United States Department of the Interior

FISH AND WILDLIFE SERVICE

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Memorandum

To: Conservation Partnerships Division, Oregon Fish and Wildlife Office, Portland, Oregon

From: Forest Resources Division, Oregon Fish and Wildlife Office, Portland, Oregon

Subject: Request for Endangered Species Act Formal and Informal Consultation for the Southern Flow Corridor Habitat Restoration Project

This memorandum and enclosed biological opinion responds to your request for intra-Service section 7 consultation pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*.), as amended. At issue are the effects of the proposed action on the threatened marbled murrelet (*Brachyramphus marmoratus*). Your request for formal consultation and a biological assessment on the proposed action was received on March 30, 2015. Our conclusion for formal consultation is that the project as proposed would not jeopardize the continued existence of marbled murrelets. If you have any questions regarding this opinion, please contact Bridgette Tuerler at (503) 231-6956, or Brendan White at (503) 231-6179.

Attachment

cc: electronic
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Biological Opinion
Regarding the Effects of Habitat Modification and Disruption
on the
Marbled Murrelet (*Brachyramphus marmoratus*),
From the Southern Flow Corridor Tidal Wetland Restoration Project
Tillamook, Oregon
(FWS Reference Number 01EOFW00-2015-F-0227, and TS# 15-561)

Prepared by the Oregon Fish and Wildlife Office
U.S. Fish and Wildlife Service
Portland, Oregon

for Jody E. Caicco
Paul Henson, Ph.D., State Supervisor

July 23, 2015
Date

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INTRODUCTION

This document transmits the U.S. Fish and Wildlife Service's (Service or USFWS) Biological Opinion (BO) based on our review of the March 17, 2015, Biological Assessment (BA) describing the Southern Flow Corridor Tidal Wetland Restoration Project (SFC) Tillamook, Oregon. The proposed action is likely to adversely affect the marbled murrelet (*Brachyramphus marmoratus*) (murrelet) are described in the BA and below. This document was prepared in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.). The Service received the March 30, 2015, intra-Service request for formal consultation on March 30, 2015.

This BO is based on the following major sources of information: The BA (USFWS 2015); the Recovery Plan for the Threatened Marbled Murrelet (USFWS 1997); the Evaluation Report for the 5-Year Status Review of the Marbled Murrelet in Washington, Oregon, and California (McShane et al. 2004):2009 Marbled Murrelet 5-year review (USFWS 2009); other pertinent reports and documents; our files; and communications between the various administrative units and Service staff.

CONSULTATION HISTORY

On May 20, 2014, the Service provided technical assistance for marbled murrelets associated with geotechnical exploration needed to develop the proposed action for this project (FWS reference number 13420-2014-TA-0174).

The USFWS Habitat Restoration Team made the following "no effect" calls, and these species and critical habitat will not be considered further in the biological opinion:

- The proposed action would have no effect on murrelet critical habitat because no critical habitat occurs within the action area.
- The proposed action would have no effect on the Oregon silverspot butterfly (*Speyeria zerene Hippolyta*) because there are no coastal prairie or meadow habitats within the project area and no known potential silverspot habitat in the pre- or post-project habitat conditions.
- The proposed action will have no effect on Nelson's checker-mallow (*Sidalcea nelsoniana)* which is known to occur in Tillamook County but only in higher coast range mountain meadows, not along the coast.
- The proposed action would have no effect on the western snowy plover (*Charadrius alexandrinus nivosus*) which is an ocean shore species that does not occur within the Action Area.
- The proposed action would have no effect on northern spotted owl (*Strix occidentalis caurina*) due to lack of suitable habitat.

Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch)* are anadromous species regulated by the National Marine Fisheries Service and are addressed under separate section 7 consultation where applicable.

Consideration of Migratory Bird Treaty Act (16 USC 703 et seq.) and Bald and Golden Eagle Protection Act (16 CFR 668) will be covered through a separate process. Data on bald eagle nesting locations in Service files was considered as was information provided by contracted field surveys of potential nest trees, Tillamook County staff, and members of the public during project scoping processes. The project will not directly remove any bald eagle nesting trees nor will it operate heavy equipment during the nesting season within 660 feet of occupied nests without the appropriate Bald Eagle Take Permits.

A National Environmental Policy Act (NEPA) document is being developed by other Federal partners to implement the habitat restoration activities addressed by the BA (*e.g.,* levee removal, tidal channel re-creation, monitoring).

Partners willing to implement this restoration project have been extensive. The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) is providing funding to the SFC project through FEMA's Public Assistance grant program. The project proposed by the Port of Tillamook Bay and Tillamook County also receives funding from the National Oceanic and Atmospheric Administration (NOAA) Restoration Center, USFWS, State of Oregon lottery funds, Oregon Watershed Enhancement Board, Tillamook County, and other public and private entities. FEMA is the federal lead agency for NEPA. Cooperating agencies include the NOAA Restoration Center, USFWS, and USACE. The NOAA Restoration Center and USFWS are the lead agencies for compliance with the Endangered Species Act. Oregon Department of Environmental Quality has oversight authority in the cleanup of the contaminated parcel. Pacific Marine and Estuarine Fish Habitat Partnership are funding part of the cleanup of the mill site, also called the Sadri parcel.

The USFWS' Habitat Restoration programs provide technical, financial, and planning support for restoration projects that engage willing landowners to restore and conserve habitat for the benefit of Federal trust species. USFWS funds or carries out projects under the Partners for Fish and Wildlife (PFW), Fisheries, Coastal, and Recovery programs. These actions fulfill natural resource responsibilities assigned to USFWS under the Fish and Wildlife Coordination Act, Endangered Species Act, and the Partners for Fish and Wildlife Act.

The USFWS' PFW and National Fish Passage Programs provided a combined $182,618 in funding in fiscal year 2014 to support project management and monitoring components of this project. National Coastal Wetlands Conservation Grant (NCWCG), administered out of Region 1 USFWS, provided $600,000 in 2011 to support on the ground restoration elements.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action includes all field processes needed to plan, evaluate, prepare, and complete restoration and monitoring implementation activities of the SFC regardless of funding source(s).

The SFC project is a blend of habitat restoration and infrastructure flood risk reduction that offers an opportunity to fully restore 526 acres of estuarine habitat that is currently predominately in agricultural pasture use with some freshwater wetland habitat, to tidal marsh and wetlands (see range of priority habitat types in Table 1). Restoration of tidal flows across the lower Wilson River floodplain and, to a smaller degree, on the lower Trask and Tillamook River floodplains, will restore natural processes to lands that have been disconnected by the diking system for decades. Among the many ecological benefits afforded by delivering full tidal inundation to 526 acres of marsh and wetland fringe, four stand out: increased habitat complexity and availability; increased use by salmonids, foraging birds and other species; water quality enhancement; and increased climate change resilience. Other related habitat improvement benefits of this project include approximately 14 miles of newly restored and connected tidal channels, 6.9 miles of levee or road removal, and 3.3 miles of drainage ditches filled.

The proposed action will involve restoration of an ecologically diverse site that spans a rapid transition zone, from freshwater spruce forest, tidally influenced freshwater wetlands, high salt marsh down to low marsh and intertidal mudflats. Removing the levees surrounding the site and along the sloughs will allow full connection with the Wilson and Trask Rivers and tidal influence within the site. The tidal prism on the site is greater than would be expected under natural conditions due to subsidence. It is expected that water levels in the site will closely parallel those in the Wilson and Trask rivers.

Table 1. Existing and Expected Acres of Future Habitat Types on lands associated with the proposed project (county owned). Other lands within the action area were not assessed for future conditions as these lands will be outside the area of wetland restoration.

Habitat Classification	**Existing Acres**	**Future Acres**
Fill	64	0
Pasture	289	0
Emergent Freshwater Wetland	34	0
Low Tidal Marsh	0	323
High Tidal Marsh	29	72
Scrub-Shrub Freshwater Wetland	11	0
Sitka Spruce Forested Wetland	59*	86
Water-No/Limited Connectivity	31	0
Water-Full River Connectivity	4	40
Totals	**521**	**521**
* within action area 160 acres		

Sediment and Morphology

The project area is located at the end of the diked reach of the Wilson River and is well positioned to capture riverine sediments. Ultimately it is expected the lands will rebuild from their current subsided condition up to high marsh, which around the Action Area typically sit one-two feet higher than Mean Higher High Water (MHHW). Rates of marsh building are expected to occur on the timescale of decades. The abundant sediment supply and proximity to the rivers should help to accelerate the process. Areas close to the river and connected tidal channels will rebuild quicker, while more distant portions of the marsh will accrete slower.

An estimated 14 miles of tidal channels will be re-established through channel construction (excavation) and the restoration of natural processes. Blind Slough will undergo enlargement as it becomes a major flood flow channel, conveying flows both from new floodgates in the dike and from the Hall Slough connector channel. Other relict tidal channels within the marsh will also adjust as they begin to convey tidal flows in and out of the site again. Some lateral movement and change of the main river channels can also be expected where rock armoring is removed.

Vegetation

Change in vegetation will be largely driven by hydrology and salinity changes after levee removal. Existing vegetation is predominately characteristic of pasture and freshwater wetland. If salinity pulses occur within the site, some of the existing vegetation will be unable to tolerate the saline waters and will quickly die off. As the marsh accretes at differential rates across the site, greater diversity of species across varying elevation bands should occur. Given that the site is subsided by several feet, the lands will initially convert predominately to low marsh or mud flat.

Lower portions of the spruce forests that have developed in diked areas in the northwest corner and southern project boundary will also likely die off, either from salinity or higher water levels. Over time, with marsh plain accretion via sediment accumulation, there will be an expected increase in net areas of Sitka spruce forested wetland, high marsh tidal wetland, and low marsh tidal wetland (Table 1).

Target Species Use

Loss of estuarine rearing habitat has limited the production of salmonids in the Tillamook Bay Basin as summarized in Table 2. Some of the key factors affecting these species survival in estuarine environments are related to their ability to access habitats and the quality of the habitats that they occupy. These, combined with the quantity of suitable habitat, play a large role in determining the magnitude of the production bottlenecks.

Implementation of the SFC will directly benefit fish species by addressing these habitat based factors (i.e. habitat access, quality, and quantity). The project will restore 526 acres of marsh and wetland fringe habitat by: 1) creating 14 miles of newly connected slough/channel habitat; and 2) creating new habitats, such as low salt marsh, through re-establishing natural hydrologic conditions. The project area location is considered to be ideal, largely because it lies within the migration pathway of listed and fish species of concern that emigrate as juveniles from the Wilson, Trask, and Tillamook rivers, and is also within the potential home range of juveniles from other tributaries and rivers. Table 2 summarizes how the project is expected to increase fish productivity, thereby fostering species viability.

Table 2. Target Species Status, Limiting Factors, & Project Relationship: Oregon Department of Fish and Wildlife. 2013, Tillamook, Oregon.

Target Species Status	Habitat Limiting Factors	Primary Limiting Factor(s) Addressed by Project
Fall Chinook: Well below historic abundance (~50% of historic), but stable.	Primary: Loss and simplification of estuarine rearing habitat Secondary: Excess fine sediments in spawning areas	This area will be utilized by rearing juvenile fall Chinook. Improved water quality and increased critical transitional salmonid habitat is expected to attract Target fish species. This additional habitat will increase the productive capacity of fall and spring Chinook in the Tillamook Bay Basin.
Spring Chinook: Well below historic abundance (~10% of historic) and decreasing slightly.	Primary: Loss and simplification of estuarine rearing habitat Secondary: Water quality (excess temperature) in summer freshwater areas	
Coho: Well below historic abundance (~10% of historic), but stable or slightly increasing.	Primary: Over-winter rearing habitat, may include upper estuary for age 0+ out migrants Secondary: Water quality (excess temperature) in freshwater habitat	The project will provide additional slow water over-winter habitat for juvenile that migrate from natal streams at age 0+ or from age 1migrants the second winter of life. The 526 acres of restored wetlands are anticipated to annually produce 6,000-9,000 adult coho (average) and 9,000-14,000 (good ocean conditions). (Nickelson 2012).
Chum: Well below historic abundance (~20% of historic), but currently stable.	Primary: Excess fine sediments in spawning areas Secondary: Loss and simplification of estuarine rearing habitat	The project will provide additional rearing areas for juvenile chum in the estuary from April-May.
Coastal Cutthroat Trout (Sea-Run): Historical information is scarce, but anecdotal reports suggest the population is lower than historic levels, but likely stable.	Primary: Loss and simplification of estuarine rearing habitat Secondary: Quality and quantity of freshwater spawning habitat	The project will provide additional habitat for foraging and will improve prey base during estuarine occupancy.

Water Quality Enhancement

The project area in the upper bay is in the transition zone between freshwater and saltwater tidal habitats. Temperature, salinity, and dissolved oxygen should parallel those measured outside the site. Salinity conditions in the lower bay are similar to those conditions present in the upper bay and in the lower tidally influenced portions of the mainstem rivers. Salinity in salt marsh channels near the Action Area was measured at values from less than 1 to 10 parts per trillion (ppt) between May and July over three years (Ellis 2002). Recent measurements in Blind, Hoquarten, and Hall Sloughs in the Action Area show similar results (Johnson 2013). Dike breaching will allow a greater natural exchange of water between the Trask River, which has high levels of dissolved oxygen, and Hoquarten Slough. This will enhance salmon habitat by improving dissolved oxygen levels in the Slough.

Resilience to Climate Change and Long Term Changes

Removing the levees that currently isolate the project area will facilitate natural marsh accretion and allow the site to keep pace with sea-level rise, fostering species' resilience and adaptability.

Restoration of tidal flows to the project site will initiate significant long term changes in the lands that have been isolated by the diking system for decades. The following information comes from analysis provided in the Southern Flow Corridor Final Design Report (NHC 2011). Much of the freshwater wetland and pasture vegetation within the Action Area will not be able to tolerate the saline waters that will enter the site and will quickly die off. Given that the site is subsided by several feet, a portion of the land will initially convert to low marsh or even mud flat habitats before transitioning over time to salt marsh community types through sediment accretion and vegetation colonization. Lower portions of the spruce forest in the northwest corner will also likely die off, either through salinity or simply higher water levels. Forested wetlands along the southern project boundary near the City of Tillamook may also see die off due to higher water levels once they are no longer protected by dikes. Recent sampling of Hoquarten, Dougherty, and Hall Sloughs by Tillamook Estuaries Partnership showed little to no salinity, indicating the project site is located in the transition zone between freshwater and saltwater tidal habitats. Vegetation within the project area farther from the bay may not see saline or brackish waters.

Removal of the dikes combined with daily high tides and river flows will immediately begin bringing sediment onto the site. Ultimately it is expected the lands will rebuild from their current subsided condition up to high marsh, which around the project site typically are 1-2 feet higher than MHHW. Rates of marsh building are difficult to predict, but are expected to occur on the timescale of decades. The abundant sediment supply and proximity to the rivers should help to accelerate the process. Areas close to the river and connected tidal channels will rebuild quicker, while more distant ends of the site will receive less sediment and accrete slower.

Channel changes due to the project are expected in several areas. Blind Slough will undergo enlargement as it becomes an important flood flow channel, conveying flows both from new floodgates in the dike and from the Hall Slough connector channel. Other relic tidal channels within the Action Area will also adjust as they begin to convey tidal flows in and out of the site again. Some lateral movement and change of the main river channels can also be expected where rock armoring is removed. Channel migration is expected to be relatively small based on historic patterns.

Project Elements

See Figure 1 and Table 3 for a list of Project elements.

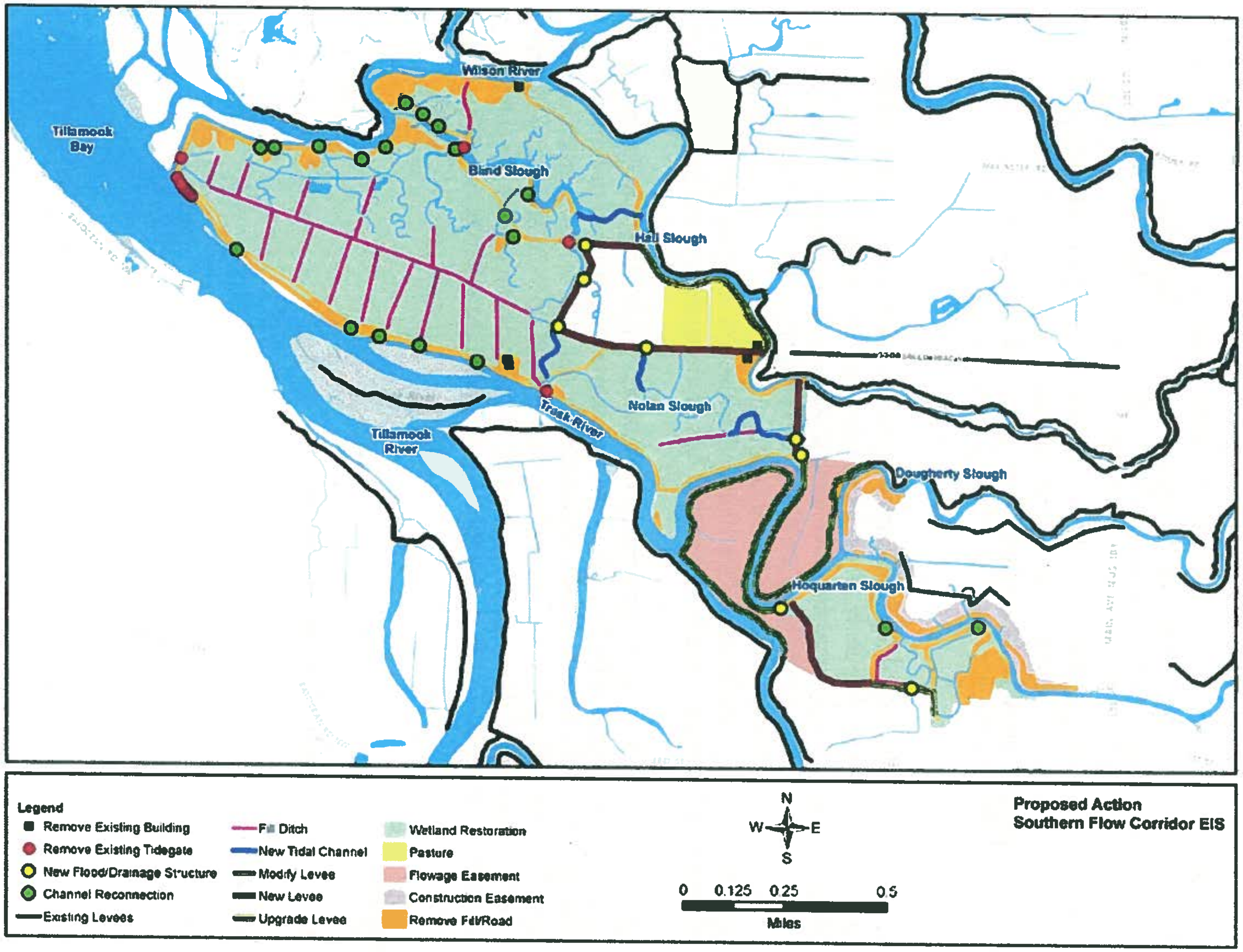


Figure 1. Southern Flow Corridor Project Design Elements (from Preliminary Environmental Impact Statement: Southern Flow Corridor Project February 2015 produced by FEMA, Bothell, WA).

Table 3. Description of elements of the proposed project.

Elements of the proposed project	DESCRIPTION*
Levee and Fill Removal	Approximately 98,000 cubic yards of fill will be removed from human-built levees and fills within the Action Area. Fill material will be removed to slightly below the natural floodplain/marsh elevation (9 feet at the mouth of the Wilson River and increasing to 10+ feet upstream). Approximately 9 Sitka spruce trees with potential murrelet nesting habitat characteristics were located by Service biologists to be within the footprint of the fill removal. These trees will be removed outside of the murrelet nesting season (prior to April 1st or after September 15th) to avoid impacts to nesting murrelets. Additional Sitka spruce with potential nesting habitat characteristics occur within the interior of the wetland area or within tree protection buffer zones and will experience some level of noise disturbance between April 1st and September 15th.
New and Upgraded Levees	An estimated 9600 feet of new or upgraded levee will be constructed to protect adjacent agricultural lands from tidal influence. Most of the levees will be built to an elevation of 12 feet. Levee construction will take place in the primary construction year window. One year post-construction an inspection for settlement will occur and necessary adjustments to raise levee heights to the design elevation will be made.
New Floodgates	Approximately 10 tidegates will be removed in the initial levee removal phase of the project. Those existing 6 foot diameter round gates and four 6x12 foot side hinge gates will be reused on replacement structures in the new levee.
Hall Slough Elements	The project will improve hydraulic connectivity between Hall and Blind Sloughs by removing Fuhrman Road berm and building a connector slough channel.
Drainage Network Improvements	Interior drainage ditches inside the new levee may be improved to ensure that the agricultural lands outside the project area maintain drainage.
Habitat Restoration Elements	Habitat restoration activities involve removing constructed features that impede free exchange of tides within the project and impede natural exchange of water, salinity, sediment, and seeds necessary for restoration. Large wood structures will be added to increase fish cover and macro-invertebrate prey substrates. Existing ditches will be filled. Plugs will be removed from relic tidal channels. Roads will be removed and roadbeds de-compacted.
Vegetation Monitoring	In order to quantify the development of vegetation communities within the Action Area, plant species richness, percent cover, and mapping of distribution and extent of plant communities will be measured.
Soils Monitoring	In order to quantify physical conditions of the site and drivers that affect vegetation and food web factors, soil parameters such as salinity, pH, percent organic matter content, carbon content and sediment accretion will be measured.
Fish, Prey, and Habitat Monitoring (including Water Quality)	In order to quantify changes in target fish species use of the site, prey resources, and habitat conditions; the following parameters will be measured. Fish: fish presence, abundance, diversity, and species richness. Prey: Benthic macro-invertebrate density and taxonomic composition. Habitat: Tidal exchange, channel water temperature, salinity, pH, dissolved oxygen, tidal channel morphology, in-stream habitat and large wood abundance.
*NOAA is a joint action agency on this habitat restoration project and is the lead Federal agency for Endangered Species Consultation related to species under their jurisdiction. Clean Water Act Compliance will be reviewed and permitted by Army Corps of Engineers and Oregon Division of State Lands.	

For the following categories, activities will occur within the murrelet breeding season except as prohibited by the General Standard on page 17.

Levee and Fill Removal

Removal of the numerous levees and fills within the flow corridor provides the conveyance capacity increase that results in reduction of flood levels over a wide area of the lower Wilson River floodplain. In general, material will be removed to slightly below natural floodplain/marsh level. This elevation is around 9 feet at the mouth of the Wilson River, increasing to 10+ feet farther upstream. Lowering areas further than this could provide some additional flood level reduction, but the cost increase would be large and the benefits temporary as the tides and river will rebuild the lands back up to natural elevations. In a few locations, primarily in the area south of Hoquarten Slough, some short levee segments that are parallel to the flood flow path may be left as is. These segments will not affect flood level reduction as they are parallel to the flow, and they have established trees growing on them that provide habitat benefit.

Construction sequencing and methods are important in this task and are discussed further in the construction section. It is estimated there are 98,000 cubic yards of fill to be removed. The removed fill will be used for the new dikes, filling ditches, and any remainder spread on site to speed rebuilding to natural salt marsh elevations.

New and Upgraded Dikes

Construction of approximately 7000 feet of new tidal dike will protect adjacent agricultural lands from tidal influence in the action area and approximately 3100 feet of existing dike will be upgraded and tied into the new dike. There will be three dike segments constructed. Most of the dikes will be built to the design elevation of 12 feet, with some adjustments where they tie into existing dikes or high ground. This elevation was selected based on modeling various dike elevations and historic tidal data – the goal is to build as low a structure as possible to pass river flood flows out while preventing high tides and coastal storm surges from getting in. The downstream side of each dike will have a 5:1 slope in order to pass overtopping floodwaters with minimal damage. Construction will consist of stripping organic topsoils, excavating any soft or unsuitable soils in the subgrade, compacting the subgrade, and then constructing the dike proper. The dike will be constructed with materials from removal of the existing levees and fill. Organic topsoils stripped from the dike footprint and from spoils being removed elsewhere on the site will be placed on the side slopes and all exposed surfaces hydroseeded. The dike will be topped with an all-weather, crushed rock driving surface. Dike construction will occur in the primary construction year, however, dike elevations will be checked for settlement the following growing season and additional grading will be completed as necessary to meet design grade requirements.

New Floodgates

A new high capacity floodgate structure will be incorporated in the middle dike in order to replace the existing gates, provide additional conveyance capacity, and allow rapid post flood drainage. The four 5x12 foot side hinge gates on the existing flood gate at the western end of the project area will be reused on the new floodgate, and an additional four gates added. The structure is anticipated to be a cast in place concrete structure with a sheet pile seepage cut off wall. The gates are designed to function only during floods and so will be set around floodplain elevation rather than in a channel. Flood flows will pass through the gates every second or third year, a sufficient frequency which will keep the channel open and able to convey flood flows out to the main river channels and bay.

Hall Slough Elements

Flood reduction requires improving the hydraulic connectivity between Hall and Blind Sloughs. This will be accomplished by removing the Fuhrman Road berm and construction of a Hall Slough – Blind Slough connector channel.

Drainage Network Improvements

Existing 5 and 6 ft diameter round tidegates currently installed on the site will be reused on replacement pipes in the new dikes to provide equal or better drainage from adjacent pasture lands. In the north dike, the outlet channels will use existing or constructed sinuous tidal channels to provide connections to the main river. Improvements to the existing drainage ditches inside the new dike will be made as necessary to connect them to the new tidegates and ensure that equal or better drainage is maintained once the project is implemented. This will be a relatively minor project component consisting of cleaning existing ditches and excavating some new connector segments near the new levee.

Habitat Restoration and Other Elements

Habitat restoration activities will generally be limited to removing constructed features that would impede the free exchange of tides within the project. The natural processes linked to the tides will bring in the water, salinity, sediment, and seeds that will initiate process based natural restoration.

Existing ditches will be filled with onsite organic materials in order to ensure natural tidal channels can develop without being short-circuited by the linear ditches. Existing relic tidal channels will have plugs and culverts removed to allow full tidal access. The few roads on site will have any crushed rock or large gravel surfaces removed and the roadbed de-compacted. There is one barn and one residence within the Action Area that will be demolished.

Monitoring Activities

An effectiveness monitoring plan for the SFC was designed to allow evaluation of progress towards project goals and expected benefits related to improved ecological function and flood attenuation (Brophy and van de Wetering 2014). As such, a suite of activities are listed in Table 4 and displayed in Figure 2 and 3.

Table 4. Description of monitoring activity types addressed in this Biological Assessment.

Parameter	Method/Equipment	Activity/Timing/Location	Staff/Dates	Protocol Citation(s)
On-site water level, temperature, & salinity	Water level via Onset HOBO datalogger. Temperature & salinity logger via Odyssey datalogger	Every 3-4 months download and redeploy dataloggers. Map 1. Water level/ salinity loggers.	Staff: 2-3 Dates: June 2014-2015.	Roegner *et al.* 2008, Rice *et al.* 2005.
Vegetation	Percent cover by species in random quadrats. Plant community mapping by heads-up digitization on orthophoto base.	Visually estimate cover in quadrats. Map vegetation through observation / groundtruthing. Locations TBD: 200-300 1-m^2 quadrants. No quantitative sampling in forested areas.	Staff: 3 Dates: One or two field trips in July or August 2014.	Roegner *et al.* 2008.
Groundwater level	Continuous water level logger (Onset HOBO) in shallow observation well. Wells are co-located with subset of accretion plots.	Every 3-4 months download data from and redeploy loggers. Map 1. Groundwater & accretion plots.	Staff: 2-3 Dates: June 2014-2015.	Sprecher 2000; Brophy 2009a, Brophy *et al.* 2011.
Sediment accumulation / Vertical accretion	Sediment stakes and feldspar horizon marker plots.	Extract cores using hand tools. Map 1. Accretion plots & soil sample.	Staff: 2-3 Dates: One field trip in September-October 2014. Repeat in September 2016.	Roegner *et al.* 2008, Cahoon and Turner 1989.
Soil organic matter, pH, and salinity	Soil cores (approximately 10 cores bulked into one bag).	Extract cores using hand tools. Map 1. Accretion plots & soil sample.	Staff: 2-3 Dates: One field trip in August – September 2014.	Dane and Topp 2002, Sparks 1996. 1989.
Mosquitos	Adult traps (which use light and dry ice); dipping for larvae using hand tools.	Adult traps: Deploy in shrubs and trees and check weekly. Larvae: use dipper for weekly sampling in water bodies. Locations TBD.	Staff: 1-2 Dates: March – September 2015.	Wes Maffei, personal communication.
Carbon accumulation	Soil cores.	Extract sample cores from up to 10 locations, using hand tools. Locations TBD.	Staff: 4-5 Dates: One field trip in spring or summer 2015.	Crooks *et al.* 2014.
Fish sampling / Water quality sampling	Seine net.	Access via 18' open boat or pickup truck. Water quality and fish sampling activities will occur simultaneously. Map 2. White dashed lines.	Staff: 4 Dates: February – October 2014-2016.	Roegner *et al.* 2008.
Benthic macroinvertebrates	3" hand held core device	Macroinvertebrate sites are accessed by a single person walking to the site Map 2.	Staff: 1 Dates: June, September 2014-2016.	Simenstad *et al.* 1991.

Figure 2. Locations of monitoring activity types addressed in this Biological Assessment: Estuary Technical Group monitoring activities at SFC, June 2014 through December 2016 (from Brophy and Van Der Wettering 2014).

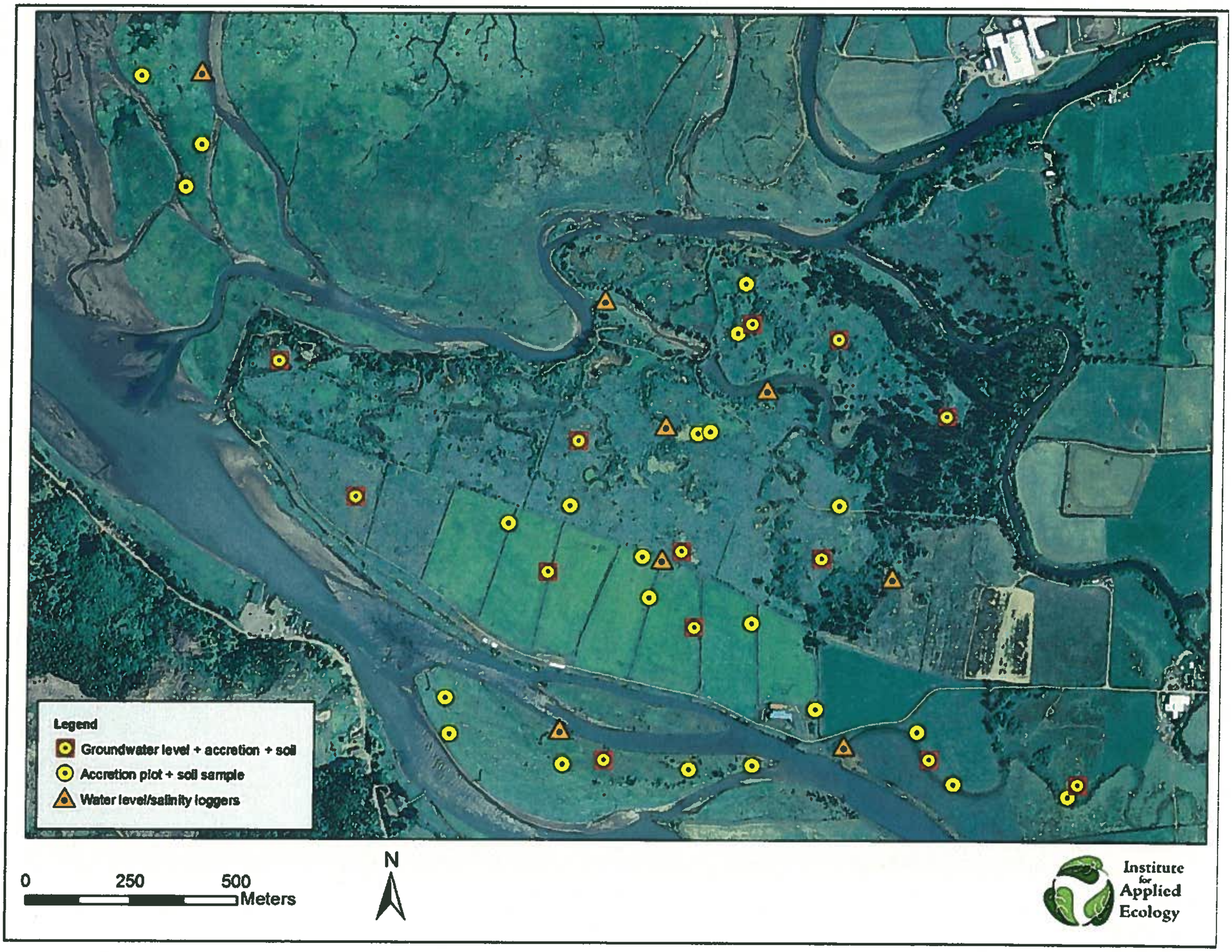
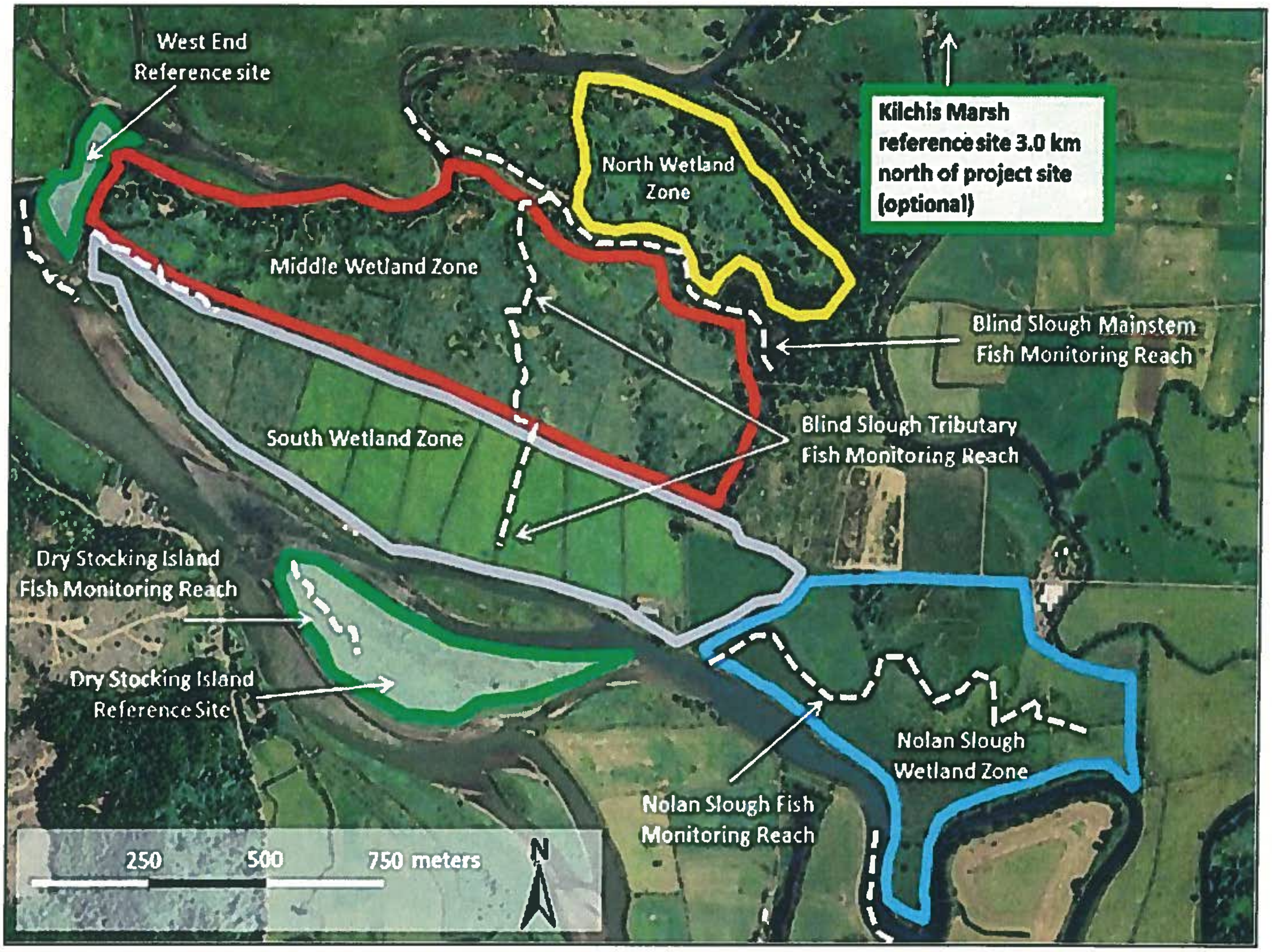


Figure 3. Locations of monitoring activity types addressed in this Biological Assessment: Confederated Tribes of Siletz Indians fish, water quality and macroinvertebrate sampling activities at SFC February 2014- December 2016 (from Brophy and Van Der Wettering 2014).



Proposed action specific to murrelets

Of the 43 murrelet trees (Sitka spruce with potentially suitable nesting platforms) associated with the levees to be removed or added and other construction activities, 34 will be included in tree protection buffers (figure 4, 5 and 6) and 9 will be removed or topped outside of the nesting season (prior to April 1st or after September 15th). A total of 12.9 acres of Sitka spruce forest will be removed.

General Standards

The following standards will be observed during all project site preparation and implementation stages and are required project elements for this action.

1. All work crews, project managers, and monitoring crews will ensure that all food waste and garbage is cleaned up and properly contained to avoid attraction of predators, such as corvids.
2. Individual tree removal does not include the loss of occupied or unsurveyed nesting structure during the breeding period. If a tree with nesting structure in an occupied or unsurveyed stand will be removed to achieve tidal wetland habitat restoration goals, it will be done prior to April 1 or after September 15th.
3. Activities associated with use of heavy equipment to complete the project actions (including site preparation, clearing, levee removal, channel creation, ditch filling) will be avoided within the disruption distance of known occupied or unsurveyed suitable murrelet habitat, or unsurveyed nesting structure from April 1 to June 15. Use of Goodspeed Road within unsurveyed suitable murrelet habitat for equipment transport and haul is allowed during the period April 1 to June 15 subject to the following restrictions: Road use shall be limited to 2 hours after sunrise to 2 hours before sunset. After June 15, activities in these areas would have no daily timing restriction due to the following factors: difficulty of implementing a multi-phase habitat restoration construction project in tidally influenced areas, and to increase the potential for completion of all project phases in one construction season to lessen overall temporal impact of the project.
4. Use of helicopters within the disruption distance of occupied murrelet habitat, unsurveyed suitable murrelet habitat, and unsurveyed murrelet nesting structure during the entire breeding period (April 1- September 15) will not be used and are not addressed in this assessment.

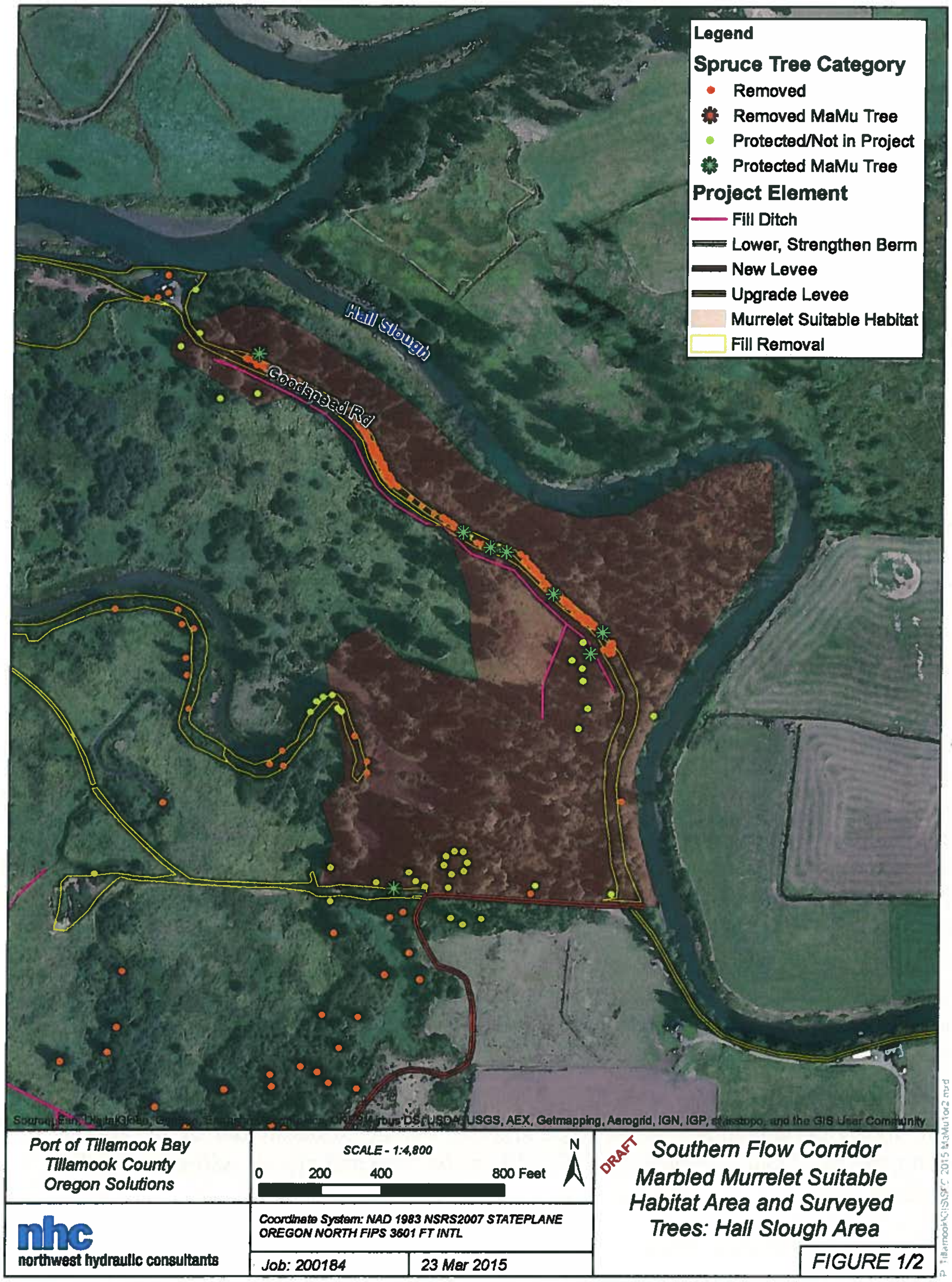


Figure 4. Wilson River – Blind Slough Area: Potential Marbled Murrelet Nesting Habitat, Surveyed Potential Nesting Trees, and Nesting Trees to be Protected (Northwest Hydraulic Consultants, Preliminary Project Design, 2015).

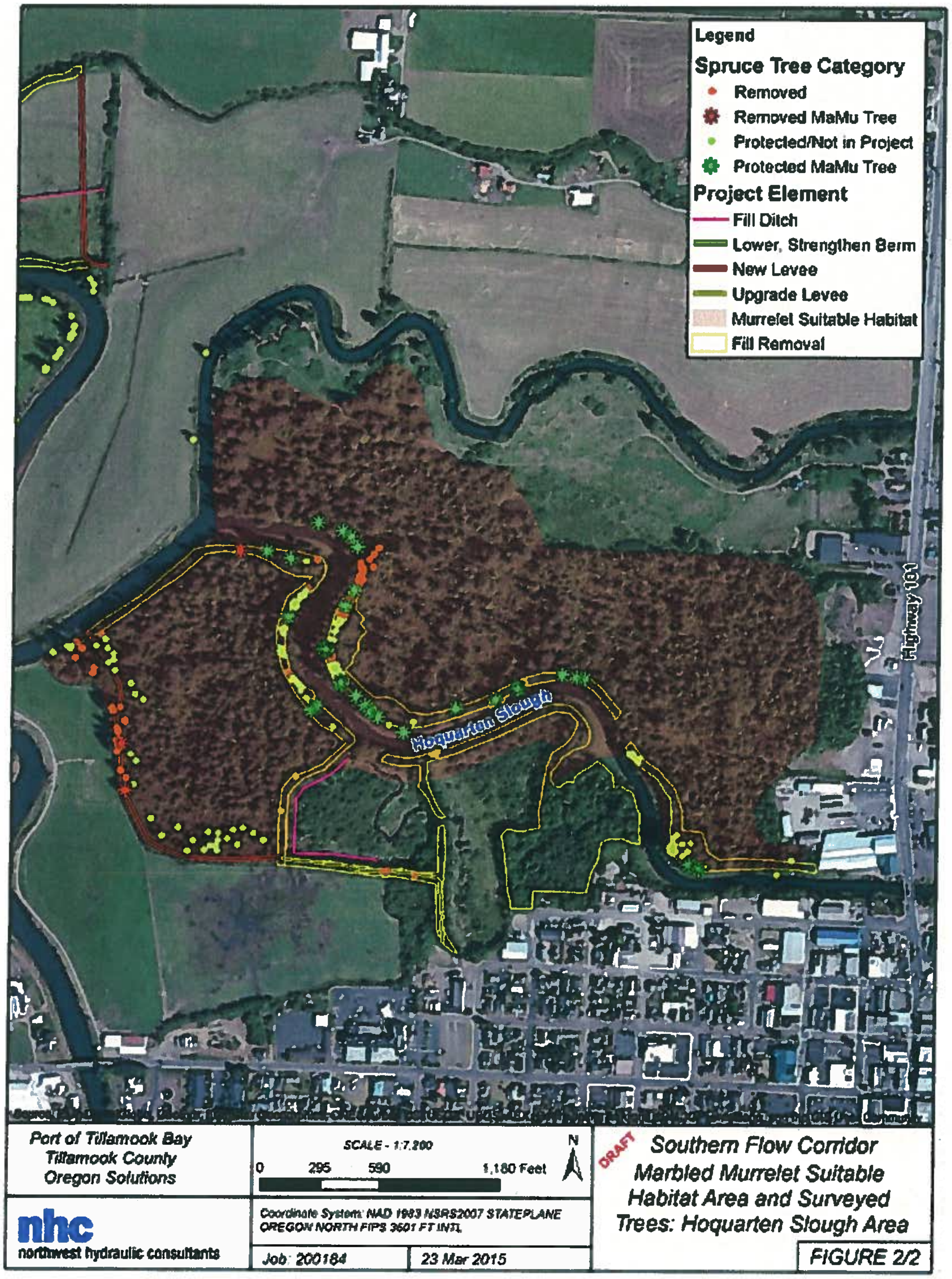


Figure 5. Trask River - Hoquarten Slough Area Potential Marbled Murrelet Nesting Habitat, Surveyed Potential Nesting Trees, and Nesting Trees to be Protected (Northwest Hydraulic Consultants, Preliminary Project Design, 2015).

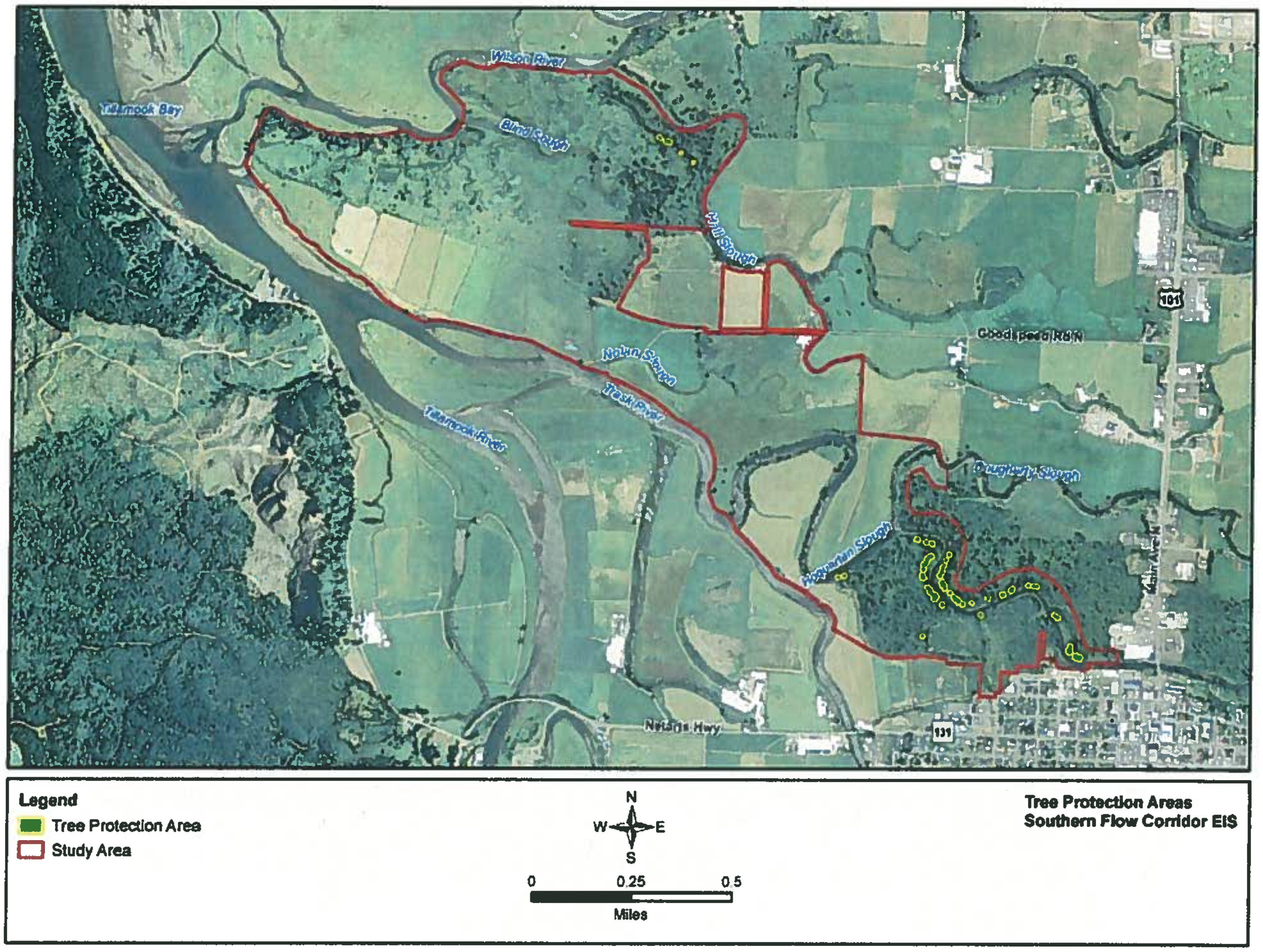


Figure 6. Tree Protection Buffers to Protect Potential Marbled Murrelet Nest Trees (from Preliminary Environmental Impact Statement: Southern Flow Corridor Project February 2015 produced by FEMA, Bothell, WA).

Definitions

Murrelet Habitat

For the purposes of this biological opinion, the following definitions are used. These are general definitions; site-specific determinations of habitat type were made by the Service wildlife biologist according to local structural characteristics as observed in field assessments.

> Habitat: refers to both suitable habitat and nesting structure (unless specifically identified as either suitable or nesting structure).
>
> Suitable Habitat: refers to conifer-dominated forest stands that generally are 80 years old or older and/or have trees greater than or equal to 18 inches mean diameter at breast height (dbh). Murrelet suitable habitat must include nesting.
>
> Nesting Structure: consists of individual tree(s) with the following characteristics:

- It occurs within 50 miles (81 km) of the coast (USFWS 1997b:32);
- It is a conifer tree (U.S. Fish & Wildlife Service 1997:18);
- It is ≥ 19.1 in. (49 cm) (dbh) in diameter, > 107 ft. (33 m) in height, has at least one platform ≥ 4 in. (10 cm) in diameter, nesting substrate (e.g., moss, epiphytes, duff) on that platform, and an access route through the canopy that a murrelet could use to approach and land on the platform (Burger 2002, Nelson & Wilson 2002:24, 27, 42, 97, 100);
- It has a platform ≥ 32.5 ft. (9.9 m) above the ground (Nelson & Wilson 2002, 28);
- And it has a tree branch or foliage, either on the tree with nesting structure or on an adjacent tree, that provides protective cover over the platform (Nelson & Wilson 2002:98 & 99)

Any tree that does not meet all of these characteristics is unlikely to support nesting murrelets. However, we recognize that not all of these characteristics are visible from the ground in all situations.

Murrelet Occupancy

Occupied Habitat: Consists of suitable habitat or nesting structure within younger stands that has been found to meet the definition of occupied by interagency established survey protocol (Evans et al. 2003).

There is no known occupancy by murrelets within the project's action area. No species surveys following approved interagency protocols have been completed for this species for this project. Therefore, trees identified to have potential suitable nesting habitat structure will be assumed to be occupied for the purposes of assessing effects to murrelets.

Habitat Modification

Habitat Removed: means to alter murrelet suitable habitat or nesting structure, so that it no longer supports nesting (e.g., suitable habitat becomes non-habitat after treatment).

Breeding Periods

The breeding period used to determine effects in this consolation for murrelets is April 1 – September 15, with the critical breeding period being April 1 – August 5.

Disturbance and Disruption Distances

Disturbance Distance: the distance from the action location outward within which the activity is likely to cause a listed species, if present, to be distracted from its normal activity. Except as stated in Table 5, the disturbance distance is 0.25 mile from nesting murrelets.

Disruption Distance: the distance from the project boundary outward within which the activity is likely to cause murrelets, if present, to be distracted to such an extent as to significantly disrupt normal behavior and create the likelihood of injury or loss of reproduction. The disruption distance is a subset of the disturbance distance. Proposed activities that would occur within the distances shown in Table 5 might disrupt the normal behavior patterns of individual murrelets or breeding murrelets if present.

Note that disturbance and disruption have both temporal and spatial components.

Table 5. Disturbance and disruption distances for murrelets during the breeding period.

Disturbance Source	**Estimated distance that a disturbance may affect a murrelet during the Breeding Period (Apr 1 – Sep 15)** *NLAA when distance is beyond disruption distances*	**Disruption Distances During the Breeding Period (Apr 1 – Sep 15)**	**Adjusted Disruption Distances with daily timing restrictions *, unless noted otherwise (Aug 6 – Sep 15)** See standard 3 for timing restrictions specific to the SFC project.
Light maintenance of roads, campgrounds, and administrative facilities	≤ 0.25 mile	NA[1]	0 yards with no daily timing restrictions
Log hauling on open roads	≤ 0.25 mile	NA[1]	0 yards with no daily timing restrictions
Chainsaws (includes felling hazard/danger trees)	≤ 0.25 mile	≤ 110 yards[2]	N/A
Heavy equipment for road construction, road repairs, bridge construction, culvert replacements, etc.	≤ 0.25 mile	≤ 110 yards[2]	N/A
Pile-driving (steel H piles, pipe piles) Rock Crushing and Screening Equipment	≤ 0.25 mile	≤ 120 yards[3]	N/A
Blasting	≤ 1 mile	≤ 0.25 mile[3]	≤ 0.25 mile[3]
** Helicopter: Chinook 47d (described as a large helicopter in the rest of this document)	≤ 0.5 mile	≤ 265 yards[5]	≤ 100 yards[6] (hovering only)
** Helicopter: Boeing Vertol 107, Sikorsky S-64 (SkyCrane)	≤ 0.25 mile	≤ 150 yards[7]	≤ 50 yards[6] (hovering only)
** Helicopters: K-MAX, Bell 206 L4, Hughes 500	≤ 0.25 mile	≤ 110 yards[8]	≤ 50 yards[6] (hovering only)
** Small fixed-wing aircraft (Cessna 185, etc.)	≤ 0.25 mile	≤ 110 yards	N/A
Tree Climbing	≤ 110 yards	≤ 110 yards[9]	N/A
Burning (prescribed fires, pile burning)	≤ 1 mile	≤ 0.25 mile[10]	N/A

Table 5 (Murrelet) Footnotes:

1. NA = not applicable. We anticipate that the few murrelets that select nest sites in close proximity to open roads either are undisturbed by or habituate to the normal range of sounds and activities associated with these roads (Hamer and Nelson 1998, p. 21).

2. Based on recommendations from murrelet researchers that advised buffers of greater than 100 meters to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2012c, pp. 6-9).

3. Impulsive sound associated with blasts and pile-driving is highly variable and potentially injurious at close distances. We selected a 0.25-mile radius around blast sites as a disruption distance based on observed prairie falcon flush responses to blasting noise at distances of 0.3 – 0.6 miles from blast sites (Holthuijzen et al. 1990, p.

273). We have conservatively chosen a distance threshold of 120 yards for impact pile-driving and rock-crushing operations to avoid potential hearing loss effects and to account for significant behavioral responses (e.g. flushing) from exposure to continuous sounds from impact pile driving.

4. Exposure to peak sound levels that are >140 A-weighted decibels (dBA) are likely to cause injury in the form of hearing loss in birds (Dooling and Popper 2007, pp. 23-24). We have conservatively selected 100 yards as an injury threshold distance based on sound levels from experimental blasts reported by Holthuijzen et al. (1990, p. 272), which documented peak sound levels from small blasts at 138 – 146 dBA at a distance of 100 m (110 yards).

5. Based on an estimated 92 dBA sound-contour (approximately 265 yards) for the Chinook 47d (Newman et al. 1984, Table D.1).

6. Because murrelet chicks are present at the nest until they fledge, they are vulnerable to direct injury or mortality from flying debris caused by intense rotor wash directly under a hovering helicopter. Rotor-wash from large helicopters is expected to be disruptive at any time during the nesting season due the potential for flying debris and shaking of trees located directly under a hovering helicopter. Hovering rotor-wash distance is based on a 300-ft radius rotor-wash zone for large helicopters hovering at < 500 above ground level (from WCB 2005, p. 2 – logging safety guidelines). We reduced the hovering helicopter rotor-wash zone to a 50-yard radius for all other helicopters based on the smaller rotor-span for all other ships.

7. Based on an estimated 92 dBA sound contour from sound data for the Boeing Vertol 107 the presented in the San Dimas Helicopter Logging Noise Report (USFS 2008, chapters 5, 6).

8. Based on Delaney et al. (1999, p. 74), which concluded that a buffer of 105 m (115) yards for helicopter overflights would eliminate flush responses from military helicopter overflights. The estimated 92 dBA sound contours for these helicopters is less than 110 yards (e.g., K-MAX (100 feet) (USFS 2008, chapters 5, 6), and Bell 206 (85-89 dbA at 100 m)(Grubb et al. 2010, p. 1277).

9. Based on recommendations from murrelet researchers that advised buffers of greater than 100 meters to reduce potential noise and visual disturbance to murrelets (Hamer and Nelson 1998, p. 13, USFWS 2012c, pp. 6-9).

10. Based on recommendations presented in Smoke Effects to Northern Spotted Owls (USFWS 2008, p. 4).

* Daily timing restrictions: Activities would not begin until two hours after sunrise and would end two hours before sunset.

**Aircraft normally use above ground level (AGL) as a unit of measure. For instance, to not cause a disruption by medium and small helicopters during the late breeding season, the AGL would be 350 feet. 350 feet AGL would account for 200 foot tall trees that murrelets would be occupying plus the 50 yards disruption distance.

Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). In delineating the action area, we evaluated the farthest reaching measurable physical, chemical, and biotic effects of the action on the environment. For the purposes of this consultation, the action area includes the project foot print (526 acres), plus all lands within 0.5 mile due to disruption effects from the proposed actions, mainly from noise from heavy equipment operation. Sediment into the water will be minimized as feasible, but there will be some that enters the aquatic environment. As this area's water continues on to the bay and is influenced by tidal action, we feel that beyond 0.5 mile the potential increase in sediment would no longer be evident. The Action Area occurs within Tillamook County, who is also the landowner.

FRAMEWORK FOR JEOPARDY ANALYSES

Analytical Framework for the Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this BiOp relies on four components: (1) the *Status of the Species*, which evaluates the listed species range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the

Environmental Baseline, which evaluates the condition of the listed species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the listed species; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the listed species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the listed species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the listed species current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the listed species in the wild.

The jeopardy analysis in this Biological Opinion places an emphasis on consideration of the range-wide survival and recovery needs of the listed species and the role of the action area in the survival and recovery of the listed species as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

The final Recovery Plan for the murrelet established six "Conservation Zones" encompassing the murrelet's range in recognition that viable populations in at least four of six zones are essential for the long-term survival and recovery of the murrelet (Service 1997, page 113). In this way, these zones are comparable to recovery units. Pursuant to Service policy, when an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the biological opinion describes how the action affects not only the recovery unit's capability, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole. For the murrelet, when an action impairs or precludes the capacity of a Conservation Zone from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the murrelet at the range-wide scale.

STATUS OF THE MURRELET

The murrelet is a small diving seabird that nests mainly in coniferous forests and forages in near-shore marine habitats. Males and females have sooty-brown upperparts with dark bars. Underparts are light, mottled brown. Winter adults have brownish-gray upperparts and white scapulars. The plumage of fledged young is similar to that of adults in winter. Chicks are downy and tan colored with dark speckling.

Legal Status

The murrelet was listed as a threatened species on September 28, 1992, in Washington, Oregon, and northern California (57 FR 45328 [October 1, 1992]). Since the species' listing, the FWS has completed two 5-yr status reviews of the species: September 1, 2004 (USFWS 2004) and June 12, 2009 (USFWS 2009). The 2004 5-year review determined that the California, Oregon, and Washington distinct population segment of the murrelet did not meet the criteria outlined in the FWS 1996 Distinct Population Segment (DPS) policy (USFWS and USDC NMFS 1996, USFWS 2004). However, the 2009 5-year review concluded the 2004 analysis of the DPS question was based on a flawed assumption regarding discreteness at the international border with Canada (USFWS 2009, pages 3-12). The legal status of the murrelet remains unchanged from the original designation.

Life history

Reproduction

Murrelets produce one egg per nest and usually only nest once a year, however re-nesting has been documented. Nests are not built, but rather the egg is placed in a small depression or cup made in moss or other debris on the limb. Incubation lasts about 30 days, and chicks fledge after about 28 days after hatching. Both sexes incubate the egg in alternating 24-hour shifts. The chick is fed up to eight times daily, and is usually fed only one fish at a time. The young are semiprecocial, capable of walking but not leaving the nest. Fledglings fly directly from the nest to the ocean. If a fledgling is grounded before reaching the ocean, they usually die from predation or dehydration, as murrelets need to take off from an elevated site to obtain flight.

Generally, estimates of murrelet fecundity are directed at measures of breeding success, either from direct assessments of nest success in the terrestrial environment, marine counts of hatch-year birds, or computer models. Telemetry estimates are typically preferred over marine counts for estimating breeding success due to fewer biases (McShane et al. 2004, p. 3-2). However, because of the challenges of conducting telemetry studies, estimating murrelet reproductive rates with an index of reproduction, referred to as the juvenile ratio (Ŕ),[1] continues to be important, despite the debate over use of this index (see discussion in Beissinger and Peery 2007, p. 296).

Although difficult to obtain, nest success rates[2] are available from telemetry studies conducted in California (Hebert and Golightly 2006; Peery et al. 2004) and Washington (Bloxton and Raphael 2006). In northwestern Washington, Bloxton and Raphael (2005, p. 5) documented a nest success rate of 0.20 (2 chicks fledging from 10 nest starts). In central California, murrelet nest success is 0.16 (Peery et al. 2004, p. 1098) and in northern California it is 0.31 to 0.56 (Hebert and Golightly 2006, p. 95). No studies or published reports from Oregon are available.

Unadjusted and adjusted values for annual estimates of murrelet juvenile ratios at sea suggest extremely low breeding success in Conservation Zone 4 (mean ratio for 2000-2011 of 0.046, range 0.01 to 0.1, CCR 2012, p. 11), northern California (0.003 to 0.029 - Long et al. 2008, pp. 18-19; CCR 2012, p. 11), central California (0.035 and 0.032 - Beissinger and Peery 2007, pp. 299, 302), and in Oregon (0.0254 - 0.0598 - CCR 2008, p. 13). Estimates for Ŕ (adjusted) in the San Juan Islands in Washington have been below 0.15 every year since surveys began in 1995, with three of those years below 0.05 (Raphael et al. 2007a, p. 16).

These current estimates of Ŕ are assumed to be below the level necessary to maintain or increase the murrelet population. Demographic modeling suggests murrelet population stability requires a minimum reproductive rate of 0.18 to 0.28 (95 % CI) chicks per pair per year (Beissinger and Peery 2007, p. 302; USFWS 1997). The estimates for Ŕ discussed above from individual studies, as well as estimates for the listed range (0.02 to 0.13) are all below the lowest estimated

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[1] The juvenile ratio (Ŕ) for murrelets is derived from the relative abundance of hatch-year (HY; 0-1 yr-old) to after-hatch-year (AHY; 1+ yr-old) birds (Beissinger and Peery 2007, p. 297) and is calculated from marine survey data.

[2] Nest success here is defined by the annual number of known hatchlings departing from the nest (fledging) divided by the number of nest starts.

value (0.18) identified as required for population stability (USFWS 1997, Beissinger and Peery 2007, p. 302).

The current estimates for Ŕ also appear to be well below what may have occurred prior to the murrelet population decline. Beissinger and Peery (2007, p. 298) performed a comparative analysis using historic data from 29 bird species to predict the historic Ŕ for murrelets in central California, resulting in an estimate of 0.27 (95% CI: 0.15 - 0.65). Therefore, the best available scientific information of current murrelet fecundity from model predictions, and from juvenile ratios and trend analyses based on population survey data appear to align well; both indicate that the murrelet reproductive rate is generally insufficient to maintain stable population numbers throughout all or portions of the species' listed range.

Population structure

Murrelets are long-lived seabirds that spend most of their life in the marine environment, with breeding adult birds annually nesting in the forest canopy of mature and old-growth forests from about March 24 through September 15. Murrelets have a naturally low reproductive rate. Murrelets lay just one egg and are thought to usually first breed at age 3.

Recovery Zones

The Recovery Plan identified six Conservation Zones (Figure 7) throughout the listed range of the species: Puget Sound (Conservation Zone 1), Western Washington Coast Range (Conservation Zone 2), Oregon Coast Range (Conservation Zone 3), Siskiyou Coast Range (Conservation Zone 4), Mendocino (Conservation Zone 5), and Santa Cruz Mountains (Conservation Zone 6). Recovery zones are the functional equivalent of recovery units as defined by FWS policy (USFWS 1997, p. 115).

Recovery Zones in Oregon

Conservation Zone 3 (Oregon Coast Range Zone): This zone extends from the Columbia River, south to North Bend, Coos County, Oregon. Conservation zone 3 includes waters within 2 km (1.2 miles) of the Pacific Ocean shoreline and extends inland a distance of up to 56 km (35 miles) from the Pacific Ocean shoreline and coincides with the zone 1 boundary line. This zone contains the majority of murrelet sites in Oregon. Murrelet sites along the western portion of the Tillamook State Forest are especially important to maintaining well-distributed murrelet populations. Maintaining suitable and occupied murrelet habitat on the Elliot State Forest, Tillamook State Forest, Siuslaw NF, and BLM-administered forests is an essential component for the stabilization and recovery of murrelets (USFWS 1997). Beissinger and Peery (2003, page 22) estimated a 2.8 to 13.4 percent annual population decline for this zone. Miller et al. (2012, page 775) estimated a 1.5 percent population decline for this zone, with a 95 percent confidence limit of 5.4 percent decline to 2.6 percent increase in the population.

Conservation Zone 4 (Siskiyou Coast Range Zone): The Siskiyou Coast Range zone extends from North Bend, Coos County, Oregon south to the southern end of Humboldt County, California. It includes waters within 1.2 miles of the Pacific Ocean shoreline (including Humboldt and Arcata bays) and, generally extends inland a distance of 56 km (35 miles) from the Pacific shoreline. This zone contains populations in Redwood National Park and several state parks. It contains nesting habitat on private lands in southern Humboldt County and at lower elevations in the western portions of Smith River National Recreation Area (USFWS

1997). Beissinger and Peery (2003, page 22) estimated a 2.5 to 13.2 percent annual population decline for this zone. Miller et al. (2012, page 775) estimated a 0.9 percent population decline for this zone, with a 95 percent confidence limit of 3.8 percent decline to 2.0 percent increase in the population.

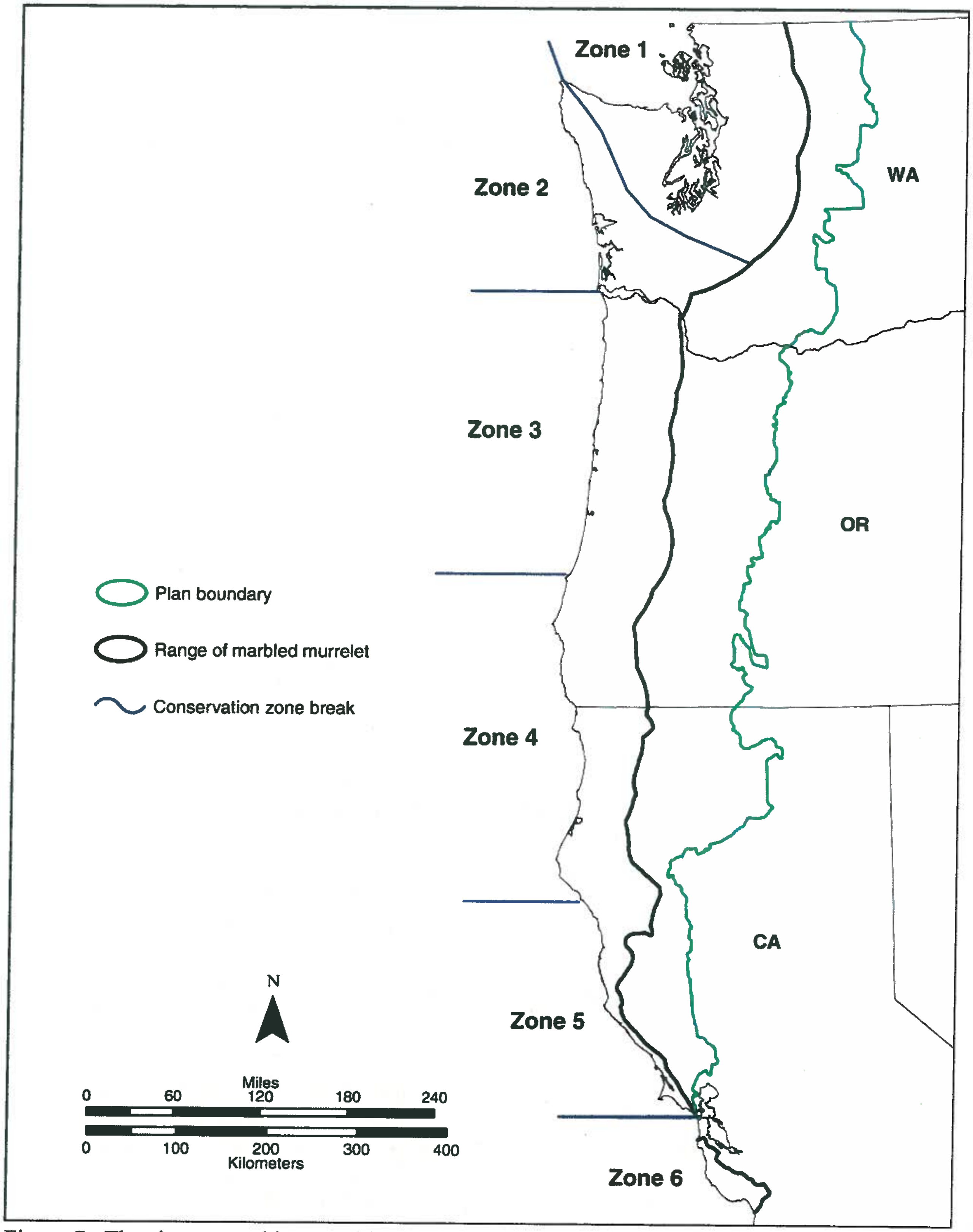


Figure 7. The six geographic areas identified as Conservation Zones in the recovery plan for the murrelet (USFWS 1997). Note: "Plan boundary" refers to the Northwest Forest Plan. Figure adapted from Huff et al. (2006, p. 6).

Ecology / Habitat Characteristics

Murrelets are long-lived seabirds that spend most of their life in the marine environment, but use old-growth forests for nesting. Courtship, foraging, loafing, molting, and preening occur in near-shore marine waters. Throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in near-shore marine waters although they have also been detected on rivers and inland lakes.

Murrelets spend most of their lives in the marine environment where they forage in near-shore areas and consume a diversity of prey species, including small fish and invertebrates. In their terrestrial environment, the presence of platforms (large branches or deformities) used for nesting is the most important characteristic of their nesting habitat. Murrelet habitat use during the breeding season is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge habitat, reduced habitat fragmentation, proximity to the marine environment, and forests that are increasing in stand age and height. Additional information on murrelet taxonomy, biology, and ecology can be found in Ralph et al. (1995), McShane et al. (2004), and Piatt et al. (2007).

Aquatic Habitat Use

Murrelets are usually found within 5 miles (8 km) from shore, and in water less than 60 meters deep (Ainley et al. 1995; Burger 1995; Strachan et al. 1995; Nelson 1997; Day and Nigro 2000; Raphael et al. 2007b). In general, birds occur closer to shore in exposed coastal areas and farther offshore in protected coastal areas (Nelson 1997). Courtship, foraging, loafing, molting, and preening occur in marine waters.

Murrelets are wing-propelled pursuit divers that forage both during the day and at night (Carter and Sealy 1986; Henkel et al. 2003; Kuletz 2005). Murrelets can make substantial changes in foraging sites within the breeding season, but many birds routinely forage in the same general areas and at productive foraging sites, as evidenced by repeated use over a period of time throughout the breeding season (Carter and Sealy 1990, Whitworth et al. 2000; Becker 2001; Hull et al. 2001; Mason et al. 2002; Piatt et al. 2007). Murrelets are also known to forage in freshwater lakes (Nelson 1997). Activity patterns and foraging locations are influenced by biological and physical processes that concentrate prey, such as weather, climate, time of day, season, light intensity, up-wellings, tidal rips, narrow passages between island, shallow banks, and kelp (*Nereocystis* spp.) beds (Ainley et al. 1995; Burger 1995; Strong et al. 1995; Speckman 1996; Nelson 1997).

Juveniles are generally found closer to shore than adults (Beissinger 1995) and forage without the assistance of adults (Strachan et al. 1995). Kuletz and Piatt (1999) found that in Alaska, juvenile murrelets congregated in kelp beds. Kelp beds are often associated with productive waters and may provide protection from avian predators (Kuletz and Piatt 1999). McAllister (in Strachan et al. 1995) found that juveniles were more common within 328 feet (100 m) of shorelines, particularly where bull kelp was present.

Within the area of use, murrelets usually concentrate feedings in shallow, near-shore water less than 98 feet (30 m) deep (Huff et al. 2006), but are thought to be able to dive up to depths of 157 feet (47 m) (Mathews and Burger 1998). During the non-breeding season, murrelets disperse and can be found farther from shore (Strachan et al. 1995). In areas with protective waters, there may be a general opportunistic shift from exposed outer coasts into more protected waters during the winter (Nelson 1997); for example many murrelets breeding on the exposed outer coast of Vancouver Island appear to congregate in the more sheltered waters within the Puget Sound and the Strait of Georgia in fall and winter (Burger 1995). In many areas, murrelets also undertake occasional trips to inland nesting habitat during the winter months (Carter and Erickson 1992). Throughout the listed range, murrelets do not appear to disperse long distances, indicating they are year-round residents (McShane et al. 2004).

Throughout their range, murrelets are opportunistic feeders and utilize prey of diverse sizes and species. They feed primarily on fish and invertebrates in marine waters although they have also been detected on rivers and inland lakes (Carter and Sealy 1986; 57 FR 45328). In general, small schooling fish and large pelagic crustaceans are the main prey items. Pacific sand lance (*Ammodytes hexapterus*), northern anchovy (*Engraulis mordax*), immature Pacific herring (*Clupea harengus*), capelin (*Mallotus villosus*), Pacific sardine (*Sardinops sagax*), juvenile rockfishes (*Sebastas* spp.), and surf smelt (Osmeridae) are the most common fish species taken. Squid (*Loligo* spp.), euphausiids, mysid shrimp, and large pelagic amphipods are the main invertebrate prey. Murrelets are able to shift their diet throughout the year and over years in response to prey availability (Becker et al. 2007). However, long-term adjustment to less energetically-rich prey resources (such as invertebrates) appears to be partly responsible for poor murrelet reproduction in California (Becker and Beissinger 2006).

Breeding adults exercise more specific foraging strategies when feeding chicks, usually carrying a single, relatively large (relative to body size) energy-rich fish to their chicks (Burkett 1995; Nelson 1997), primarily around dawn and dusk (Nelson 1997, Kuletz 2005). Freshwater prey appears to be important to some individuals during several weeks in summer and may facilitate more frequent chick feedings, especially for those that nest far inland (Hobson 1990). Becker et al. (2007) found murrelet reproductive success in California was strongly correlated with the abundance of mid-trophic level prey (e.g., sand lance, juvenile rockfish) during the breeding and postbreeding seasons. Prey types are not equal in the energy they provide; for example parents delivering fish other than age-1 herring may have to increase deliveries by up to 4.2 times to deliver the same energy value (Kuletz 2005). Therefore, nesting murrelets that are returning to their nest at least once per day must balance the energetic costs of foraging trips with the benefits for themselves and their young. This may result in murrelets preferring to forage in marine areas in close proximity to their nesting habitat. However, if adequate or appropriate foraging resources (i.e., "enough" prey, and/or prey with the optimum nutritional value for themselves or their young) are unavailable in close proximity to their nesting areas, murrelets may be forced to forage at greater distances or to abandon their nests (Huff et al. 2006). As a result, the distribution and abundance of prey suitable for feeding chicks may greatly influence the overall foraging behavior and location(s) during the nesting season, may affect reproductive success (Becker et al. 2007), and may significantly affect the energy demand on adults by influencing both the foraging time and number of trips inland required to feed nestlings (Kuletz 2005).

Nesting Biology

Incubation is shared by both sexes, and incubation shifts are generally one day, with nest exchanges occurring at dawn (Nelson 1997, Bradley 2002). Hatchlings appear to be brooded by a parent for one or two days and then left alone at the nest for the remainder of the chick period (from hatching until fledging) while both parents spend most of their time foraging at sea. Both parents feed the chick (usually a single fish carried in the bill) and the chick typically receives 1-8 meals per day (mean 3.2) (Nelson 1997). About two-thirds of feedings occur early in the morning, usually before sunrise, and about one-third occur at dusk. Feedings are sometimes scattered throughout the day (Hamer and Nelson 1995a). Chicks fledge 27-40 days after hatching, at 58-71 percent of adult mass (Nelson 1997). Fledging has seldom been documented, but it typically appears to occur at dusk (Nelson 1997).

Nest Tree Characteristics

Lank et al. (2003) states that murrelets "occur during the breeding season in near-shore waters along the north Pacific coastline from Bristol Bay in Alaska to central California", nesting in single platform trees generally within 20 miles of the coast and older forest stands generally within 50 miles of the coast. Unlike most auks, murrelets nest solitarily on mossy platforms of large branches in old-forest trees (Lank et al. 2003). Suitable murrelet habitat may include contiguous forested areas with conditions that contain potential nesting structure. These forests are generally characterized by large trees greater than 18 inches dbh, multi-storied canopies with moderate canopy closure, sufficient limb size and substrate (moss, duff, etc.) to support nest cups, flight accessibility, and protective cover from ambient conditions and potential avian predators (Manley 1999, Burger 2002, Nelson and Wilson 2002). Over 95 percent of measured nest limbs were ≥15 cm diameter, with limb diameter ranges from 7-74 cm diameter (Burger 2002). Nelson and Wilson (2002) found that all 37 nest cups identified were in trees containing at least seven platforms. All trees in their study were climbed, however, and ground-based estimates of platforms per tree in the study were not analyzed. Lank et al. (2003) emphasizes that murrelets do not select nest sites based on tree species, but rather they select those individual trees that offer suitable nest platforms. Nest cups have been found in deciduous trees, albeit rarely and nest trees may be scattered or clumped throughout a forest stand.

Nest Stand Characteristics

Nest stands are typically composed of low elevation conifer species. In California, nest sites have been located in stands containing old-growth redwood and Douglas-fir, while nests in Oregon and Washington have been located in stands dominated by Douglas-fir, western hemlock and Sitka spruce. Murrelets appear to select forest stands greater than 123.6 acres (50 ha) (Burger 2002), but nest in stands as small as one acre (Nelson and Wilson 2002). In surveys of mature or younger second-growth forests in California, murrelets were only found in forests where there were nearby old-growth stands or where residual older trees remained (USFWS 1992, Singer et al. 1995).

At the stand level, vertical complexity is correlated with nest sites (Meekins and Hamer 1998, Manley 1999, Waterhouse et al. 2002, Nelson and Wilson 2002), and flight accessibility is probably a necessary component of suitable habitat (Burger 2002). Some studies have shown higher murrelet activity near stands of old-forest blocks over fragmented or unsuitable forest areas (Paton et al. 1992, Rodway et al. 1993, Burger 1995, Deschesne and Smith 1997, Rodway and Regehr 2002), but this correlation may be confounded by ocean conditions, distance inland, elevation, survey bias and disproportionately available habitat. Nelson and Wilson (2002) found that potential nest platforms per acre were a strong correlate for nest stand selection by murrelets in Oregon.

Adjacent forests can contribute to the conservation of the murrelet by reducing the potential for windthrow during storms by providing area buffers and creating a landscape with a higher probability of occupancy by murrelets (USFWS 1996, Burger 2001, Meyer et al. 2002, and Raphael et al. 2002). Trees surrounding and within the vicinity of a potential nest tree(s) may provide protection to the nest platform and potentially reduce gradations in microclimate (Chen et al. 1993).

Consulted on effects from October 1, 2003 to January 31, 2013 that impact nest stands are summarized in Table 6.

Table 6. Aggregate Results of All Suitable Habitat (Acres) Affected by Section 7 Consultation for the Murrelet; Summary of Effects By Conservation Zone and Habitat Type From October 1st, 2003 to May 28, 2015.

Conservation Zone[1]	Authorized Habitat Effects In Acres[2]		Reported Habitat Effects in Acres[2]	
	Stands[3]	Remnants[4]	Stands[3]	Remnants[4]
Puget Sound	-69	0	-1	0
Western Washington	-75	0	-12	0
Outside CZ Area in WA	0	0	0	0
Oregon Coast Range	-2,887	-1,050	-2,217	0
Siskiyou Coast Range	-2,581	0	-138	0
Outside CZ Area in OR	-2	0	0	0
Mendocino	0	0	0	0
Santa Cruz Mountains	0	0	0	0
Outside CZ Area in CA	0	0	0	0
Total	**-5,614**	**-1,050**	**-2,368**	**0**

Notes:

1. Conservation Zones (CZ) six zones were established by the 1997 Recovery Plan to guide terrestrial and marine management planning and monitoring for the Murrelet. *Marbled Murrelet Recovery Plan, September, 1997*
2. Habitat includes all known occupied sites, as well as other suitable habitat, though it is not necessarily occupied. Importantly, there is no single definition of suitable habitat, though the Murrelet Effectiveness Monitoring Module is in the process. Some useable working definitions include the Primary Constituent Elements as defined in the Critical Habitat Final Rule, or the criteria used for Washington State by Raphael et al. (2002).
3. Stand: A patch of older forest in an area with potential platform trees.
4. Remnants: A residual/remnant stand is an area with scattered potential platform trees within a younger forest that lacks, overall, the structures for murrelet nesting.

Landscape Characteristics

Studies have determined the characteristics of murrelet nesting habitat at a landscape-scale using a variety of methods, including predictive models, radio telemetry, audio-visual surveys, and radar. McShane et al. (2004, pg. 4-103) reported, "At the landscape level, areas with evidence of occupancy tended to have higher proportions of large, old-growth forest, larger stands and greater habitat complexity, but distance to the ocean (up to about 37 miles [60 km]) did not seem important." Elevation had a negative association in some studies with murrelet habitat occupancy (Burger 2002). Hamer and Nelson (1995b) sampled 45 nest trees in British Columbia, Washington, Oregon, and California and found the mean elevation to be 1,089 feet (332 m).

Multiple radar studies (e.g., Burger 2001, Cullen 2002, Raphael et al. 2002, Steventon and Holmes 2002) in British Columbia and Washington have shown that radar counts of murrelets are positively associated with total watershed area, increasing amounts of late-seral forests, and with increasing age and height class of associated forests. Murrelet radar counts are also negatively associated with increasing forest edge and areas of logged and immature forests (McShane et al. 2004). Several studies have concluded that murrelets do not pack into higher densities within remaining habitat when nesting habitat is removed (Burger 2001, Manley et al. 2001, Cullen 2002).

There is a relationship between proximity of human-modified habitat and increased avian predator abundance. However, increased numbers of avian predators does not always result in increased predation on murrelet nests. For example, Luginbuhl et al. (2001, pg. 565) report, in a study using simulated murrelet nests, that "Corvid numbers were poorly correlated with the rate of predation within each forested plot". Luginbuhl et al. (2001, pg. 569), conclude, "that using measurements of corvid abundance to assess nest predation risk is not possible at the typical scale of homogenous plots (0.5-1.0 km^2 in our study). Rather this approach should be considered useful only at a broader, landscape scale on the order of 5-50 km^2 (based on the scale of our fragmentation and human-use measures)."

Artificial murrelet nest depredation rates were highest in western conifer forests where stand edges were close to human development (Luginbuhl et al. 2001), and Bradley (2002) found increased corvid densities within three miles of an urban interface, probably due to supplemental feeding opportunities from anthropogenic activities. Golightly et al. (2002) found extremely low reproductive success for murrelets nesting in large old-growth blocks of redwoods in the California Redwoods National and State Parks. Artificially high corvid densities from adjacent urbanization and park campgrounds are suspected to be a direct cause of the high nesting failure rates for murrelets in the redwoods parks.

If the surrounding landscape has been permanently modified to change the predators' numbers or densities through, for example, agriculture, urbanization, or recreation, and predators are causing unnaturally high nest failures, murrelet reproductive success may remain depressed. Because corvids account for the majority of depredations on murrelet nests and corvid density can increase with human development, corvid predation on murrelet habitat is a primary impact consideration. The threat of predation on murrelet populations (both nests and adults) appears to be greater than previously anticipated (McShane et al. 2004).

Population Status

Historical status and distribution

Murrelet abundance during the early 1990s in Washington, Oregon, and California was estimated at 18,550 to 32,000 birds (Ralph et al. 1995).

The historical breeding range of the murrelet extends from Bristol Bay, Alaska, south to the Aleutian Archipelago, northeast to Cook Inlet, Kodiak Island, Kenai Peninsula and Prince William Sound, south coastally throughout the Alexander Archipelago of Alaska, and through British Columbia, Washington, Oregon, to northern Monterey Bay in central California. Birds winter throughout the breeding range and also occur in small numbers off southern California. At the time of listing, the distribution of active nests in nesting habitat was described as non-continuous (USFWS 1997, p. 14). The at-sea extent of the species currently encompasses an area similar in size to the species' historic distribution, but with the extremely low density of murrelets in Conservation Zone 5, and the small population in Conservation Zone 6, the southern end of the murrelet distribution is sparsely populated compared to Conservation Zones 1-4 (Table 7).

Current status and distribution of the listed species in rangewide (summary)

Based primarily on the results from the Northwest Forest Plan (NWFP) Effectiveness Monitoring (EM) Program, the 2013 murrelet population for the listed range (Table 7) is estimated at 19,617 birds (95 percent confidence interval [CI]: 15,396 to 23,838; Table 7). Zone 3 had the largest single-zone estimate of population size, and Zone 4 had the greater murrelet density (Zone 4 is 30% less than Zone 3, resulting in fewer murrelets despite Zone; Falxa et al. 2014, p.4).

The at-sea distribution also exhibits discontinuity within Conservation Zones 1, 2, 5, and 6, where five areas of discontinuity are noted: a segment of the border region between British Columbia, Canada and Washington, southern Puget Sound, WA, Destruction Island, WA to Tillamook Head, OR, Humboldt County, CA to Half Moon Bay, CA, and the entire southern end of the breeding range in the vicinity of Santa Cruz and Monterey Counties, CA (McShane et al. 2004, p. 3-70).

The current breeding range of the murrelet is the same as the historic breeding range. Birds winter throughout the breeding range and also occur in small numbers off southern California.

Table 7. 2001-2013 murrelet density and population size estimates (rounded to nearest 100 birds) in all conservation zones combined (Falxa et al. 2014, p. 7).

Year	Density (birds/km2)	Bootstrap Standard Error	Coefficient of Variation of Density (%)	Birds	Birds Lower 95% CL	Birds Upper 95% CL
2001	2.52	0.27	10.5	22,200	17,600	26,800
2002	2.64	0.33	12.6	23,200	17,400	28,900
2003	2.52	0.24	9.5	22,200	18,000	26,300
2004	2.43	0.25	10.5	21,400	17,000	25,700
2005	2.30	0.25	10.8	20,200	15,900	24,500
2006	2.14	0.17	8.0	18,800	15,900	21,700
2007	1.97	0.27	13.5	17,300	12,700	21,900
2008	2.03	0.18	9.1	17,800	14,600	21,000
2009	1.97	0.21	10.4	17,300	13,800	20,900
2010	1.91	0.21	11.0	16,800	13,200	20,400
2011	2.57	0.31	12.2	22,600	17,200	28,000
2012	2.41	0.27	11.0	21,200	16,600	25,800
2013	2.23	0.25	11.0	19,600	15,400	23,800

Trend

There are two general approaches that researchers use to assess murrelet population trend: at-sea surveys and population modeling based on demographic data. In general, the FWS assigns greater weight to population trend and status information derived from at-sea surveys than estimates derived from population models because survey information generally provides more reliable estimates of trend and abundance.

At-Sea Surveys

For the combined 5-conservation zone area for the 2001-2013 period, a weak downward trend (1.2% decline per year; P=0.16; Falxa et al. 2014, p 4). At the scale of individual conservation zones and with a statistical significance threshold of $P \leq 0.05$, there was an estimated strong annual decline in Conservation Zone 1 (3.9% decline per year; P= 0.05; see Table 2 for details) and Zone 2 (7.4% decline per year; P=0.002; Falxa et al. 2014, p 4).

Population Models

Prior to the use of survey data to estimate trend, demographic models were more heavily relied upon to generate predictions of trends and extinction probabilities for the murrelet population (Beissinger 1995; Cam et al. 2003; McShane et al. 2004; USFWS 1997). However, murrelet population models remain useful because they provide insights into the demographic parameters and environmental factors that govern population stability and future extinction risk, including stochastic factors that may alter survival, reproductive, and immigration/emigration rates.

In a report developed for the 5-year Status Review of the Murrelet in Washington, Oregon, and California (McShane et al. 2004, p. 3-27 to 3-60), computer models were used to forecast 40-

year murrelet population trends. A series of female-only, multi-aged, discrete-time stochastic Leslie Matrix population models were developed for each conservation zone to forecast decadal population trends over a 40-year period and extinction probabilities beyond 40 years (to 2100). The authors incorporated available demographic parameters (Table 8) for each conservation zone to describe population trends and evaluate extinction probabilities (McShane et al. 2004, p. 3-49).

McShane et al. (2004) used mark-recapture studies conducted in British Columbia by Cam et al. (2003) and Bradley et al. (2004) to estimate annual adult survival and telemetry studies or at-sea survey data to estimate fecundity. Model outputs predicted 3.1 to 4.6 percent mean annual rates of population decline per decade the first 20 years of model simulations in murrelet Conservation Zones 1 through 5 (McShane et al. 2004, p. 3-52). Simulations for all zone populations predicted declines during the 20 to 40-year forecast, with mean annual rates of 2.1 to 6.2 percent decline per decade (McShane et al. 2004, p. 3-52). These reported rates of decline are similar to the estimates of 4 to 7 percent per year decline reported in the Recovery Plan (USFWS 1997, p. 5).

Table 8. Rangewide murrelet demographic parameter values based on four studies all using Leslie Matrix models.

Demographic Parameter	Beissinger 1995	Beissinger and Nur 1997*	Beissinger and Peery (2007)	McShane et al. 2004
Juvenile Ratio (Ȓ)	0.10367	0.124 or 0.131	0.089	0.02 - 0.09
Annual Fecundity	0.11848	0.124 or 0.131	0.06-0.12	-
Nest Success	-	-	0.16-0.43	0.38 - 0.54
Maturation	3	3	3	2 - 5
Estimated Adult Survivorship	85 % – 90%	85 % – 88 %	82 % - 90 %	83 % – 92 %

*In USFWS (1997).

McShane et al. (2004, pp. 3-54 to 3-60) modeled population extinction probabilities beyond 40 years under different scenarios for immigration and mortality risk from oil spills and gill nets. Modeled results forecast different times and probabilities for local extirpations, with an extinction risk[3] of 16 percent and mean population size of 45 individuals in 100 years in the listed range of the species (McShane et al. 2004, pp. 3-58).

Threats; including reasons for listing, current rangewide threats

When the murrelet was listed under the Endangered Species Act (57 FR 45333-45336 [October 1, 1992]) and threats summarized in the Recovery Plan (USFWS 1997, pp. 43-76), several anthropogenic threats were identified as having caused the dramatic decline in the species.

- habitat destruction and modification in the terrestrial environment from timber harvest and human development caused a severe reduction in the amount of nesting habitat
- unnaturally high levels of predation resulting from forest "edge effects" ;

[3] Extinction was defined by McShane et al. (2004, p. 3-58) as any murrelet conservation zone containing less than 30 birds.

- the existing regulatory mechanisms, such as land management plans (in 1992), were considered inadequate to ensure protection of the remaining nesting habitat and reestablishment of future nesting habitat; and
- manmade factors such as mortality from oil spills and entanglement in fishing nets used in gill-net fisheries.

There have been changes in the levels of these threats since the 1992 listing (USFWS 2004, pp. 11-12; USFWS 2009, pp. 27-67). The regulatory mechanisms implemented since 1992 that affect land management in Washington, Oregon, and California (for example, the NWFP) and new gill-netting regulations in northern California and Washington have reduced the threats to murrelets (USFWS 2004, pp. 11-12). The levels for the other threats identified in 1992 listing (57 FR 45333-45336 [October 1, 1992]) including the loss of nesting habitat, predation rates, and mortality risks from oil spills and gill net fisheries (despite the regulatory changes) remained unchanged following the FWS's 2004, 5-year, range-wide status review for the murrelet (USFWS 2004, pp. 11-12).

However, new threats were identified in the FWS's 2009, 5-year review for the murrelet (USFWS 2009, pp. 27-67). These new stressors are due to several environmental factors affecting murrelets in the marine environment. These new stressors include:

- Habitat destruction, modification, or curtailment of the marine environmental conditions necessary to support murrelets due to:
  - elevated levels of polychlorinated biphenyls in murrelet prey species;
  - changes in prey abundance and availability;
  - changes in prey quality;
  - harmful algal blooms that produce biotoxins leading to domoic acid and paralytic shellfish poisoning that have caused murrelet mortality; and
  - climate change in the Pacific Northwest.

- Manmade factors that affect the continued existence of the species include:
  - derelict fishing gear leading to mortality from entanglement;
  - energy development projects (wave, tidal, and on-shore wind energy projects) leading to mortality; and
  - disturbance in the marine environment (from exposures to lethal and sub-lethal levels of high underwater sound pressures caused by pile-driving, underwater detonations, and potential disturbance from high vessel traffic; particularly a factor in Washington state).

The Service also believes climate change is likely to further exacerbate some existing threats such as the projected potential for increased habitat loss from drought-related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that the murrelet will be adversely affected, we lack adequate information to quantify the magnitude of effects to the species from the climate change projections described above (USFWS 2009, page 34).

Several threats to murrelets, present in both the marine and terrestrial environments, have been identified. These threats collectively comprise a suite of environmental stressors that, individually or through interaction, have significantly disrupted or impaired behaviors which are essential to the reproduction or survival of individuals. When combined with the species naturally low reproductive rate, these stressors have led to declines in murrelet abundance, distribution, and reproduction at the population scale within the listed range.

Detailed discussions of the above-mentioned threats, life-history, biology, and status of the murrelet are presented in the Federal Register, listing the murrelet as a threatened species (57 FR 45328 [October 1, 1992]); the Recovery Plan, Ecology and Conservation of the Murrelet (Ralph et al. 1995); the final rule designating murrelet critical habitat (61 FR 26256 [May 24, 1996]); the Evaluation Report in the 5-Year Status Review of the Murrelet in Washington, Oregon, and California (McShane et al. 2004); the 2004 and 2009, 5-year Reviews for the Murrelet (USFWS 2004; USFWS 2009), and the final rule revising critical habitat for the murrelet (76 FR 61599 [October 5, 2011]).

Conservation

Needs

Reestablishing an abundant supply of high quality murrelet nesting habitat is a vital conservation need given the extensive habitat removal during the 20th century. However, there are other conservation imperatives. Foremost among the conservation needs are those in the marine and terrestrial environments to increase murrelet fecundity by increasing the number of breeding adults, improving murrelet nest success (due to low nestling survival and low fledging rates), and reducing anthropogenic stressors that reduce individual fitness[4] or lead to mortality.
The overall reproductive success (fecundity) of murrelets is directly influenced by nest predation rates (reducing nestling survival rates) in the terrestrial environment and an abundant supply of high quality prey in the marine environment during the breeding season (improving potential nestling survival and fledging rates). Anthropogenic stressors affecting murrelet fitness and survival in the marine environment are associated with commercial and tribal gillnets, derelict fishing gear, oil spills, and high underwater sound pressure (energy) levels generated by pile-driving and underwater detonations (that can be lethal or reduce individual fitness).

General criteria for murrelet recovery (delisting) were established at the inception of the Plan and they have not been met. More specific delisting criteria are expected in the future to address population, demographic, and habitat based recovery criteria (USFWS 1997, p. 114-115). The general criteria include:

- documenting stable or increasing population trends in population size, density, and productivity in four of the six Conservation Zones for a 10-year period and
- implementing management and monitoring strategies in the marine and terrestrial environments to ensure protection of murrelets for at least 50 years.

Thus, increasing murrelet reproductive success and reducing the frequency, magnitude, or duration of any anthropogenic stressor that directly or indirectly affects murrelet fitness or survival in the marine and terrestrial environments are the priority conservation needs of the species. The FWS estimates recovery of the murrelet will require at least 50 years (USFWS 1997).

[4] Fitness is measure of the relative capability of individuals within a species to reproduce and pass its' genotype to the next generation.

Current Actions

On Federal lands under the NWFP, surveys are required for all timber sales that remove murrelet habitat. If habitat outside of mapped Late-Successional Reserves (LSRs) is found to be used by murrelets, then the habitat and recruitment habitat (trees at least 0.5 site potential tree height) within a 0.5-mile radius of the occupied behavior is designated as a new LSR. Timber harvest within LSRs is designed to benefit the development of late-successional conditions, which should improve future conditions of murrelet nesting habitat. Designated LSRs not only protect habitat currently suitable to murrelets (whether occupied or not), but will also develop future suitable habitat in large blocks.

ENVIRONMENTAL BASELINE

The environmental baseline is defined as "the past and present impacts of all Federal, state or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation in process [50 CFR 402.02]."

The Action Area is located at the head of Tillamook Bay, the third largest estuary in Oregon, on County and privately owned properties outside of designated murrelet critical habitat. It includes areas of forest cover in what was historically a tidally influenced mudflat, scrub, and forested wetland.

Murrelet

Action area

The SFC action area contains areas of forest surrounded by pasture, tideland, and urban areas. The forest, totaling about 160 acres (59 acres owned by Tillamook County), has a fairly open canopy of interspersed deciduous trees and spruce trees and many low shrubs. Within this forest, spruce trees may include trees with appropriate size, deformity, and cover to potentially support nesting murrelets.

While audio-visual surveys for murrelets have not been conducted, a field review by Service staff surveyed the entire potentially suitable nesting habitat within the footprint of levees to be removed or added and other areas of major earthwork. Those surveys, conducted in June and September of 2014, documented 43 Sitka spruce with potentially suitable nesting platforms that were in the footprint of intensive earthwork associated with either the removal of the human-built levee system or the building of the new levees.

Locations of the 43 Sitka spruce trees which have potential nesting habitat characteristics within the footprint of construction were recorded using Global Positioning System (GPS) (Figure 8 and 9). The project was then redesigned to leave protective buffers around 34 of the 43 trees. Specifically, the protective buffers are short segments of the levee running parallel to the flood flow path which will help maintain these high quality murrelet nesting trees (figure 4, 5 and 6). This project redesign resulted in only nine potential murrelet nesting trees within 12.9 acres of Sitka spruce forest, designated for clearing and grubbing.

The remaining forested area within the action area beyond the project footprint was not walked to identify murrelet nest trees. The biggest trees were on the levees, although the adjacent forested area also contains scattered large trees and smaller trees with deformities that would also support murrelets for nesting. Therefore, the remaining forested area outside the project footprint, which was not walked, is assumed habitat due to our process of giving the benefit of the doubt to the species.

There are no known murrelet survey data within the action area. In the absence of two sequential years of murrelet surveys that follow approved interagency protocols for detecting murrelets, the murrelet habitat within the action area will be assumed occupied (160 acres of potential habitat) for the purposes of the effect determination.

Figure 8. Wilson River – Blind Slough Potential Marbled Murrelet Nest Trees. Red dots represent GPS-marked locations of trees with potential marbled murrelet nesting habitat characteristics within the footprint of either levee to be removed or new levee to be constructed.

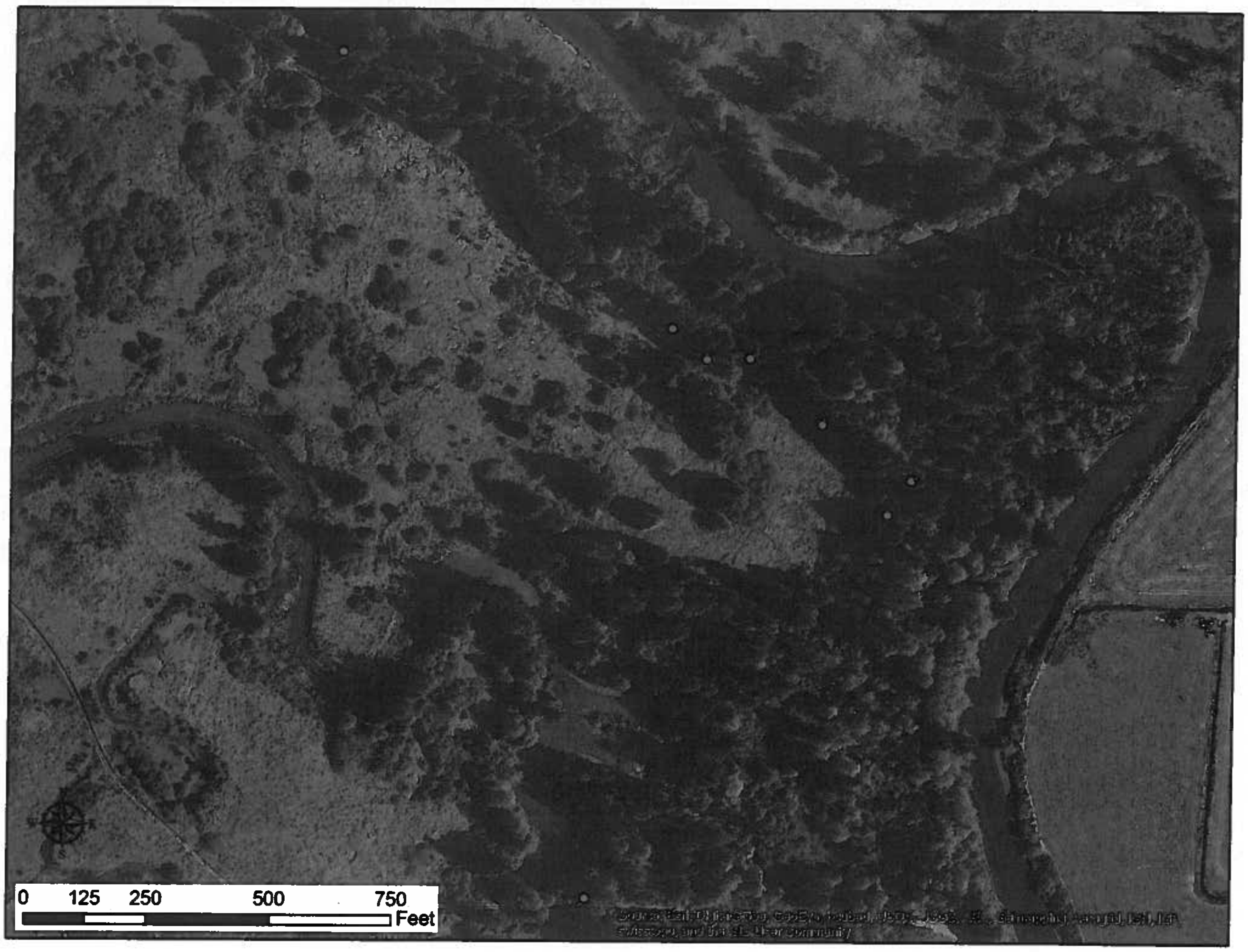
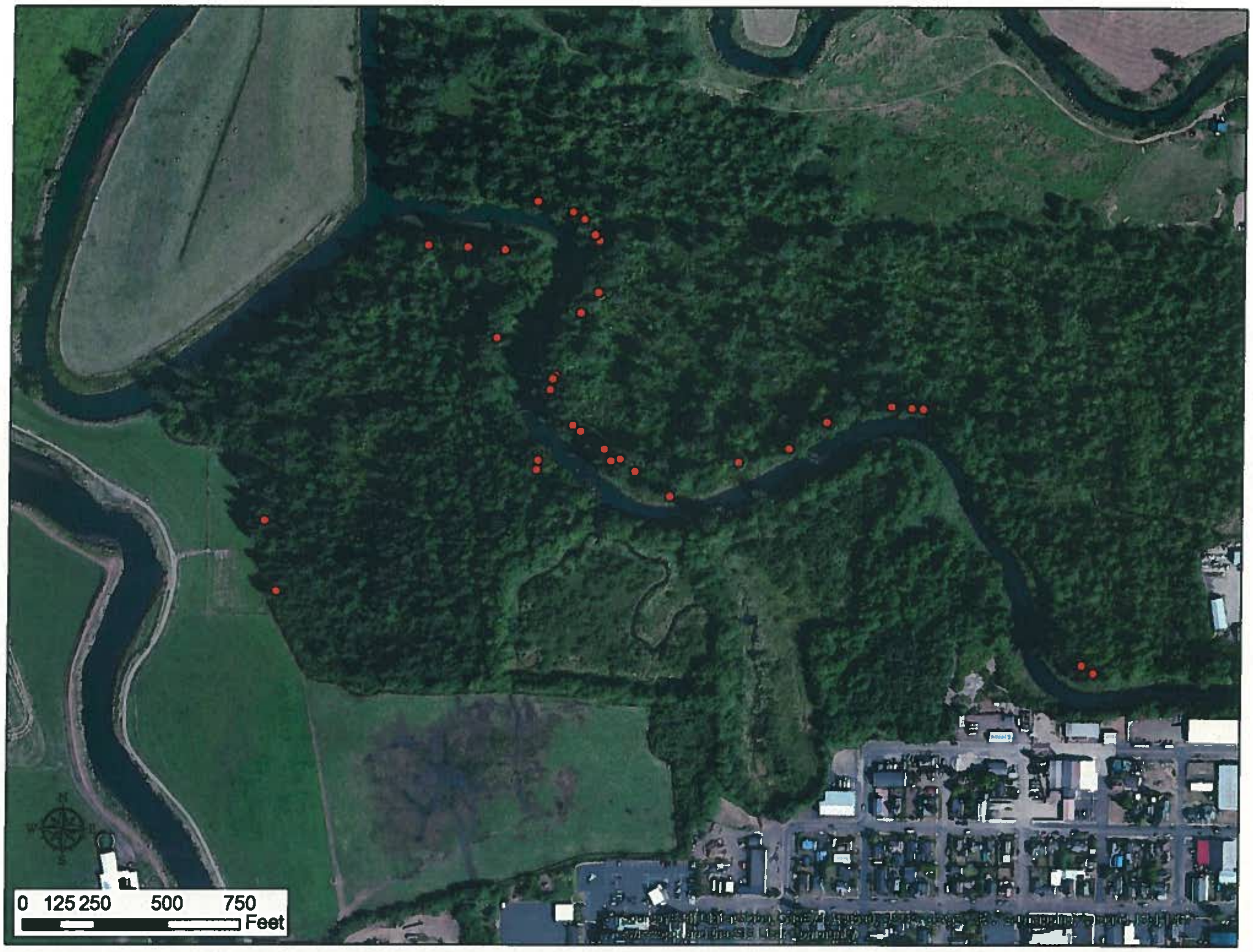


Figure 9. Trask River - Hoquarten Slough Potential Marbled Murrelet Nest Trees. Red dots represent GPS-marked locations of trees with potential marbled murrelet nesting habitat characteristics within the footprint of either levee to be removed or new levee to be constructed.



Conservation Zone 3

The action area for this consultation falls within murrelet conservation zone 3: Oregon Coast Range. This zone extends from the Columbia River, south to North Bend, Coos County, Oregon. This zone includes waters within 1.2 miles of the Pacific Ocean shoreline and extends inland a distance of up to 35 miles from the Pacific Ocean. The boundary encompasses all of the murrelet critical habitat units (the boundary extends slightly beyond 35 miles in certain areas).

This zone includes the majority of known murrelet occupied sites in Oregon. Murrelet occupied sites along the western portion of the Tillamook State Forest are especially important to maintaining well distributed murrelet populations. The murrelet recovery plan states that efforts should focus on maintaining these occupied sites, minimizing the loss of unoccupied but suitable habitat, and decreasing the time for development of new habitat. Relatively few known occupied sites occur north of the Tillamook State Forest. Recovery efforts should be directed at restoring some of the north-south distribution of murrelet populations and habitat in this Zone. Maintenance of suitable and occupied murrelet nesting habitat in the Elliott State Forest, Tillamook State Forest, Siuslaw National Forest, and Bureau of Land Management-administered forests is an essential component for the stabilization and recovery of the murrelet (USFWS 1997).

In 2014, the population for Conservation Zone 3 was estimated at 8,840 murrelets (95% CI: 7,937 to 10,822 birds). The population estimate was above the mean of 15 years of annual data (CCR 2015, page 2).

NWFP

The action area is not under the NWFP, which established a conservation strategy for the murrelet on Federal lands. NWFP lands are lacking in this area and north of this area.

Recovery Plan for the Murrelet

The recovery plan recommends two actions relating to these types of proposed projects. Recovery Action 2 includes protecting terrestrial habitat essential for murrelet recovery (i.e. critical habitat, late-successional reserves). Recovery Action 3 includes maintaining occupied habitat, unoccupied and un-surveyed habitat; maintaining and enhancing (i.e. using silviculture to speed development) buffers around occupied habitat, unoccupied and un-surveyed habitat; and reduce nest disturbance.

Role of the Action Area in the Survival and Recovery of the Murrelet

Lands under the NWFP are lacking in this area and north. As Federal lands are lacking, critical habitat was designated on state lands in this area and on lands further north. It is expected that private lands would likely play a minor role in supporting murrelets. Though as mentioned above, maintaining murrelet habitat is recommended to support recovery.

EFFECTS OF THE ACTION

Effects of the action refer to the permanent or temporary direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action, occur later in time, but are still reasonably certain to occur.

EFFECTS TO SPECIES - MURRELETS

Disturbance Effects-General

The effects to murrelets from disturbance are largely unknown, although effects such as increased energetic expenditure, elevated stress levels, and susceptibility to predation have been documented in other wildlife and may affect murrelets, as well. Disturbance is considered a threat to this cryptic secretive species (McShane et al. 2004). Summary studies on effects of disturbance have not documented any nest failure, abandonment, or chick mortality directly attributed to noise disturbance (Singer et al. 1995, Hamer and Nelson 1998, Golightly et al. 2002). Although murrelet breeding biology may preclude such ready detection of the effects of sub-lethal noise disturbance at the population level, the effect of noise disturbance on murrelet fitness and reproductive success should not be completely discounted (McShane et al. 2004).

Murrelet responses to smoke and corvids that are attracted by human presence, and excessive noise levels at or in the immediate vicinity of murrelets are expected to include the following: a nesting adult flushes and leaves the eggs exposed to predation, an adult aborts a feeding attempt potentially reducing the fitness of the young, or a juvenile prematurely fledges potentially reducing the fitness due to having sub-optimal energy reserves before leaving the nest. A murrelet that may be disturbed when it flies into the stands for other reasons than nest exchange or feeding young is presumably capable of moving away from disturbance without a significant disruption of its behavior. Therefore, effects to non-nesting murrelets would be minor. Murrelets feed at sea and only rely on forest habitat for nesting. Therefore, forest management or other activities in the murrelet breeding season (April 1 – September 15) may affect murrelets that are nesting.

In the late breeding period (August 6 – September 15), potential effects from disturbance decline because all breeding murrelets have established a nest, most are finished incubating and either have completed nesting (about half of the chicks have fledged) (Hamer et al. 2003) or adult murrelets are still feeding the chick. Adults still tending their young in the late breeding period are heavily invested in chick-rearing, and General Standard 14 prohibits most disturbance activities for the two hours after sunrise and two hours before sunset when most food deliveries to young are made. This standard reduces the likelihood of nest abandonment or significant alteration of breeding success in the late breeding period because it prohibits activities that create disruption during the periods of the majority of food deliveries to the chick. Therefore the likelihood of causing injury by annoying the adult murrelets to such an extent as to significantly disrupt normal behavior patterns, which includes but are not limited to, breeding feeding or sheltering is not certain to occur in the late breeding period with daily timing restrictions (excluding activities that cause physical injury or mortality).

Although disruption distances in Table 5 are based on the interpretation of the best available information, the exact distance where different types of noise, smoke and/or temporary increases in predation due to human presence may disrupt breeding including feeding young are difficult to predict and can be influenced by a multitude of factors. Site-specific information (e.g. topographic features, project length or frequency of disturbance to an area) could factor into the severity of effects. The potential for noise or human intrusion-producing activities to create the likelihood of injury to murrelets is also dependent on the background or baseline levels in the environment. In areas that are continually exposed to higher ambient noise or human presence levels (e.g. areas near well-traveled roads, camp grounds), murrelets are probably less susceptible to small increases in disturbances because they are accustomed to such activities and the change in corivid densities caused by human presence is also less as the baseline level of corvids within these areas are already high. Murrelets do occur in areas near human activities and may habituate to certain levels of noise.

For disruption of murrelet behavior to occur as a result of disturbance (noise, smoke and/or temporary increases in predation risk due to human presence) caused by a proposed action, the effects and the murrelet(s) must be in proximity to one another during the murrelet nesting season (see Table 5).

Disturbance Effects for SFC

Disturbance effects are expected from SFC project due to construction during the murrelet breeding season in 2015 and from monitoring activities through 2021 (Table 9). Standard 4 prohibits helicopter use during the breeding season.

Construction will involve human presence and heavy equipment use within the disruption distances of un-surveyed murrelet habitat during the murrelet breeding season, including the critical breeding season. Construction will start in May, but construction within the disruption distances of murrelet habitat will be delayed until June 16 (Standard 3). Additionally, use of the Goodspeed road adjacent/within murrelet habitat will have two hour daily timing restrictions during the crepuscular periods from April 1 to June 15 (Standard 3). These restrictions do not eliminate adverse effects from construction but they do delay the timing of the proposed project potentially avoiding the nest initiation phase in some breeding murrelets. Additionally, these restrictions provide for the project and associated adverse effects to be completed in one season. Standard 1 requires food waste and garbage to be cleaned up and properly contained to avoid attraction of corvids, a known predator of murrelet eggs and checks.

Construction will also remove liner strips of forest located on the levees being breached. This will result in the loss of 9 trees with murrelet nesting structure. These trees will be removed outside the breeding season to avoid injury impacts to murrelets actively nesting (Standard 2). Impacts from the loss of habitat are discussed in the next two sections below.

One year post-construction, an inspection for settlement will occur and necessary adjustments to raise levee heights to the design elevation will be made. Any post-construction work would again be completed after June 15. As above for construction, this restriction does not eliminate adverse effects from post-construction but they do delay the timing of the proposed project potentially avoiding the nest initiation phase in some breeding murrelets. Work in any location is expected to be of a short duration, as fill will only be added on an as needed basis. Therefore, even though two hour daily timing restrictions during the crepuscular periods will not be adhered to, it is not reasonably certain that murrelets will be adversely affected from post-construction work due to the progression of this work along the levee as effects are expected to be of short duration in any one location.

Current and future monitoring activities will not modify habitat. Monitoring activities could affect murrelets due to noise above ambient levels during the murrelet breeding season (April 1 – September 15) and may attract corvids, predators of murrelet egg and young, due to human presence. Monitoring crews are comprised typically of 3 people for all elements described, except for soil cores for carbon accumulation which use 6 people. The carbon soil cores happen at ten locations, only once, and spend about 30 minutes per location. It would be highly unusual for them to be working during crepuscular hours. The fish monitoring crews are not working within disturbance distances of the forested / habitat areas. Because monitoring will be limited to a small group of people plus equipment, all garbage will be removed to reduce corvid attraction, duration at any locations would be under 3 hours, and work is not likely to occur in the crepuscular periods when murrelets are more active with nest exchanges and feeding young, the project design and conservation measures have minimized potential impacts to murrelets.

It is the Service's opinion that the small number of people combined with garbage removal and short exposure in any one location and with the protection of the murrelet's most active time periods, that monitoring activities may affect, but are not likely to affect murrelets.

Therefore, disruption (noise and a potential increase in corvid levels) from the proposed construction action is expected to increase the likelihood of injury to murrelets breeding on the 160 acres of murrelet habitat within the project area during one breeding season. Injury is expected as a result of an increase in predation risks to an egg or chick, adults aborting feeding attempts potentially reducing the fitness of the young, or a juvenile prematurely fledging reducing the fitness due to having sub-optimal energy reserves before leaving the nest. These outcomes increase the likelihood of injury or death to an egg or chick, or reduced fitness that may also contribute to the likelihood of injury or death after a chick fledges.

Table 9. Disturbance and disruption distances with effects determinations for the murrelet for proposed actions.

MURRELET				
SOURCE OF DISTURBANCE	Distance from an Occupied or Unsurveyed Stand/Tree			Time Period
Monitoring by a small group of people*	≤ 0.25 mile	> 0.25 mile		
	MA-NLAA	NE		April 1 – September 15
	NE	NE		September 16 – March 31
Construction: human presence and heavy equipment use or chainsaw*	≤ 110 yards*	111 – 440 yards/ 0.25 miles*	> 440 yards/ 0.25 miles	
	MA-LAA	MA-NLAA	NE	April 1 – August 5
	MA-NLAA	MA-NLAA	NE	August 6 – September 15
	NE	NE	NE	September 16 – March 31

*between April 1 and September 15 actions should not begin until 2 hours after sunrise and would end 2 hours before sunset

NE = No Effect
MA-NLAA = May affect but not likely to adversely affect
MA-LAA = May affect and likely to adversely affect

Habitat Effects-General

The murrelet was listed as threatened mainly due to the loss of nesting habitat throughout its range in the Pacific Northwest. The effects of habitat modification activities on murrelet habitat depend on the silvicultural prescriptions applied and the location of the harvest related to habitat (suitable habitat and potential nesting structure). Impacts may include a complete loss of habitat, lowering of habitat quality, or harvest of unsuitable habitat adjacent to and contiguous with habitat which will impact interior forest conditions. Silvicultural prescriptions that promote multi-aged and multi-storied stands may in some cases retain suitability for murrelets or accelerate the development of habitat over time.

Considerable evidence links the declining numbers of murrelets to the removal and reduction of available nesting habitat (Ralph and Miller 1995, p. 360). The removal of habitat or forest stands buffering habitat can potentially adversely affect the murrelet population in several ways. These include:

- The immediate displacement of birds from traditional nesting areas;
- The concentration of displaced birds into smaller, fragmented areas of suitable nesting habitat that may already be occupied;
- Increased competition for suitable nest sites;
- Decreased potential for survival of remaining murrelets and offspring due to increased predation (Common ravens (*Corvus corax*) and Steller's jays (*Cyanocitta stelleri*) which are both corvids are known to take both eggs and chicks at the nest, while sharp-shinned hawks (*Accipiter striatus*) are known to take chicks. Suspected predators at nests include great horned owls (*Bubo virginianus*), barred owls (*Strix varia*), Cooper's hawks (*Accipiter cooperi*), northwestern crows (*Corvus caurinus*), American crows (*C. brachyrhynchos*), gray jays (*Perisoreus Canadensis*), northern flying squirrel (*Glaucomys sabrina*), red squirrel (*Tamiasciurus hudsonicus*), Douglas squirrel (*Tamiasciurus douglasi*), deer mouse, and bushy-tailed woodrat (*Neotoma cinerea)*);
- Diminished reproductive success for nesting pairs;
- Diminished population due to declines in productivity and recruitment; and
- Reduction of future nesting opportunities.

Habitat Effects-SFC

Given the above concerns, the loss of 12.9 acres of habitat containing 9 trees with murrelet nesting structure is likely to adversely affect murrelets. The remaining 34 trees identified with nesting structure within the project footprint are incorporated into protective buffers and will be retained, thereby minimizing the impacts from the loss of habitat.

Combined Effects Relative to the Recovery Plan Guidance for the Murrelet

Protect Terrestrial Habitat Essential for Murrelet Recovery (Task 2.1)

This project is not within murrelet critical habitat.

Maintain occupied Nesting Habitat (Task 3.1.1.1) and Buffer Habitat (Task 3.1.1.3)

Habitat loss of 12.9 acres including 9 trees with nesting structure will occur. Impacts have been significantly reduced due to 34 trees identified with nesting structure within the draft project footprint were incorporated into protective buffers in the final proposed project. Specifically the protective buffers are short segments of the levee running parallel to the flood flow path which will help maintain this stand as trees growing on the levee are high quality murrelet nesting trees. Additionally the remaining post-project stand size will remain about 91 percent intact with an expected increase in habitat in the future. Over time, with marsh plain accretion via sediment accumulation, there will be an expected increase in net areas of Sitka spruce forested wetland (59 acres to 86 acres), high marsh tidal wetland, and low marsh tidal wetland on county owned lands (Table 3).

Adjacent stands are not being modified. Therefore work will not remove buffer habitat adjacent to murrelet habitat.

Minimize Nest Disturbance to Increase Reproduction Success (Task 3.1.3)

Disruption has been minimized to 1 year and will not occur during the crepuscular periods from April 1 to June 15.

Combined Effects to the Murrelet Population

Effects from loss of habitat are limited to removal of 12.9 acres, with 9 individual trees containing nesting structure, from a 160 acre stand that will have some nesting structure maintained. This impact may cause the loss of reproduction from a murrelet pair until a new nest site can be established, but as nesting structure will be maintained within the stand we are not reasonably sure this will occur. We are also concerned with increased berry growth that may occur from creating an opening adjacent to the remaining stand, but berry growth is not expected to change significantly because one side of the levee is already exposed to excess sunlight due to the river it is holding back. Therefore, changes in berry growth are expected to be minor and not impact the level of corvids utilizing the action area.

Effects from harassment are limited to the disruption of breeding murrelets within the 160 acre stand during two breeding seasons. However, post-construction actions in the second breeding season are not reasonably certain to occur. Generally, harassment is expected to stress breeding murrelets and result in a reduced fitness of the young.

Murrelet adults are expected to survive the proposed adverse effect events associated with this proposed project. It is the potential loss of a murrelet egg or chick and growth of the population that is of concern for recovery.

The latest estimate comparing the murrelet population to the amount of suitable habitat inland shows a strong correlation with an average of 186 acres of nesting habitat per murrelet (Huff et al. 2006, page 141). The sex ratio is believed to be equal for murrelets. Juvenile murrelets are estimated to be 8 percent of the population (McShane et al. 2004, p3-45). Efforts to determine the proportion of adults breeding have resulted in estimates of 31 to 95 percent, potentially varying based on food availability (McShane et al. 2004, pp 3-39 and 40). Therefore, the assumption that murrelets occur inland at a density of 372 acres (2 x 186) per pair would be a conservative assessment for the species as this number does not factor out the non-breeding murrelets. It also must be noted that although the Service is estimating the potential for murrelets, murrelets are not territorial (spacing nesting areas out – a repelling factor) nor are they documented as colonial (seeking out nest sites based on the location of others nest site – an attracting factor[5]). Therefore, the Service estimates that one to zero murrelet pair is nesting within the action area, as the area is smaller than 372 acres of habitat.

A conservative estimate is that 35 percent of murrelets that attempt to nest successfully fledge a young (McShane et al. 2004, page 3-3). Assuming murrelet pairs miss reproducing in two breeding seasons due to disruption or from locating a new nesting location, we would expect the loss of one young associated with disturbance from the proposed action (2 breeding attempts x 0.35 fledging rate = 0.7 chicks fledged). Only a small percentage of the murrelets that fledge make it to the age of reproduction, estimated at 2-5 years of age (McShane et al. 2004, page 3-1). A juvenile survival rate is not available for murrelets, although other bird (class Aves) studies have used 71 percent of adult survival (McShane et al. 2004, page 3-5). Annual adult survival is estimated at 83 to 93 percent (McShane et al. 2004, page 3-4). A conservative value would be 66 percent survival for a fledgling to survive until age two when they would be expected to breed (0.71 x 0.93=0.66).

Although the reproduction potential of every murrelet is important for the species, the fact that the exact location of nesting murrelets are usually not known (we are assuming occupancy as a worst case scenario), and the low reproduction success of murrelets, the proposed impacts are likely to be less than the potential loss of one fledgling or one breeding murrelet into the murrelet population.

The current population in this conservation zone is estimated at 8,840 murrelets and above the 15 year average for the third year in a row (CCR 2015, page 2). The loss of one adult into this population may impact the population by 0.01 percent. At the range wide scale, the loss of one adult may impact the population by less than 0.01 percent (19,617 murrelets range wide).

The loss of murrelet reproduction for one breeding season at this site, while an adverse effect, will not appreciably reduce the likelihood of survival and recovery at the conservation zone or range wide scales.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The BA states that surrounding lands are in agriculture and within 0.5 miles of an urban area associated with the City of Tillamook. The murrelet habitat identified within the action area is non-federal lands and associated with the prosed project. The SFC, while fairly large in nature, does not have future phases or additional actions for which there would be cumulative effects.

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[5] It is to be noted that Nelson and Wilson (2002, page 107) calculated murrelet nesting densities of 0.1 to 3.0 nests per hectare (or 1 nest per 24.21 to 0.83 acres). Murrelets in the study were nesting in patches of suitable habitat, and the density of nests at the stand scale is likely lower (Nelson and Wilson 2002, page 107). In general nests are spaced far apart (Nelson and Wilson 2002, page 107).

The adjacent parcel outside of the immediate project area is privately owned, and Tillamook County has a construction easement with them to remove their levee, but no long term protection agreement.

This adjacent private property is zoned SFW-20 which means that there can be no commercial or residential development. It could be logged but Oregon Department of Forestry rules for Sitka spruce wetland are very limiting and it would be unlikely to be worth the effort.

Conclusion

After reviewing the current status of the murrelet, the environmental baseline for the action area, the effects of the proposed action on the murrelet, and the cumulative effects, it is the Service's biological opinion that the proposed project is not likely to jeopardize the continued existence of the murrelet.

Combined with no expected cumulative effects, we believe the conservation needs of the murrelet will continue to be met at the action area, provincial, and range-wide scales because significant minimization measures have been included in the proposed action and will only impact nine nesting trees outside the breeding season and cause disruption to the remaining nesting habitat during one breeding season. The expected impact to the population is the potential loss of one year of reproduction (maximum loss of one murrelet) from breeding that maybe disrupted. Additionally, the project will not occur within murrelet habitat reserves; habitat, including some of the best nesting trees, will be maintained in about 91 percent of the stand. In addition, impacts from fragmentation are expected to be minimal as habitat removed is from existing openings; and no buffer habitat is being removed.

Combined with no expected cumulative effects, we believe the proposed project will not appreciably reduce the likelihood of survival or recovery for the murrelet population, as the impacts to murrelet demography are expected to be small. Therefore, the Service believes this project will not appreciably diminish survival or recovery of the murrelet population.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the Act, take that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by all partners so that they become binding conditions of any grant or permit issued to any applicant, as appropriate, for the exemption in section 7(o)(2) to apply. All partners have a continuing duty to regulate the activities covered by this Incidental Take Statement. If partners: (1) fails to assume and implement the terms and conditions, or (2) fails to require cooperators to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, partners must report the progress of the action and its impact on the species to the Service as specified in this Incidental Take Statement. [50 CFR §402.14(i)(3)]

Amount or Extent of Take

For the reasons set forth above under the "Effects of the Action" section of this document the Service anticipates that the proposed project is likely to cause the incidental take of one pair of murrelets. This pair will either have their nest tree removed (from a maximum of nine trees) or be subjected to noise and visual harassment during one breeding season from restoring 526 acres of estuarine habitat, including the removal of 12.9 acres of a Sitka spruce forest matrix. Harm and harassment is expected to affect reproduction and interfere with the fledging of one murrelet.

Reasonable and Prudent Measures

The design of the proposed action was refined and the nature of the actions covered under this consultation minimize the incidental take of murrelets. Based on the proposed project, and working with SFC partners, the Service believes that incidental take of murrelets has been minimized to the maximum extent possible.

Additionally, the proposed project includes post construction monitoring. The Service will recieve the post project monitoring report (2 years post project) from Brophy and Van der Wettering and a post project As Built survey from the engineering firm (estimated due date of October 2017). There will also be a flood survey report, which will be triggered by a hydrologic event rather than by a particular date.

Terms and Conditions

Not applicable because the effects of take have been minimized and because a monitoring plan is already part of the proposed action.

If a dead, injured, or sick endangered or threatened species specimen is located, initial notification must be made to the nearest Service Law Enforcement Office, located at 9025 SW Hillman Court, Suite 3134, Wilsonville, Oregon 97070; phone: 503-682-6131. Care should be taken in handling sick or injured specimens to ensure effective treatment or the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered and threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by implementing conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities designed to minimize or avoid adverse effects of a proposed action on listed species or designated critical habitat, to assist in the implementation of recovery plans or to obtain information.

The Service believes the following conservation recommendation will reduce the impact of the proposed action on murrelets within the action area:

1. Due to pre-project collaborations with FWS no additional conservation recommendations are needed.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or benefit listed species or their habitats, the Service requests notification regarding the implementation of any conservation recommendation.

Reinitiation Notice

This concludes formal consultation on the actions outlined in your Biological Assessment. As provided in (50 CFR § 402.16), reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agencies' action that may affect listed species or critical habitat in a manner or to an extent not considered in this BO; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this BO; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation of formal consultation.

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