nehalem Bay; Foley Creek; Cook Creek; Lower, Middle, and Upper North Fork Nehalem; Humbug Creek; Beneke Creek; Fish Hawk Creek; the Lower, Middle, and Upper Salmonberry River, Lousignont Creek, Wolf Creek, and Lower, Middle, and Upper Rock Creek.

Through the implementation of this SAP, the Nehalem Partnership intends to reach the following restoration goals within these 17 sub-watersheds by 2030:

- Protect 150 acres of standing old-growth timber;
- Add LWD to 60 miles of identified anchor habitats;
- Plant 100 miles of riparian vegetation;
- Recruit dam-building beavers to colonize 20% of the Coho-bearing tributaries (by miles) within selected sub-watersheds;
- Reconnect 100 acres of tidal wetlands and other estuarine habitats; and
- Restore access to 50 miles of slough and tributary channels, including associated off-channel habitats.

The Nehalem Partnership developed a monitoring framework to evaluate both the rate at which the SAP is being implemented and the degree to which it is producing the desired results

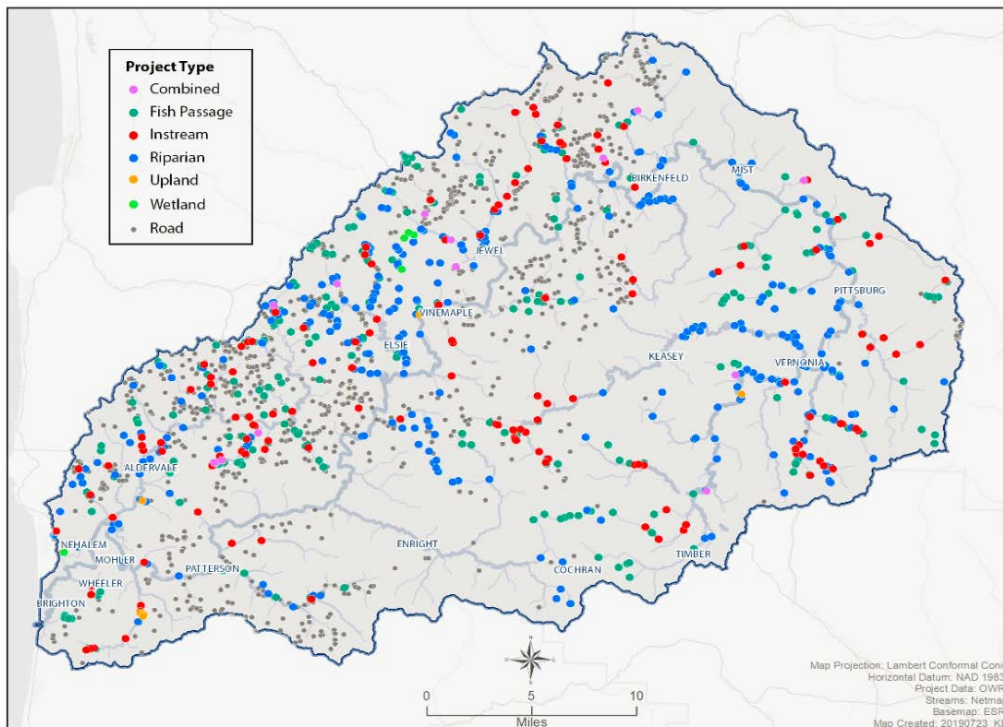
at a meaningful scale. The monitoring framework also presents several important data gaps, which – once filled – may redirect the Nehalem Partnership’s priorities.

The Nehalem Partnership recognizes that this SAP, like all plans, has been generated with imperfect information. Most notably, considerable uncertainty exists regarding how global climate change will challenge many of the assumptions made about future watershed conditions and how aquatic systems may respond to restoration actions. Thus, adaptive management is essential to the long-term success of this plan and the partners’ ability to reach stated outcomes.

# 1. Introduction: The Nehalem River Coho Partnership and the Purpose of this Plan

Scientists estimate that one to two million adult Coho salmon (*Oncorhynchus kisutch*), once returned to the Oregon Coast (OC) Coho Evolutionarily Significant Unit (ESU) (NMFS 2016), which includes populations from Cape Blanco, Oregon north to the Columbia River (ODFW 2007). In the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, these runs drove the settlement of small fishing communities and fueled a nascent coastal economy. While the runs began to decline in the early 20<sup>th</sup> century, Coho and other Pacific Salmon continued to support commercial and recreational fisheries through most of the century, bolstering local economies up and down the coast. The Coho fishery was largely closed following the initial listing of the OC Coho ESU as “threatened” under the Endangered Species Act (ESA) in 1998. For the past 20 years, a recovery effort has been underway focused heavily on the protection and restoration of critical Coho habitats.

One of 21 independent populations in the OC Coho ESU, the viability of the Nehalem Coho population has mirrored that of the ESU. Once numbering an estimated 240,000 fish in the 1800s (Meengs and Lackey 2005), population abundance declined to less than 3,000 in 2012 (ODFW 2019a). Since the passage of the Oregon Plan for Salmon and Watersheds (ODFW 1997), state and federal agencies, local watershed groups, NGOs, and public and private landowners have led a substantial local recovery effort. Figure 1-1 shows many of the restoration projects implemented within the Nehalem watershed over the last two decades.



**Figure 1-1. Habitat Restoration and Forest Road Maintenance Projects (1995 – 2018).**

Along the rural, resource-dependent coast of northwest Oregon, watershed conservation and species recovery require the establishment of strategic partnerships in which a variety of public and private stakeholders work together towards a common vision. This vision must coalesce economic, ecological, and social goals and align the limited social and financial capital available in the region towards solutions that promote sustainable watershed and community health. Development of this Strategic Action Plan (SAP) by the Nehalem River Coho Partnership (Nehalem Partnership) intends to meet these needs. Through this plan, the partners listed below seek to engage local stakeholders in developing and implementing habitat protection and restoration actions that will recover the Nehalem Coho population, while sustaining and nurturing the long-term viability of working farms, forests, and communities.

The Nehalem Partnership includes the following federal, state, local, and corporate partners:

- Columbia Soil and Water Conservation District (SWCD),
- Lower Nehalem Watershed Council (LNWC),
- National Marine Fisheries Service (NMFS),
- Oregon Department of Environmental Quality (DEQ),
- Oregon Department of Fish and Wildlife (ODFW),
- Oregon Department of Forestry (ODF),
- Tillamook Estuaries Partnership (TEP),
- Upper Nehalem Watershed Council (UNWC), and
- Weyerhaeuser.

### **1.1 The Vision of a Healthy Coho Population**

The Nehalem Partnership envisions healthy ecological, economic, and social conditions in the Nehalem basin that ensure a sustainable future for native Coho salmon through highly connected, functional, and productive landscapes.

Through the implementation of this plan, the partners hope to achieve the following long-term ecological outcomes:

- *Protect and restore summer, winter, and incubation habitats sufficient to produce a detectable change in Coho productivity in high-priority 6<sup>th</sup> field watersheds, and promote the long-term viability of the Nehalem Coho population.*
- *Protect and restore watershed processes to ensure sufficient habitat diversity for the expression of multiple life-history strategies within the Nehalem Coho population.*

## 1.2 Why Coho?

Coho salmon have a unique life cycle among Pacific Salmon that makes them an excellent indicator of watershed health. Adult Coho return from the ocean to the river each fall, spawning in the basin's low gradient tributaries. The resulting offspring emerge from the gravel the following spring, then – unlike other Pacific Salmon – spend a full year in freshwater before migrating to the ocean. This extended freshwater residency requires a watershed that is functioning sufficiently to maintain a variety of habitat types throughout the year, especially “off-channel” areas such as beaver ponds, oxbows, and side channels. These habitats allow juvenile Coho to find areas with cool water temperatures when the mainstem heats up in the summer, and resting areas in the winter when peak flows threaten to sweep them downstream. If a watershed can generate and maintain enough complex instream and off-channel habitats to sustain a viable Coho population, the system is likely capable of producing services that communities rely on, such as clean drinking water, flood control, and recreation.

In addition, restoring Coho habitats benefits other species. Coho habitats are created by the interaction of complex watershed processes like hydrology, sediment delivery, and riparian (streamside) and floodplain interactions. The protection and restoration of these and other processes for Coho help the watershed produce and maintain habitats for Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), steelhead (*O. mykiss*), and cutthroat trout (*O. clarki clarki*), and a range of plant and animal species, many of which Coho require for their survival.

Finally, Coho are a “keystone species,” which numerous plants and animals rely on at some point during their lives. All life stages of Coho (egg, fry, smolt, and adult) provide sustenance to aquatic and terrestrial organisms ranging from otter and black bear, which consume returning adults, to the smallest aquatic invertebrates that shred the carcasses of decaying fish after they have spawned.

Forest and plant communities also directly benefit from the decaying fish. Adult Coho return to the watershed after taking up phosphorus, nitrogen, and other nutrients from the ocean. After they spawn, they decompose and release these critical “marine-derived nutrients” (MDN) into the ecosystems where they become available to grasses, shrubs, trees, and other plant life. Studies on MDN have not been conducted in the Nehalem basin, but according to Merz and Moyle (2006), “research over more than three decades has shown that the annual deposition of salmon-borne [MDN] is important for the productivity of freshwater communities throughout the Pacific coastal region.” Helfield and Naiman (2001) found “that trees and shrubs near spawning streams derive ~22-24 percent of their foliar nitrogen (N) from spawning salmon.” Subsequent research by Naiman et al. (2002) suggests that even in highly modified watersheds in northern California, “robust salmon runs continue to provide important ecological services

with high economic value.... Loss of Pacific Salmon can not only negatively affect stream and riparian ecosystem function, but can also affect local economies where agriculture and salmon streams coexist.”

### **1.3 Scope of this Strategic Action Plan**

The federal government and the State of Oregon have developed recovery plans for the OC Coho ESU that encompass the Nehalem population, including the Final ESA Recovery Plan for Oregon Coast Coho Salmon (NMFS 2016) and the Oregon Coast Coho Conservation Plan (ODFW 2007), respectively. While these plans identify population-scale limiting factors and recommend a suite of strategies to recover each of the populations in the ESU, both plans stress that recovery can only be achieved through the implementation of plans that are locally generated and include finer-scale, targeted conservation actions. Decisions on where and how these actions are implemented must be made in locally-convened forums, so the input of the landowner community and other stakeholders can be fully integrated into both the long-term habitat restoration strategy and the selection of specific projects in the short term.

This SAP seeks to meet these needs for the Nehalem River community. Chapter 5 presents a long-term “strategic framework” for Coho habitat protection and restoration. Specifically, this chapter describes the habitat restoration strategies that will have the highest potential to restore watershed function and identifies numerous locations throughout the basin where these strategies can generate the greatest benefit. Chapter 6 presents a short-term work plan that maps the specific locations where the social, economic, and regulatory conditions exist to put projects on the ground that align with the long-term strategic framework.

It is important to note that the Nehalem Partnership’s ability to achieve the outcomes described in Section 1.1 is influenced by a variety of threats that cannot be fully addressed by this SAP since it focuses largely on physical habitat restoration. Over the course of this plan’s development, participants considered many of these threats, including predator management (sea lions, cormorants, etc.); the sufficiency of state water quality rules; and fishery, farm, and forest management. Ultimately, the partners opted to limit the scope of this plan to priorities that the Nehalem Partnership has greater control over: namely, where, when, and how Coho habitats can and should be restored in the watershed. Reviewers of this plan are encouraged to consider the policies governing land use and species/habitat management in the Nehalem basin alongside this plan’s restoration goals and to use existing venues to promote policies that align with the vision of Coho recovery as described above.

Finally, the Nehalem Partnership wishes to underscore that implementation of this plan is entirely voluntary. While maps contained in the sections that follow identify instream and upland habitats on some private lands as a high priority for restoration, the implementation of

actions on these lands is up to individual landowners. The identification of high-quality habitats on both public and private lands will guide outreach to landowners, but participation in the implementation of this plan relies entirely on voluntary actions, and no new actions will be required of public or private landowners. Likewise, this SAP does not propose any new regulations or the modification of existing regulations.

#### **1.4 SAP Implementation Timeline: Long-Term Outcomes & Short-Term Goals**

The Nehalem Partnership projects the implementation of this plan – including new projects identified through the adaptive management process – to run through 2040. Such a long implementation horizon will be necessary to achieve the plan’s outcomes in part because of the time required for the system to respond to restoration treatments (for example, trees planted in a riparian zone may take a decade or more to begin providing sufficient shade to improve water temperatures.) In addition, the Nehalem Partnership recognizes that it will take many years for the implementation of a sufficient number of projects to demonstrate an improvement in sub-watershed function.

We hope to achieve the outcomes stated in Section 1.1 by reaching several SAP implementation goals. By 2040 the Nehalem Coho Partnership seeks to:

- Protect 536 acres of standing timber in the Nehalem River watershed;
- Add LWD to 60 miles of identified anchor habitats in the high-ranked sub-watersheds;
- Plant 100 miles of riparian vegetation in the high-ranked sub-watersheds;
- Recruit dam-building beavers to colonize 20 percent of the Coho-bearing tributaries (by miles) in each of the high-ranked sub-watersheds;
- Reconnect 25 acres of tidal wetlands and other estuarine habitats; and
- Restore access to 50 miles of slough and tributary channels, including associated off-channel habitats.

#### **1.5 Implementing Partners**

While this SAP has been developed by the team of partners listed in Section 1.1, a subset of agencies and organizations will lead its implementation on the ground. Table 1-1 lists these partners and the role each will play in implementing this SAP.

Table 1-1. Core Implementing Partners.

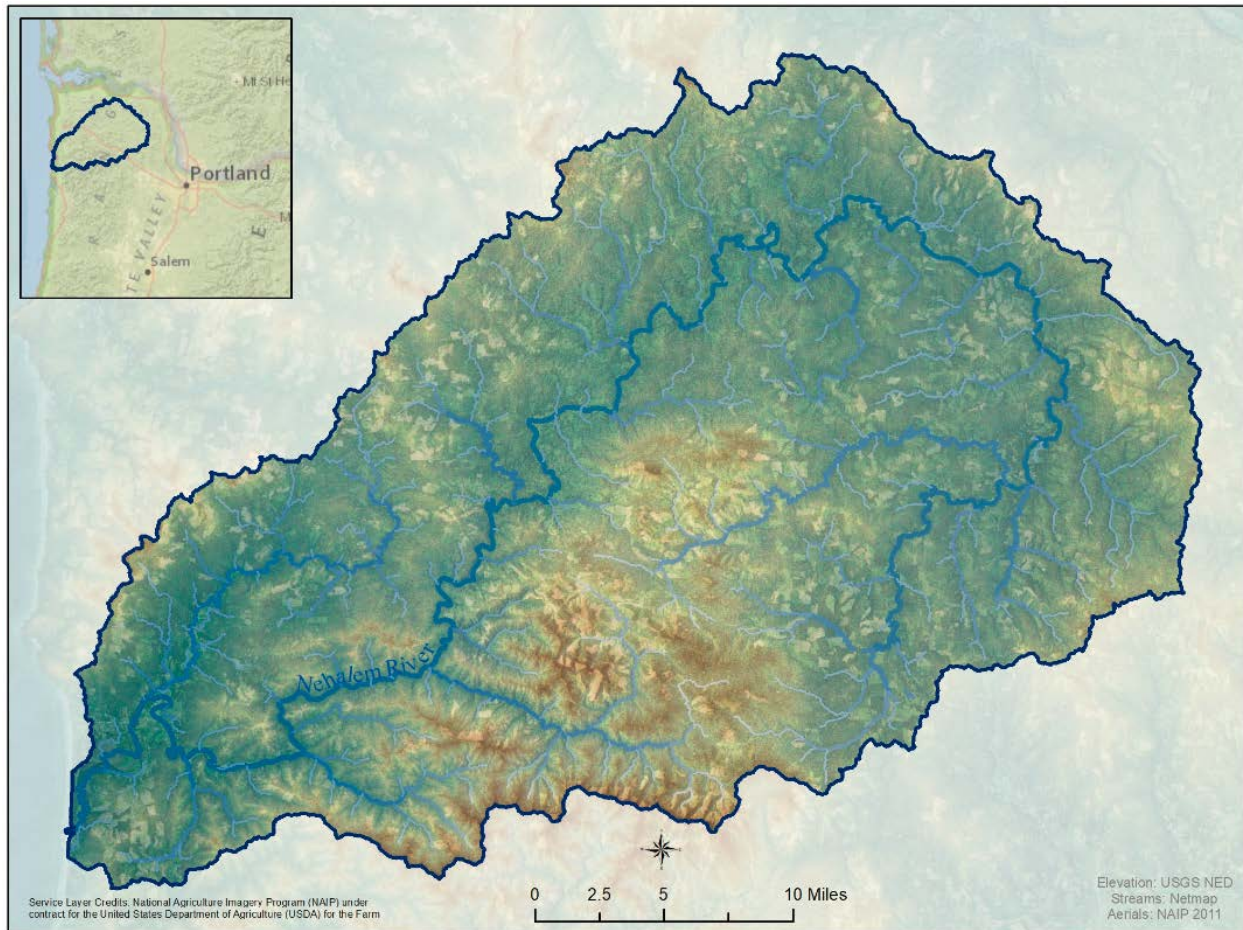
Core Implementation Partner	Experience	Anticipated Contributions
<b>Columbia SWCD</b>	<p>The Columbia SWCD was created in 1946 to support private landowners with stewardship and conservation of working (timber and agriculture) and non-working lands. It has partnered with private landowners throughout Columbia County within the Nehalem watershed on instream and riparian restoration, weed management, and other restoration projects.</p>	<p>The Columbia SWCD will implement the SAP by providing technical assistance to landowners within the parts of the Nehalem watershed that intersect with Columbia County. The SWCD will undertake outreach to landowners, raise implementation funds, manage project implementation, and monitor and report on progress.</p>
<b>Lower Nehalem Watershed Council</b>	<p>The LNWC is dedicated to the protection, preservation, and enhancement of the Nehalem watershed through leadership, cooperation and education. Since its inception in the 1990s, the LNWC has been working with public and private landowners in the watershed to implement habitat restoration, monitoring, and education projects.</p>	<p>The LNWC will be a lead implementer of the SAP in the lower watersheds. It will conduct landowner outreach, raise implementation funding, manage the implementation of habitat restoration projects, and monitor and report on progress.</p>
<b>Oregon Department of Forestry</b>	<p>As the owner and manager of the Tillamook-Clatsop State Forest, ODF is the largest public landowner in the Nehalem basin. The agency has partnered with the watershed councils and other groups on the implementation of the Oregon Plan for Salmon and Watersheds since the 1990s and has decades of experience leading and supporting upland, instream, and riparian habitat restoration projects.</p>	<p>ODF will provide technical support for project implementation, in-kind donation of trees and other project materials, and access to sites for SAP implementation.</p>
<b>Oregon Department of Fish and Wildlife</b>	<p>ODFW has expertise in regional fisheries, aquatic and terrestrial habitat issues, and supporting and leading state-wide partnerships. Local field staff in the Nehalem have provided technical assistance to the vast majority of the habitat restoration projects implemented in the Nehalem since the development of the Oregon Plan.</p>	<p>ODFW staff will continue to provide technical support for locally-led habitat restoration projects, as well as assistance in data management, landowner outreach, public education, and project development.</p>

<p><b>Tillamook Estuaries Partnership</b></p>	<p>TEP is a 501 (c) (3) non-profit organization dedicated to the conservation and restoration of Tillamook County's estuaries and watersheds. It has managed habitat restoration, monitoring, and education projects in the Nehalem watershed since 2002, when it expanded its service area beyond just Tillamook Bay.</p>	<p>TEP will implement habitat restoration projects in the Nehalem watershed, while providing technical and financial support to the lead implementers as resources are available.</p>
<p><b>Upper Nehalem Watershed Council</b></p>	<p>Founded in 1996, the mission of the UNWC is to foster stewardship and understanding of the natural resources of the Upper Nehalem Watershed among the stakeholders of the watershed communities in order to protect, conserve, restore and sustain the health and functions of the watershed. For over 20 years, it has collaborated with public and private landowners to implement numerous habitat restoration projects, while also supporting local research, monitoring, and education efforts.</p>	<p>The UNWC will be a lead implementer of the SAP in the upper part of the basin. It will conduct landowner outreach, raise implementation funding, manage the implementation of habitat restoration projects, and monitor and report on progress.</p>
<p><b>Weyerhaeuser</b></p>	<p>Weyerhaeuser is one of the largest private landowners in the U.S. and offers a diverse suite of resource-based services and products. The company is the largest private landowner in the Nehalem watershed. In addition to ongoing timber operations and other land management activities, it partners with local conservation organizations to restore critical habitats.</p>	<p>Weyerhaeuser will continue to partner with the watershed councils and other stakeholders to implement habitat restoration projects on its lands, as well as support restoration efforts on other lands within the watershed.</p>

## 2. The Nehalem River Watershed

The Nehalem River is the third-longest coastal river in Oregon. Located in the northwestern corner of the state, the river drains approximately 855 square miles of Washington, Columbia, Clatsop, and Tillamook Counties (Figure 2-1). The Nehalem River flows 118.5 river miles from its source on Giveout Mountain (west of the town of Timber) to Nehalem Bay and the Pacific Ocean. Along the way, the mainstem Nehalem River collects input from over 935 miles of tributaries (Maser 1999).

The Nehalem River watershed is home to an independent population of OC Coho salmon (NOAA 2007; Lawson et al. 2007) that relies on the watershed and its habitat-forming processes for adult spawning, juvenile rearing, and migration to and from the ocean.



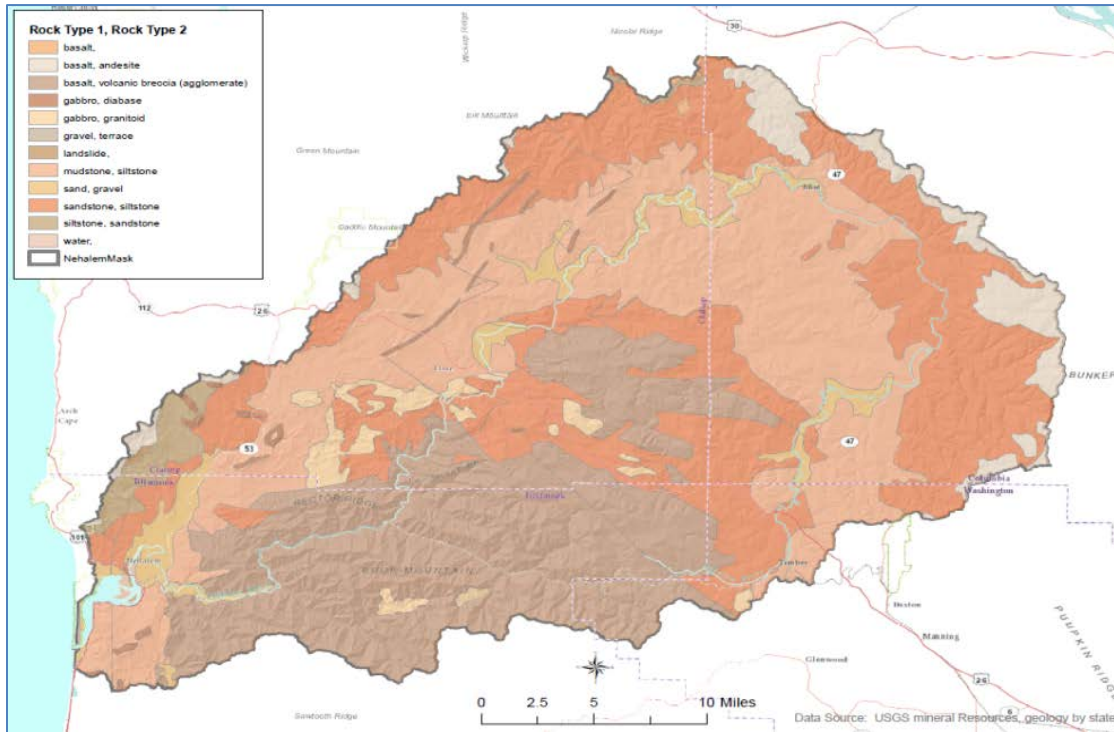
**Figure 2-1. The Nehalem River Watershed.**

## **2.1 Geology and Physical Geography**

The Nehalem River watershed is located within the Oregon Coast Range Ecoregion. Coniferous forests dominate this region, with 98 percent of the watershed in forest cover (NRCS 2005). Sitka spruce, Douglas-fir, western red cedar, and western hemlock are common in these forestlands (NOAA 2007). Elevation in the watershed ranges from sea level to 4,000 feet, with average temperatures of 50 degrees Fahrenheit and average annual rainfalls of 60 to 180 inches.

The watershed contains four EPA Level IV Ecoregions (EPA 2019): coastal lowlands (sea level to 300 feet), coastal uplands (elevations up to 500 feet), volcanics (from 1,000 to 3,200 feet), and Willapa hills. The Nehalem River estuary is a “drowned river mouth estuary” created from the inundation of the lower river mouth and coastal plains resulting from rising sea levels that followed the last ice age. Bounding the coastal lowlands – and the extensive network of marshes, sloughs, and swamps that comprise it – are coastal uplands. Upland areas in the Nehalem basin include uplifted marine-consolidated and semi-consolidated sandstones and siltstones. Volcanic geology includes Tillamook volcanics in the southern part of the watershed and Columbia Basalt in the northeast (Francisco 2012). Between the volcanic outcroppings lie the Willapa hills, a series of low-lying hills in the western hemlock zone (NOAA 2007).

Figure 2-2 provides a map of Nehalem basin geology. According to Jones et al. (2012), the Nehalem basin is mostly comprised of sedimentary rocks that break down quickly. Stream



**Figure 2-2. Geology of the Nehalem River Watershed.**

power is high until the head of tide, where gravel from volcanic rock settles. Sand and silts from sedimentary rocks settle mostly in the tidal reaches and on floodplains.

Prior to the arrival of European and American homesteaders and the rise of the commercial timber and agriculture industries, the Nehalem River and its tributaries were a complex mosaic of habitat types providing a variety of functions for aquatic species and sustenance for indigenous cultures. In the upper reaches, large wood (both standing and downed), beaver dams, and boulders promoted interaction between tributary and mainstem channels and their adjacent floodplains. High flows across this complex landscape generated well-connected side channels, oxbows, and ponds of cool, calm water that were ideal for Coho rearing. High flows also sorted river substrates, creating gravel and cobble riffles that were ideal for spawning salmon.

In the lower reaches of the basin, historically, the floodplain broadened into a connected network of sloughs, marshes, and swamps. Plentiful amounts of large wood contributed to the dynamic river as it relocated across the floodplain, creating side channels, alcoves, bars, and islands.

As a result of European settlement, much of the lower river has been leveed for flood protection and agriculture production, disconnecting the Nehalem River from its historic floodplain, and straightening and deepening the mainstem. Marshes and swamps have been drained to support agricultural use. Past logging activities – which included floating cut logs down the Nehalem River and tributaries to the lumber mills in log drives, splash dams, and diversion dams – scoured entire reaches of critical spawning substrates. The log drives, along with “river cleaning” to support boating, led to the clearing of habitat-forming large woody debris. Altered hydrology from human management of the landscape has also greatly simplified stream habitats. Timber harvest and land clearing for agriculture and development also stripped riparian areas of large wood.

## **2.2 Water Resources**

Rainfall in the Nehalem basin ranges from 55 inches per year near Vernonia to 200 inches in the higher elevations of the Salmonberry subwatershed (Maser 1999). The United States Geologic Survey (USGS) maintains a long-term gage on the Nehalem River near Foss, Oregon. Average discharge during the 1940-1999 period of record was 2,672 cubic feet per second (cfs) with a maximum discharge of 70,300 cfs recorded on February 8, 1996 following a rain-on-snow event. The minimum discharge was 34 cfs during the period August 29-31, 1967. The average peak flow is 28,776 cfs. Eighty-five percent of the total discharge in the watershed occurs between November and April (Maser 1999).

Within the Nehalem population, water quantity has been identified as a stressor for Coho salmon in the Upper Nehalem River, Middle Nehalem River, and Lower Nehalem River – Cook Creek hydrologic units (Bauer et al. 2008). There are 542 permitted water rights (Maser 1999) in the Nehalem watershed representing 93.25 cfs, an amount that can have a substantial impact on summer stream temperatures and juvenile fish migration.

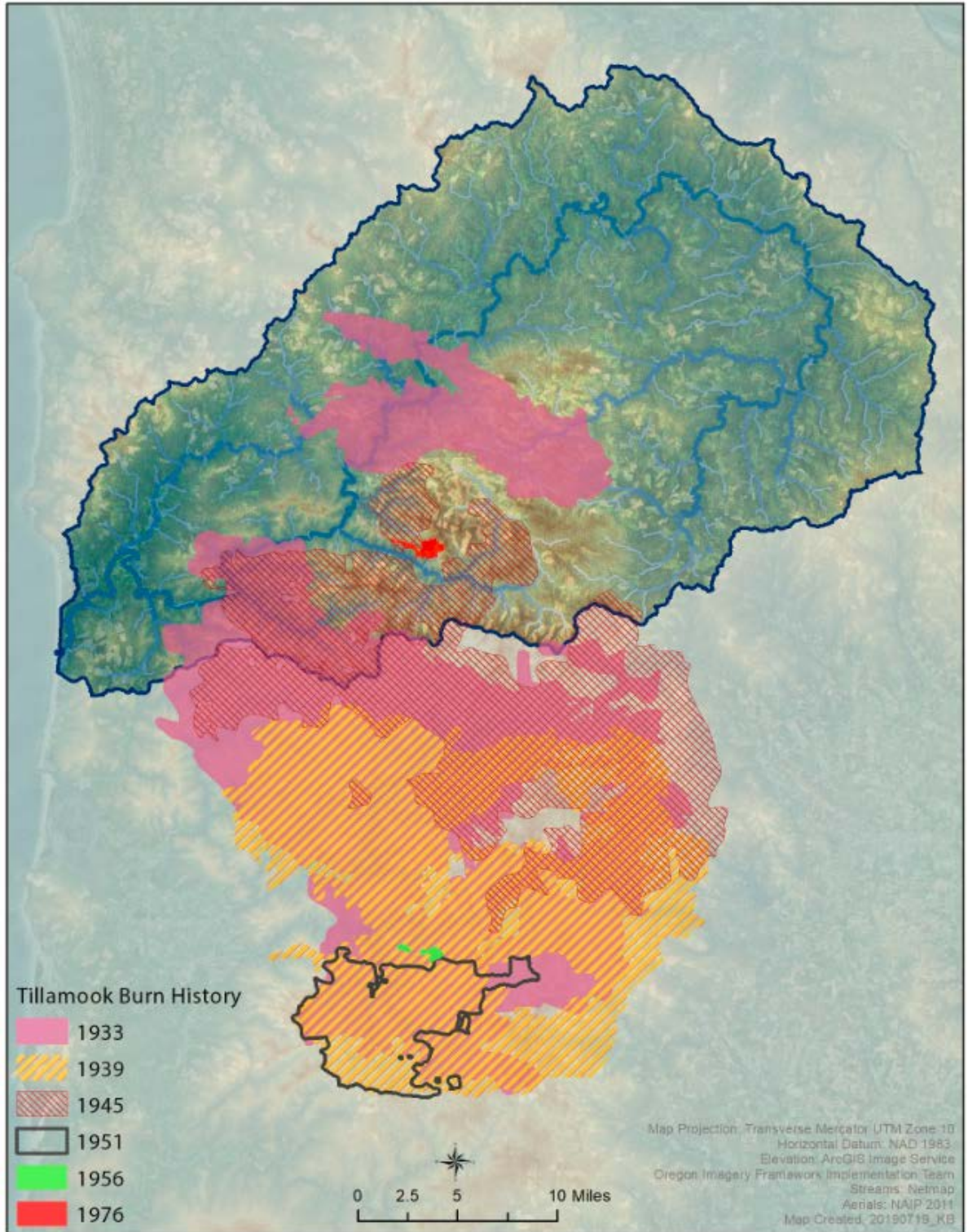
## **2.3 Forest Resources**

The vast majority (almost 90%) of the Nehalem River watershed is in state and private forest ownership. The history of the Nehalem forests is one of disturbance, both natural and anthropogenic. Prior to timber harvest by European and American homesteaders, old-growth Douglas fir forests dominated the watershed, with areas periodically disturbed by fire. According to the Nehalem Valley Historical Society (via Maser 1999), the Nehalem Indians regularly managed forestland with fire to allow meadows to persist for deer and elk grazing. Timber harvest by white settlers began in the 1870s with the construction of the Pittsburg lumber mill on the East Fork Nehalem River (Maser 1999; Ferdun 2003). The industry accelerated with the construction of the Wheeler sawmill, which operated from 1902-1930. With timber production booming, roads and railroads were built to support the industry, and by

1945 virtually all of the Nehalem watershed's old-growth timber had been harvested (Sword 1999 via Maser 1999; Ferdun 2003).

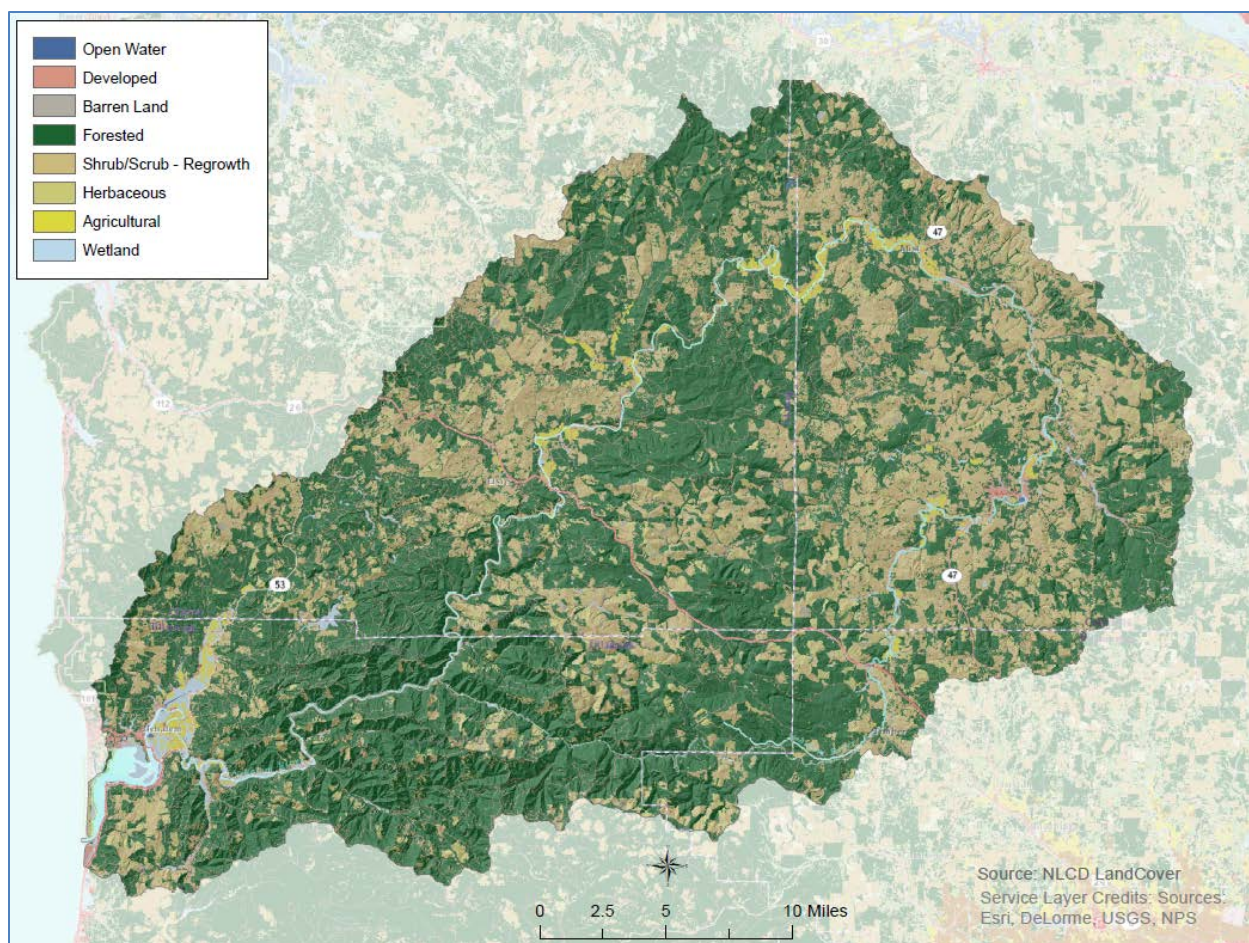
As shown in Figure 2-3, two major fires affected large areas of the Nehalem basin. In 1933, the infamous Tillamook Burn torched 270,000 acres in the Salmonberry River, Cook, Humbug, and Rock Creek drainages, as well as 30 river miles of the Nehalem mainstem. Twelve years later, in 1945, the Salmonberry Fire burned much of the Salmonberry River and Cook Creek drainages. The damage from these fires stripped the forest of its timber value, forcing many landowners into foreclosure. This resulted in land ownership being transferred to the State of Oregon, which initiated a massive reforestation program from 1949 to 1973.

Today, commercial timber harvest occurs on these reforested lands. Lands on the Tillamook-Clatsop State Forest are managed by the Oregon Department of Forestry under the Northwest State Forest Management Plan. Private lands are held by small woodlot owners, timber investment management organizations, and logging companies. The ODF regulates all of these privately owned forests under the Oregon Forest Practices Act (FPA). Due to this combination of historic clearcutting, catastrophic fire events, and ongoing timber harvest (often under 30- or 40-year rotations on private lands), most of the forested land in the watershed is younger than 70 years.



**Figure 2-3. Extent of fires collectively known as “The Tillamook Burn”**

<http://oregonstate.edu/instruct/geo422/522-Paper%20hoadley.pdf>.

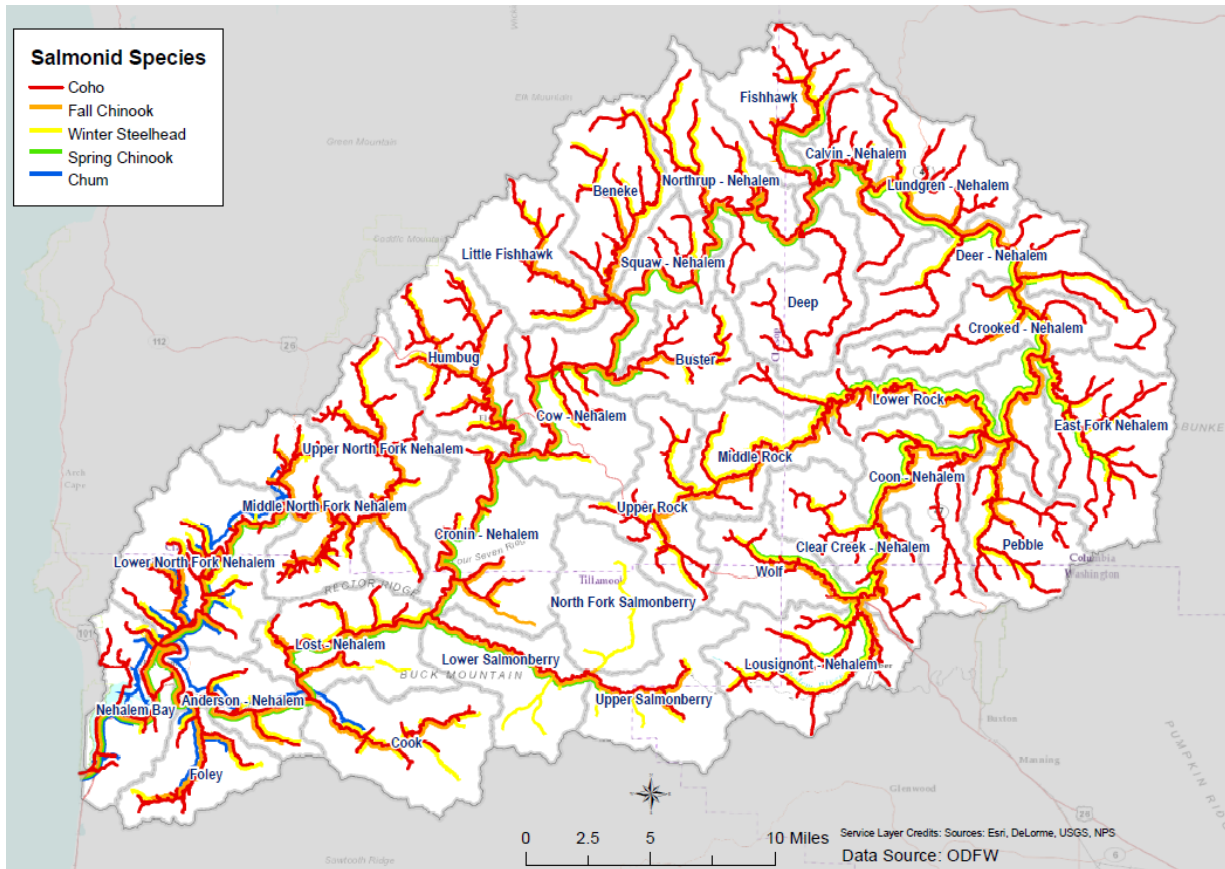


**Figure 2-4. Land Cover in the Nehalem River Watershed.**

## 2.4 Biotic Systems

The Nehalem River watershed vegetation structure and composition vary with elevation, proximity to the Pacific Ocean, and timber harvest history (Figure 2-4). The higher elevation areas are dominated by conifer trees, while lower elevation areas, particularly mainstem riparian areas, are dominated by stands of broadleaf species or a mix of broadleaf and conifers (Maser 1999). Within the Nehalem River estuary, a variety of habitats exist including mudflats, aquatic beds, emergent marsh, scrub-shrub, and forested wetlands (Brophy and So 2005).

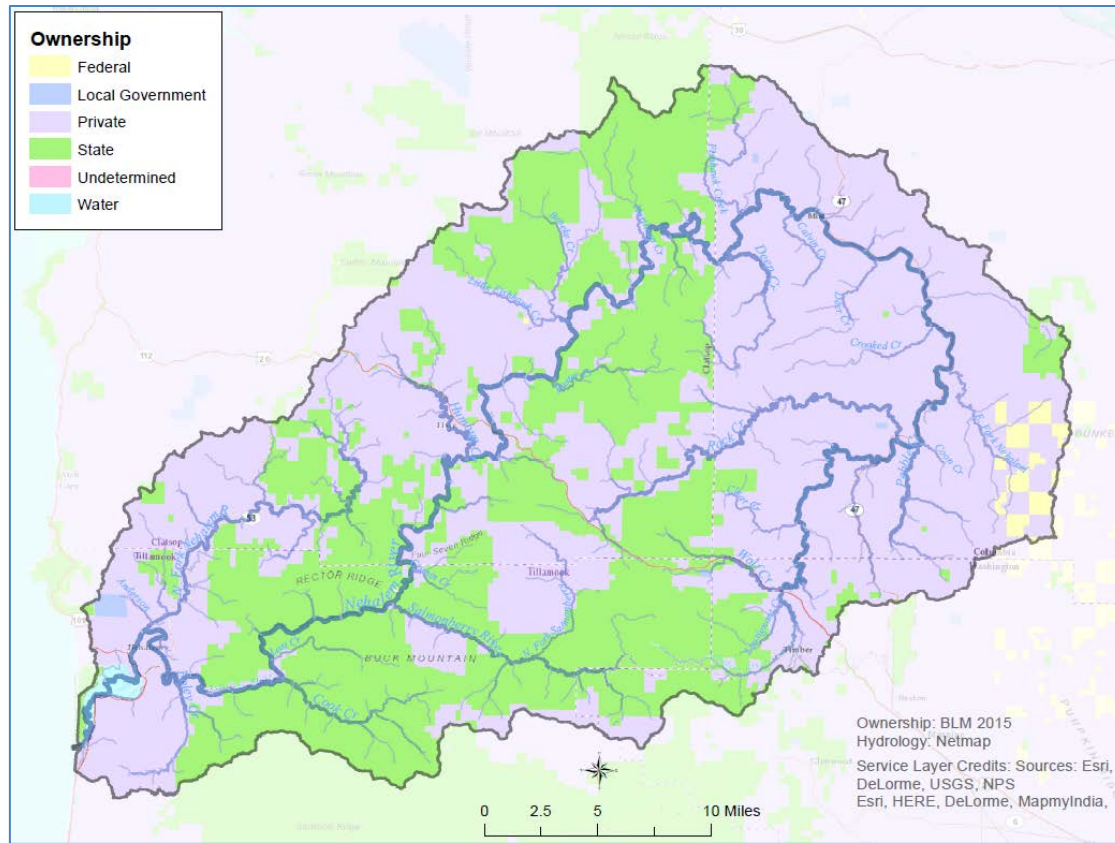
Figure 2-5 shows the distribution of salmon and steelhead throughout the basin. Four salmon and steelhead species – Coho salmon (*Oncorhynchus kisutch*), fall and early-run fall Chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), and winter steelhead (*O. mykiss*) – occur in the mainstem and tributaries of the Nehalem basin. Of these, only Coho salmon are protected under the ESA. Resident and anadromous cutthroat trout (*O. clarki clarki*), white sturgeon (*Acipenser transmontanus*), and Pacific lamprey (*Lampetra tridentata*) are also present within the basin (Kavanagh et al. 2005, 2006).



**Figure 2-5. Fish Distribution in the Nehalem River watershed.**

## 2.5 Human Settlement and Demographics

Today, the Nehalem River watershed has relatively low population growth and economic development compared to its boom period in the early 1900s. The watershed is sparsely populated, with large amounts of forested land. Land use is dominated by timber harvest, with a relatively smaller area comprised of agriculture and rural development. Land ownership within the watershed is 40 percent public (comprised primarily of the Tillamook-Clatsop State Forest), 48 percent private industrial timberlands, and 12 percent private non-industrial lands (Figure 2-6). Of the approximately 650 miles of Coho salmon streams in the basin, 30 percent of the total length is found on public lands, 40 percent on private industrial forest lands, and the remaining 30 percent on private non-industrial forest lands (Watershed Professionals Network 2007).



**Figure 2-6. Land Ownership in the Nehalem River watershed.**

Evidence of settlement along the Oregon coast dates to 25 Before Common Era (Ferdun 2003), and the Nehalem River is named for Native Americans who inhabited the watershed for thousands of years (Maser 1999). European explorers began visiting Oregon as early as 1579 (Ferdun 2003). The 1770s and 1780s brought more European explorers, and with them came diseases which led to the native population being decimated, with estimates of the native population loss ranging from 75 to 90 percent (Maser 1999).

Nearly a century later in 1866, Hans Anderson was the first European settler in the Nehalem River valley (Maser 1999; Ferdun 2003). Shortly after Anderson’s arrival, the towns of Nehalem and Wheeler were established just upstream of Nehalem Bay. In 1878, a lumber mill was built in Pittsburg along the East Fork Nehalem River (Maser 1999; Ferdun 2003). With the establishment of towns came industry and development, which led to canneries, lumber mills, and farms.

As settlers continued to move to the Nehalem watershed and establish homesteads, the resource-dependent economy boomed. The early 1900’s economy was built on timber harvest, dairy farming, and fishing, and all three industries continued to grow through the 1920s as

export markets expanded. This period brought the most significant changes to the physical and social environment of the Nehalem watershed to date (Ferdun 2003).

The resource-based economy continued through the 1930s, 40s, and 50s. To support commercial fishing, canneries and hatcheries were established. Aggressive logging, timber exports, and the Tillamook Burn significantly altered the forests, and little to no old-growth forests remained in the watershed after 1945 (Maser 1999; Ferdun 2003). Numerous dairy farms were in operation in the Nehalem River floodplain by this time. These farms leveed wetlands and converted them to pasture for dairy production. In 1960, the Nehalem's remaining cheese factories consolidated under the Tillamook County Creamery Association (Ferdun 2003). Coho runs continued to return in viable numbers to the Nehalem River, and in 1976 managers witnessed the highest recorded harvest rate on OC Coho salmon, at about 90 percent of the run (ODFW 2007).

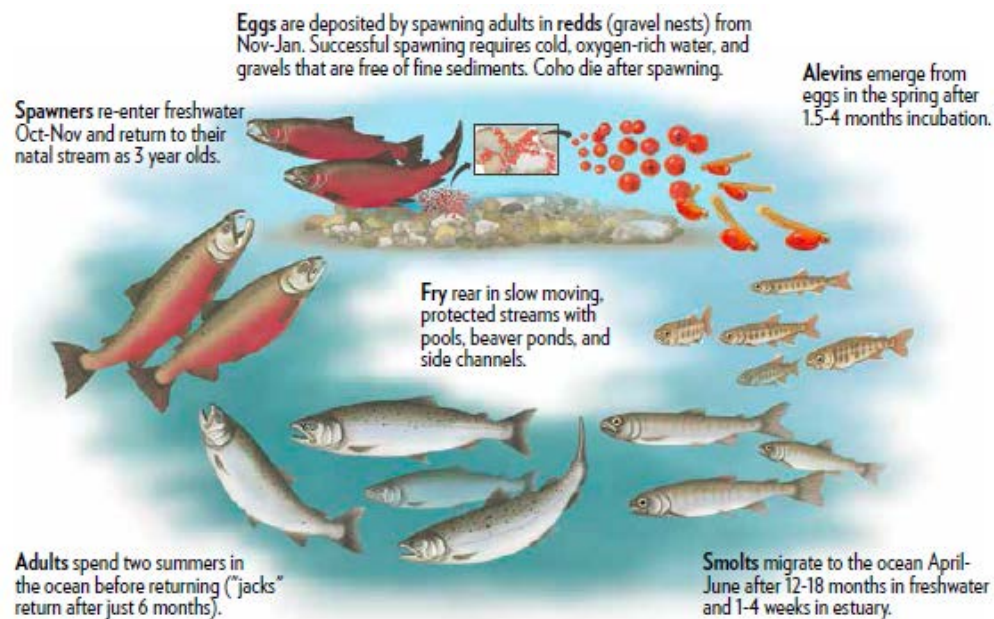
Today, recreation, retirement, and tourism services drive the local economy (Headwaters Economics 2019). Timber harvest continues, but the river remains closed to commercial fishing, and recreational fishing for Coho has been curtailed. Farming continues with approximately 250 farms in operation (NRCS 2005).

The watershed today has three main population centers: the towns of Vernonia, Wheeler, and Nehalem. The 2009 combined population of these areas was 3,009 people (US Census Bureau 2010). Several other smaller towns and isolated farms sit outside of these main population centers. The average median income for the towns is roughly \$38,000, and 42 percent of jobs are in educational, social, and health care services and manufacturing. Agriculture, forestry, fishing/hunting, and mining account for nine percent of the jobs in the towns and five percent in the counties (not including Washington County, since it includes much larger urban areas in the Willamette Valley) (TNC 2012).

### 3. Nehalem Basin Coho and Habitats

#### 3.1 Coho Salmon Life Cycle and Habitat Needs

Adult Coho salmon return to the Nehalem River from the ocean and migrate to their natal streams from October through December, spawning between November and January (Kavanagh et al. 2015). Coho salmon preferentially spawn in tributaries but have been observed spawning in the mainstem of the upper Nehalem as well (Kavanagh et al. 2005, 2006). Successful spawning requires the appropriate mix of gravels and cobble substrate in stream riffles. Female Coho salmon build redds (gravel nests) and deposit their eggs, which are fertilized by one or more males. Adults die soon after spawning, typically within two weeks (Maser 1999). Figure 3-1 depicts the standard Coho salmon life cycle.



**Figure 3-1. The Coho salmon life cycle.**

Coho salmon redds require a steady flow of oxygenated water to allow eggs and alevins (juveniles that have emerged from the egg but rely on attached yolk sacs for nourishment while they remain within the gravels) to survive (Kavanagh et al. 2005, 2006). The common understanding of Coho salmon maturation has focused on a “standard” or “conventional” life-history type in which Coho salmon fry rear near their natal stream for a year or so before migrating to the estuary in spring as smolts (juvenile salmon undergoing physiological changes to adapt from freshwater to a saltwater environment) (Sandercock 1991; Nickelson 1998). However, as early as the 1960s researchers described age-zero (first year of life) fry, which migrate downstream shortly after emergence (Chapman 1962).

The early migration of these individuals, called “nomads,” was originally believed to be caused by density dependence, which is a natural population dynamic in which juveniles migrate due to a habitat having reached its carrying capacity. Subsequent research into Coho and other Pacific Salmon species indicates that these migrations are not driven by density dependence, high flows, or other sources of displacement, but in fact, represent alternative life-history strategies (Reimers 1973; Bottom et al. 2005; Koski 2009; NMFS 2016). The expression of multiple life-history strategies within a population increases the likelihood that the population can persist following sudden or gradual variations in watershed function and the availability of high-quality habitats. This resilience is essential to the viability of Pacific Salmon populations and a key to the species’ success (Moore et al. 2014).

Research on juvenile Nehalem Coho migration and residency patterns indicates that multiple life-history strategies are expressed within the population (Bio-Surveys 2011a). During the development of this SAP, the team considered the presence of six potential unique life-history variations based on a range of environmental and behavioral variables. See Appendix 2.

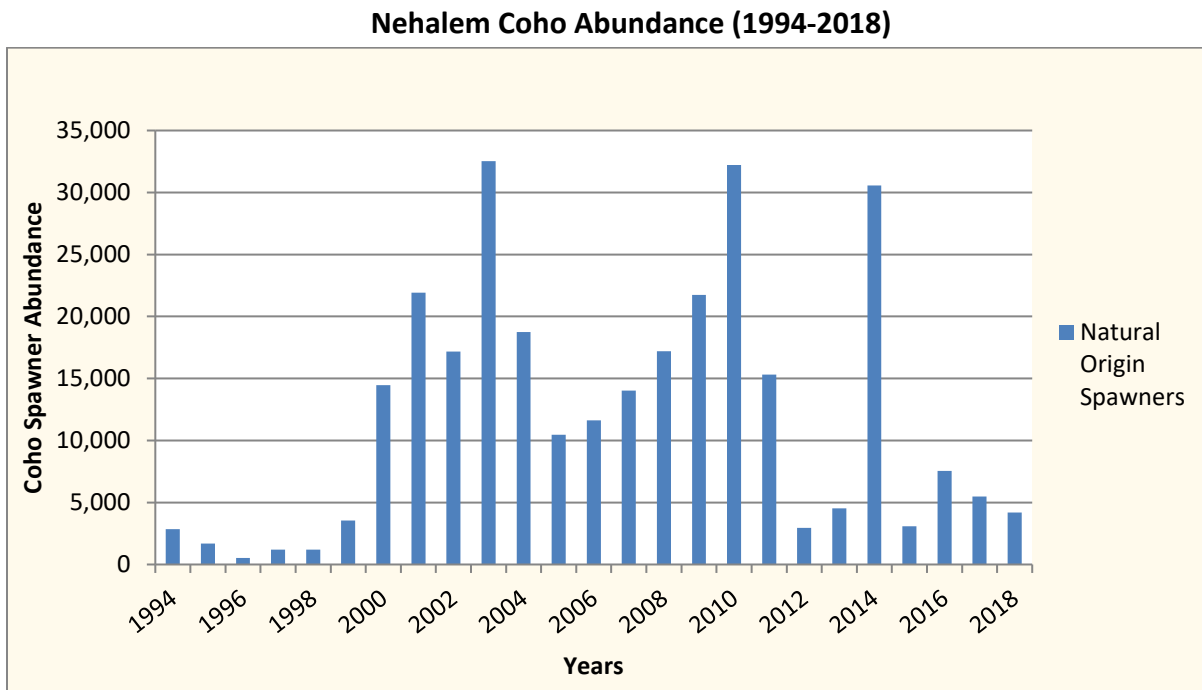
The standard life-history strategy establishes that Nehalem Coho salmon smolts will typically spend less than a month in the estuary feeding, growing, and adapting to saline environments before entering the Pacific Ocean. However, results of research conducted in the Salmon River estuary (about 60 miles south of the Nehalem Bay) “reveals a wide range of sizes and times of juvenile Coho migration to the estuary and ocean, including many nomads that successfully rear and grow in the estuary for extended periods” (Jones et al. 2011). The Nehalem Partnership agreed that it is highly likely that this estuary-dependent life-history variation is present within the Nehalem population and included it among the life-history strategies considered throughout the planning process.

Coho salmon generally spend about 18 months in the ocean as adults before returning to their natal streams to spawn in their third year of life (ODFW 2007); however, some males return to freshwater after only one year in the ocean (Mullen 1979). These precocious males, commonly called “jacks,” offer another example of the life-history variation observed within Coho populations.

### **3.2 Coho Salmon Population Abundance**

A long-term assessment of Nehalem Coho abundance indicates a steadily declining trend from historical to contemporary estimates (Ferdun 2003). Fisheries catch data from the 1920s and 1930s show an average annual catch of over 50,000 Coho salmon from the Nehalem River, with a severe decline in the catch after 1950. Coho salmon numbers continued to decline steadily from the 1960s through much of the 1990s (ODFW 1993).

Since the mid-1990s, ODFW has utilized several sampling methods to understand adult spawner abundance, juvenile abundance, and adult escapement. These sampling efforts have been employed at the scale of the North Coast stratum down to the sub-watershed, and examined both wild and hatchery Coho salmon. As shown in Figure 3-2, the data indicate large fluctuations in the numbers of natural-origin Coho salmon returning to spawn in the Nehalem watershed in recent years. The Nehalem Coho population bottomed out in 1996 with an estimated abundance of just over 500 natural-origin spawners. This pattern reflects an ESU-wide trend, which led to the ESA listing of the OC Coho ESU in 2011. Wild spawner abundance began to rebound slightly starting in the late 1990s, and over the next 15 years estimates ranged from a low of roughly 10,000 natural-origin spawners in 2005 to over 30,000 in 2003 and 2010. Wild spawner abundance dipped down to pre-2000 levels in 2012, 2013, 2015, and 2018 (ODFW 2019a).



**Figure 3-2. Recent Nehalem Coho Salmon Spawner Abundance Estimates.** Source: ODFW Salmon and Steelhead Recovery Tracker (ODFW 2019a).

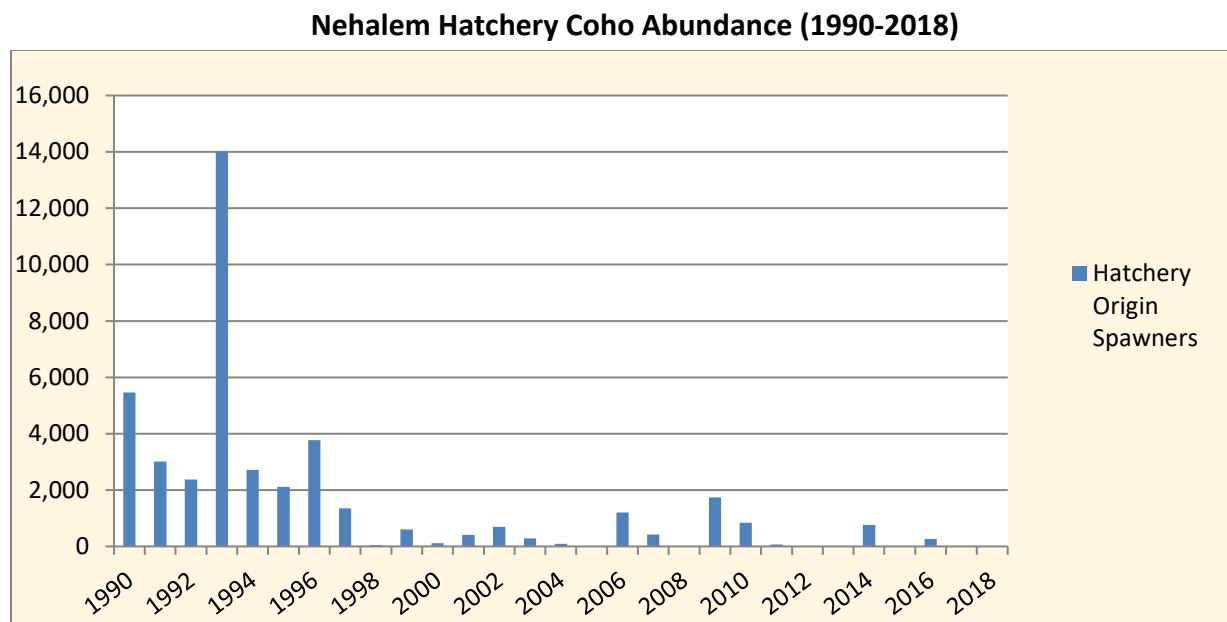
### 3.3 Hatchery Production

Early 20<sup>th</sup> century declines in salmon population abundance and the growth of commercial fishing in the Nehalem River spurred the creation of Nehalem hatchery programs. Nehalem fisheries have been influenced by hatcheries since 1926 when the Foley Creek Hatchery began supplementing wild populations of cutthroat and winter steelhead trout. The Foley Creek

Hatchery closed in 1966 and was replaced that year by the North Fork Nehalem Hatchery, which still operates today, producing Coho, Chinook, and winter steelhead.

Hatchery production of Coho salmon has been described by NMFS (2016) as adversely impacting Coho populations ESU-wide and as a contributor to the ESA-listing determination. The federal recovery plan points to two impacts: 1) the interaction of wild and hatchery fish on the spawning grounds leading to a reduction in the fitness of the resulting offspring, and 2) inadvertent harvest of natural-origin Coho resulting from recreational angling that targeted the hatchery run (NMFS 2016).

In the 1980s and 1990s, the North Fork Nehalem hatchery released an average of 535,000 Coho smolts per year. Between 1990 and 1995, the average release increased to 822,000 a year, but by the late 1990s and early 2000s, releases decreased to 100,000 to 200,000 a year (Ferdun 2003). Today, the North Fork hatchery releases 100,000 smolts on-site to “provide fish for sport and commercial harvest in both the ocean environment and the Nehalem Bay and North Fork Nehalem River” (ODFW 2019). The North Fork Nehalem hatchery rears a stock of varied origin (known as the “32 stock”) every two years. In the third year, ODFW rears stock from Fish Hawk Lake. Known as the “99 stock,” this stock was established in 1978, and smolts return as adults just one year after release (Suring et al. 2015).



**Figure 3-3. Estimated Abundance of Hatchery Coho Spawners.** Source: Oregon Adult Salmonid Inventory and Sampling (OASIS) Project. (ODFW 2019b).

Figure 3-3 shows the adult hatchery returns, which declined significantly after the ESA listing and now represent a fraction of the wild run (and in some years no hatchery fish are observed). NMFS (2016) states that “the North Fork Nehalem Coho stocks are managed as an isolated harvest program. Natural-origin fish have not been intentionally incorporated into the broodstock since 1986, and only adipose fin-clipped broodstock have been taken since the late 1990s. Because of this, the stock is considered to have substantial divergence from the native natural population and is not included in the Oregon Coast Coho salmon ESU.”

### **3.4 Overview of Habitat Needs and Watershed Components**

Coho salmon seek different habitat types during their various life stages, and spatial and temporal use of these habitats varies according to the life-history strategy being expressed by the individual. In order to fully express the range of life-history strategies present within a population, Coho salmon require diverse, complex, and highly connected habitats in freshwater and estuarine ecosystems. During their freshwater residency, juvenile Coho salmon rely on slow-moving water (ideally flows of less than two cfs) with complex in-stream and riparian structure capable of generating and maintaining pools, off-channel rearing areas, and channel-floodplain interaction. Among other attributes that are important to Coho, these conditions generate food, shelter from predators, refuge from high water temperatures in summer, and low velocity resting areas during fall/winter high flows.

While it’s described in the Oregon Coast Coho Conservation Plan by the broader term “instream complexity,” insufficient winter rearing habitat is the most common factor limiting Coho populations in the OC Coho ESU, including the Nehalem population (ODFW 2007). According to the Oregon Coast Coho Conservation Plan, “high-quality over-wintering habitat for juvenile Coho is usually recognizable by one or more of the following features: large wood, pools, connected off-channels, alcoves, beaver ponds, lakes, connected floodplains, and wetlands” (ODFW 2007).

The specific habitats that Coho require are generated and maintained within a complex, interconnected system of watershed “components.” The “Common Framework for Coho Recovery Planning,” which the Coast Coho Partnership (2015) developed to standardize how coast Coho habitats are defined, classified, and evaluated in plans like this one, defined these components as follows:

- **The Mainstem River** includes portions of rivers above head of tide (Coastal and Marine Ecological Classification Standard [CMECS] definition); these are typically 4th order, downstream of Coho spawning distribution, and “non-wadeable.” The mainstem river component includes associated riparian and floodplain habitats. Mainstem areas support upstream migration for adults and downstream migration for juveniles and limited

spawning.

- **Tributaries** include all 1st to 3rd order streams with drainage areas  $> 0.6 \text{ km}^2$ . This includes fish-bearing and non-fish-bearing, perennial and intermittent streams, and the full aquatic network including headwater areas, and riparian and floodplain habitats. Tributaries support spawning, incubation and larval development, fry emergence, and juvenile rearing.
- **Freshwater Non-Tidal Wetlands** include those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support – and under normal circumstances do support – a prevalence of vegetation typically adapted for life in saturated soil conditions. Habitats include depressions, flat depositional areas that are subject to flooding, broad flat areas that lack drainage outlets, sloping terrain associated with seeps, springs and drainage areas, bogs, and open water bodies (with floating vegetation mats or submerged beds). This component is restricted to those wetlands that are hydrologically connected to Coho streams. (Estuarine associated wetlands are addressed in the estuarine section.) Wetlands are essential to capturing sediment and other contaminants before they enter tributaries and mainstem rivers, and to maintaining and regulating cold water flows.
- **Off-channel areas** include locations other than the main or primary channel of mainstem or tributary habitats that provide velocity and/or temperature refuge for Coho. Off-channel habitats include alcoves, side channels, oxbows, and other habitats connected to the mainstem or tributary. These off-channel habitats are essential to the survival of juvenile Coho, providing refuge from high flows in winter and high water temperatures in summer.
- **Estuaries** include areas in tidally influenced lower reaches of rivers that extend upstream to the head of tide and seaward to the mouth of the estuary. These areas have been historically available for feeding, rearing, and smolting Coho. Head of tide is the inland or upstream limit of water affected by a tide of at least 0.2 feet (0.06 meter) amplitude (CMECS). This includes tidally influenced portions of rivers that are considered to be freshwater (salinity  $< 0.5$  parts per thousand). Estuaries are considered to extend laterally to the uppermost extent of wetland vegetation (mapped by CMECS). Estuarine habitats include saltmarsh, emergent marsh, open water, subtidal, intertidal, backwater areas, tidal swamps, and deep channels. This includes the ecotone between salt and freshwater and the riparian zone.
- **Uplands** include all lands that are at a higher elevation than adjacent water bodies and alluvial plains. They include all lands from where the floodplain/riparian zones terminate,

and the terrain begins to slope upward forming a hillside, mountainside, cliff face, or another non-floodplain surface.

- **Lakes** include inland bodies of standing water. Habitats include deep and shallow waters in the lakes, including alcoves, and confluences with streams.

## 4. Development of the Nehalem River Strategic Action Plan

The process undertaken to generate this plan generally followed guidance described in the document, *Components of a Strategic Action Plan for Participation in the Focused Investment Partnerships Program* (OWEB 2017). This process is summarized below.

### 4.1 Visioning

The Nehalem River SAP process began with a discussion of participant values and priorities that would guide the planning process and generate a long-term vision statement for the Nehalem Partnership. The exercise explored ways in which Coho conservation aligns potentially competing social, economic, and ecological priorities among local stakeholders. In addition to a vision statement, the discussion yielded guiding principles for the planning process, as well as two outcome statements, which articulate the Nehalem Partnership's desired long-term results from the implementation of the plan. The discussion also led to the development of outreach documents for team members to share when describing the planning process to landowners, stakeholder groups, and the general public.

### 4.2 Defining Terms

The Nehalem Partnership reviewed and revised the "Common Framework," a document developed by the Coast Coho Partnership to standardize the terminology used in the development of SAPs for Coho populations up and down the Oregon coast. The Nehalem Partnership reviewed and tailored the framework to incorporate social and ecological conditions unique to the Nehalem River watershed. The Nehalem common framework: 1) defines the habitat types (called "components") used by the Nehalem Coho population; 2) identifies the essential functions that these habitats must provide for Coho to persist (called "key ecological attributes" or KEAs); and 3) lists the "stresses" and "threats" that impair or have the potential to impair the KEAs. The framework also provides a list of indicators that can be used to assess and track the KEAs. In aggregate, these indicators can provide a sense of whether watershed function is improving or declining over time at the watershed or sub-watershed scale.

The terminology adopted in the Nehalem common framework is included throughout this plan. The full document is contained in Appendix 3.

### Common Framework Terminology

**Habitat Components.** Components are the types of habitats that are essential to support the (non-marine) life cycle of coho salmon. The Nehalem River common framework identifies and defines these habitat types, which are presented in Chapter 3.

**Key Ecological Attributes.** Key Ecological Attributes, or “KEAs”, are characteristics of watersheds and specific habitats that must function in order for coho salmon to persist. KEAs are essentially proxies for ecosystem function. If KEAs like habitat connectivity, instream complexity, water quality, riparian function, and numerous others are in good condition then watershed processes are likely functioning sufficiently to generate and maintain the habitats required to sustain viable coho populations.

**Stresses.** Stresses are impaired attributes of an ecosystem and are equivalent to altered or degraded KEAs. They are not threats (defined below), but rather degraded conditions or “symptoms” that result from threats. In the common framework, stresses represent the physical challenges to coho recovery, such as decreased low flows or reduced extent of off-channel habitats.

**Threats.** Threats are the human activities that have caused, are causing, or may cause the stresses that destroy, degrade, and/or impair components. The common framework includes a list of threats with definitions and commonly associated stresses. This list is based on threats listed (sometimes using different terms) in existing coho recovery plans. The definitions are based on previous classifications (IUCN 2001; Salafsky et al. 2008) with minor modifications reflecting the work of the Coho Partnership.

### 4.3 Determining Focal Areas

The Coast Coho Partnership convened, in part, due to recognition among both restoration practitioners and funders of the immense challenges faced in generating (and statistically demonstrating) benefits from habitat restoration beyond just the project scale. This challenge is due partially to restoration organizations working in large geographies and lacking the capacity to implement projects at the pace and scale necessary to produce measurable impacts. In addition, coordination among restoration partners is often undermined by the varying ownerships and land uses present within a basin, as well as the complex funding and regulatory landscape that implementers must navigate to put projects on the ground. Because of these and other factors, it’s difficult to focus and coordinate restoration efforts sufficiently to generate a measurable watershed response beyond just the project or reach scale.

Partners in the Nehalem sought to address this challenge by focusing this SAP on a limited number of focal areas (or “high-ranked sub-watersheds” as they were called during the planning process). The selection of focal areas was driven by the outcomes and guiding principles generated in step one above. First, the team applied a stronghold approach, which

argues that in the long run, the most cost-effective strategy is to protect and restore habitats that are in good or excellent condition. The approach adopts a “build from strength” model, which is founded on the belief that expanding areas of functioning habitat is more likely to provide the desired results and show a more immediate return on investment than starting in more highly degraded systems. The approach recognizes that the stresses on highly modified systems are either so numerous (e.g., in urbanized areas) or take so long to reverse (e.g., severe channel entrenchment) that restoration benefits are often uncertain or unrealized. Accordingly, this plan gives priority to sub-watersheds that are relatively intact and demonstrate greater ecosystem function than other more degraded systems.

The process used to assess ecosystem function and habitat productivity across all 34 of the Nehalem basin’s 6<sup>th</sup> field sub-watersheds is detailed in Appendix 6. After consideration and evaluation of a range of criteria to assess function and productivity, the Nehalem Partnership determined that the extent of “anchor habitat” was the most effective indicator of Coho production potential. The anchor habitat approach is described in Section 4.5.

The second criterion used to identify focal areas was the degree to which each sub-watershed was capable of supporting unique life-history variations. For example, two of the sub-watersheds selected as focal areas are the Salmonberry River and Cook Creek watersheds. Both are north-flowing tributaries originating in volcanic geology. Due to their geomorphology and large watershed area, the Salmonberry River and Cook Creek represent the two most important contributions of both flow and cold water to the mainstem Nehalem (PC Trask 2017; Oregon DEQ 2003), which is temperature limited from the head of tide to RM 112 (Oregon DEQ 2003). Because Coho parr cannot persist in the mainstem during the summer months when temperatures often exceed 80 degrees Fahrenheit (Sullivan et al. 2000), these two drainages provide important thermal refugia and flow volumes that mitigate elevated mainstem temperatures and shorten their duration. Results of ongoing and recently completed juvenile Coho monitoring indicate that the nomadic components of several unique Nehalem Coho life histories depend on these two systems for survival in periods of elevated summer water temperatures (Bio-Surveys in progress).

The main purpose of ranking sub-watersheds (i.e., selecting focal areas) was to assist the Nehalem Partnership in coming to an agreement on a long-term habitat restoration strategy within the Nehalem basin. The ranking is not intended to recognize one sub-watershed as more important than another, or to disregard the contributions of lower-ranked sub-watersheds in the basin-wide dynamics that make the Nehalem such a historically productive Coho system. The Nehalem Partnership recognizes the inherent challenges in focusing on discrete pieces of

an interconnected system, but each of the participants believes this geographic focus is essential to effectively invest scarce restoration resources.

#### **4.4 Determining Restoration Priorities by Focal Area**

Following the identification of focal areas, the team evaluated the major stresses present in each. In the absence of limiting factors analyses in all but the Rock Creek watershed, the planning team agreed that restoration strategies should be determined based on a combination of best professional judgement and modeling. At the outset of the SAP process, NOAA commissioned TerrainWorks to use its Netmap tool to model the optimal locations for restoration strategies that are best suited to address priority stresses. Netmap develops a “virtual watershed” using a LiDAR digital elevation model (DEM) (with 10m DEMs where LiDAR is unavailable). The virtual watershed enumerates multiple aspects of watershed landforms, processes, and human interactions over a range of scales (Benda et al. 2015; Barquin et al. 2015). NetMap’s virtual watershed contains six analytical capabilities to facilitate optimization analyses: 1) delineating watershed-scale synthetic river networks using DEMs; 2) connecting river networks, terrestrial environments, and other parts of the landscape; 3) routing watershed information downstream (such as sediment) and upstream (such as fish); 4) subdividing landscapes and land uses into smaller areas to identify interactions and effects; 5) characterizing landforms; and 6) attributing river segments with key stream and watershed information.

The TerrainWorks’ analyses included a range of outputs that were considered by the planning team, including prioritized sites for riparian restoration, protection of thermal refugia, road maintenance/decommissioning, and fish passage improvement. NOAA modelers and the planning team also developed a model using Netmap to prioritize locations for beaver recruitment (and potentially reintroduction) that build upon existing approaches and applied Nehalem-specific beaver data. Through all of these analyses, Netmap provided managers with modeled priority sites in sub-watersheds where data or participant expertise was limited. Chapter five provides details on the model runs and the results generated.

The UNWC and LNWC both retain a license to use the Nehalem River Netmap data, as well as access to the Netmap software.

#### **4.5 Identifying Anchor Habitats**

ODFW (2007) identified reduced instream complexity as the primary limiting factor for the Nehalem Coho population. While limiting factors analyses have not been completed for each of the Nehalem’s 34 6<sup>th</sup> field sub-watersheds, reduced instream complexity resulting in insufficient

over-wintering habitat, is likely the primary limiting factor in most Nehalem sub-watersheds. Accordingly, it is essential that practitioners are able to invest in strategies that enhance complexity with a high degree of confidence that projects are being located in reaches that can deliver the greatest benefit. To facilitate this, the Nehalem Team adopted an anchor habitat approach.

An anchor habitat is a stream reach that provides all of the essential habitat features necessary to support the complete Coho freshwater life history. These features meet the seasonal habitat needs of Coho salmon from egg to smolt outmigration and are characterized by a low gradient, high potential for channel-floodplain interaction, and accumulation of spawning gravels (Bio-Surveys 2011a). The protection, restoration, and expansion of sites exhibiting these conditions provide important opportunities to enhance function and increase instream complexity. Chapter five presents the potential anchor sites where local partners will augment instream complexity through floodplain and off-channel habitat reconnection, large wood and beaver dam analogue (BDA) installation, and the protection of upland areas capable of delivering large wood and gravel to anchor habitats.

Appendix 6 contains a detailed description of how Coho anchor habitats are modeled in the Nehalem basin. Figure 4-1 provides the results of this exercise.

**Figure 4-1. Modeled Anchor Habitats in the Nehalem Watershed Basin.**



#### **4.6 Monitoring and Indicators**

Using the Common Framework, the Nehalem Partnership developed a list of indicators that can be used to monitor the pace and effectiveness of SAP implementation. This action is a modest, but essential, step towards addressing one of the main concerns leading to the development of coast Coho SAPs: that managers were struggling to detect the cumulative benefits of restoration at a sub-watershed or population scale. During the development of the “Nehalem framework” the Nehalem Partnership identified a list of indicators that they hoped to improve through SAP implementation. This list was revisited and revised at the conclusion of the SAP process to incorporate information generated and lessons learned during the process. Chapter 7 presents the final list of indicators for the Nehalem SAP and the associated monitoring required to assess those indicators.

#### **4.7 Estimating SAP and Project Costs**

The Nehalem Partnership’s final step in drafting the Nehalem River SAP was to estimate the anticipated costs of projects selected for the plan. Costs were generated by reviewing the OWEB Oregon Watershed Restoration Inventory (OWRI) database and by reviewing costs from projects that have been implemented in the Nehalem River area by local partners. The OWRI database was queried to focus on projects that were implemented within the Oregon Coast Coho ESU from 2010 to 2016. These costs were reviewed and modified for use in the Nehalem SAP by partners with extensive experience in implementing projects on the north coast. Project costs are presented in Chapter 8.

#### **4.8 Community Outreach**

The Nehalem Partnership includes a variety of public and private partners. Throughout the SAP development process, participants maintained consistent communication with the boards and managers of the groups participating in the process. Equally important, the managers who work with private landowners provided periodic updates to landowners and industry representatives. This ongoing outreach ensured that questions and concerns raised by local stakeholders were considered by the Nehalem Partnership and acted upon during plan development.