



**Valsetz Water Storage Concept
Analysis**

Prepared for:
**Polk County
Community Development
Dallas, Oregon**

Prepared by:
ENVIRON International Corporation

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- Appendix B – Water Quality, Water Quantity, Hydrology, and Sediment Transport
- Appendix C – Aquatic Resources/Fisheries
- Appendix D – Terrestrial Resources/Wildlife/Vegetation

Appendix E – Contaminants/Hazardous Materials/Pathogens
Appendix F – Cultural Resources

Acronyms

AFY: acre-feet per year
MDD: maximum daily demand
Mgd: million gallons per day
PDD: peak daily demand

1 Introduction

Polk and Lincoln Counties are facing increasing water demand and increasingly scarce water supplies. Both counties have been working collaboratively to explore whether a storage reservoir on the South Fork Siletz River at the site of the historic town of Valsetz could meet water demands projected for 2050 for water providers and agricultural users. This potential storage facility would be located near the coastal mountain divide. Impounded water would be diverted to the west to serve Lincoln County and to the east to serve Polk County. There also is the potential to serve the greater regional area including Benton, Marion and Yamhill County citizens. The South Fork Siletz River and the Luckiamute River would be used to convey water to withdrawal points located lower in each basin.

The purpose of this study is to conduct an appraisal level assessment of potential environmental effects and benefits of the Valsetz water storage project. The assessment focuses on three storage concept alternatives determined by dam height and reservoir storage. This analysis serves as a preliminary, concept-level review of the resources that may be affected if a project were developed. This initial investigation relies on existing information, an extremely limited amount of field data and some preliminary modeling and analysis. This is a first step in understanding potential effects in the area that would be inundated by a project and the Siletz and Luckiamute Rivers. Further investigation and technical studies will be required to definitively evaluate the magnitude and type of impacts and feasibility of project development.

1.1 Authorization

This study is funded by a Senate Bill 1069 [2008] Water Conservation, Reuse, and Storage Grant Program grant awarded by the Oregon Water Resources Commission on November 20, 2008. The grant provides funding for developing information needed to further evaluate the potential of developing a water conservation, reuse, or storage project in the South Fork Siletz Basin. The funded planning study includes collection of streamflow and environmental information; completion of hydrologic, streamflow, and water demand analyses; development of baseline environmental impacts assessments; and completion of a storage concept and alternative analysis.

1.2 Project Purpose, Need and Objectives

1.2.1 Needs and Benefits

Lincoln and Polk Counties represent fast-growing areas covering over 1,700 square miles in western Oregon. The State of Oregon's Department of Economic Analysis projects that Polk County's population will more than double by 2040. Lincoln County's population is expected to grow from over 45,000 to over 57,000 residents during the same period of time. Current water resources may impact future residential and economic growth potential in Lincoln and Polk Counties.

The Polk County water providers completed a Regional Water Needs Assessment in 2004. This report identified future supply and demands of the major water providers in the area and examined some alternatives to meet the forecasted water deficit of the County. The water demand for communities of Monmouth, Independence, Dallas, and Falls City combined, was expected to exceed the available water supply by 2020. The needs assessment estimated 2.35

million gallons per day (mgd) shortfall in 2020 during peak summer demand, which is expected to grow to 9.32 mgd in 2040.

Lincoln and Polk Counties had an updated assessment of future water demand completed in 2009 (WHPacific 2009). This report indicates the water demand for both counties combined may reach a daily average of 29.85 mgd with a peak seasonal demand of 37.36 mgd by 2050.

Realizing that water demand could exceed supply in the next decades, the Counties have been exploring options for attaining additional water supply. One of the options that has been identified is the construction of a new water storage facility. A preliminary assessment of the potential to develop a water storage facility at the location of the old Valsetz dam was completed in the 2009 Regional Water Projection (WHPacific 2009). The site was found to have sufficient water to meet the expected future demand. The site is strategically located to supply water to both Lincoln and Polk Counties. In addition to addressing the regional water supply needs, the Valsetz storage project also has the potential to benefit downstream fish populations by increasing flow and decreasing water temperature during the summer. The 2009 Regional Water Projection (WHPacific 2009) recommended the completion of studies to assess potential fatal flaws to the Valsetz reservoir concept.

1.2.2 Purpose and Objectives

The purpose of this study is to conduct an appraisal level assessment of potential environmental effects and potential benefits of the Valsetz water storage project. The assessment focuses on three storage concept alternatives determined by dam height and reservoir storage. This analysis serves as a preliminary, concept-level review of the resources that may be affected if a project were developed. This initial investigation relies on existing information, an extremely limited amount of field data and some preliminary modeling and analysis. This is a first step in understanding potential effects in the area that would be inundated by a project and the Siletz and Luckiamute Rivers. Further investigation and technical studies will be required to definitively evaluate the magnitude and type of impacts and feasibility of project development.

The assessment focuses on three storage concept alternatives:

1. Low dam Option (Storage: 14,000 Acre-feet; Water level at 1,120 ft)
2. Medium Dam Option (Storage: 70,000 Acre-feet; Water level at 1,160 ft)
3. High Dam Option (Storage: 162,000 Acre-feet; Water level at 1,200 ft)

Specific objectives of this preliminary assessment include:

- Summarize water demand forecasts
- Evaluate the ability of the alternatives to meet future water demand
- Evaluate project effects of the alternatives on hydrology and water quality
- Assess potential project effects on fish, wildlife, and wetlands
- Identify any known cultural or historic resources of significance
- Identify any known hazardous materials in the project vicinity
- Compare the potential impacts of the three alternatives
- Summarize conclusions and recommendations for future actions

1.3 Overall Approach and Methodology

The general scope and approach to the project is summarized by topic below:

Water Supply, Demand, Alternatives and Water Rights Analysis:

- Verify current and planned future water supply sources in Lincoln and Polk Counties.
- Verify water demands in Lincoln and Polk Counties, including agricultural water demand.
- Identify locations and timing of potential insufficient water availability by researching the Oregon Water Resources Department (OWRD) database which describes in-stream water demands and availability by location. Evaluate areas and times of insufficient water availability.
- Briefly review water rights at the site and examine potential issues or mitigation strategies.

Water Quality/ Quantity/ Hydrology/ Sediment Transport:

- Collect flow, water quality, and meteorological data in the South Fork Siletz.
- Evaluate potential changes to instream flows and potential effects on channel form and function (by alternative).
- Evaluate temperature of flow releases and potential impacts on receiving waters (by alternative).
- Define Siletz and Luckiamute Existing Hydrologic Conditions.
- Estimate storage capacity of each storage concept alternative.
- Evaluate in-stream flow requirements and potential project effects on instream flows.
- Estimate flow releases and temperature of flow releases for each reservoir management scheme and evaluate impacts on summer time stream temperature.

Aquatic Resources/ Fisheries:

- Document existing aquatic habitat quality and quantity based on existing data and data collected by the project during the 2010 field season.
- Document water temperature in the basin and assess potential effects of the alternatives on water temperature and subsequent effects on aquatic resources.
- Document instream flow requirements and assess potential effects of the alternatives on instream flows.
- Identify likely passage needs and requirements.
- Evaluate potential effects from inter-basin transfer of pathogens, disease, and exotic organisms.
- Discuss the potential fishery that would be created under the alternatives.

Terrestrial Resources/ Wildlife/ Vegetation:

- Identify and map terrestrial habitat types and distribution in the project area, focusing on areas potentially affected by the alternatives.

- Map known wetlands relying on existing information and identify potential wetland impacts and mitigation requirements for each of the alternatives.
- Identify general habitat requirements and known distribution of listed species, sensitive species, and potentially culturally important species susceptible.
- Quantify potential habitat losses and assess other potential impacts of the alternatives on listed, sensitive, and culturally important species.

Contaminants/ Hazardous Materials:

- Review existing information and summarize information on potential contaminant sources in the project area.

Cultural Resources:

- Review and summarize existing information regarding known culturally important resources.

Regulatory Requirements:

- Examine the regulatory requirements for a water storage project in the South Fork Siletz basin and evaluate regulatory risk.

The detailed analyses have been documented in a series of technical appendices including:

Appendix A – Water Supply, Demand, and Water Rights Analysis

Appendix B – Water Quality, Water Quantity, Hydrology, and Sediment Transport

Appendix C – Aquatic Resources/Fisheries

Appendix D – Terrestrial Resources/Wildlife/Vegetation

Appendix E – Contaminants/Hazardous Materials/Pathogens

Appendix F – Cultural Resources

This report summarizes the information contained in those appendices, and provides additional information regarding setting, project background, and alternatives evaluated. This document also summarizes the conclusions of the technical appendices regarding potential project effects on the various resources and provides an overall comparison of the likely effects of the three alternatives under consideration. Following the discussion of the effects of the project alternatives is a general summary of permitting requirements and brief evaluation of issues and regulatory risk.

2 Site & Watershed Conditions

2.1 Watershed History

The Valsetz site is located on the South Fork of the Siletz River in the Oregon Coast Range. Since the 1880s, the history of the Siletz Basin has been strongly associated with Oregon's timber industry. Four companies including Cobbs and Mitchell, Valsetz Timber, Boise Cascade, and, currently, Forest Capital have managed timber operations at the Valsetz site. The Cobbs and Mitchell Timber Company established the town of Valsetz in 1922. Valsetz had a lumber mill, a log pond known as Valsetz Lake, a residential area that was home to over 1,000 mill workers and their families, and a small commercial district. Cobbs and Mitchell operations

extended beyond the town, and included a series of logging camps that were constructed along the railroad. Cobbs and Mitchell operations were later replaced by the Valsetz Lumber Company and the Boise Cascade Veneer Mill. In 1984, Boise Cascade closed the Valsetz mill. After the mill closed and residents moved out of town, the buildings and structures in Valsetz were destroyed. Valsetz Lake was drained in 1988. Today, the logging roads and timber at the site are privately owned and managed by Forest Capital. Forest Capital controls access to the site. Recreational use of the site is by permission only from the current landowner.

2.2 Watershed Characterization

The South Fork of the Siletz River (SF Siletz) is located in Polk County, Oregon on the crest of the Oregon Coast Range. The proposed dam would be located in Township 8S, Range 8W, Section 34, Willamette Meridian (Latitude 44° 50' 00"N, Longitude 123° 39' 20"W).

The basin joins the North Fork of the Siletz River (NF Siletz) at river mile 68.5 and drains west to the Pacific Ocean near Kernville, Oregon. The South Fork Siletz River basin encompasses 17,189 acres. The mainstem of the SF Siletz is approximately 13 miles in length. Major tributaries include Rogers, Handy, Fanno, Sand, and Beaver Creeks. Total relief in the SF Siletz basin is about 2,650 feet, ranging in elevation from 700 feet at the confluence with the NF Siletz to 3,333 feet at the top of Fanno Peak.

Bedrock in the region represents a complex geologic history of tectonic uplift, deformation, erosion, and volcanic activities associated with tectonic convergence between the North American continental margin and the subducting rocks of the oceanic plate. These large-scale crustal processes produced a heterogeneous collection of rock types within the basin. The geologic formations exposed in the watershed are, from oldest to youngest: 1) Siletz River Volcanics composed of basalt flows, pillow basalt, basalt breccias, and minor amount of tuffaceous sedimentary rocks; (2) Tyee Formation composed of rhythmically bedded sandstone and siltstone deposited in a marine environment, (3) Yamhill Formation which is another marine sedimentary formation that intruded into the older rocks in the area and (5) Pleistocene and Recent alluvial deposits consisting of floodplain deposits (Baldwin 1964). Upstream of the former Valsetz dam, geology is predominately composed of the Tyee Formation with alluvial deposits within the footprint of the old lakebed. Downstream of the former dam, geology is predominately composed of Siletz River Volcanics.

The USDA Soil Conservation Service has published a soils map of Polk County, which includes the SF Siletz (USDA 1982). The major soil types in the basin include the Astoria silt loam, Bohannon gravelly loam, Brenner silt loam, Kilchis-Klickitat complex, and the Valsetz-Yellowstone complex. Soils in the upper basin are dominated by Astoria silt loam and Bohannon gravelly loam developed on the sandstone/siltstone of the uplands. These are moderate to deep soils. The Brenner silt loam has developed on alluvial deposits in the float lowlands along major streams. The Brenner alluvial soils are deep and generally poor drainage. Soils in the lower basin include the Kilchis stony loam, Klickitat gravelly clay loam, Valsetz stony loam, and Yellowstone stony loam. These soils formed over basalts and are generally coarse-grained.

Climate in the basin is strongly influenced by the maritime setting. Warm Pacific air masses produce warmer and wetter weather than is found further inland at similar elevations. The maritime climate limits the development of a deep persistent snowpack favoring a transient

snowpack which builds and melts through the course of the winter. The mean annual precipitation recorded from 1948 to 1983 at the Valsetz gage is 129 inches and occurs mainly as rain (Boise Cascade 1995). The watershed average is 120 inches per year and the maximum average January temperature is approximately 40 to 45°F.

2.3 Current and Future Water Demand

Current and future water demands are estimated through a) a review of existing information and b) through the development of updated population projections and calculation of expected demand. Details regarding the assessment are provided in Appendix A. Current average daily water demand for public water supply for domestic, commercial, and municipal uses in Polk and Lincoln Counties is estimated at 14.82 million gallons per day (mgd) (Table 1). This excludes the water demand for agriculture and also excludes West Salem, although that community water is provided by the City of Salem. Current peak daily demand and maximum daily demand are estimated at 18.53 mgd and 29.64 mgd, respectively. By the year 2050, average daily demand is estimated at 28.35 mgd and peak and maximum daily demand are estimated at 35.44 and 56.70 mgd, respectively.

Area	2005	2010	2020	2030	2040	2050
Lincoln County	6.71	6.94	7.45	7.94	8.47	9.05
Polk County	8.11	9.0	11.8	14.6	16.8	19.3
Total	14.82	15.94	19.25	22.54	25.27	28.35
PDD	18.53	19.93	24.06	28.18	31.59	35.44
MDD	29.64	31.88	38.50	45.08	50.54	56.70

Source: Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344, 52 p.

Estimated average daily demand for 2050 is distributed over twelve months to estimate monthly demand (Table 1). The allocation by month is based on several local sources of information (Appendix A). Average monthly water demand is highest in July and August, when it peaks at over 45 mgd..

Month	MGD
January	22.73
February	20.25
March	21.44
April	25.31
May	25.21
June	26.88
July	46.21
August	49.17
September	26.28
October	27.24

November	23.85
December	24.50
Average Daily Demand (ADD)	28.35

In addition to water use for domestic, commercial, and municipal purposes, it is likely that the Valsetz project may also enhance supplies for agricultural water use. Agricultural demand is difficult to predict as the water demand may change (increase or decrease) over time as demands for agricultural products increase and/or demands for water per acre of irrigated land change to reflect changes in crops. WHPacific (2009) reported the total irrigated acreage for Polk and Lincoln Counties at 21,889 based on a study completed for Oregon Water Resources Department in 2008. Total water needs for irrigated agriculture can be assumed to be 48,970 acre feet per year by the year 2050 (WHPacific 2009), up from the current estimates of 45,000 Acre-feet per year (AFY) (Appendix A).

2.4 Water Storage Needs

Potential water deficits are anticipated in Polk County and potentially in Lincoln County. Although total water demand for Lincoln County may not exceed total water availability, water right holders are not necessarily capable nor willing to transfer water from one place to another. Therefore, water available to some suppliers may not be available to meet shortfalls in other locations. The review of previous work, current conditions, and future plans suggests that the anticipated regional demand exceeds supply for domestic, commercial, municipal, and industrial (DCMI) water, with an estimated 38 mgd of supply currently available, and a peak to maximum daily demand of between 35 mgd and 57 mgd forecasted by 2050 (see table 1). This does not include agricultural or aquaculture needs.

For Polk County, the analysis completed in 2005 suggests that seven of twelve regional providers will not be able to supply their constituents by 2020. The analysis is supported by the updated research contained in this report. For Polk County, the 2005 report likely underestimated future demand since population growth is currently outpacing projections despite the global economic slowdown that began in 2008. The estimates presented in the 2005 report suggest that the sum of peak demand deficits in all districts is between 12.8 and 15.8 mgd by the year 2040. This deficit estimate assumes that districts with surplus water do not transfer their water to districts with water shortages. The deficit is likely to increase by the year 2050. As future water supplies become more uncertain, municipalities may become less willing to transfer water rights to other municipalities.

In Lincoln County, the analysis completed in 2008 suggests that four of ten regional providers will not be able to supply their constituents by 2020 during the peak months. The analysis is supported by the updated research contained in this report. For Lincoln County, the 2008 report appears to slightly overestimate future demand since population growth is currently less than some projections had expected. The estimates presented in the 2008 report suggest a total deficit of 10.4 mgd by the year 2050. Although this may overestimate the deficit for Lincoln County, the estimate for Polk County is likely an underestimate. Using the larger expected deficit for Polk County (15.8 MGD), and adding the expected deficit for Lincoln County (10.4 MGD), the total deficit for the two-county region is expected to be 26.2 mgd by 2050.

For the purpose of developing a range of demand scenarios, the deficits described above for DCMI water use in the year 2050 are assumed to occur during the months of July and August. However, population growth can vary considerably from the expected growth over the course of 40 years. Additionally, there is uncertainty regarding water rights and capacity, as well as the variability of water use from year to year, and from day to day during the peak months. A range of DCMI water use estimates was developed for the year 2050 that brackets the estimated 26.2 mgd deficit described above. The bracketed estimates essentially define a plus, or minus 25% range for the expected deficit and timing (see Table 3). The maximum scenario also assumes there will be smaller deficits in late June and early September than in July and August. The minimum use scenario assumes a 25% reduction in the anticipated deficit in July and August – reduced from 26.2 mgd to 19.6.

Table 3. Estimated Average Monthly Water DCMI Deficits to be Supplied by the Project.

Month	Average need (MGD)	Min need (MGD)	Max need (MGD)
Jan	0	0	0
Feb	0	0	0
Mar	0	0	0
Apr	0	0	2.5
May	0	0	2.5
Jun 1-15	0	0	8
Jun 16-30	13.1	0	8
Jul 1-15	26.2	19.6	32.75
Jul 16-31	26.2	19.6	32.75
Aug	26.2	19.6	32.75
Sep 1-15	13.1	0	8
Sep 16-30	0	0	8
Oct 1-15	0	0	8
Oct16-31	0	0	8
Nov	0	0	2.5
Dec	0	0	2.5

3 Description of Alternatives Used in Analyses

The potential storage site is located near the coastal mountain divide in the Valsetz basin. The Valsetz basin is located in Township 8S, Range 8W, Section 34, Willamette Meridian (Latitude 44° 50' 00"N, Longitude 123° 39' 20"W). Impounded water would be diverted in both directions serving the Lincoln County citizens on the west side and Polk County citizens on the east side. There also is the potential to serve the greater regional area including Benton, Marion and Yamhill County citizens. In concept, the South Fork of the Siletz River and Luckiamute Rivers, respectively, would convey water to withdrawal points lower in their respective basins.

The location of the proposed dam was selected based on the site topography, field inspection and the available geologic information. The Geologic Map of Oregon (USGS, 1991) indicates the soil characteristic of the potential dam location is classified as instructive rock (Tt), which is suitable as dam foundation. There are no fault lines known to pass through or near the proposed dam site area (www.oregon.gov/DOGAMI). The dam site also supported a rock and wood dam at approximately the same location from 1920 to 1988.

Three alternative sizes for the dam were evaluated. These include:

- Low dam Option (Storage: 14,000 Acre-feet; Water level at 1,120 ft)
- Medium Dam Option (Storage: 70,000 Acre-feet; Water level at 1,160 ft)
- High Dam Option (Storage: 162,000 Acre-feet; Water level at 1,200 ft)

In addition, potential pipeline routes were evaluated. The location of the proposed dam, the location of the former Lake Valsetz and the reservoir perimeter of the three alternatives are depicted on Figure 1.

4 Environmental Review

An assessment of the existing conditions and potential environmental impacts of the proposed project alternatives was completed. The assessments drew upon existing information and on data collected in the basin in 2010. Detailed documentation of methods used to collect data and complete the assessment, description of the existing environment, and assessment of potential project effects of the three alternatives is provided in the following appendices:

Appendix A – Water Supply, Demand, and Water Rights Analysis

Appendix B – Water Quality, Water Quantity, Hydrology, and Sediment Transport

Appendix C – Aquatic Resources/Fisheries

Appendix D – Terrestrial Resources/Wildlife/Vegetation

Appendix E – Contaminants/Hazardous Materials/Pathogens

Appendix F – Cultural Resources

This section provides a summary of the methods and environmental review information contained in Appendices B through F. Water Supply, Demand and Water Rights (Appendix A) is summarized above under Section 3 (Site and Watershed Conditions). Subsection 4.1 addresses approach and methodology and Subsection 4.2 summarizes existing environmental conditions.

Section 5 (Alternatives Comparison) is a summary of the potential impacts with a comparison across the three alternatives examined. In Section 6 (Federal State and Local Regulatory Requirements), the likely regulatory requirements for the project are summarized and a brief discussion regarding significant issues and regulatory risk is presented. Section 7 is the Summary and Conclusions of the report.

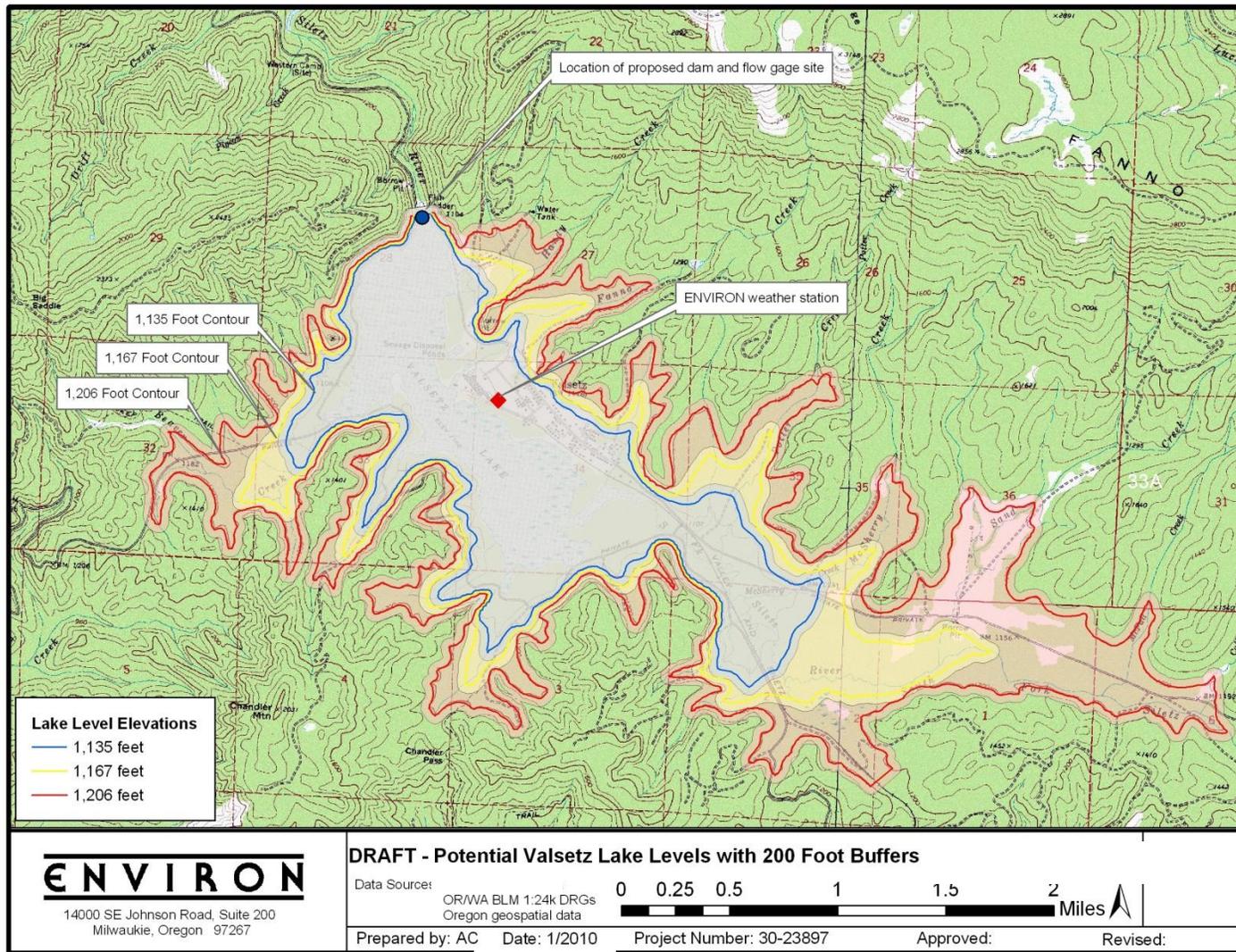


Figure 1. Depiction of the boundaries of the three alternatives considered in this document.

4.1 Approach & Methodology

4.1.1 Water Quality, Water Quantity, Hydrology, and Sediment Transport

A brief summary of the methods used to assess potential project impacts on water resources, including field data collection and modeling, is provided below. Additional detail regarding methods used can be found in Appendix D.

4.1.1.1 Data and Information Collection

Data and information related to water quality, quantity and sediment are from existing and publicly available data and limited field data collection. Prior to completing data collection efforts in the South Fork Siletz River in 2010, there were no continuous flow records upstream of the confluence with the North Fork Siletz River. Only a few miscellaneous data were available on streamflow. A pressure transducer (to record water depth) was installed at the road crossing located about 350 feet downstream of the proposed dam (

Figure 2). Flow was recorded from December 2, 2009 through December 13, 2010. Flow measurements were taken to develop a rating curve for the transducer measurements (stream flow as it is related to depth). Additionally, flow measurements were taken in the North Fork Siletz River near the confluence with the Siletz River and in the South Fork Siletz River, near the confluence with the North Fork. These measurements were used to help estimate the amount of flow in the North Fork relative to the South Fork Siletz River.

A meteorological station was installed near the former town of Valsetz on December 9, 2009. This station recorded air pressure, dew point, humidity, wind speed, wind direction, barometric pressure, and rainfall through November 12, 2010. Meteorological data for the period from March 20 to May 25, 2010 was lost due to an equipment malfunction.

A continuous temperature recorder was deployed on February 18, 2010 adjacent to the pressure transducer and the recorder was removed on November 12, 2010. Continuous temperature recorders were also deployed at the proposed dam site and in the North Fork Siletz River on February 18, 2010. These two recorders were lost in a storm event; therefore the data available at these two sites stops on July 9, 2010. In addition, spot measurements of dissolved oxygen and temperature were recorded when crews were in the field.

The proposed project would divert water into the Luckiamute River. Several potential discharge points have been identified. The scope of the study conducted did not address the effects of increased flow on fish habitats downstream of the discharge points. This is an issue that should be addressed in the future. At the discharge points that were accessible (some were behind locked gates with no landowner permission to cross), cross-section and pebble count data was collected to support the analysis of the potential for downcutting in the Luckiamute River.

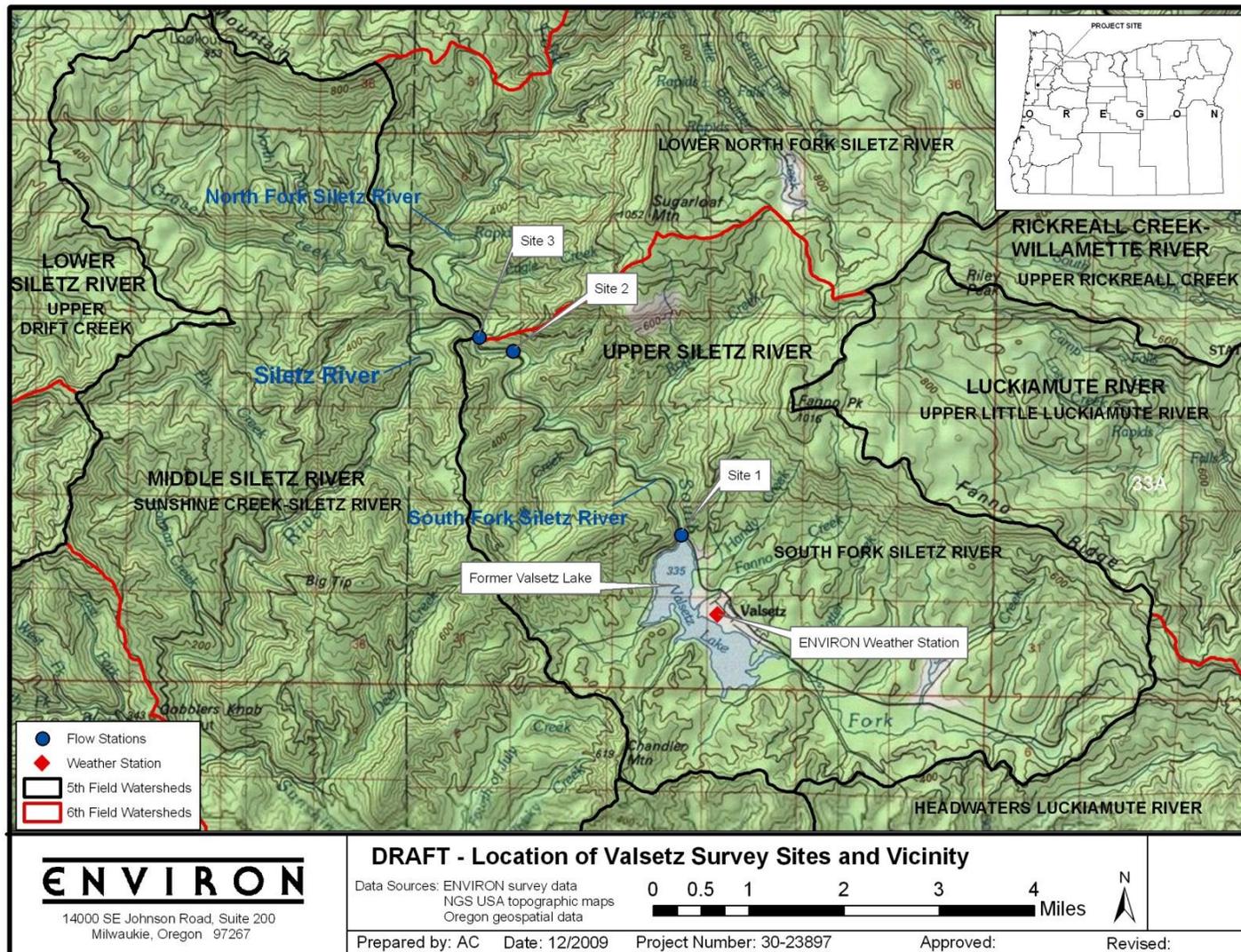


Figure 2. Location of weather station, gage site (Site 1) and sites where continuous temperature was recorded (Sites 1, 2, and 3).

4.1.1.2 Modeling

Flood peak discharges for the South Fork of Siletz River at the proposed reservoir site and the North Fork of Siletz River at the confluence were estimated using the USGS regression equation for ungaged watersheds in Oregon Region 1 (Coastal Watersheds) (Table 10 of the USGS publication). The flows at the South Fork Siletz at Valsetz were obtained by correlating the USGS gage flows on Siletz with the flow measurements on the South Fork at Siletz during 2009-2010. The flows at the North Fork Siletz River (at the confluence) were obtained by correlating the USGS gage flows on Siletz with the flow measurements on the North Fork during 2009 and 2010.

The measured and estimated flows and recorded stream temperature were used as input to two hydraulic models that were employed to simulate hydraulics and temperature for Valsetz reservoirs and for Siletz River, extending from the dam to the existing USGS gage, roughly 50 km downstream. A key input in these hydraulic models is the range of forecasted monthly water supply to be provided by the Project, as provided in Table 3. As noted above, there is significant uncertainty regarding the regional water supply deficit in 2050 as well as the proportion of this deficit that will be met through the Project. Modeling results are based on the assumption that all forecasted deficits will be met through the Project. To the extent that actual municipal water demand from the Project varies from this projection, the effects on hydraulics and temperature would also vary.

The hydrodynamics and temperature of the Siletz reservoir and the existing Siletz River above the reservoir were simulated using the CEQUAL-W2 model, Version 3.6 (Cole and Wells 2008, Wells 2010). This model is two-dimensional, (distributed in elevation, but laterally homogenous) hydrodynamic and water quality model. It is well suited for long and narrow water bodies, such as lakes, rivers, estuaries, or combination there-of. The model was developed by the US Army Corps of Engineers- Waterways Experiment Station, and Portland State University.

The hydrodynamics and temperature in the Siletz River (50-km reach) downstream of the reservoir were simulated using the US EPA QUAL-2K model (Chapra et al. 2008). The QUAL-2K is a 1-dimensional (vertically and laterally mixed) stream water quality model that simulates steady-state flows while the heat budget and temperature are simulated as a function of meteorological data. The one-dimensional channel model for Siletz River is appropriate, as that river is on average a shallow stream. The outlet for the reservoir is assumed to draw water from the lower portion of the reservoir.

The CEQUAL-W2/QUAL2K model simulations were conducted for the following conditions:

- Existing Conditions on Siletz River (no reservoir)
- Small reservoir (Storage: 14,000 Acre-feet; Water level at 1,120 ft)
- Medium reservoir (Storage: 70,000 Acre-feet; Water level at 1,160 ft)
- Large reservoir (Storage: 162,000 Acre-feet; Water level at 1,200 ft)

The United States Geological Survey (USGS) publication Estimation of Peak Discharges for Rural Unregulated Streams in Western Oregon (USGS, 2005) was used to estimate flood peaks at six diversion locations in the Luckiamute River watershed. Estimates of channel erosion and erosion potential at the proposed diversion sites were developed using one-dimensional hydraulic and sediment transport model HEC-RAS (Version 4.0).

The *hydraulic mode* of the model HEC-RAS (Version 4.0) was used to obtain flow velocities, hydraulic depth, top flow width, and bottom shear stress, based on the channel geometry at diversion locations DP4, DP5, and DP6, channel flows, and channel and floodplain roughness. These values were then used to estimate sediments that move at certain velocities and bottom shear stress.

The *sediment transport capacity mode* of the model HEC-RAS (Version 4.0) was used to estimate the sediment capacity at targeted reaches of the Luckiamute tributaries. The sediment transport capacity was calculated using the Engelund-Hansen sediment transport function (Vanoni, 2006).

Further details regarding the approach used for the hydrologic assessment are provided in Appendix B.

4.1.2 Aquatic Resources

A brief summary of the methods used to assess potential project impacts on aquatic resources, with a focus on fisheries, is provided below. Appendix C provides an expanded description and detail of the methods used for data collection are provided in the Aquatic Resources/ Fisheries Study Plan for the Valsetz Water Storage Instream Habitat Assessment (ENVIRON 2010).

ODFW collected data in the South Fork Siletz in 1994 using the ODFW protocols for stream habitat surveys (Moore et al 2006). This data was collected six years after the old Valsetz Dam was removed in 1988. The ODFW data covered the entire South Fork Siletz and its tributaries. At the time the ODFW data was collected, the South Fork Siletz River had not re-established a stable channel through the old lake bed. We assumed that the ODFW data may not be representative of current conditions within the footprint of the old lake bed because substantial changes in channel morphology and overall habitat quality could have developed between 1994 and 2010. Therefore, re-sampling of the habitat conditions within the reach formerly occupied by Lake Valsetz was identified as a priority data collection effort. Habitat data were collected in this reach using the ODFW protocols (Moore et al 2006) to maximize comparability of the datasets. This information is used as a preliminary estimate of effects of the proposed reservoir alternatives on the habitats within this reach. Data were also collected in the lower reaches of the major tributaries where they cross the old lakebed. Habitat within those tributary reaches also could have changed significantly since 1994. Although the intent of the sampling program was to sample the entire length of the old lakebed, only portions of the habitat were assessed due to dangerously high accumulations of soft sediment in the stream. Data reported herein are extrapolated from the portion of the lakebed reach that could be accessed safely.

Downstream of the former dam site, habitat was not expected to have changed significantly since ODFW collected their data in 1994. Two reaches were randomly selected within the reach that extends from the former dam site downstream to the confluence with the North Fork Siletz River. Within these reaches, habitat data was collected following the ODFW protocols (Moore et al 2006). These data were used to characterize the typical habitat conditions available downstream of the proposed dam site.

Since the ODFW data were collected (and for several decades prior to the collection of that data), the timberlands along the major tributaries of the South Fork Siletz River have been managed under Oregon's Forest Practices Rules (<http://www.oregon.gov/ODF/lawsrules.shtml>)

which have restricted harvesting in riparian areas for almost 40 years. We therefore assumed that the data collected by ODFW in 1994 was likely reasonably representative of the habitat in the tributaries.

The aquatic habitat data collected during the field season in 2010 was used to estimate the volume of pool habitat and the amount of spawning area in the reach previously occupied by Lake Valsetz. This area contains deep sediment deposits that could be dangerous to work in. Crews were able to collect data in a limited area within the footprint of the old reservoir; which also contained substantial deposits of fine sediment. The data collected were assumed representative of the habitat within the reach, although the reach that could not be sampled is known to contain greater quantities of fine sediment. The data collected in 2010 were also used to characterize existing riparian conditions and instream woody debris abundance.

The data collected downstream of the proposed dam were assessed and compared to data collected in earlier studies (ODFW 2004) to evaluate how the habitat has changed in the reach over time.

The previous data collected by ODFW (2004) were used to characterize habitat in the tributaries to the proposed reservoir, upstream of the footprint of the former Lake Valsetz. Population estimates for all the reaches sampled were developed using snorkeling data collected in 2010.

The quantity of fish habitat that would be inundated by the proposed alternatives was estimated by overlaying the extent of the reservoirs on the habitat information. The quantity of habitat impacted was broken down into pools and spawning areas within the tributaries so that the quantity and quality of habitat remaining upstream of the proposed dam could be estimated.

The assessment of effects of the proposed project on habitats downstream of the reservoir focuses on temperature effects. The outputs of the hydrologic modeling was used in conjunction with the existing literature on temperature preferences and tolerances of steelhead and Chinook salmon to estimate the likely impacts to fish spawning and rearing downstream of the dam.

Key sources of information include the prior ODFW data on habitat (ODFW 2005) and the data collected by this project in 2010.

4.1.3 Terrestrial Resources

A brief summary of the methods used to assess potential project impacts on terrestrial resources, including wetlands, wildlife, and endangered species, is provided below. Additional detail regarding methods used can be found in Appendix D.

4.1.3.1 Wetlands

The distribution of wetland habitats is based on data from Oregon Wetlands Explorer for wetlands (Oregon Wetlands Geodatabase 2009) verified with a limited reconnaissance level site visit. This database was used to identify moderately extensive palustrine forested (PFO) and scattered scrub-shrub (PSS), emergent (PEM) and excavated (PUBH) wetlands in the project area. The database is likely an incomplete record of the wetlands in the project area.

In addition, the Natural Resources Conservation Service soils map (NRCS 2010) was used to identify hydric soils in the project area that may contain wetlands. Another study was previously

completed to identify existing wetland resources and to assess the changes in the amount of wetland after the historic dam was removed (Sharp and Wilson 1992). This study provided additional insight into area wetlands and wetland plants.

Potential direct impacts to wetlands were estimated using GIS analysis of proposed pool levels associated with the different dam alternatives. Potential impacts of pipeline routes were also incorporated into the assessment.

4.1.3.2 Wildlife and Endangered Species

The assessment of wildlife focused on potential project impacts on habitat types present in the project area. The assessment relied on existing information regarding habitat types and species occupying the area.

The primary source of terrestrial habitat types used to identify existing conditions and evaluate potential impacts of the alternatives included cover or habitat typing identified by the Northwest GAP Analysis Program (USGS 2004). The gap analysis cover types are based on the National Vegetation Classification Standard.

Prior to removal of the dam, an inventory of plant and animals around the historic Valsetz Lake was conducted in 1984 and 1985 for Boise Cascade (Davis 1985). Information was gathered on likely presence of rare, threatened, or endangered animals and plants and the use of existing habitats by these biota. The data sources include the Oregon Biodiversity Information Center, Oregon Wetlands Explorer, Oregon Flora Project, USFWS Threatened and Endangered Species Program, Oregon Department of Fish and Wildlife's (ODFW) Oregon Conservation Strategy (2006), and consultations with natural resource professionals working for the ODFW, U.S. Forest Service, and Confederated Tribes of Siletz Indians. Because most of the lands within the project vicinity are privately owned, natural resource professionals with these agencies have no site-specific data.

Potential direct impacts to riparian habitats and other upland terrestrial habitats were assessed using GIS analysis of proposed pool levels associated with the different dam alternatives. Potential impacts of pipeline routes were also incorporated into the assessment.

4.1.4 Contaminants, Pathogens, and Invasive Species

The potential that the project would inundate existing contaminated areas was addressed through queries of publicly available records available from the Oregon Department of Environmental Quality. Records were queried to ascertain if site investigations had been conducted in the project area. No interviews, meetings or telephone communications were conducted.

The potential for the transfer of invasive species or pathogens from the Siletz Basin to the Luckiamute Basin was addressed through a review of invasive species databases maintained by state and federal resources and scientific organizations.

4.1.5 Cultural Resources

Historic Research Associates, Inc. (HRA) staff conducted a review of the archaeological site and survey records on file at the Oregon SHPO and searched the SHPO's Oregon Historic Sites Database on January 27, 2011. The search area included the project area and a distance of

approximately two miles around the general area. No formal consultation and no site surveys were conducted.

4.2 Existing Environmental Conditions

The following sections describe the pre-project existing conditions for hydrology, water quality, aquatic resources, terrestrial resources (including wetlands and endangered species), and cultural resources. Greater detail regarding existing conditions can be found in Appendices B through E.

4.2.1 Hydrology & Water Quality

4.2.1.1 Hydrology

As is typical of western Oregon, flows at the proposed dam site were highest in November through January and lowest in July through mid-October (Figure 3). The peak flow recorded between December 2, 2009 and December 13, 2010 occurred on December 13, 2010 and damaged the transducer. The peak recorded flow on that day was 722 cubic feet per second (cfs). Stream flow at the USGS gage in the lower South Fork Siletz River was roughly an order of magnitude higher. Stream flow at the USGS 14190500 gage on the Luckiamute River near Suver followed a similar pattern of peaks and lows (Figure 4), although the magnitude of flows at that gage were higher than the flows at the proposed dam site, reflecting the larger basin size above that gage.

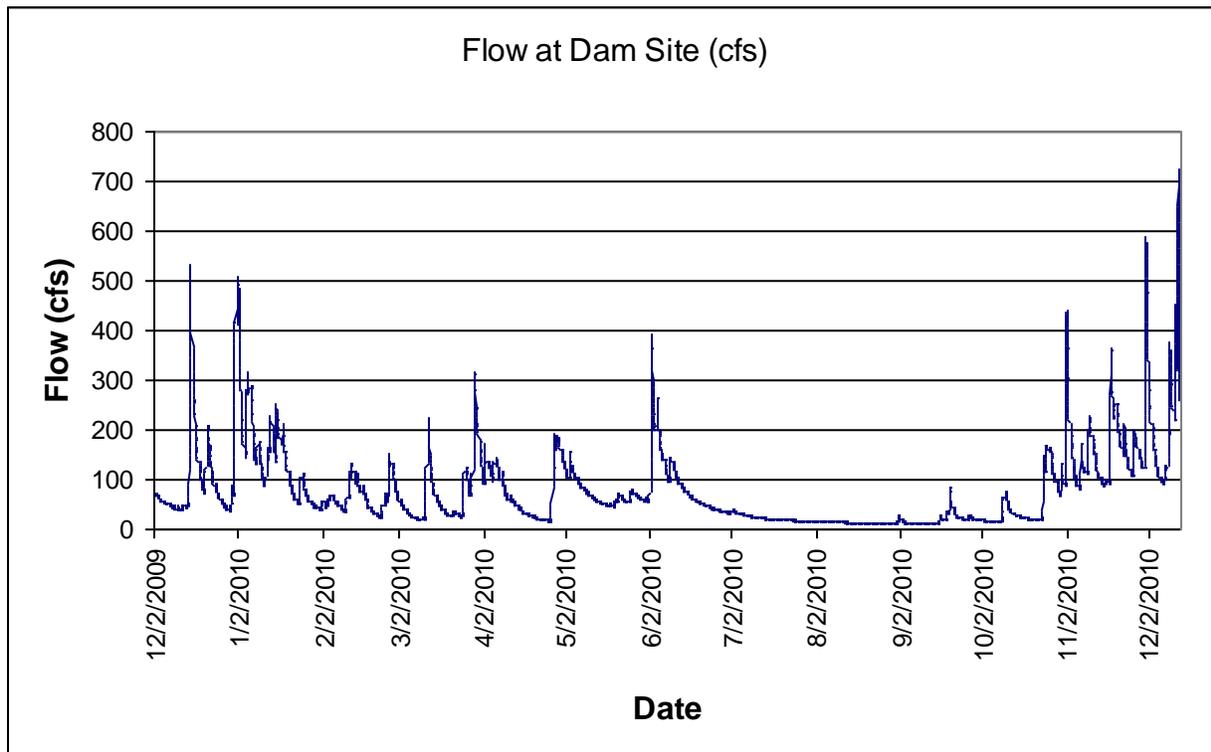


Figure 3. Flows (cfs) recorded at the proposed dam site between December 2, 2009 and December 13, 2010.

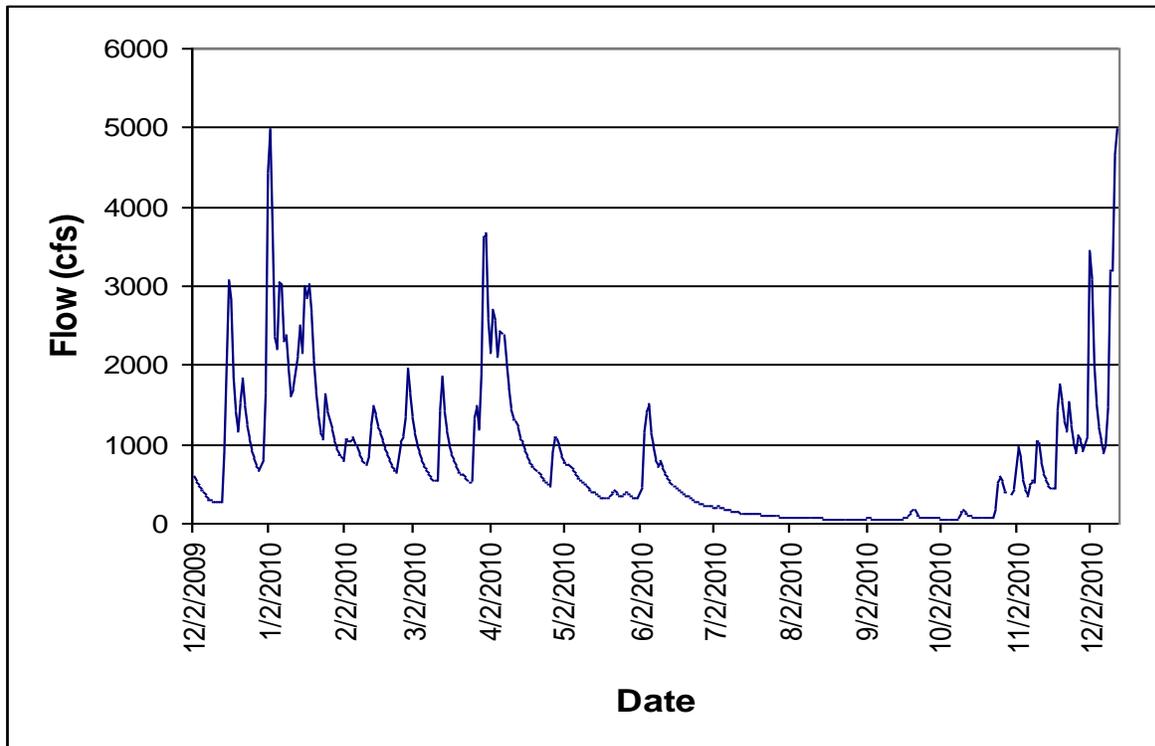


Figure 4. Stream flow (cfs) at the USGS gage 14190500 on the Luckiamute River near Suver, Oregon from December 2, 2009 through December 12, 2010.

Peak flows at the proposed dam site range from 2,167 cfs for the 2-year flood to 5,206 cfs for the 100-year flood (Table 4).

Table 4. Estimated Flood Peak Flows on Siletz and Luckiamute Rivers

River	Gage	Area (sq. miles)	Flood Peak Discharges (cfs) for Selected Return Periods (years)						
			2	5	10	25	50	100	500
Siletz River	USGS gage - Siletz (14305500)	203	19,900	26,200	30,300	35,400	39,200	43,000	51,800
	South Fork Siletz at Valsetz ⁽¹⁾	17	2,167	3,065	3,498	4,182	4,693	5,206	6,388
	North Fork Siletz at confluence ⁽¹⁾	43	5,067	7,101	8,061	9,580	10,709	11,839	14,428
Luckiamute River	USGS gage - Hoskins (14189500)	34	2,990	3,980	4,630	5,440	6,040	6,640	8,040
	USGS gage - Pedee (14190000)	116	6,390	8,710	10,300	12,500	14,200	16,000	20,400

Note: ⁽¹⁾ Values calculated using regression equation

4.2.1.2 Water Quality

The South Fork Siletz River currently meets State of Oregon water quality standards (www.deq.state.or.us). Summer daily maximum temperature is typically below 18°C, although temperatures peak up to 22°C on occasion (Figure 5).

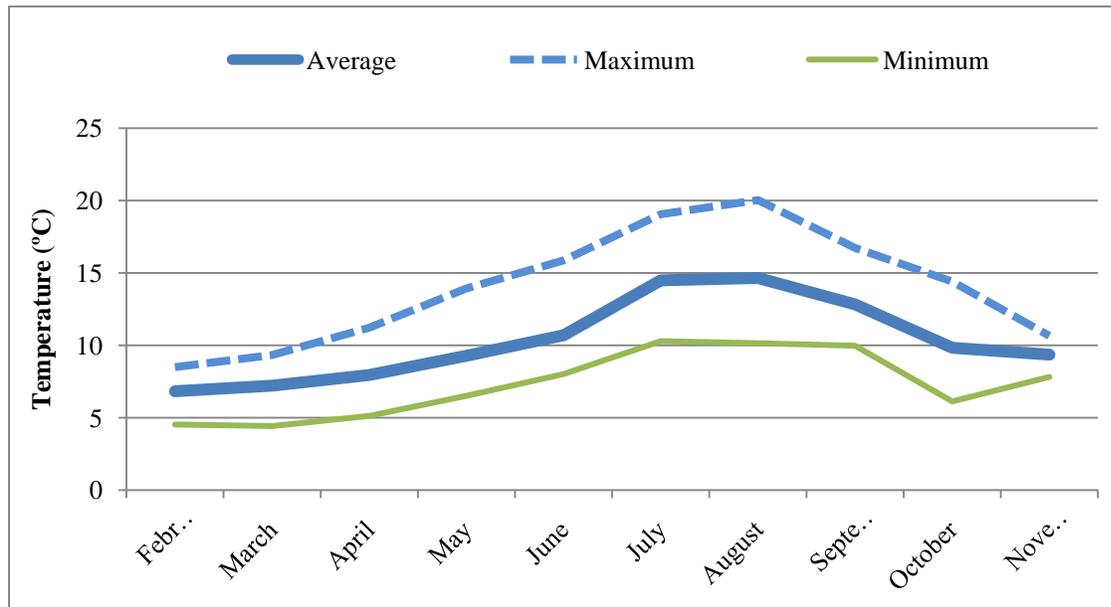


Figure 5. Average, Maximum, and Minimum Water Temperature in the S.F. Siletz River Collected in 2010.

Spot checks of turbidity and dissolved oxygen indicate the river generally has very low turbidity and is well oxygenated (Table 5).

4.2.2 Aquatic Resources

Data regarding existing aquatic habitat and fish species was collected in the summer of 2010. This information is documented in Appendix C. The following summarizes the information presented in that appendix relative to existing conditions.

4.2.2.1 Fish Distribution and Abundance

The Siletz River supports viable runs of seven species of anadromous salmonids (spring and fall Chinook salmon, coho salmon, chum salmon, summer and winter steelhead, sea-run cutthroat trout, Pacific lamprey, and dace and sculpins). The Siletz is unique in that it is the only Coast Range basin in Oregon with a native run (race) of summer steelhead. Siletz Falls at River Mile 64.5 (roughly 2 miles downstream of the confluence of the North and South Forks of the Siletz River) creates a partial natural barrier to upstream fish migration. A fish ladder has been in operation at this location since the mid-1950s. Since the fall of 1994, only summer steelhead and spring Chinook salmon have been assisted upstream to the North and South Forks of the Siletz River (Buckman 1995). By limiting the species that pass the falls, the upper Siletz basin (above the falls) is managed primarily as a summer steelhead refuge. Anadromous

species present in the South Fork Siletz River are therefore limited to steelhead and spring Chinook.

Location	Date	Time (approx.)	Temperature (C)	DO (mg/L)	Turbidity (NTU)
Site 1- S.F. Siletz River d/s from dam site at bridge crossing (pressure transducer site)	5/26/10	13:45	9.6	11.9	2.0
Site 2- N.F. Siletz River	5/26/10	15:14	8.9	11.8	0.8
Site 3- S.F. Siletz River just u/s from dam site	5/26/10	12:30	9.3	10.8	2.2
Site 1- S.F. Siletz River d/s from dam site at bridge crossing (pressure transducer site)	7/9/10	14:20	18.0	9.8	1.4
Site 2- N.F. Siletz River	7/9/10	15:00	16.3	10.3	0.5
Site 3- S.F. Siletz River just u/s from dam site	7/9/10	17:00	19.5	8.3	2.5
Site 1- S.F. Siletz River d/s from dam site at bridge crossing (pressure transducer site)	11/12/10	15:30	8.5	12.7	1.6
Site 2- N.F. Siletz River	11/12/10	14:30	7.6	13.2	0.5
Site 3- S.F. Siletz River just u/s from dam site	11/12/10	16:00	8.4	11.2	1.6

The Oregon Coast Steelhead DPS, which includes the Siletz steelhead, was listed by the National Marine Fisheries Service as a species on concern on April 15, 2004 (FR 69:19975-19979). Coho salmon in the Siletz (located downstream of Siletz Falls) are listed as Threatened under the ESA and identified as a distinct, independent population in the Oregon Coast Coho Evolutionarily Significant Unit ESU (Ford et al. 2004, Wainwright et al. 2008).

The Luckiamute system provides habitat for fewer and less diverse species and races of salmonids. Winter steelhead, coho salmon, and, potentially, spring Chinook juveniles occur in the Luckiamute river (Garano et al. 2004). Cutthroat trout in the Luckiamute are resident (non-anadromous).

Winter steelhead and spring Chinook salmon in the Luckiamute basin are part of Upper Willamette ESUs that are listed as Threatened under the ESA (Meyers et al. 2006). Oregon chub (ESA Endangered) were historically present in the Luckiamute River but are considered extirpated (USFWS 2010, USFWS 1998, USFWS 1993).

Pacific lamprey are present in both the Siletz and Luckiamute River systems (Altman et al., 1997). Western brook lamprey may be present but are not documented. Both lamprey species are thought to be in decline and of regional concern (Kostow 2002, Van de Wetering 2008).

The Siletz, Rogue, and Umpqua Rivers contain the only spawning populations of native summer steelhead in Western Oregon (Wilson 2008b). Summer steelhead are present in the river as early as late March and hold in the river until the following winter (Wilson 2008b). At the Siletz Falls trap, steelhead counts peak between late June and Mid-July (Wilson 2008B). Spawning begins in January and extends through May (Wilson 2008b). Juvenile fish will remain in the river for nearly a year.

Spring Chinook salmon enter the river between May and August and spawn in September and October (Wilson 2008a). Chinook salmon juveniles migrate to salt water after a few months of freshwater residence (Wilson 2008a, b). Spring Chinook salmon use the SF Siletz in relatively small numbers (Wilson 2008a, b).

Lamprey are anadromous. Pacific lamprey along the coast of Oregon usually begin to spawn in May when water temperatures reach 10°C to 15°C and continue to spawn through July (Confederated Tribes of the Umatilla Indian Reservation, 2004). The young spend 4 to 6 years as larvae living in the fine sediments in freshwater. After they emerge as adults, they migrate to seawater where they live for 2 to 3 years before returning to spawn (BPA 2005).

Populations of small, resident cutthroat trout are found in many streams in the SF Siletz basin (Smith and Lauman 1972). Life history requirement of cutthroat trout vary. Some populations migrate between streams and rivers in a basin during different seasons while some are non-migratory and will not move far from a home pool. Cutthroat trout in the SF Siletz basin are considered a resident population.

Summer steelhead are found in the mainstem Siletz River up to Callahan Creek (Figure 6). They are also found in several of the lower portions of all the tributaries to the SF Siletz (Wilson 2008b). The relative use of the mainstem, including the areas upstream and downstream of the old Valsetz reservoir, and the relative use of the tributaries is unknown.

The distribution of spring Chinook salmon is only known to extend up to Rogers Creek, which is located downstream of the old Valsetz dam site (Wilson 2008a; Figure 6).

Snorkel surveys were completed in August of 2010 in the portions of Beaver Creek and Handy Creeks within the footprint of the old lakebed, and Reaches 1 (upstream of the confluence with the North Fork), 2 (downstream of the proposed dam location), and 5 (the upper end of the historic lakebed) of the S.F. Siletz River. No salmonids and only one sculpin were identified in the reach that was surveyed within the old lakebed. No fish were observed in Handy Creek and snorkeling was not possible in Fanno Creek due to low flow. The dominant species observed in Reach 1 and Reach 2 of the S.F. Siletz River was potentially steelhead, but could also be resident rainbow trout. The majority of fish observed were 4 to 6 inches long.

Fish densities were estimated at 9.1 steelhead per 100 feet and 1.3 steelhead/resident trout per 100 feet of stream length in Reach 1 and Reach 2, respectively. Observed fish densities expanded to the entire reach length yielded an estimated population of 750 and 91 juvenile steelhead in reaches 1 and 2, respectively. Reach 1 contained the overwhelming majority of the steelhead/resident trout observed.

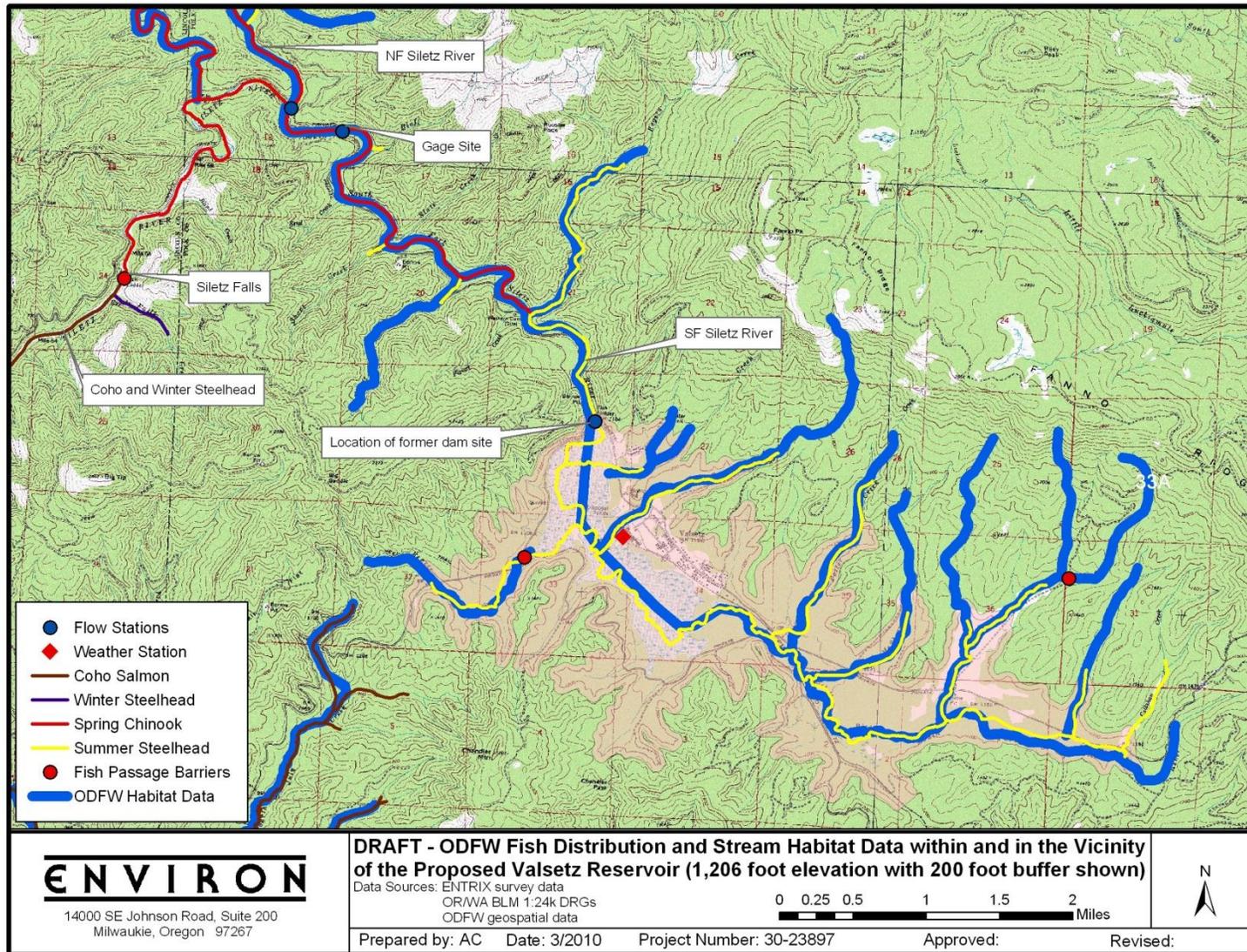


Figure 6. Fish Distribution in the project area.

4.2.2.2 Habitat Quality

An aquatic habitat survey in support of the Valsetz Water Storage Concept Analysis was completed on August 25 through August 27, 2010. A total of eight reaches were surveyed, which included five reaches in the S.F. Siletz River and three old Valsetz Lake tributary reaches (Beaver Creek, Fanno Creek, and Handy Creek) (Figure 8).

Pool habitat, which is abundant in all stream reaches, is overwhelmingly the most abundant habitat type found in the area upstream of the historic Valsetz dam site (Reaches 3 through 5). Based on the total area within a reach, pools occupy greater than 97 percent of the upper S.F. Siletz River habitat. Figure 7 summarizes the variety of stream habitat found within the S.F. Siletz River and the tributary streams.

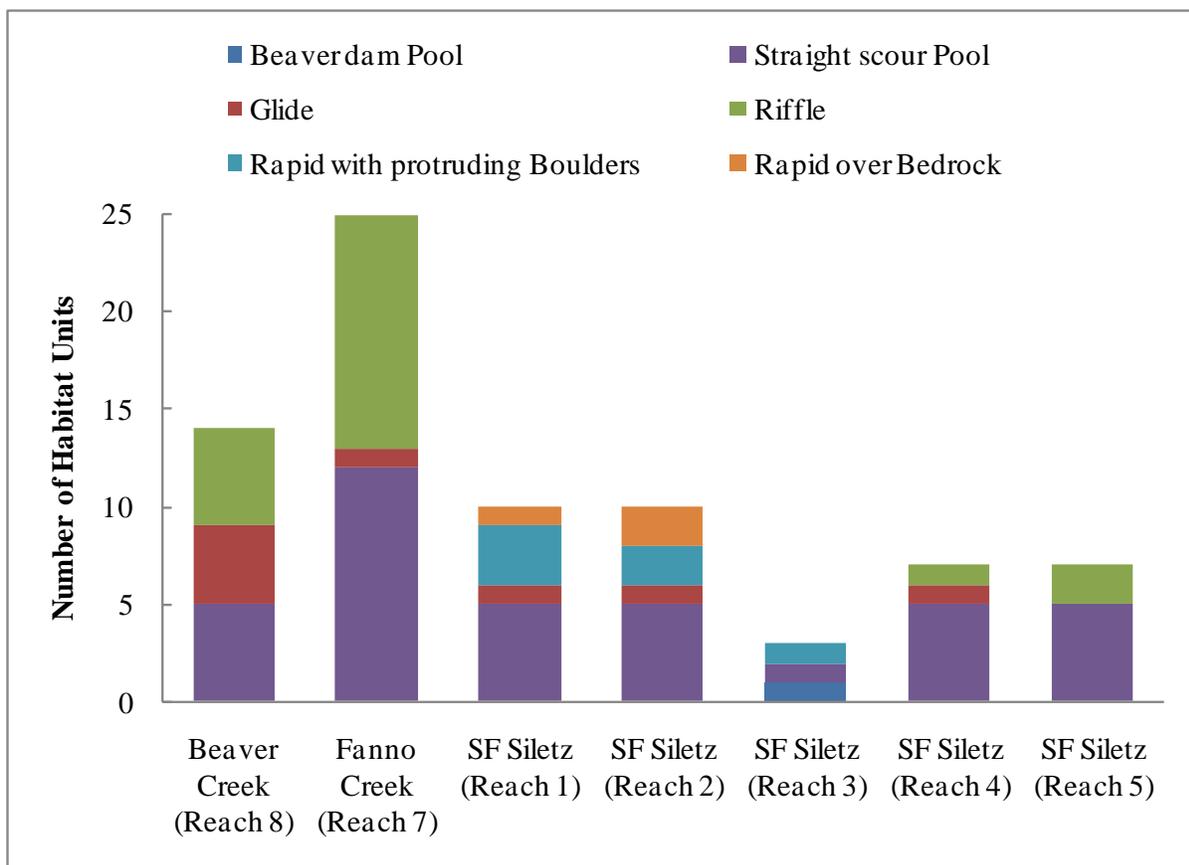


Figure 7. Composition of Habitat Units by Sample Reach.

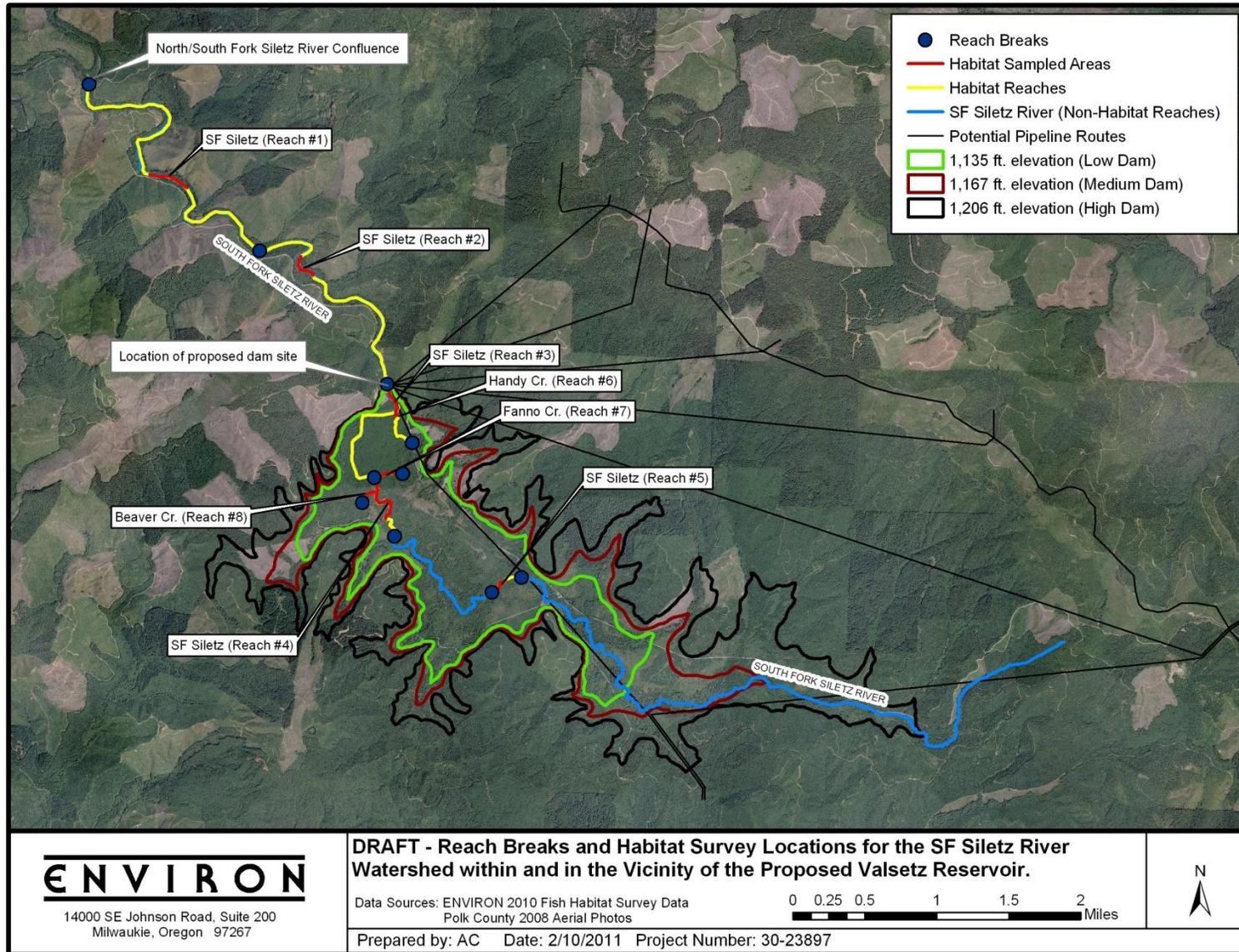


Figure 8. Reaches included in the 2010 habitat and snorkel survey.

The portion of the river downstream of the former dam contains a variety of larger substrate sizes while the upper portion is dominated by either silt and organics or gravel and sand. The reaches downstream of the former dam contain 30 to 40 percent gravel and cobble, which is suitable for spawning. The upper portion is dominated by either silt and organics or gravel and sand, reflecting the prior presence of the historic Valsetz Lake. Within the tributary reaches, small substrate is also predominant, with primarily sand in Beaver Creek and bedrock in Fanno Creek. The reaches within Fanno and Beaver Creeks lie within the footprint of the historical Valsetz Lake. The old lakebed does not contain suitable spawning habitat. Spawning habitat is concentrated in the reaches downstream of the historic dam site and potentially in the reaches of some of the tributaries upstream of the old lakebed.

4.2.3 Terrestrial Resources

The following description of existing terrestrial resources summarizes the more detailed information available in Appendix D.

4.2.3.1 Wetlands

Wetland areas within the historic lakebed consist of a mixture of palustrine forested (PFO), scrub-shrub (PSS), and emergent (PEM) wetlands (Figure 9). Palustrine broad-leaved deciduous forested wetlands comprise most of the estimated total acreage within the proposed project vicinity. Species observed in these wetlands include early successional tree species, such as red alder (*Alnus rubra*), willows (*Salix* spp.), small-fruited bulrush (*Scirpus microcarpus*), northern bugleweed (*Lycopus uniflorus*), water parsley (*Oenanthe sarmentosa*), and various sedges.

PFO, PSS, PEM, and unconsolidated bottom (PUB) and unconsolidated shoreline (PUS) wetlands are relatively minor cover types that comprise the balance of wetlands in the vicinity of the potential project. Plant species typical of scrub-shrub and emergent wetlands in the eco-region and observed in the wetlands within the old lake bed include a mixture of broad-leaved shrubs, emergent plants, grasses, sedges, and rushes. Some of the species common in these wetland types and observed in lake bed wetland communities include willows, red-osier dogwood (*Cornus sericea*), spiraea (*Spiraea douglasii*), European burreed (*Sparganium emersum*), lady's thumb (*Polygonum persicaria*), marshpepper (*Polygonum hydropiperoides*), marsh seedbox (*Ludwigia palustris*), devil's beggar-ticks (*Bidens frondosa*), weak mannagrass (*Puccinellia pauciflora*), western water-hemlock (*Cicuta douglasii*), soft rush (*Juncus effusus*), sawbeak sedge (*Carex stipata*), spike bentgrass (*Agrostis exarata*), and small-fruited bulrush (Appendix D).

In addition to the more common PFO, PSS, and PEM wetland types found throughout the region, there are some less common PSS and PEM fen wetland plant associations that are part of the Fanno Meadows Preserve in the headwaters of the Little Luckiamute River. Fens are a type of peatland and less common in the eco-region and statewide and support a number of rare plants. Fens are among identified high priority conservation habitats (ODFW 2006) in part because of the rare plant populations that they often support.

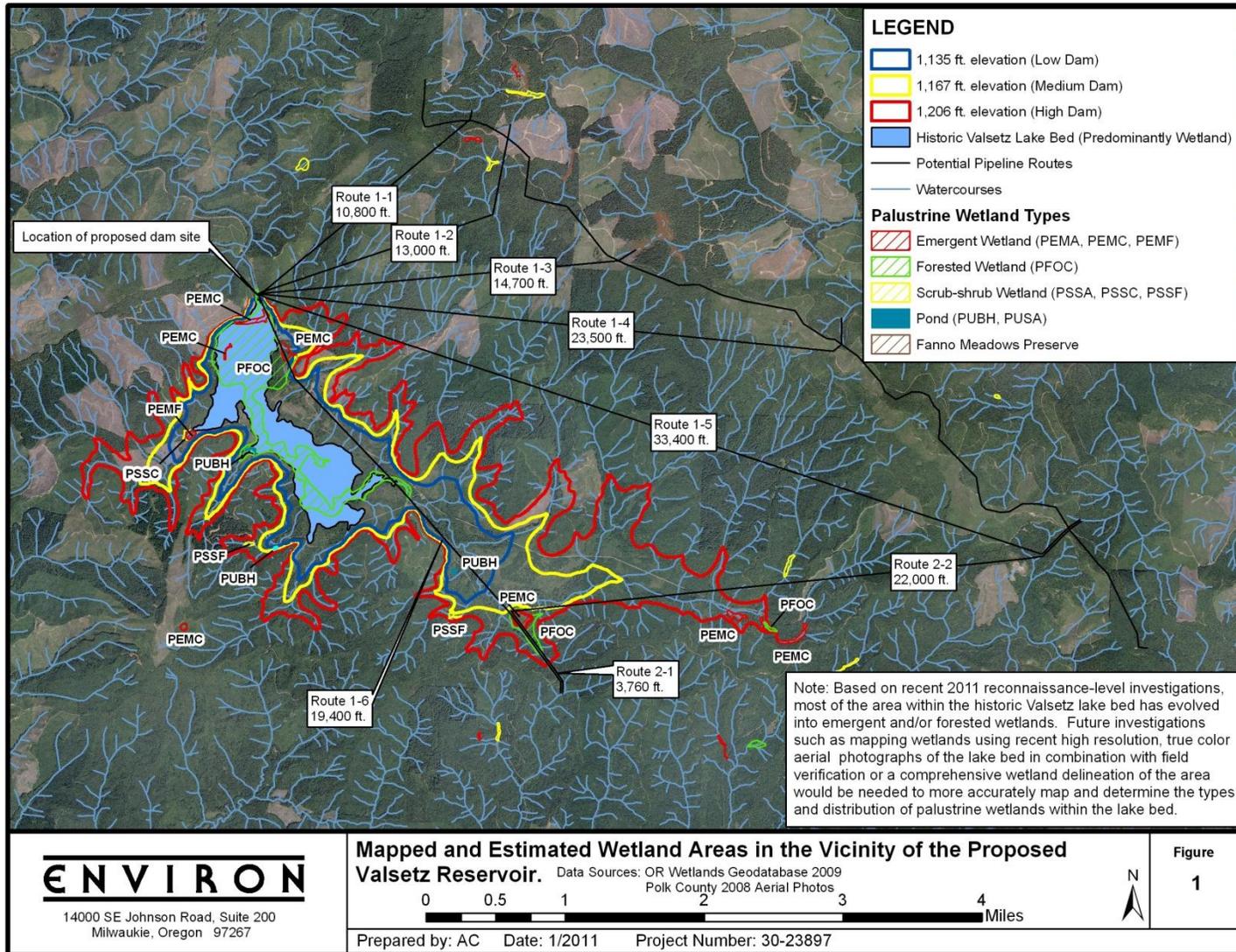


Figure 9. Mapped and estimated wetland areas in the vicinity of the proposed project.

4.2.3.2 Upland Habitats

According to the Northwest GAP Analysis data, the five most common cover types in the vicinity of the lake and/or pipeline routes are (in descending order of abundance):

- Harvested Forest – Tree Regeneration
- North Pacific Maritime Mesic to Wet Douglas fir – Western Hemlock Forest
- North Pacific Maritime Dry-Mesic Douglas fir – Western Hemlock Forest
- North Pacific Lowland Riparian Forest and Shrubland
- North Pacific Lowland Mixed Hardwood-Conifer Forest and Woodland

Four other cover types are much less common within the project vicinity. The last three are among identified priorities for conservation.

- North Pacific Dry Douglas fir – (Madrone) Forest
- North Pacific Oak Woodland
- North Pacific Herbaceous Bald and Bluff
- North Pacific Bog and Fen

Harvested, regenerating forest types are, by far, the most abundant cover types in the project vicinity. They are typically characterized by relatively young, even-aged stand conditions and are prevalent throughout the eco-region. Douglas fir (*Pseudotsuga menziesii*) is among the dominant tree species in these managed stands. Understory associates vary depending on stand age but include a mix of common native, non-native, and invasive trees, shrubs, and forbs, such as those identified as occurring in the cover types described below.

North Pacific Maritime Mesic to Wet Douglas fir - Western Hemlock Forest is an abundant habitat covering relatively large, contiguous areas predominantly on the slopes above the proposed reservoir. Dominant trees include Douglas fir, western hemlock (*Tsuga heterophylla*), and sometimes western red cedar or Port Orford cedar (*Chamaecyparis lawsoniana*). Big-leaf maple and red alder are codominant in managed forests, such as this area.

North Pacific Maritime Dry-Mesic Douglas fir-Western Hemlock Forest is abundant and covers large areas primarily on the higher slopes within the project area. Douglas fir is the dominant overstory tree beneath which is generally a subcanopy of western hemlock.

Riparian forest cover types are another abundant habitat type that covers relatively large expanses within the proposed reservoir and adjacent upland areas and in association with the many streams flowing into the South Fork Siletz River valley bottom. Red alder, willows, black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), big-leaf maple (*Acer macrophyllum*), western red cedar, and Oregon ash (*Fraxinus latifolia*) are among the dominant tree species in North Pacific Lowland Riparian Woodland and Shrubland. North Pacific Lowland Mixed Hardwood-Conifer Forest and Woodland is typically composed of Douglas fir, western red cedar (*Thuja plicata*), grand fir (*Abies grandis*), western hemlock and/or Sitka spruce (*Picea sitchensis*).

North Pacific Dry Douglas fir-(Madrone) Forest occurs in small patches within the project vicinity, but is more common in the Willamette Valley. North Pacific Oak Woodland occurs in small patches on drier, well drained, low elevations sites. North Pacific Herbaceous Bald and Bluff is another less common community occurring in small patches, which is important to conservation of populations of a number of rarer plants and animals. Montane grasslands, such as balds, are a high priority for conservation identified by ODFW (2006). There are a few bald habitats in the vicinity of the project, such as the one associated with Fanno Peak. North Pacific Bog and Fen is another uncommon ecotype that is limited to some low lying, flat areas within the Little Luckiamute River. This peatland wetland is found in association with upland plant associations that are part of the Fanno Meadows.

4.2.3.3 Terrestrial Threatened, Endangered, and Sensitive Species

There are three bird, two invertebrate, and eight plant species listed as threatened or endangered under the Endangered Species Act (16 U.S.C. § 1531 et seq.) or Oregon's Endangered Species Act (ORS 496.171 to 496.192 and 498.026) that may occur within the vicinity (Appendix D). There does not appear to be suitable habitat for many of these species within the area potentially impacted by the project and some of these species are not known to occur within the Coast Range eco-region.

Two of the birds (marbled murrelet and spotted owl) are not known to exist in the project area. Bald eagles (a state listed species) are not known to nest in the project area, however they do forage on spawned out salmon and steelhead, which are present in the S.F. Siletz and Luckiamute Rivers, and are known to be in the area. Fender's blue butterfly and Oregon silverspot butterfly may occur in the North Pacific Herbaceous Bald and Bluff habitats which are present in the project area.

Elegant fawn lily is known to occur in wet meadows at the Fanno Meadow Preserve. Nelson's checker-mallow occurs in relatively open areas on damp soil, in meadows, wet prairie remnants, fencerows, roadsides, deciduous forest edges, occasionally Oregon ash wetlands. Systematic surveys would be needed to determine presence or absence of all plant and animal species for which there is suitable habitat within the proposed project area.

4.2.4 Contaminants, Pathogens, and Invasive Species

Oregon DEQ's 1992 report and No Further Action determination (<http://www.deq.state.or.us/lq/ECSl/ecsidetailfull.asp?seqnbr=15#contamination>) concluded that the information and investigations they had reviewed or conducted did not suggest that hazardous materials were deposited or were present on the site. Their determination did not consider the potential flooding of the site to create a lake used for a drinking water supply. Inundation has the potential to mobilize contaminants that are currently safely buried.

Three invasive species are recognized in the Siletz that are not recorded in the Luckiamute system. One of these species, dwarf eelgrass, is associated with marine systems, and would not be viable even if seeds or vegetative propagules were somehow permitted to transfer to the Luckiamute system. The other two species, pickerelweed and Himalayan knotweed, could be present and, if present, could be carried onto the Luckiamute system through into basin water transfer. The prevalence of these latter two species in the project area is uncertain.

A survey of readily available literature sources identified at least 12 fish pathogen species associated with diagnoses conducted on Siletz-Yaquina River fish, in varying degrees of prevalence. No reports of pathogens in the Luckiamute system were found, so the presence of pathogens in that basin is unknown.

4.2.5 Cultural Resources

A review of the archaeological site and survey records on file at the Oregon SHPO and searched the SHPO's Oregon Historic Sites Database did not identify any known culturally significant resources in the project area (Appendix F). Given the fact that the town of Valsetz was razed in the 1980s, there is likely a low probability that any above-ground historic resources are present in the project area of interest (AOI). However, given the intensive use of the area as logging town, there is a high probability for historic archaeological resources to occur in the project area.

There is also a moderate to high probability that prehistoric archaeological resources are or were once present within the project area. Campsites and fishing areas or other resource procurement sites may have been present. Other cultural resources that could be present are historic properties of religious and cultural significance to an Indian Tribe. Interested tribes have not yet been consulted, but they may provide information on such resources.

5 Alternatives Comparison

The text below (Subsections 5.1 through 5.8) summarize the potential environmental impacts and benefits of the proposed project on water available for allocation, water quality, aquatic resources, terrestrial resources, cultural resources, contaminants, and the transfer of pathogens and invasive species. The last Subsection 5.9 examines and compares the three alternatives and includes a matrix of project effects that compares the overall effects.

5.1 Water Yield and Generation

The reservoir simulation analysis indicates that all three reservoirs options have sufficient capacity to satisfy both the instream flow needs and the water supply-water demand needs specified in Table 3. The reservoirs are sufficient under the average flow conditions in Siletz River and under drought conditions in Siletz River.

5.2 Land Use and Access

The proposed project would remove land from commercial forestry use. The acres affected would be up to 1104.4 acres for the low height dam, 1568.6 acres for the medium height dam, and 2756.6 acres for the highest dam.

Impacts on existing access routes will likely be substantial under all three alternatives. The private road running along the northeast side of the historic Lake Valsetz lakebed is the primary haul road between Falls City and locations in the lower Siletz basin. This will be inundated by all alternatives. The road running along the southwest side of the historic Lake Valsetz lakebed is the primary haul road between lands to the south and destinations between Falls City and the lower Siletz basin. This will also be inundated by all alternatives. In addition, a major haul road is present extending from the upstream end of the historic lakebed to Pedee. This will be lost under all alternatives.

In addition to the loss of major haul roads, the alternatives will eliminate access to local forest roads which connect to the main haul roads. The miles of roads affected increases with the increasing size of the reservoir.

Major haul roads and other access can be reconnected as part of project mitigation. If the access roads and feeder roads are reconstructed at a new location, they should be designed in a manner that would minimize the potential of introducing sediment and contaminants into the reservoir.

5.3 Hydrology and Geomorphology

The hydrology of the South Fork Siletz River will be altered by all alternatives. Peak flows would be captured to fill the reservoir during winter. During major flood events, water would be released downstream once the reservoir is filled. The amount of water released prior to attaining full capacity of the reservoir would depend on operational constraints and requirements. All alternatives can meet the minimum instream flows as well as water demand. Under current modeling assumptions, additional water may be available for discharge to enhance summer flows under the medium and high dam alternatives.

The potential effects of discharge of water into the Luckiamute headwater streams were evaluated. The three sites located to the north and furthest east (sites 1, 2, and 3), were not evaluated due to lack of access for data collection. The potential effects of discharges into these sites remain unknown. Discharge of up to 20 cfs into discharge points 4, 5, and 6 would likely mobilize the smaller particles within the channel bed resulting in a coarser bed over time. The alternative pipeline discharge points are easily modified. Pipeline routes and discharge points should be selected carefully to ensure that the channel morphology would not be significantly altered.

5.4 Water Quality

All three reservoirs are expected to vertically stratify. Numerous assumptions were made to support the modeling of predicted water temperature downstream of the three dam scenarios. These include an assumption that all water would be released from the bottom of the reservoir. Assumptions are further discussed in Appendix B. Multiple level intakes could potentially result in a substantial modification of the modeled results.

Based on projected reservoir inflows and outflows and the model assumptions, surface water temperatures may reach approximately 23°C under all the alternatives and water will generally be warmer on the surface than the natural river temperature throughout the year except in winter and early spring (Figure 10). The water near the bottom of the reservoirs would be substantially cooler than the temperature of the river during much of the year for the three reservoir alternatives (Figure 11). The small and medium reservoirs are expected to become warmer than the river beginning about mid-August extending through the fall. The large reservoir is expected to be cooler than the river water during the entire year providing potential to provide cooler water downstream in the summer.

Releases of water from the reservoir were modeled with the assumption that water is taken from below the thermocline where cool water is present. Temperature differences in the river downstream of the reservoir between the three reservoir alternatives are the largest in the reach

immediately downstream of the reservoir. The differences progressively decrease in the downstream direction. Differences between the predicted and natural temperature are not significant under all the alternatives once the North Fork Siletz River and South Fork Siletz mix.

Modeling suggests that the minimum temperature difference between all alternatives is in March when all temperatures are very similar; the largest temperature differences are projected to occur in the fall when the releases from the medium reservoir or low reservoir are warm, while the high reservoir remains cool.

The modeling also indicates that the small reservoir generally releases water into the river that is warmer than current conditions throughout the year, except during the winter season (Figure 11). The medium reservoir is expected to release water that is cooler than the current temperature condition in all months except the period from August through November. The large reservoir would likely release water that is cooler than current conditions throughout the year.

A reservoir with a volume ranging from the size of the large reservoir down to a size a little larger than the medium reservoir appears to have the potential to provide cooler temperatures to the river during the summer than exist currently. A multiple level outlet would provide flexibility to adjust temperature and oxygen levels in water released from a larger reservoir.

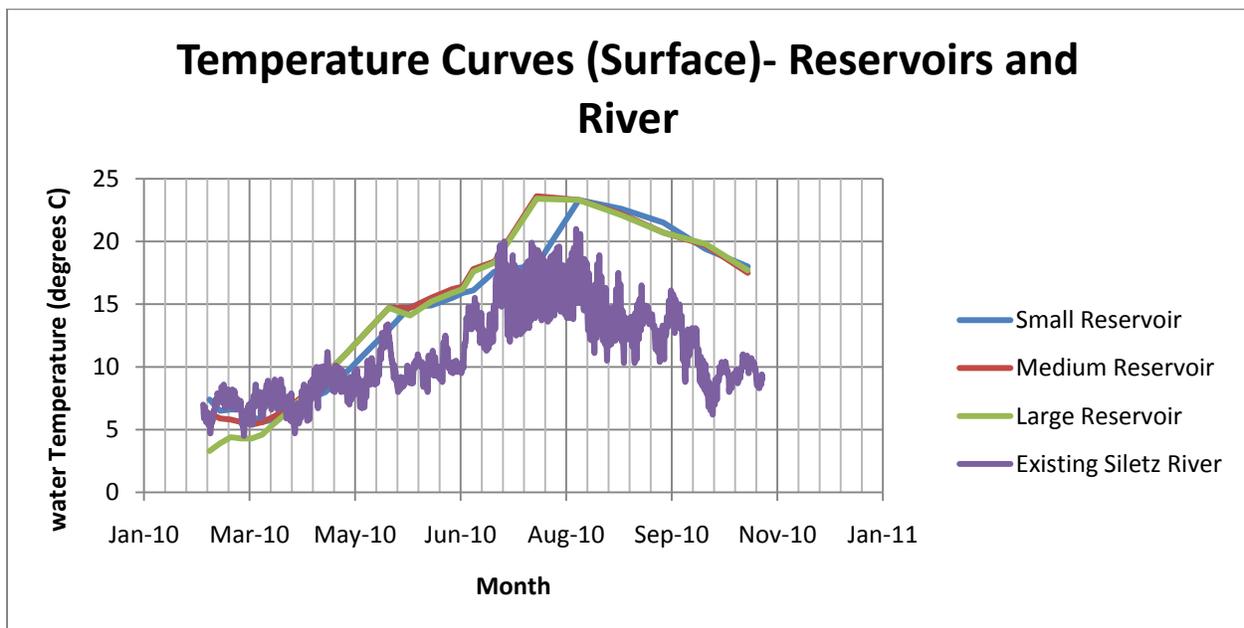


Figure 10. Recorded stream temperature in the South Fork Siletz River and predicted surface temperature in the reservoir under the three alternatives.

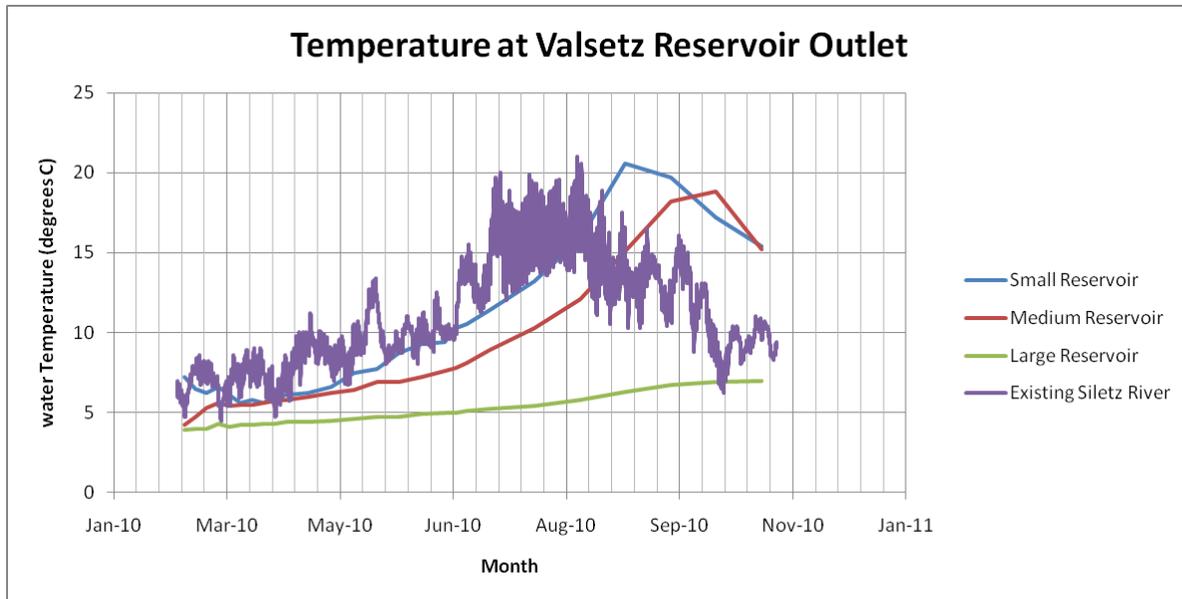


Figure 11. Existing temperature of the South Fork Siletz River and water temperature that would be released into the river under the three alternatives.

5.5 Aquatic Resources

5.5.1 Habitat Availability

Based on a review of salmonid distribution in the basin and the inundation zones, there would be approximately 32 acres, 36 acres, and 40 acres of fish habitat inundated under the low, medium and high dam alternatives, respectively. The reservoir would inundate between 2.2 and 4.3 percent of the total miles of fish habitat in the Siletz River basin and would inundate between 11.3 and 22.1 percent of the available habitat upstream of the Siletz Falls (Table 6). The portion of the habitat available upstream of the proposed dam that would be inundated by the reservoir under the low, medium, and high dam alternatives is 45.4%, 62.8%, and 89.4%, respectively. The utilization of the habitats within the footprint of the historic lakebed is largely unknown and data regarding the utilization of the tributaries is sparse. The quality of habitat within the old lakebed is poor, so the estimates of habitat area affected may not be representative of the proportion of the fish populations that would be affected.

Inundation of potential spawning (i.e., riffles) and rearing (pools and glides) habitat by alternative was calculated based on the ODFW (2004) data on tributary streams upstream of the proposed dam (Appendix C). This data suggests that a minimum of 70 percent of glides and 42 percent of pools currently present upstream of the proposed dam would be inundated by the three alternatives. However, only 8 to 54 percent of riffles would be inundated. Therefore, much of the rearing habitat currently available upstream of the proposed dam would be inundated by the reservoir but much of the spawning habitat would remain available under the alternatives. A substantial portion of the rearing habitat that would be inundated is located within the area of the old lakebed. Substrates and fluvial processes in channels within the old lakebed likely provides poor quality habitat for rearing salmonids. No salmonids were found in the areas sampled within the old lakebed (sampling was incomplete in that area due to hazardously deep sediments), so the area of potential habitat inundated does not necessarily

correlate to the proportion of the fish populations that would be impacted. The preponderance of high quality habitat is located downstream of the proposed dam location.

Table 6. Estimated percent of the total length of available habitat in the portion of the river upstream of Siletz Falls and the entire South Fork Siletz River that would be inundated by the three dam alternatives¹.

Portion of Occupied Habitat	Low Dam (%)	Medium Dam (%)	High Dam (%)
Percent of total length of fish habitat in the Siletz River inundated	2	3	4
Percent of total length of fish habitat upstream of Siletz Falls inundated	11	15	23

¹ Portion of habitat does not account for variances in the quality of habitat or the number of fish that could be supported within those habitats – the highest quality existing habitat is located downstream of the proposed dam location

5.5.2 Temperature Effects on Fish Populations

Water temperature in the South Fork Siletz River is naturally within the range that is well tolerated by salmonids and lamprey. The reservoir alternatives modify temperature within the reservoir itself and in the reach downstream of the proposed dam. All modeling of temperature effects assumed that water would be withdrawn from the bottom of the reservoir where the coolest water is present. The summaries of effects of the various alternatives are based on that modeling. Multilevel intakes could be used to modify effects on temperature downstream of the proposed dam. The use of multilevel intakes was not evaluated in this assessment and is recommended for further study.

All three reservoirs are expected to vertically stratify. Surface water temperatures reach approximately 23°C under all the alternatives, which is warmer than is generally tolerated by salmonids (Figure 10). The water near the bottom of the reservoirs would be substantially cooler than the temperature of the river during much of the year for the three reservoir alternatives (Figure 11). The small and medium reservoirs would become warmer than the river beginning about mid-August through the fall. The cooler waters in the small and medium reservoirs may be able to support a cold water fishery, provided that dissolved oxygen remains high enough to support the population. The largest reservoir is expected to stratify strongly. Reservoirs with pronounced stratification often develop low dissolved oxygen levels in the lower, colder strata of the reservoir, which may limit the ability of the reservoir to support a cold water fishery. The reservoir effect on dissolved oxygen was not evaluated in this study and is recommended for future evaluation.

The modeling predicts that the smallest reservoir would tend to warm the river downstream of the dam during the summer months. The greatest predicted effect would occur in August when water temperatures are predicted to increase roughly 5 to 6 degrees above the natural water

temperature, reaching 22°C. The model suggests that the warm water released in August would cool very quickly to 18°C and would continue to cool in a downstream direction, reaching natural river temperatures where the water mixes with the North Fork Siletz River. Predicted water temperatures are not expected to be lethal to fish, but are in the range that can cause substantial stress to rearing salmonids and lamprey, affecting growth and possibly survival. The predicted effects are greatest within the first 2 km of the river downstream of the proposed dam and dissipate when the waters of the South Fork Siletz River mix with the North Fork Siletz River. A similar pattern is predicted to occur in September, although the released water is predicted to be a couple degrees cooler. The temperature of the water released in all other months is predicted to be well within the tolerated range for salmonids and preferred range for lamprey.

The medium dam alternative is predicted to release water that is cooler than natural river temperatures in February through August. In September, predicted release temperatures are similar to the natural river temperature. In October and November, release water is predicted to be warmer than the natural water temperature. The warmest release waters, as modeled, occur in September when the temperature of the released water is predicted to be 18°C. In that month, water temperature is expected to cool to 13°C within 1 or 2 km of the dam and continues to cool in a downstream direction. The medium dam is not predicted to negatively affect fish due to changes in water temperature, with the possible exception of February. In February, the release water is predicted to be 6 degrees cooler than the natural water temperature, which could potentially reduce winter growth. These cooler waters are predicted to persist for a short distance and could be mitigated by releasing a mix of surface and bottom waters.

The modeling predicts that the highest dam would tend to discharge water that is cooler than the natural river temperature throughout most of the year. Cold water releases could potentially reduce growth and productivity of salmonids and lamprey in August and September between the dam and the confluence with the North Fork Siletz River. A multi-level intake could be used to mix surface and bottom water so the temperature of the release water is closer to the natural temperature of the river or closer to the optimum temperature for fish growth and productivity.

The potential effect of the alternatives on dissolved oxygen was not evaluated. A drop in dissolved oxygen in the deeper waters of reservoirs commonly occurs in stratified reservoirs. The release of waters with low dissolved oxygen can cause mortality or avoidance of the affected waters. This situation can be mitigated through the design of spillways that incorporate features that reintroduce oxygen into the water as it passes from the dam through a spillway or other construct.

5.5.3 Instream Flows

ODFW currently holds two water rights which protect instream flows. The second water right includes the rights protected under the first right issued. At present, the instream flows protected under these rights range from 10 cfs in summer to 60 cfs in winter and early spring (Table 7). The quantity of water that would be required to be released is the lesser of the instream flow water rights and the natural flow of the river.

ODFW evaluated the suitability of the instream right assessment process and determined that the assessment methods do not adequately address the flows required to maintain a channel.

Therefore, ODFW has developed a guidance document for assessing instream flow requirements for fish and required channel maintenance flows for storage projects (Robison 2007). The guidance generally recommends that the full flow in storm flow events of a magnitude equivalent to the 2-year event and larger be released downstream to assume the maintenance of the channel. The need for downstream maintenance flows would need to be discussed further with ODFW to determine the exact goals they would want to attain regarding bedload movement.

Table 7. Instream flow rights held by ODFW.	
Period	Flows (cfs) protected under the right issued on March 26, 1974
October 1 – October 15	30
October 16 – October 31	40
November 1 – May 31	60
June 1 – June 15	30
June 16-June 30	30
July 1 – July 15	10
July 16 – September 30	10

5.5.4 Passage

Passage over the dam is likely to be required under project permits. OAR 635-412-0005 prohibits the construction of any artificial obstruction across any waters of the state that are inhabited, or were historically inhabited, by native migratory fish without providing passage for native migratory fish. Exemptions from this requirement are possible if a) ODFW finds that the impacts to fish have been adequately mitigated or b) there is no appreciable value in providing passage. The second situation is likely to occur in cases where no suitable habitat would remain upstream of the facility. The utilization of the habitats may be low. Additional information regarding fish utilization of those habitats is needed. Discussions with ODFW will determine if the remaining habitat has sufficient value to support the construction of a fish ladder.

5.6 Terrestrial Resources

5.6.1 Wetlands

A preliminary estimate of the potential wetland impacts from inundation of the old lake bed and construction of the eight potential pipeline routes is provided in Table 8. 2. The majority of the wetlands are located within the footprint of the historical Lake Valsetz; therefore, the area affected is similar under all the alternatives. This estimate is based on known wetlands. Additional wetlands likely exist in the project area. Additional investigations, including field surveys, are needed to refine the estimates of wetland area.

Table 8. Comparison of Total Wetland Habitat Impacts by Option (in acres)

Palustrine Wetland Classification ¹	Low Dam	Medium Dam	High Dam
Forested wetlands	242.1	243.1	257.8
Scrub-shrub wetlands	0.9	1.1	2.9
Emergent wetlands	10.8	11.0	21.9
Unconsolidated bottom	1.7	1.8	1.8
Historic lake bed ²	212.9	212.9	212.9
Total	468.4	469.9	497.3

Source: Estimates of wetland vegetation class impacts calculated from the Oregon Wetlands Geodatabase data (2009).

¹ All wetlands follow the USFWS classification system (Cowardin et al. 1979)

² Much of the historic lake bed outside of the mapped wetlands shown in Figure 1 has evolved into wetland based on ENVIRON's reconnaissance-level observations. This value assumes the entire area is wetlands and reflects a worst case estimate. As noted in the text above, future investigations are required to more accurately estimate wetland impacts.

The construction of a dam would tend to shift the types of wetlands present in the project area. The mosaic of palustrine and riverine wetland currently present in the project area would be replaced with a lacustrine wetland environment with fringing lacustrine wetlands near the ordinary high water mark. Potential fringing wetlands could be a combination of forested, scrub-shrub and emergent wetlands. Where the shoreline is relatively steep, such as near the dam, wetlands will likely be quite narrow and perhaps less than 10 feet (3 m) wide. Near stream deltas, such as Fanno Creek, where topography is less steep and sediment deposits will likely accumulate over time, a continuum of aquatic bed, emergent, scrub-shrub or forested fringing wetlands will likely form. More extensive aquatic bed wetland vegetation would be expected to form in shallower waters (< 10 ft [3 m]), such as those that would be expected towards the upstream end of the new lake. Seasonally changing reservoir elevations may inhibit the development of wetlands along the perimeter of the reservoir. Therefore, the area of expected wetland development could not be estimated at this time.

Fanno Meadows Preserve contains a complex of wetland and upland habitat types, including relatively rare fens, a kind of peatlands. The fens would be expected to be very sensitive to disturbance. Pipeline routes should be selected to avoid these sensitive habitats.

The creation of a reservoir may be beneficial to some species, such as waterfowl and cavity-dependent species. There likely would be an increase in snag density along the lake shoreline where trees are drowned. Snags would provide additional foraging opportunities and roosts for woodpeckers and flycatchers and over time additional habitat for cavity-dependent species, including some species of concern, such as purple martin (*Progne subis*).

5.6.2 Riparian and Upland Habitats

The Valsetz water storage project would directly and indirectly impact riparian and other upland forests. A majority of the direct impacts would be drowning of riparian and upland forest types within the footprint of the proposed pool. Construction of pipelines would also affect a narrow band of upland vegetation. Potential impacts to riparian forest types that likely would evolve around the perimeter of the reservoir at the ordinary high water level would be influenced by rates of drawdown, timing, frequency and duration of drawdown events which influence plant establishment, growth, and survival.

The area of potential impact varies substantially between the alternatives (Table). The low dam alternative impacts the least amount of priority riparian forest and wetland habitats. The medium and high dam options impact proportionally more area. The largest impacts to priority conservation habitats occur under the high dam option. This option would inundate 1.1 acres of Willamette Valley Wet Prairie. Additional field verification is needed to confirm the presence and extent of the wet prairie habitat. The size of the reservoir could be adjusted to avoid impacts to that habitat.

GAP Habitat Type	Low Dam	Medium Dam	High Dam
Cultivated Cropland	24.0	24.5	33.1
Developed, Open Space	114.5	147.9	240.8
Harvested Forest- Tree Regeneration	456.5	628.9	1122.9
North Pacific Broadleaf Landslide Forest and Shrubland	0.7	1.1	2.4
North Pacific Dry Douglas Fir (Madrone) Forest	2.7	6.4	28.0
North Pacific Herbaceous Bald and Bluff	0.0	0.0	0.2
North Pacific Lowland Mixed Hardwood-Conifer Forest and Woodland	57.8	135.9	301.6
North Pacific Lowland Riparian Forest and Shrubland	420.3	563.3	812.0
North Pacific Maritime Dry-Mesic Douglas Fir-Western Hemlock Forest	3.1	6.4	20.7
North Pacific Maritime Mesic-Wet Douglas Fir-Western Hemlock Forest	24.2	53.2	190.6
North Pacific Oak Woodland	0.4	0.9	3.1
Willamette Valley Wet Prairie	0.0	0.0	1.1
Total GAP Habitat Acres	1104.4	1568.6	2756.6
Total Proposed Reservoir Inundation Acres	1106.0	1570.3	2752.6
Source: Northwest Regional GAP Analysis Project (USGS 2004)			

5.6.3 Terrestrial Threatened, Endangered, and Sensitive Species

None of the water storage project dam options appear to have any direct impacts on critical habitat for any federal- or state-listed threatened or endangered terrestrial species (anadromous species were discussed previously). However, critical habitat maps for marbled murrelet depict two areas of mapped critical habitat, one lying within the McFall Creek drainage as just outside (~100 feet) of the estimated reservoir boundary for the high dam option and the other lying about 3,000 about 1,000 feet west of the estimated reservoir pool level for the high dam option. Pipeline routes should be selected to avoid impacting these areas. As stated above, forest habitat types in the vicinity are predominantly early successional phases and not the late successional or old-growth forest types typically used by marbled murrelet. Additional field studies would be required to confirm the presence of suitable habitat for the species and to better define the exact area that should be avoided.

Several federal and state listed threatened or endangered species are associated with native prairie or grassland habitats. Fender's blue butterfly and Oregon silverspot butterfly, Willamette daisy, elegant fawn-lily, Bradshaw's lomatium and Kincaid's lupine are all found in native prairie habitat types. It is uncertain if any of these species may occur in the identified Willamette Valley Wet Prairie or North Pacific Bald and Bluff habitats in the project vicinity. Neither the low or medium dam options under consideration appear to directly or indirectly affect native prairie habitats. The high dam option appears to inundate 1.1 acre of Willamette Valley Wet Prairie. This can be avoided by adjusting the height of the dam.

Other potentially suitable habitat for some of these species may occur in the North Pacific Herbaceous Bald and Bluff upslope and northeast of the lake that is associated with Fanno Peak. Additional field investigation would need to be completed to verify if this habitat are present and to determine if it supports any of the federally- or state-listed threatened or endangered invertebrates and plant species associated with these wet prairie/meadow or grassland habitat types. Fanno Meadows Preserve is a fen wetland complex. There are known populations of elegant fawn-lily (state-listed threatened) within the preserve and populations of western lily (federally- and state-listed endangered) could be present, though none have been documented at the site. Pipelines should be routed to avoid the North Pacific Herbaceous Bald and Bluff habitats and the Fanno Meadows Preserve.

Nelson's checker mallow is the only other federally-listed species of plant that may occur in habitats within the vicinity. These species has broader habitat tolerances and more systematic surveys would be required to determine whether it is present within meadows, forests, and grasslands within the vicinity, particularly in the old lake bed.

5.6.4 Other Species of Concern

Amphibian species that could be affected by habitat changes include western toad (*Anaxyrus boreas*), clouded salamander (*Aneides ferreus*), coastal tailed frog (*Ascaphus truei*), and northern red-legged frog (*Rana aurora*). Changes in water levels can result in death of amphibian eggs laid on emergent vegetation through desiccation. The potential magnitude of effect will depend upon reservoir operations affecting water levels while amphibian eggs incubate.

The increase in the amount of open water will likely be beneficial to other sensitive species. Diving ducks and other migratory waterfowl attracted to lakes would be expected to benefit.

5.7 Cultural Resources

There are no records of historical or cultural sites in the project area. Given the history of the site, there is potential that historical or cultural sites of interest exist (Appendix F). The presence of such sites is greatest near the location of the historic Lake Valsetz. A survey of the area and consultation with tribal interests is needed to assess the potential impacts of the alternatives.

5.8 Contaminants, Pathogens, and Invasive Species

When the town of Valsetz was razed, hazardous materials were cleaned up to the satisfaction of the State of Oregon. The state did not consider the potential for the area to be inundated, which could mobilize buried contaminants. It is unclear where the site has been tested for dioxin, a

likely component in plywood glue. Surface and subsurface sampling of soil and groundwater in the area of the former glue settling pond and known incineration areas is strongly advised to address any potential dioxin contamination. Burn areas used for disposal of solid wastes, including plywood, should also be evaluated for dioxins and dibenzofurans. Laboratory analysis for volatile organic compounds, pesticides/herbicides, petroleum products, and other analyses may also be appropriate. It is possible that lead contamination exists on the site from the burning of the demolition debris from the town. To address potential lead contamination, surface and subsurface soil and groundwater sampling is recommended. Further research, interviews and possible subsurface investigation is recommended to address concerns regarding USTs.

Two invasive species were identified that are present in the Siletz system and have not been reported in the Luckiamute System. Localized site data on invasive species distributions are limited. Field surveys are recommended to provide site-specific information regarding the presence or absence of invasive species within the inundation area.

Seven potentially invasive pathogens identified in fish or invertebrate species in the Siletz system. Documentation of the presence or absence of pathogens in the Luckiamute system is not available. Therefore, the potential to introduce currently absent diseases into the Luckiamute system through water transfers is unknown. Enquiries with state agency representatives and possible sampling are necessary to conclusively summarize the status of human and animal pathogens recorded in both watersheds.

Engineering solutions associated with the water transfer should be considered that will minimize the potential spread of invasive species and pathogens through water transfer. Such solutions include screening, filtration, and water treatment. The ability to implement such measures on the high flow volume anticipated for transfer would require engineering analysis.

5.9 Overall Environmental Benefits & Impacts

Table 10 summarizes the overall potential environmental benefits and impacts of the proposed project by alternative. All three dams are expected to meet future water demand.

The three alternatives would variably affect wetlands, fish, and wildlife. All three alternatives inundate a substantial amount of wetlands, most of which are located within the footprint of the former reservoir. All three alternatives inundate fish habitat in the South Fork Siletz; the quantity of habitat affected increases with the size of the dam. Changes in water temperature downstream of the dam vary with the size of the proposed dam. In most cases, the effects are not expected to be substantial. It is likely that most of the temperature effects can be avoided by using multi-level intakes to modify the temperature of the released water and/or retain cooler water longer into the season.

There is insufficient information to address project effects on cultural resources or contaminants. The concerns regarding these resources are potentially substantial and should be addressed in future studies for the project.

Table 10. Alternative Comparison Matrix			
	Low Dam 14,000 AF	Medium Dam 70,000 AF	High Dam 162,000 AF
Design & Operations			
Dam Height	50	82	121
Water Surface Elevation	1,120	1,160	1,200
Dam Crest Elevation	1,145	1,177	1,216
Years to Reach Full Capacity (climate dependent)	1-6	4-28	10-66
Total Acres Inundated at Full Pool	1106	1576	2753
Environmental Evaluation			
Water Demand	Has sufficient storage capacity to meet water demand and required minimum instream flows under normal and drought conditions.	Has sufficient storage capacity to meet water demand and required minimum instream flows under normal and drought conditions.	Has sufficient storage capacity to meet water demand and required minimum instream flows under normal and drought conditions.
Land Use and Access	Up to 1106 acres of potential commercial forest land inundated. Main haul roads through area will be inundated and will need to be relocated.	Up to 1576 acres of potential commercial forest land inundated. Main haul roads through area will be inundated and will need to be relocated. Minor access roads also obliterated.	Up to 2753 acres of potential commercial forest land inundated. Main haul roads through area will be inundated and will need to be relocated. Largest number of minor access roads obliterated.
Hydrology / Channel Morphology	Can meet instream flows and expected demand.	Can meet instream flows and expected demand.	Can meet instream flows and expected demand.

<p>Water Quality - Reservoir</p>	<p>Temperature of the surface and bottom waters of the reservoir will exceed natural temperatures in summer and fall. Surface waters may reach 23°C and bottom waters are predicted to reach 20°C in late summer and fall. Reservoir likely to stratify.</p>	<p>Temperature of the surface and bottom waters of the reservoir will exceed natural temperatures in summer and fall. Surface waters may reach 23°C and bottom waters are predicted to reach 18°C in late summer and fall. Reservoir likely to stratify.</p>	<p>Temperature of the surface and bottom waters of the reservoir will exceed natural temperatures in summer and fall. Surface waters may reach 23°C late summer and fall. Bottom temperatures remain very cool (<7°C) throughout the year. Reservoir will stratify very sharply and will overturn (mix) for only a short period during the year.</p>
<p>Water Quality – Siletz River Downstream of Dam</p>	<p>Water temperature would tend to exceed the natural water temperature in the river immediately downstream of the dam in June through November. Temperature could reach 22°C immediately below the dam in August. The water cools rapidly within the first 1 to 2 km downstream of the dam and reaches natural water temperatures by the time the South Fork Siletz waters mix with the waters of the North Fork.</p>	<p>Water temperature would tend to exceed the natural water temperature in the river immediately downstream of the dam in October and November. Temperature could reach 18°C immediately below the dam in October. The water cools rapidly within the first 1 to 2 km downstream of the dam and reaches natural water temperatures by the time the South Fork Siletz waters mix with the waters of the North Fork. All other months, the temperature of the release water is slightly cooler than or similar to the natural water temperature.</p>	<p>Water temperature released by the dam would tend to be very cool (2 to 6°C). In all months, the released water warms rapidly within the first 1 to 2 km downstream of the dam and reaches natural water temperatures by the time the South Fork Siletz waters mix with the waters of the North Fork. A multilevel intake could be used to optimize water temperature and oxygen levels.</p>

<p>Aquatic Resources</p>	<p>32 acres of habitat inundated which is 2.2% of the habitat available in the Siletz basin and 11.3% of the habitat available upstream of Siletz Falls.</p> <p>Released water temperature may cause salmonids and lamprey to avoid the area within 1 to 2 km of the dam in August and possibly September. Water temperatures cool rapidly downstream. Effects on temperature generally small between 2 km downstream of the dam and the confluence with the North Fork and negligible downstream of the North Fork. The exception to this occurs in October which water released is much warmer (18°C) than the natural river temperature (7°C). The warmer waters occur at a time when steelhead are migrating upstream and may interfere with upstream movements.</p>	<p>36 acres of habitat inundated which is 3.0% of the habitat available in the Siletz basin and 15.6% of the habitat available upstream of Siletz Falls.</p> <p>Released water temperature tends to be 2 to 3°C cooler than the natural river temperature throughout most of the year. Water temperatures change rapidly downstream. Effects on temperature generally small between 2 km downstream of the dam and the confluence with the North Fork and negligible downstream of the North Fork. The exception to this occurs in October which water released is much warmer (18°C) than the natural river temperature (7°C). The warmer waters occur at a time when steelhead are migrating upstream and may interfere with upstream movements.</p>	<p>40 acres of habitat inundated which is 4.3% of the habitat available in the Siletz basin and 22.1% of the habitat available upstream of Siletz Falls.</p> <p>The temperature of the water released would tend to be very cool. Cold water releases could potentially reduce growth and productivity of salmonids between the dam and the confluence with the N.F. Siletz River. This impact may be mitigated by installing a multi-level intake into the dam.</p>
<p>Fish Passage</p>	<p>Upstream passage over the dam likely required.</p>	<p>Same as low dam</p>	<p>Passage less likely to be required since very little habitat upstream of the dam will be available.</p>

<p>Wetlands</p>	<p>468.4 acres of wetland habitat inundated</p> <p>Wetlands will be shifted to lacustrine conditions. An unknown quantity of wetland habitat will develop around the edges of the reservoir. The acreage of the new wetlands cannot be estimated because the seasonal drawdown of the reservoir is likely to limit wetland development.</p> <p>Sensitive wetland areas in the Fanno Meadows Preserve should be avoided by pipeline routes</p>	<p>469.9 acres of wetland habitat inundated</p> <p>Comments regarding the development of new wetlands and the routing of pipelines are the same as the low dam alternative.</p>	<p>497.3 acres of wetland habitat inundated</p> <p>Comments regarding the development of new wetlands and the routing of pipelines are the same as the low dam alternative.</p>
<p>Wildlife</p>	<p>1104.4 acres of habitat inundated</p> <p>Inundated habitat includes forested and riparian habitat.</p>	<p>1568.6 acres of habitat inundated</p> <p>Inundated habitat includes forested and riparian habitat.</p>	<p>2756.6 acres of habitat inundated</p> <p>Inundated habitat includes forested and riparian habitat. The alternative, as currently defined, also inundates a small area of, sensitive habitats at the head of the reservoir. Impacts to these habitats could be avoided by adjusting the size of the dam.</p>

<p>Terrestrial Threatened, Endangered, and Sensitive Species</p>	<p>North Pacific Herbaceous Bald and Bluff habitat which may be home to Fender’s blue butterfly, Oregon silverspot butterfly, Willamette daisy, elegant fawn-lily, Bradshaw’s lomatium, and Kincaid’s lupine, is present in the basin. Fanno Meadows Preserve which is occupied by the elegant fawn-lily and may support the western lily is also located in the basin. These habitats should be avoided by pipeline routes.</p> <p>Reservoir operations may affect the abundance of amphibians in the project area.</p> <p>The creation of a reservoir is expected to benefit migratory water fowl.</p>	<p>Same as for low dam.</p>	<p>Same as for low dam. Additional impacts include:</p> <ul style="list-style-type: none"> • The reservoir will be within 100 feet of marbled murrelet critical habitat; care should be taken to avoid disturbance of that habitat. • 1.1 acres of Willamette Valley Wet Prairie, which potentially supports listed butterflies and plants, would be inundated as currently designed. This can be avoided by adjusting the size of the reservoir.
<p>Cultural Resources</p>	<p>Unknown, but substantial resources may be present.</p>	<p>Unknown, but substantial resources may be present over a larger area than for the low dam.</p>	<p>Unknown, but substantial resources may be present over the largest area of the three alternatives.</p>
<p>Pathogens</p>	<p>Possible transfer to the Luckiamute can be filtered or treated to avoid affect.</p>	<p>Same as the low dam</p>	<p>Same as the low dam</p>
<p>Invasive Species</p>	<p>Possible, presence uncertain</p>	<p>Same as the low dam</p>	<p>Same as the low dam</p>

<p>Contamination</p>	<p>Contaminants that are currently buried and stable may leach into a reservoir once inundated. The majority of the area potentially containing contaminants is located within the footprint of the low dam reservoir.</p>	<p>Same as the low dam</p>	<p>Same as the low dam</p>
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6 Federal, State and Local Regulatory Requirements

There are numerous federal, state, and local government laws, rules, and regulations that govern dam construction and operation, water storage, use, and distribution. Many of these relate to the potential impacts of dam construction on natural, archaeological, cultural, and historic resources. The various permits and approvals that may be needed to construct and operate the water storage project are briefly discussed in the following section. Regulations are constantly changing and additional permits and requirements may become necessary in the future. Table 11 summarizes the federal, state, and local laws and regulatory requirements that may need to be addressed. A more complete and accurate list of permits and approvals will require a detailed project description including but not limited to construction and operation methods, anticipated water uses, funding sources, and timing.

6.1 Federal Regulations

Many of the federal laws, permits, and approvals expected to be applicable to the Valsetz water storage project directly relate to protection of wetlands, water quality, and aquatic resources. Some are triggered by use of federal monies or federal permits (e.g., NEPA compliance). Others apply to hydroelectric facilities and may or may not be applicable to this project. Information contained in this section was derived from the applicable laws and regulations, agency websites, and past permitting experience.

National Environmental Policy Act (NEPA)

NEPA is a procedural law that requires agencies to consider the potential impacts of proposed projects on environmental and human health. It is triggered by projects with a federal nexus, which includes projects proposed by a federal government agency, any project requiring a federal permit, or projects receiving federal funding. The lead agency is responsible for ensuring that NEPA requirements are met. For the proposed project, it is likely that the Corps would act as the lead agency due to the need for a Section 404 permit unless a hydroelectric facility is proposed, in which case the Federal Energy Regulatory Commission (FERC) would act as lead agency. This project will require the development of a NEPA compliance document, most likely an Environmental Impact Statement (EIS). For a project of this type located within anadromous fish habitat, the EIS will likely receive numerous comments and a supplemental EIS may also be required if substantial issues or substantial additional analyses are required to address those public comments.

Clean Water Act (CWA)

Sections 404, 402, and 401 of the CWA pertain to filling or dredging, discharge of pollutants, and water quality certification of Waters of the U.S., including wetlands.

Dam construction will require a Section 404 permit from the U.S. Army Corps of Engineers (Corps) and Oregon Department of State Lands (DSL) for construction of the dam on the Siletz River. A joint permit application (JPA) form is submitted by applicants for both permits. The JPA is submitted to both the Corps Portland District Regulatory Branch and DSL for their respective approvals. Mitigation of impacted wetlands will be required.

Sections 402 National Pollutant Discharge Elimination System (NPDES) permit program and Section 401 Water Quality Certification are authorized by the CWA but implemented at the state

level by Oregon Department of Environmental Quality (DEQ). These processes are discussed below under State Regulations.

Coastal Zone Management Act (CZMA)

Oregon has a federally approved coastal zone management program that applies to activities within the state coastal zone, which extends from the boundary of the territorial sea to the crest of the Coast Range. Projects that require a federal license or permit within the coastal zone require a consistency determination. There are three components to consistency, including conformance with statewide planning goals adopted by the Land Conservation and Development Commission (LCDC) and comprehensive plans and land-use regulations adopted by local governments identified by the LCDC as being in compliance with statewide planning goals. In addition, projects must conform to requirements of Oregon state agencies with regulatory authority within the Oregon Coastal Management Program, such as DSL, DEQ, Parks and Recreation, DOE, ODFW, and Department of Geology and Mineral Industries (DOGAMI).

Table 11. Summary of federal, state, and local regulatory requirements that may need to be addressed.		
Federal Regulation	Authority	Issue/Issuing Agency
Clean Water Act (CWA)	33 USC § 1251 et seq.	Dam construction will fill waters of the U.S. and require a Section 404 permit from U.S. Army Corps of Engineers (Corps).
CWA	33 USC § 1251 et seq.	Water Quality Certification (Section 401) from Oregon Department of Environmental Quality (DEQ) is associated with the Section 404 permit process.
Coastal Zone Management Act (CZMA)	16 USC § 1451 et seq.	Coastal Zone Consistency Determination from Oregon Department of Land Conservation and Development, part of Section 404 permit process.
Endangered Species Act (ESA)	16 USC § 1531 et seq.	Federal permit triggers need for compliance and consultation with the USFWS and NMFS. Preparation of a Biological Assessment with permit application to Corps.
Federal Power Act	Section 18	Federal Energy Regulatory Commission permit is required for hydroelectric facilities.
Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA)	16 USC § 1801 et seq.	Demonstrate in BA or BE that no significant impacts to essential fish habitat for designated species, including listed anadromous fishes.
Migratory Bird Treaty Act	16 USC § 703 et seq.	Projects with a federal nexus (permit or monies) need to comply with the USFWS and state programs to conserve migratory bird populations and habitats.
National Environmental Policy Act	42 USC § 4321 et seq,	Consideration of environmental impacts in compliance with NEPA may be required.
State	Statute & Rules	Issue/Issuing Agency
Standard Review Process	ORS 537 et seq. OAR 690-310-0040	Permit required from Oregon Water Resources Department (WRD) for use and storing water in any reservoir storing more than 9.2-acre with a dam more than 10-feet high.
Oregon Removal/Fill Law	ORS 196.795 et seq. OAR 141-090-0005 et seq.	Removal/fill permit for dam construction in waters of the state from Oregon Department of State Lands (DSL).
Dam Safety Program	ORS 540.350 et seq. OAR 690-020-0000 et seq.	State Dam Safety Permit requires preparation of design plans and review for conformance with dam safety standards by WRD.

Table 11. Summary of federal, state, and local regulatory requirements that may need to be addressed.		
Archaeological Objects and Sites Law Native American Graves and Protected Objects State Law	ORS 358.905 et seq. ORS 97.740 et seq. OAR 736-051-0080 et seq.	Protection of archaeological, cultural, and historic resources from State Historic Preservation Office (SHPO).
Clean Water Act	ORS 468B.025 et seq. CWA Section 402	Construction stormwater permit (C-1200) National Pollutant Discharge Elimination System (NPDES) Permit for sites > 1 acre administered by Oregon DEQ.
Energy Facility Site Certificate	ORS 469.300 et seq.	Large, new energy facilities in Oregon require a site certificate before construction begins from the Oregon Department of Energy (DOE).
Fish Passage and Other ODFW Requirements	ORS 509.580 et seq. OAR 635-412-0005 et seq.	Must present plans or otherwise demonstrate compliance with Oregon Department of Fish and Wildlife (ODFW) fish passage requirements for dams.
Forest Practices Act	ORS 527.610 et seq OAR 329-623-0400 et seq.	Notice of operation form to Oregon Department of Forestry (ODF) and possibly written plans for timber harvesting near significant wetlands, Type F streams, or important wildlife habitat identified by ODFW.
Mine Operating Permit	ORS 517.750 et seq. OAR 600	A mine operating permit from the Department of Geology and Mineral Industries (DOGAMI) to permit mining rock and other materials needed to construct the proposed dam.
Local	Authority	Issue/Issuing Agency
Polk County Comprehensive Plan and Zoning Code	Environmental elements of the comprehensive plan and zoning code	Conditional use and floodplain permits for reservoir construction from Polk County.
Polk County Comprehensive Plan and Zoning Code	Environmental elements of the comprehensive plan and zoning code	Conditional use permit for water intake facilities, pumping stations, and distribution lines from Polk County.
Polk County Comprehensive Plan and Zoning Code	Environmental elements of the comprehensive plan and zoning code	Conditional use permit for mining and processing of aggregate and mineral resource used for dam construction.

Endangered Species Act (ESA)

Section 7 consultation with the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA Fisheries) and U.S. Fish and Wildlife Service (USFWS) will be required as a result of the need for the a Corps Section 404 permit (i.e., federal nexus). Section 7 consultation is expected to be coupled with the Section 404 permit. As such, the Corps initiates consultation with NMFS and USFWS as the federal action agency. As part of the Section 404 permit application, it is anticipated that preparation of either a Biological Evaluation (BE) or Biological Assessment (BA) will be required. A BE is typically prepared as part of an informal consultation process for which the effects determination for listed species is expected to not likely result in significant adverse affects. By contrast, a BA is prepared as part of formal consultation process and when it is anticipated that the project may have significant adverse affects on listed species that are known to occur in the project area. The later requires preparation of a biological opinion and a plan identifying all reasonable and prudent measures to ensure that recovery of listed species is not jeopardized.

Federal Power Act

The Federal Power Act of 1935 ([16 USC 791 et seq.](#)) was enacted by Congress to regulate non-federal hydropower projects to support comprehensive development of rivers for energy generation and other beneficial uses, such as water supply, flood control, recreation, and fish and wildlife management. FPA regulations are administered by the Federal Energy Regulatory Commission (FERC). The FERC must also comply with other federal statutes covering environmental reviews and protection, financial reporting, information technology reporting, and historic preservation. The Federal Power Act (FPA) would be applicable to the proposed project only if a hydroelectric facility was proposed. The FERC licensing process is a very rigorous process focused on ensuring that all federal laws and regulations have been met prior to issuing a license.

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)

The MSFCMA has both federal and regional implications. The Northwest Power Planning Council (NPPC) is one of eight councils that were created under the MSFCMA for support and advice in the management of marine and anadromous fisheries resources. The NPPC must be consulted during study design, construction, and operation of a new or proposed hydroelectric project.

MSFCMA as amended also authorizes the NOAA Fisheries to promote the protection of essential fish habitat (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity. This includes the freshwater migratory, spawning and rearing habitat of the various species of salmonids with designated essential fish habitat. Often a section on potential impacts on EFH and measures used to mitigate potential impacts are integrated into the BE or BA as part of the Section 7 ESA consultation process. EFH is normally addressed in NEPA compliance documents as well.

The PFMC is responsible for implementing the Pacific Salmon fishery management plan. Amendment 14 to the Pacific Salmon fishery management plan provides details on the life

history, habitat needs, and specific EFH definitions for each species and their various life stages. It also provides details on the definition of the geographic extent of EFH, describing fresh water areas currently or historically used by salmon by their U.S. Geological Survey (USGS) hydrologic units and details about which aquatic areas above which dams are excluded from the salmon EFH definition. EFH does not apply to steelhead, but does apply to spring Chinook.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) as amended is the law for implementing international treaties between the U.S. and other nations for the protection and conservation of migratory birds. In general, it prohibits the taking (killing, harassment, capture) and selling of migratory birds. The USFWS is the primary federal agency responsible for implementation of the MBTA and typically cooperates with state agencies, such as the Oregon Department of Fish and Wildlife (ODFW) to conserve migratory birds through population assessment and management, habitat protection and management, and regulating take. Projects that have a federal nexus (permit or monies) may need to take into consideration potential impacts to migratory bird habitat and populations, such as modifying proposed project timing, scope, or design to avoid or reduce potential impacts to breeding habitat for populations of migrants that may be declining.

6.2 State Regulations

A number of state, rules, and regulations will be applicable to the project. These include programs regulating water use and storage, removing or filling waters of the state for dam construction, safe dam operation, and protection of aquatic and cultural resources. Information contained in this section comes from the Introduction to Water-related Permits and Reviews Issued by Oregon State Agencies (Jarvie 2008), state agency rules and regulations, agency websites, and past permitting experience.

ORS 537.130 and ORS 537.535 Water Rights

The construction of a reservoir or pond of any size to store water requires a permit from the Water Resources Department (WRD). A permit for a reservoir with the sole purpose of storing water is considered the primary permit, a water right permit. Because the proposal also will use water beyond the amount needed to initially fill in the reservoir an additional, or secondary application, water use permit also will be required from WRD. The application will need to demonstrate that the project will not affect any downstream holders of existing water rights.

OAR 690-051-000, Appropriation and use of water for Hydroelectric Power and Standards for Hydroelectric Applications

This regulation sets constraints on the allowable impacts of a hydroelectric facility in the State of Oregon. This regulation would only be applicable if a hydroelectric facility was proposed with the project. Constraints include a requirement for no net loss to natural resources. Mitigation for project effects must be in the project vicinity.

The law requires a demonstration that the project meets the following criteria:

- water is available for appropriation and that water appropriation will not interfere with existing water rights,

- the project complies with water quality standards established in OAR Chapter 340, Division 41
- the project will not have significant adverse impacts on fish populations
- the project will not unreasonably interfere with upstream and downstream passage of fish
- the project is designed to mitigate adverse impacts on spawning, rearing or other habitat areas necessary to maintain the levels and existing diversity of fish species
- unavoidable adverse impacts on fish will be mitigated
- timing of construction will be designed to minimize fishery impacts
- no net loss of wild game fish results from project construction
- the project shall not result in mortality or injury to an individual salmon or steelhead and shall not result in the loss of salmon or steelhead habitat or mitigation is reasonably certain to restore, enhance or improve existing salmon and steelhead habitat
- the project will not jeopardize the continued existence of an animal species
- the project will minimize adverse effects on wildlife habitat
- the project will not have significant deleterious effects on recreational uses
- the project will not result in significant adverse impacts on historical or cultural sites; unavoidable impacts on historical or cultural sites are adequately mitigated
- adverse effects on prime forestlands are avoided or minimized and offset by acceptable mitigation
- adverse effects on wetlands are avoided or appropriately mitigated
- impacts on scenic and aesthetic views and sites are avoided and the project is designed to blend in with the natural environmental
- the project will not disturb fragile or unstable soils or cause soil erosion which would impair other water users, and
- the need for power can be demonstrated

Oregon Removal/Fill Law

In addition to the Corps regulation of fill, DSL regulates removals or fills involving 50 cubic yards or more that alter streambed, streambanks, or wetlands. For projects located in essential salmon habitat waterways, any quantity of alteration requires a removal/fill permit from DSL. For the proposal, it is likely an Individual Permit would be required. As indicated above, a JPA would be completed and submitted simultaneously to the Corp and DSL. A wetland delineation that more accurately identifies the extent, type, and distribution of existing wetlands in the old lake bed and tributary streams will be required as part of the JPA. Average processing time for an Individual Permit is 120 days, which includes a 30-day period by DSL staff for a completeness review, a 30-day period for public review, and up to 60 days for final processing and preparation of permit decisions documents. Longer processing times are not uncommon

and may occur as a result of incomplete applications, requests for additional data, and responsiveness of the applicant or applicant's agent. Permits are valid for up to five years upon request and receipt of annual renewal fees and may be renewable after five years with submission of an updated JPA form.

Archaeological Objects and Sites Law; Native American Graves and Protected Objects State Law

The State Historic Preservation Office (SHPO) within the Oregon Parks and Recreation Department's Heritage Program is responsible for implementing laws designed to protect archaeological, historic, and cultural sites. Archaeological Objects and Sites Law defines archaeological sites as being a minimum of 75 years of age. This law also defines items of significance and cultural patrimony, covers artifacts associated with human remains, and prohibits damage to such sites on public or private lands. The Native American graves and Protected Objects State Law protects all Native American cairns, graves, and associated cultural items. An on-the-ground survey for historical and cultural resources within the area potentially impacted will be required. An application is submitted to SHPO, which has 30 days to complete its review, assuming sufficient information is provided. Concurrence of consistency with the provisions of these laws and state and local planning goals and objectives is required for a project to proceed.

1200-C Construction Stormwater Permit

In addition to implementing the Section 401 Water Quality Certification Program, DEQ implements Section 402, the National Pollutant Discharge Elimination System Permit (NPDES) Program. Construction stormwater (1200-C) permits are required for projects that disturb greater than one acre. Applications, including erosion and sedimentation control plans, are submitted to DEQ for review and approval to ensure stormwater runoff is controlled and adverse impacts to waters of the state and aquatic resources do not occur during construction.

Section 402, National Pollutant Discharge Elimination System Operations Permit (NPDES)

At present, a NPDES permit for the transfer of water from the Siletz to the Luckiamute basin will not be required. On June 13, 2008, EPA issued a ruling exempting interbasin water transfers from the NPDES requirements, providing there is no intervening use of the water and no pollutants are added in the transfer process. The ruling was upheld in the Eleventh Circuit Court, but is being challenged in other courts. Therefore, the future need for a NPDES permit for water transfers is somewhat uncertain at this time.

If the project includes any facilities that generate wastewater (e.g. bathrooms), release of that water into the river would require a wastewater discharge permit. We do not expect this will be necessary. We anticipate there will be few, if any, permanent employees on site. Wastewater from sinks and bathrooms can be managed through the construction of a septic tank (subject to County regulations).

Section 401 Water Quality Certification (Section 401 of the CWA)

As noted above, Section 401 Water Quality Certification of the CWA is triggered by the need for a Corps Section 404 permit and implemented at the state level by DEQ. An application must be

submitted to DEQ that identifies proposed construction, operation, maintenance, stormwater management, restoration and mitigation plans as applicable. DEQ evaluates the application materials and must certify that the project will comply with state water quality standards and not adversely affect aquatic resources or potentially public health.

Fish Passage and Other ODFW Requirements

OAR 635-412-0005 prohibits the construction of any artificial obstruction across any waters of the state that are inhabited, or were historically inhabited, by native migratory fish without providing passage for native migratory fish. Exemptions from this requirement are possible if a) ODFW finds that the impacts to fish have been adequately mitigated or b) there is no appreciable value in providing passage. The second situation is likely to occur only in cases where no suitable habitat would remain upstream of the facility. OAR 635-412-0005 also defines specific design requirements for upstream and downstream fish passage. These requirements would have to be incorporated into the engineering design of the project.

There is no specific application for these approvals to date but the JPA for removal/fill permits can be used provided there is sufficient information included in the JPA and a copy is provided to ODFW for review. Submissions should include all information necessary to show that ODFW fish passage criteria ([OAR 635-412-0035](#)) and/or guidance will be met. A monitoring and reporting plan may be required for certain sites. Assuming fish passage facilities are provided and properly maintained, the permit is valid for the life of the dam or next review trigger (e.g., dam removal or modification).

Other ODFW reviews and requirements including in-water timing guidelines (ORS 496.012 et seq. & ORS 506.109 et seq.) and in-water blasting permit (ORS 509.140 et seq., OAR 635-425-0000 et seq.), which may be required for construction of any new dam. ODFW provides review comments for in-water construction as part of other permit processes, such as removal/fill or in-water blasting permit. Guidance is provided such as limiting timing of construction activities to periods that avoids potential impacts during critical life history phases of migratory fishes.

If any in-water blasting is anticipated or will be used for constructing dam foundations, an application for an in-water blasting permit must be submitted at least 90 days before the anticipated in-water blasting for a “major project,” a project that requires multiple detonations or multiple days, or crosses two or more department regions or districts. The application must include information on the applicant, the type of explosives that would be used, alternatives, if any, to the proposed in-water blasting, information on fish and wildlife habitat and species that would be affected by the proposed blasting, predicted effects of the proposed blasting on these species, and proposed measures for preventing injury to fish, wildlife, and their habitat.

Energy Facility Site Certificate

If the proposed dam will include a hydroelectric facility, a site certificate may be required from DOE before construction begins. Site certificates are obtained from the Energy Facility Siting Council for the types of facilities subject to jurisdiction as defined by ORS 469.300 et seq. Smaller facilities with an average electric generating capacity of 35 megawatts or more and with high voltage (230 kV or more) that are less than 10 miles long and within one city, county, or state may be exempt from this requirement. It is recommended that DOE be contacted to more accurately determine the thresholds for exempt hydroelectric facilities.

Forest Practices Act

Before conducting any operation or forest practice, landowners are required to inform the Oregon Department of Forestry (ODF) by submitting a Notification of Operation to the local ODF office at least 15 days before the start of the proposed project. Some activities, such as those within 300 feet of a “significant wetland,” within 100 feet of a fish bearing streams, or within 300 feet of areas identified by ODFW as important for certain wildlife species, may require written plans of proposed operation or forest practice before such operations or forest practice begins. ODF should be contacted to determine if forest practices conducted in conjunction with land preparation for the proposed water storage project require any written plans because they are within proximity to significant wetlands, fish bearing streams or important wildlife habitats identified by ODFW.

Mine Operating Permit

According to DOGAMI, an operating permit is required for mining operations with an activity level that exceeds one acre and/or 5,000 cubic yards of new disturbance in any 12-month period, unless the excavated material stays on the property. Assuming quarry operations for constructing a new dam would surpass this threshold, a mine operating permit would be required. A completed application, including but not limited to proposed mine plans, erosion and sediment control plans, stormwater management plans, site plan map, proof of ownership, and a land survey must be submitted to DOGAMI. Permits may take up to 165 days or more to approve and must be renewed annually.

6.3 Local Government Permits and Approvals

Polk County’s comprehensive plan and zoning ordinance are the primary documents that planning and land use goals and policies that must be followed to construct, store, and operate the proposed reservoir and distribution system. The reservoir will be located in Polk County in the floodplain, watercourse, and adjacent wetlands of the Siletz River. Goals and policies of the 2008 Comprehensive Plan pertaining to Forest Lands and Natural Resources will be applicable to the proposed water storage project. The proposed water storage appears to be consistent with the stated policies in the Natural Resources section of the comprehensive plan for Reservoir Sites as well as policies pertaining to natural areas, fish and wildlife, and other resources. The zoning ordinance for Polk County, adopted in December 1975, is the most important tool for implementing the comprehensive plan goals and policies. Conditional use and floodplain permits are expected to be necessary for reservoir construction, water intake facilities, pumping stations, and distribution lines. A conditional use permit also is expected to be required for mining and processing aggregate and mineral resources used for dam construction.

6.4 Issues and Regulatory Risk Assessment

The presence of ESA - listed salmonids in the South Fork of the Siletz River and in the Luckiamute River system will be a prominent consideration in future analysis of Project effects and development of operational parameters (e.g. instream flow releases). Likewise, potential impacts on listed terrestrial species and impacts to wetlands are likely to be significant issues.

ESA consultation will require that a finding of no significant adverse effect on federally listed species can be supported. These include coho (threatened, located downstream of the

passage barrier), Oregon coastal steelhead (species of concern), Willamette steelhead (threatened), Willamette spring Chinook (threatened), marbled murrelets (threatened), northern spotted owl (threatened), Fender's blue butterfly (endangered), Oregon silverspot butterfly (threatened), Willamette daisy (endangered), water howlia (threatened), elegant fawn-lily (species of concern), western lily (endangered), Bradshaw's lomatium (endangered), Kincaid's lupine (threatened), and Nelson's checker mallow (threatened).

Potential project effects on the birds, plants, and butterflies can likely be avoided or minimized and mitigated. The largest dam alternative inundates some habitat potentially occupied by some of the listed plants and butterflies, but minor adjustment of the reservoir size would avoid those impacts.

The potential impacts to the Willamette steelhead and spring Chinook salmon will be limited largely to increases in summer flows in the Willamette and Luckiamute Rivers, which may be found to benefit these species. Tight control on pathogens will be necessary to ensure no disease is introduced into the Luckiamute River. If it is ultimately found that fish diseases exist in the Siletz River, which are not present in the Luckiamute, treatment of water before it is released may be required.

7 Conclusions & Recommendations

7.1 Conclusions

As discussed above, the study relies on existing information, extremely limited field data, and preliminary modeling and analysis. This concept-level review of the resources that may be affected by the project provides the following the preliminary conclusions:

- All dam alternatives are projected to meet expected water demand in 2050.
- The low and medium dams may both release warm water into the South Fork Siletz River during part of the year. The low dam alternative may release warm water through much of the summer and fall. Compared to the low dam, the medium dam is expected to release warm water for a shorter period of time in the fall. Both the small and medium reservoirs are expected to release water that is substantially warmer than the natural river temperature in October, which could potentially affect upstream movement of adult steelhead near upstream of the confluence with the North Fork Siletz. All temperature effects are expected to dissipate quickly downstream. Released water temperature approaches natural water temperature within 1 to 2 km of the dam and differences in temperature downstream of the North Fork Siletz are likely negligible.
- The high dam alternative is expected to release cool water into the river downstream of the dam. The differences in temperature between the release water and natural river temperatures likely dissipate quickly downstream. Released water temperature are expected to approach natural water temperature within 1 to 2 km of the dam and differences in temperature downstream of the North Fork Siletz are likely negligible. The releases of cool water may potentially benefit fish occupying the South Fork Siletz River downstream of the dam by reducing the naturally occurring peaks in water temperature in the river. A multi-level intake that can blend water from the surface and deeper could minimize effects and maximize benefits.

- All of the alternatives will inundate existing fish habitat. The area inundated increases with the size of the dam. Studies conducted in summer of 2010 indicate that there is little quality habitat and very few fish present in the reach that occupies the historic lakebed. Fish are presumed to be present in the tributary waters that would be inundated, but actual utilization of those habitats is unknown and more information is needed to assess this issue.
- The surface waters in the reservoir under all three alternatives are expected to be too warm in summer to support cold water species. The low and medium dams have cooler waters in the bottom of the reservoir which may provide quality habitat for cold water fish species during most of the year. The high dam has cold water in the bottom and the reservoir is expected to stratify sharply. Low dissolved oxygen levels in the colder portion of the lake are possible.
- All of the alternatives will inundate a substantial area of wetland habitat. The wetlands are concentrated in the historic lakebed. As a result, there is little difference between the alternatives in the area of wetland impacted. Sufficient project information is not yet available to estimate the area of wetlands that are expected to develop around the reservoir. Wetland impacts will have to be mitigated.
- All of the alternatives will inundate a substantial area of terrestrial habitat. The area inundated increases with the size of the dam.
- The high dam alternative is the only alternative that potentially impacts species listed under the Endangered Species Act within the footprint of the reservoir. These impacts could be avoided by making small adjustments in the size of the dam and resulting reservoir.
- Pipeline routes could potentially affect sensitive habitats which are known to support or could potentially support endangered species. These impacts can be avoided by carefully selecting pipeline routes.
- Given the history of the site, historical and cultural sites of interest may be present. No existing information is available to determine the presence or absence of these resources.
- The presence of buried contaminants in the potentially inundated area is possible. Additional investigation is needed to determine the extent, if any, of those contaminants.

7.2 Recommendations

Recommended next steps include:

- Conduct field investigations to verify the presence of the rare habitats potentially affected by the largest dam and/or pipeline routes and map those habitats. This information can be used to refine the size of dam and pipeline route.
- Conduct additional modeling of the reservoir to determine the range of water temperatures that could be accommodated through the use of multi-level intakes.
- Using the model results of the seasonal change in water elevation, develop estimates of the quantity of wetland habitat that is likely to form around the reservoir. Also conduct

field surveys to better quantify wetlands present in the project area. These steps will further inform the expected impacts to wetlands and the wetland mitigation that may be required by the project.

- Evaluate the potential effects of a reservoir on dissolved oxygen levels within the reservoir.
- Conduct surveys of fish populations in the tributaries upstream of the dam to determine the number of fish utilizing these habitats. This will provide useful information regarding the importance of those habitats in sustaining the steelhead population in the South Fork Siletz River.
- Conduct preliminary investigations of potentially contaminated sites to determine the types and extent of the contamination, if any, in the project area.

Further investigate the presence of pathogens in the Luckiamute River by contacting agency representatives and taking tissue samples, if necessary.

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