Attachment C

Water Quality Standards Revisions: Aquatic Life Use Updates Technical Support Document

October 2023 - Final

State of Oregon
DEQ Department of Environmental Quality

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Table of Contents

Executive Summary

Objective of the Aquatic Life Use Updates

The objective of this project is to update the aquatic life use designations associated with Oregon's temperature and dissolved oxygen standards based on the most current data available, and to ensure that DEQ applies the correct water quality criteria to protect aquatic life in Oregon waters.

Through this rulemaking, DEQ is correcting and updating the state's use designations, meaning which use subcategories are assigned to each waterbody across the state. The rulemaking will also adjust or identify the timeframe to which the seasonal spawning criteria apply. DEQ is not changing the criteria values, we are only updating the designations to determine where and when certain water quality criteria apply.

Under the Clean Water Act, states are required to establish water quality standards that provide for the protection and propagation of fish, shellfish and wildlife. However, protection of fish and shellfish, what we call "Fish and aquatic life," is a very broad use, and different species, life stages or communities have different water quality requirements. Therefore, states may specify **Subcategories** of uses within the broader aquatic life use.

Water quality standards are comprised of designated uses that establish the goal for the waterbody, water quality criteria for pollutants to protect the uses, and an antidegradation policy to protect existing uses, determine whether and to what degree a lowering of water quality is allowable, and to restore and maintain high quality waters from degradation.

The beneficial use designations for fish and aquatic life set the protection goals for a waterbody, and in the case of Oregon's temperature and dissolved oxygen standards, determine where and when each criteria applies. Accurate aquatic life use designations are important for DEQ to apply appropriate criteria to develop discharge permit limits, assess Oregon waters and identify impaired waters, establish load and waste load allocations through total maximum daily load calculations (TMDLs), and certify federal permits and licenses for hydroelectric and fill and removal projects meet water quality standards.

The scope of this project is divided into three main components:

1. General update to the existing use subcategory designations associated with the temperature standard. This includes the 'year-round fish use' categories and the seasonal 'spawning use' category already included in the water quality standards rules under OAR-340-04141.
2. Formal designation of where and when the use subcategories in the dissolved oxygen standard apply. DEQ will adopt the procedures documented and used to implement the dissolved oxygen standard since 1998 as the basis for designation in the administrative rules for the first time.
3. Additional minor miscellaneous rule amendments to definitions in OAR-340-041-0002 and the pH criteria assigned to the Crooked River and Trout Creek sub-basins of the Deschutes River in OAR-340-041-0130.

Oregon has established the fish and aquatic life use subcategories for its temperature and dissolved oxygen standards. Each use subcategory has different criteria to protect that species or community. Because the temperature uses are based on sensitive species and life stages, the criteria will also protect other organisms with less sensitive life stages that co-occur. The dissolved oxygen standard use subcategories are based on the aquatic community, or a mix of species, rather than individual species. Therefore, the use subcategories for dissolved oxygen are similar, but not identical, to the use subcategories for temperature.

Through this rulemaking, DEQ is correcting and updating the state's use designations, meaning which use subcategories are assigned to each waterbody reach across the state. Where the spawning use has been designated, the rulemaking will also adjust or identify the timeframe to which the seasonal spawning criteria apply. The use designations reflect the biological needs of the habitat or aquatic life that are present, or expected to be present, in waterbodies. The uses are not determined based on currently attained water temperatures. DEQ is not proposing to change the criteria values, only updating where and when the different criteria apply.

The primary tasks of the revisions to update existing use subcategory designations associated with the temperature standard are first, to conduct a statewide evaluation and update of the existing designations. These are found on what are commonly referred to as the 'fish use' and 'spawning use' maps and figures in Oregon's basin-specific rules. The main goal is to incorporate about 18 years of additional habitat distribution data collected and compiled by ODFW since 2003. Second, we are specifically reviewing the designations for bull trout spawning to make sure they conform with the final critical habitat rule adopted by USFWS in 2010. The USFWS Biological Opinion from 2015 also required DEQ to add some waters to this designation. Finally, DEQ is proposing to add more waters to the core cold water habitat based on additional temperature data. This data is used to identify streams that provide cold water all through the summer. This includes tributaries that provide cold water refuge for fish migrating in the Columbia River mainstem, which EPA identified a cold-water refuge plan for the Columbia River.

The primary tasks of the revisions to update existing use subcategory designations associated with the dissolved oxygen standard are first, to designate waterbodies for each category in the basin-specific rules. Second, there is a special focus on improving the way we identify resident tout spawning areas for designating the salmonid spawning use for the D.O. standard. This use category includes both the migratory salmon and steelhead spawning identified in the temperature rule with the addition of spawning habitat for resident trout and related cold-water fish. There is historically a lack of specific information on the location of resident trout spawning areas in Oregon and there are still significant data gaps. However, spawning likely occurs in a large proportion of the range.

DEQ also proposes to include two additional minor corrections to the basin specific rules in this rulemaking: clarification or removal of conflicting definitions for Cold-, Cool- and Warm-water aquatic life used in OAR-340-041-0002, and revision of the pH criteria designated for the Crooked River and Trout Creek Subbasins of the Deschutes River basin.

Purpose of this document

This Technical Support Document contains information about the data sources, methods, and supporting analyses for identifying the appropriate aquatic life use subcategory for waterbodies based on the most up to date data and information. DEQ is not required to provide additional justification for the existing designation of waterbodies, or when assigning a designation associated with a more stringent criterion. A separate Use Attainability Analysis documents the rationale where the use subcategories identified through these methods would result in a less stringent criterion.

Organization of the Document:

Chapter 1: This section provides background information about the goals for this rulemaking, the temperature and dissolved oxygen standards, and the technical review process followed by DEQ.

Chapter 2: This section identifies the decision rule methodology used to designate the aquatic life use subcategories for the temperature and dissolved oxygen standards. Sub-sections under each subcategory of the designations identifies where data sources and decision methods used to designate the aquatic life uses have changed from the last rulemaking in 2003 and indicates whether any additional methods or data sources were considered during DEQ's technical review.

Chapter 3: This section provides details of supporting analyses and literature reviews, GIS procedures, and discussion of alternatives considered but not adopted into the decision rule methodology.

Appendices: Appendix A provides a summary of the decision rules methods detailed in Chapter 2 for easy reference. Appendix B provides a detailed cross walk of data sources and variables used between the 2003 decision rule methodology and the proposed decision rule methodology. Appendix C provides a list of data sources used to designate use subcategories. All data used by DEQ is from publicly available sources.

Data and Information

DEQ primarily relied on the Oregon Department of Fish and Wildlife (ODFW) Fish Habitat Distribution (FHD) database[1] for information on fish distribution and Timing / In-water work area mapping[2] (aka Timing Tables) for life-stage activity and timing information.

DEQ also incorporated additional information from the U.S. Fish and Wildlife Service, U.S. Geological Survey, U.S. Forest Service, the U.S. Environmental Protection Agency, Oregon DEQ's Water Quality Monitoring Program, and from third parties that submitted data to DEQ's statewide water quality assessment for the 2018 and 2022 integrated reports.

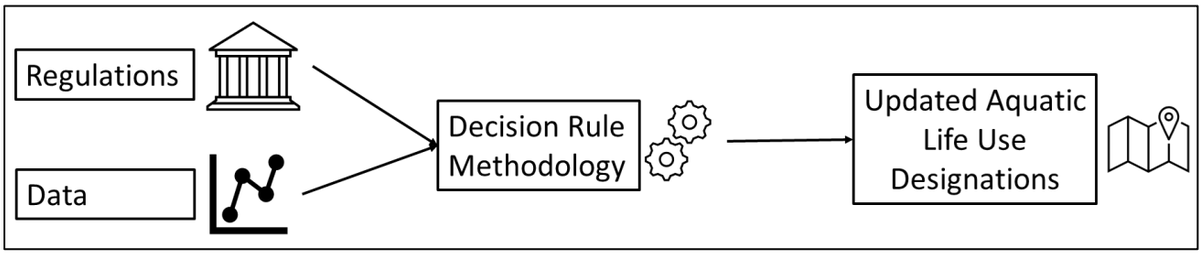
Key Terms

Anadromous Species	A term for the life history of fish born in freshwater who spend most of their lives in saltwater and return to freshwater to spawn, such as salmon and steelhead.
Salmonid	In this document, the term refers to native fishes classified in the family Salmonidae: salmon, trout, char, and whitefish.
Salmon and steelhead	In this document, the term refers to the native salmon and anadromous trout species of Oregon: Chum, Chinook, Coho, and Sockeye Salmon, and steelhead trout.
Resident Trout	In this document the term refers to the native resident trout and whitefish species of Oregon: Coastal, Lahontan, and Westslope Cutthroat, Rainbow, and Redband Trout, and Mountain Whitefish.

Methods

DEQ used a technical development process that combines the requirements of state and federal regulations with the data available to identify distribution and habitats of sensitive species of aquatic life.

Figure 1 Conceptual Model of DEQ's Technical Development Process



DEQ's aquatic life use designations are based on the **regulations** of Clean Water Act and water quality standards adopted into state administrative rules for the protection of aquatic life. The different subcategories of aquatic life use and the species or communities associated with them are defined in Oregon's water quality standards. Various publicly available **data** sources provide the means to identify the location of populations and habitats that fit each subcategory of the aquatic life uses. DEQ was assisted in identifying and interpreting data sources by an interagency technical work group (see more information in Section 1.5).

The defined use subcategories are identified through application of the data using a **methodology** referred to as **decision rules.** The decision rules are a logical chain of operations for evaluating the data to identify the waterbodies where and when each specific use subcategory occurs. This is so DEQ can target them for protection that is consistent with our regulations. In 2003, DEQ published decision rules as part of the rulemaking record where the current use subcategories were designated (DEQ 2003a). DEQ is retaining most of the original methods used in 2003 , with adjustments where necessary to account for new data sources and variables, or to fill gaps in the original rules. As a result, most of the use designations are not

[1] https://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=fishdistdata
[2] https://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=dataresources

changing. Where they are changing, the differences are where the amount or accuracy of the data has increased. **Figure 3** below illustrates where the use designations are changing and where they are staying the same.

Finally, the end product of the technical development process are the proposed updates to the **aquatic life use designations** in the proposed rule amendments**. Figure 2, Figure 4,** and **Figure 5** below depict the waterbodies assigned to each use subcategory statewide.

Proposed Use Changes

The fish and aquatic life use subcategory updates will be adopted as amended basin-specific rule maps or tables in Oregon's administrative rules OAR-340-041-0101 to OAR-340-041-0345. Because DEQ is using much of the pre-existing decision rule methods for assigning the use subcategories for temperature, and existing implementation procedures for dissolved oxygen, the majority of waterbodies will likely remain designated for the same uses, and therefore subject to the same criteria currently implemented in DEQ's water quality programs (**Figure 3**). Updating the aquatic life use designations with the best available and up to date scientific data and information will ensure that the highest attainable use is designated and that existing uses are protected.

DEQ proposes to designate use subcategories with more stringent criteria in waters where dam removal, restored passage, or reintroduction of populations have restored use in waters that were previously inaccessible. Or in cases where increased availability of continuously monitored temperature indicates waters currently attain more stringent criteria.

DEQ proposes changes to use subcategory designations with less stringent criteria in waters where the existing designations were based on incomplete or provisional data or assumptions that have been replaced with more specific data. There are also hydrography and mapping errors that will be corrected. None of these changes result from degradation of the habitat or an actual change to the use present in the waterbody.

Maps of the draft proposed use designation changes in Chapter 2 are available to the public through the Oregon Geospatial Enterprise Office on ArcGIS Online. https://arcg.is/vDS0D These maps are provided for illustrative and informational purposes only. The draft published maps on the DEQ rulemaking webpage are those that will be revised if warranted and then proposed for adoption into rule by the Environmental Quality Commission.

Figure 2 Overview map of proposed year-round aquatic life use designations for temperature

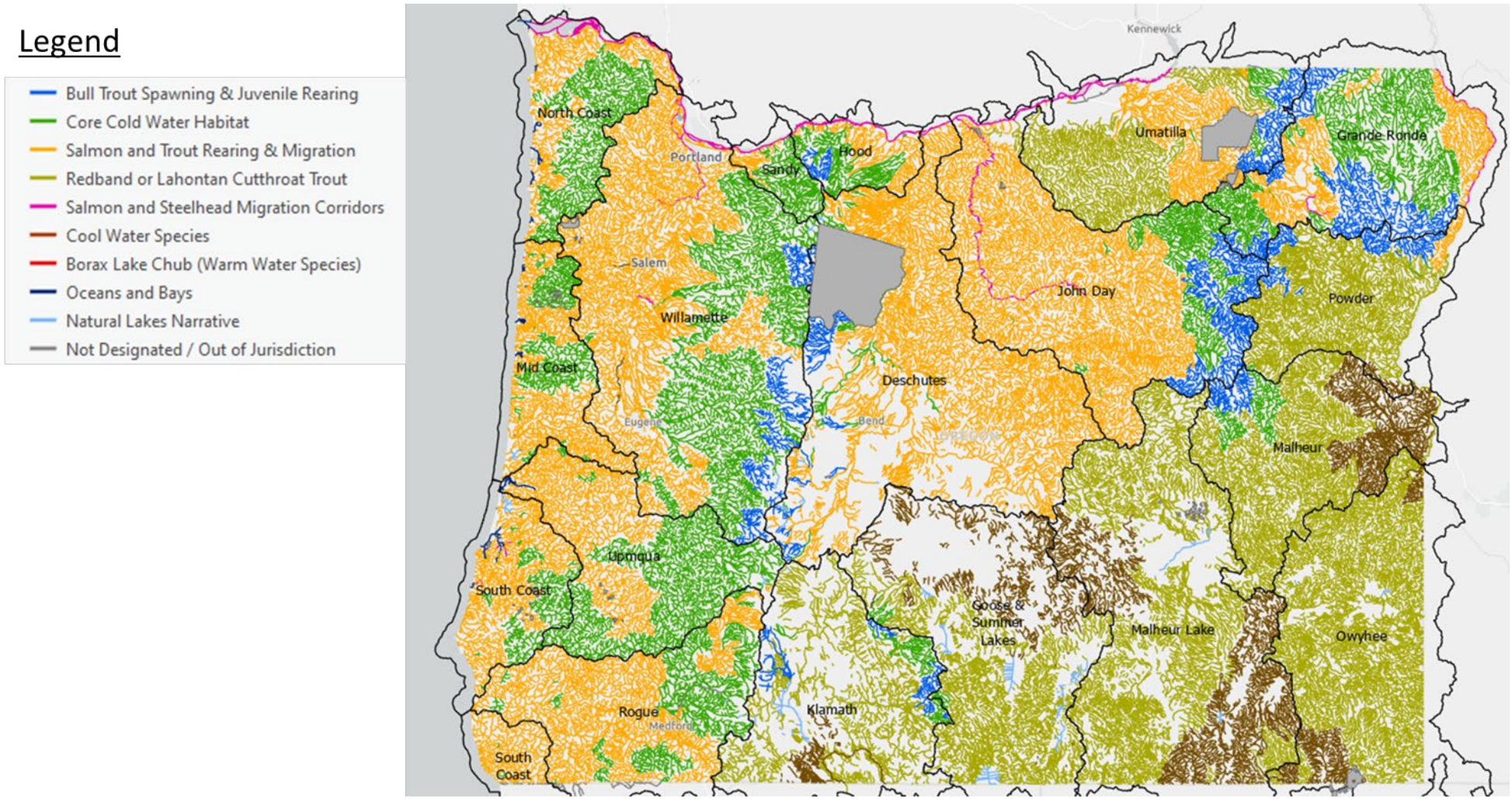


Figure 3 Overview map of changes to year-round aquatic life use designations for temperature resulting from the proposed updates

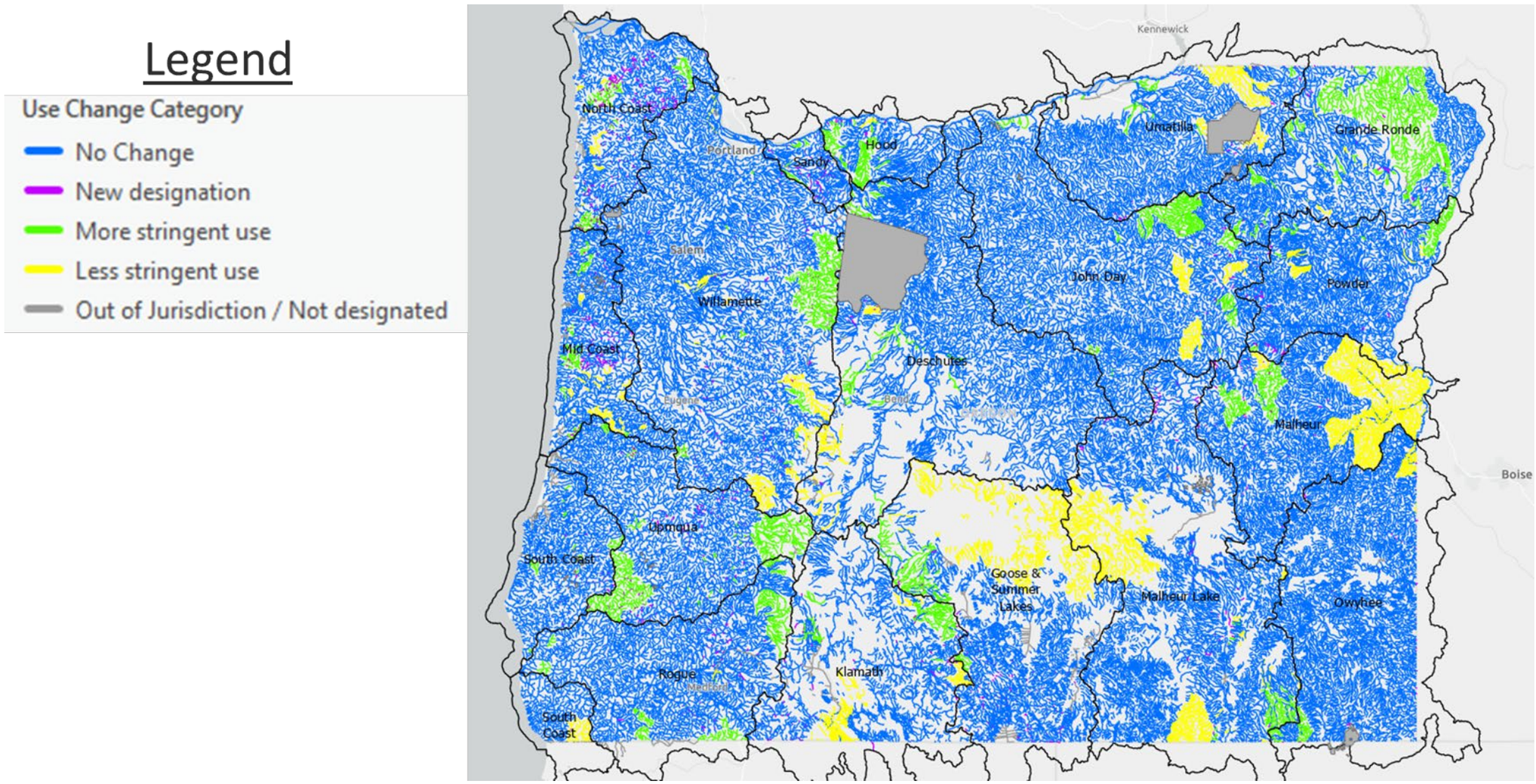


Figure 4 Overview map of proposed year-round aquatic life use designations for dissolved oxygen

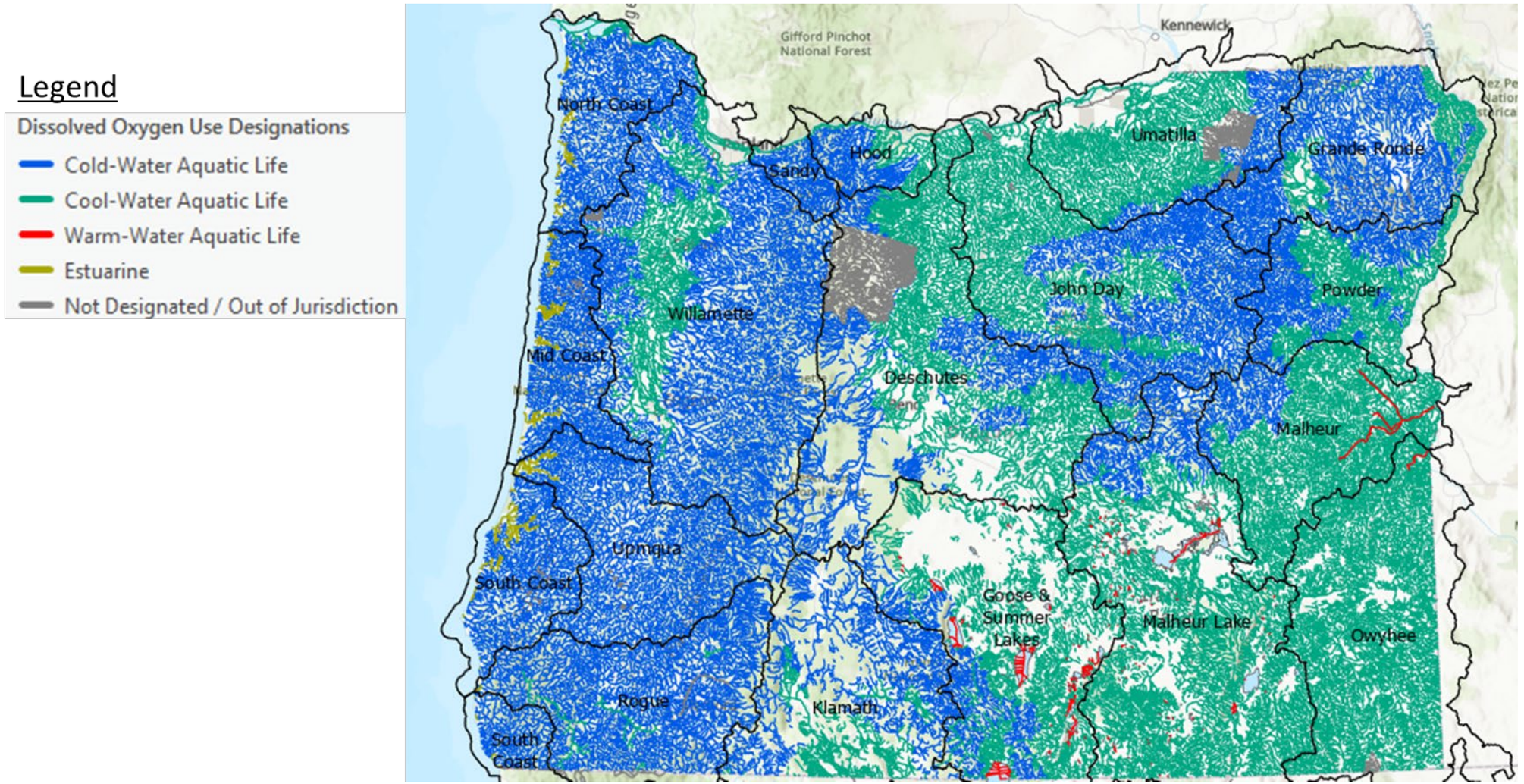
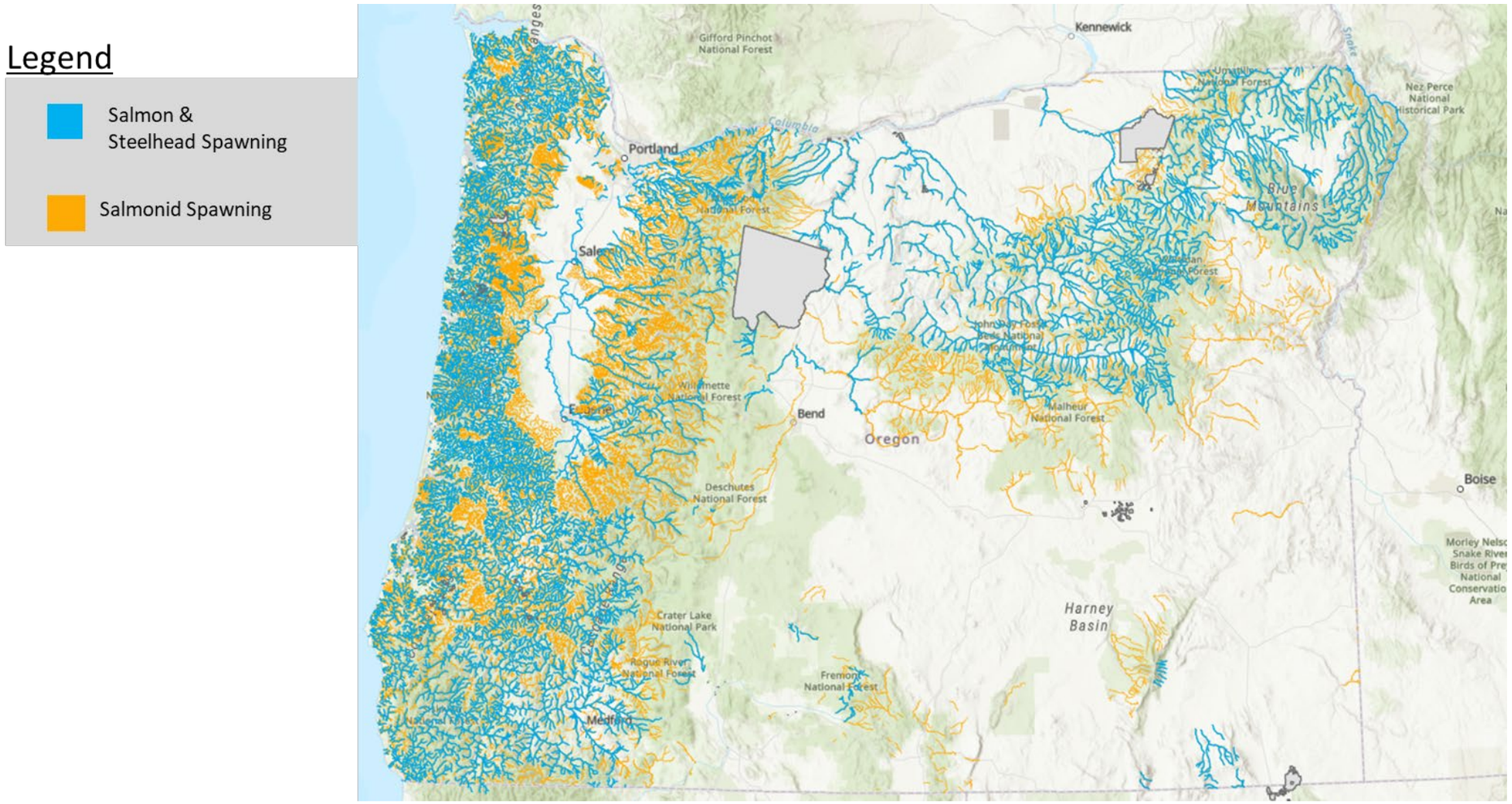


Figure 5 Overview map of proposed designations for Salmon and Steelhead Spawning (temperature) and Salmonid Spawning (dissolved oxygen).



1 Introduction

This document contains the proposed procedures, documentation, and analysis to support updates and new designation of aquatic life use subcategories related to Oregon's water quality standards for temperature and dissolved oxygen (D.O.). These designations are currently found in figures and tables in Oregon's Administrative Rules (OAR)'s under basin-specific rules at OAR-340-041-0101 to OAR-340-041-0345. The Oregon Department of Environmental Quality (DEQ) will use this document in agency and advisory committee discussions in preparation for rulemaking to revise the aquatic life use designations as appropriate. DEQ may update existing "fish use maps" or create new maps or other designation for adoption into state administrative rules as the official designation of these uses. DEQ plans to propose rule amendments for Environmental Quality Commission (EQC) adoption in early 2023.

Section 2 summarizes the methodology used to combine data and information to designate the aquatic life use subcategories consistent with the definitions and requirements of Oregon's temperature and D.O. standards in OAR-340-041-0002, OAR-340-041-0028, OAR 340-041-0016 and Table 21.

Section 3 identifies where data sources and decision methods used to designate the aquatic life uses have changed from the last rulemaking in 2003, and additional methods or data sources that were considered during DEQ's technical review. Detailed inventory of data sources, including variables used, literature review, and other supporting analyses are documented in appendices.

Appendices are provided that detail the data sources and variables used in each designation, a shorthand of the decision rules, and flow charts.

1.1 Background

Water quality standards are comprised of designated uses, sometimes referred to as beneficial uses (40 CFR 131.10), water quality criteria established to protect the uses (40 CFR 131.11), and antidegradation policies and implementation methods designed to prevent degradation of water quality and protect existing uses, specify how the State determines whether, and to what extent, water quality may be lowered, and to protect and maintain current high water quality (40 CFR 131.12; EPA WQS Handbook 2012).

Fish and Aquatic Life Use is a designated use in virtually every waterbody in Oregon. The only exception being a constructed irrigation water conveyance canal screened off from aquatic organisms. Because Fish and Aquatic Life use is a broad category and many species, populations, or communities of organisms can have different biological tolerances and requirements to water quality parameters, the Clean Water Act allows states to establish use subcategories within their water quality standards to differentiate waterbodies where specific criteria may be applied for protection of the use. Several of Oregon's water quality standards contain multiple subcategories of the Fish and Aquatic Life use.

Oregon's temperature standard has criteria for subcategories of aquatic life use based on sensitive salmon, steelhead, resident trout and other native fish species and their life stages within flowing freshwaters (Table 1). These also include separate narrative criteria and use subcategories for cool water species, lakes, and oceans & bays.

Oregon's dissolved oxygen standard has criteria for subcategories of aquatic life based on community subcategories. The dissolved oxygen criteria were designed to protect community assemblages in estuarine, marine, and freshwater systems dominated by warm, cool, and cold-water species with similar dissolved oxygen requirements and are adapted to different habitats.

Designated use subcategories for temperature and dissolved oxygen standards differ because of the way criteria were developed and because standards were adopted separately at different times. The temperature standard use subcategories rely on a species-based approach that focuses on the protection required for the most sensitive species present in a given waterbody, or stream reach. The Dissolved Oxygen standard use subcategories rely on a broader aquatic community-based approach that focuses on protection of an aquatic community, or grouping of species, with similar D.O. requirements.

In 2003, as part of the temperature standard rulemaking, DEQ mapped the waterbodies designated for each use subcategory associated with the different temperature criteria contained in its temperature standard rule (DEQ 2003a). These 'fish use maps' were the product of a litigation settlement because the court found that it was not clear when and where Oregon's various temperature criteria applied. The 2003 mapping effort relied primarily on data for fish species and life stage distribution and timing information provided by the Oregon Department of Fish and Wildlife (ODFW). The 2003 ODFW database incorporated the best data available at the time, which was sometimes incomplete or provisional. In the absence of more comprehensive statewide availability of observations or survey data and to address data gaps, the professional opinion of biologists was used to determine fish uses and spawning dates. DEQ's 2003 use designations are contained in a variety of tables and maps in the water quality standards rules (Oregon Administrative Rules 340, Chapter 41). It was not a requirement to adopt explicit designation maps for the subcategories used in the dissolved oxygen standard when DEQ adopted the standard in 1996.

DEQ has not updated the fish use maps and tables since 2003, with a few exceptions. Since then, ODFW has continued to improve its information on fish habitat distribution. In addition, restoration projects and dam removals have opened certain previously impassable streams to fish passage. Since 2003, the United States Fish and Wildlife Service (USFWS) has also adopted a Critical Habitat rule for Bull Trout, making the state's existing designations inconsistent with the federal designation of critical habitat.

Finally, DEQ has recently adopted the NHD high-resolution (1:24,000) hydrography to align with statewide geospatial data standards. Waterbodies will be designated for Oregon's aquatic life uses are using the National Hydrography Dataset (NHD) High Resolution 1:24,000 scale hydrography for Oregon. Prior to 1996 and following its original adoption of the aquatic life use in 1996, uses were designated at the scale of Oregon Water Resources Department administrative basins and visible for only major rivers and tributaries on the lower-resolution hydrographic maps of the time. DEQ did not intend these basin level designations to indicate that the use designations applied to every stream reach within a basin. The maps adopted in 2003 improved on the available information, using the StreamNET hydrography at a scale of 1:100,000.

DEQ determined there is a need to update Oregon's aquatic life use designations to:

1. incorporate new and improved data, especially the major improvements by ODFW to the base data used in 2003,
2. correct errors (e.g., inaccuracy resulting from different base hydrography), and
3. add habitat that is newly accessible since 2003.

These updates will ensure that the use designations in Oregon's water quality standards are accurate, up to date, and based on the best available scientific information; ensuring that the highest attainable use is designated and existing uses are protected.

Table 1 List of native salmonid species of Oregon referred to in this document.

Common Name	Genus	Species
Anadromous Species		
Chum Salmon	*Oncorhynchus*	*keta*
Spring Chinook Salmon	*Oncorhynchus*	*tshawytscha*
Fall Chinook Salmon	*Oncorhynchus*	*tshawytscha*
Coho Salmon	*Oncorhynchus*	*kisutch*
Sockeye Salmon	*Oncorhynchus*	*nerka*
Summer Steelhead Trout	*Oncorhynchus*	*mykiss*
Winter Steelhead Trout	*Oncorhynchus*	*mykiss*
Resident Species		
Bull Trout (char)	*Salvelinus*	*confluentus*
Coastal Cutthroat Trout	*Oncorhynchus*	*clarkii spp. clarkii*
Lahontan Cutthroat Trout	*Oncorhynchus*	*clarkii spp. henshawi*
Westslope Cutthroat Trout	*Oncorhynchus*	*clarkii spp. lewisi*
Rainbow Trout	*Oncorhynchus*	*mykiss*
Redband Trout	*Oncorhynchus*	*mykiss spp. gairdneri*
Mountain Whitefish	*Prosopium*	*williamsoni*

The seasonal runs of Spring and Fall Chinook and summer and winter steelhead are divided among two populations, even though they are the same species, because of the different life history strategies they use for migration and reproduction. Spring Chinook enter freshwater in spring or summer, holding in freshwater and/or migrating long distances to spawning grounds, until they spawn in fall. Fall Chinook enter freshwater in the fall and migrate directly to spawn shortly afterwards. Summer steelhead enter freshwater in the late summer, holding in freshwater or migrating very long distances to spawning grounds, where they spawn later during the winter. Winter steelhead enter freshwater in the winter and migrate directly to spawning grounds and spawn soon after arriving. The summer steelhead usually start spawning earlier in the season than the winter steelhead.

For both salmon and steelhead, spring to summer run timings tend to occur where migration distances to spawning areas are extremely long or where there are partial barriers to access that favor summer migration periods. Usually these are waters where natural obstacles such as rapids or waterfalls are difficult to pass during high flows during late fall and winter but are passable during lower flows during spring or summer.

1.2 The Temperature Standards

Oregon's temperature standards (Oregon Administrative Rules Division 41 Rule 0028) are based on the available body of science describing the temperature requirements and preferences of the state's native aquatic life (McCullough et al. 2001). They are not intended to mimic what the "natural" stream temperatures of a waterbody are expected to be. The purpose of the temperature standards is to protect the beneficial uses. The decision rule methodology for identifying waterbodies to designate for the aquatic life uses for the temperature standards are detailed in Section 2.3 and 2.4.

In general, the temperature regime of streams and rivers in the Pacific Northwest follow a similar pattern. The annual maximum temperatures occur in the summer months (July and August), while temperatures are cooler in the spring and fall, and coldest during the winter months (December and January) (Figure 6). Water temperature is determined by the solar radiation and air temperature that deliver heat to the stream, the characteristics of the stream channel through which the water flows, and the physical characteristics of the flowing water itself (Poole et al. 2001).

Water quality criteria to protect beneficial uses apply at all times of the year (Table 2). Every water body in Oregon has a year-round aquatic life use designation. In many cases, habitat supports multiple species with a range of thermal tolerance. Waterbodies can also fit the requirements for multiple of the year-round aquatic life use designation subcategories. DEQ designates the aquatic life use based on the most sensitive use that occurs in the waterbody. DEQ has historically focused on salmonids as the most temperature sensitive species in cold or cool water aquatic communities. They are also usually the species for which the most data on thermal tolerance and distribution is available.

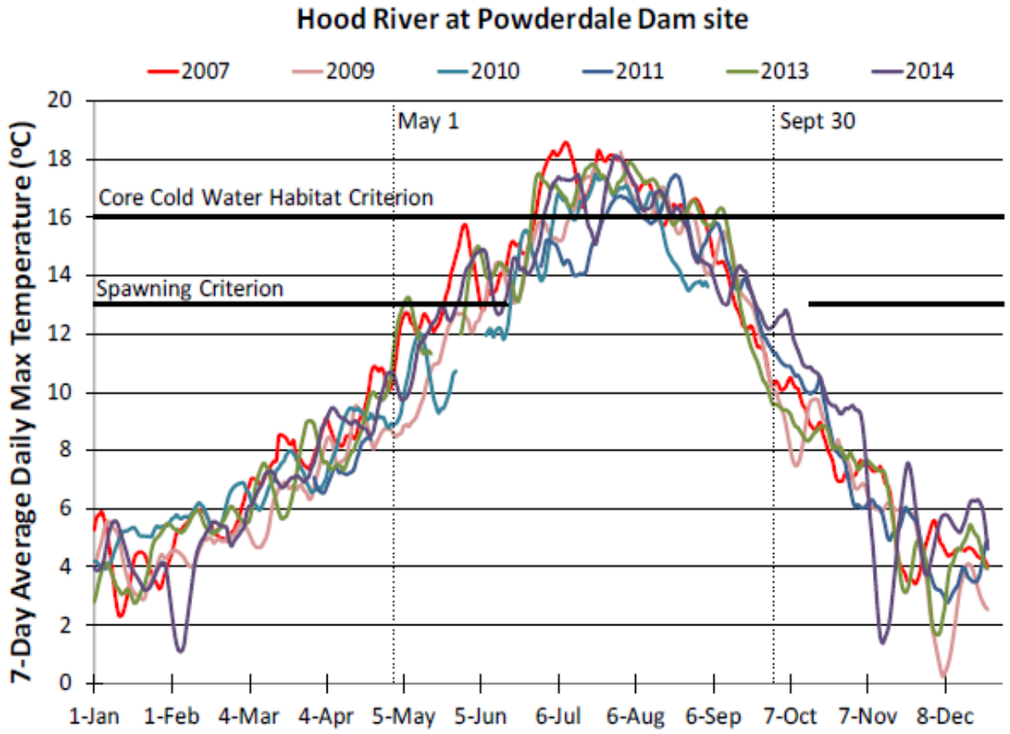
DEQ emphasizes attainment of the temperature criteria during the summer, because if they are attained during the hottest part of the year, there is assurance that stream temperatures will be cooler than the criteria for much of the rest of the year.

Table 2 Orgon's Use Subcategories and Criteria for Temperature. Ordered from most stringent to least stringent. Where a waterbody fits multiple use categories the most stringent category is designated.

Aquatic Use Subcategory	Criterion (7dADM[3])	When Applied
Year- Round Use Subcategories		
Bull Trout Spawning and Juvenile Rearing	12°C	Year-round
Core Cold Water Habitat	16°C	Year-round
Salmon and Trout Rearing and Migration	18°C	Year-round
Salmon and Steelhead Migration Corridors	20°C	Year-round
Redband or Lohantan Cutthroat Trout	20°C	Year-round
Cool Water Species	narrative	Year-round
Borax Lake Chub	narrative	Year-round
Seasonal Use Subcategories		
Salmon and Steelhead Spawning	13°C	During designated spawning time periods

[3] Seven-day average daily maximum temperature (7dADM) means the average of the daily maximum temperatures from seven consecutive days made on a rolling basis. The daily maximum temperature experienced during the warmest consecutive 7-day period of the year must be no higher than the criterion for a waterbody to attain the corresponding criterion. Average daily water temperatures and maximum temperatures at most other times of year will be cooler than the temperature of the criterion.

Figure 6 Seasonal Variation in Stream Temperature and Critical Periods for Criteria. General example using data from the Hood River at Powerdale Dam. Horizontal lines show criteria thresholds and time periods and when year round and seasonal criteria are in effect. (DEQ 2018)



1.3 The Dissolved Oxygen Standards

Oregon's dissolved oxygen standards (Oregon Administrative Rules Division 41 Rule 0016) are based on integrated the scientific information describing the oxygen levels needed by fish and aquatic life. The objective of the water quality standard for dissolved oxygen is to protect aquatic life from anthropogenic alteration of dissolved oxygen levels. There are various cold-water, cool-water and warm-water aquatic life communities in Oregon that each have different general dissolved oxygen requirements. Since fish and aquatic life is a beneficial use that is designated for essentially every waterbody in Oregon, each water body will be assigned one of these year-round aquatic life use subcategories for dissolved oxygen. The decision rule methodology for identifying waterbodies to designate for the aquatic life uses for the temperature standards are detailed in Section 2.5 and 2.6.

In general, the dissolved oxygen regime of streams and rivers in the Pacific Northwest follow an inverse pattern to water temperature. Dissolved oxygen concentrations can fluctuate both daily and seasonally. The annual minimum dissolved oxygen concentrations occur in the summer months when productivity and water temperatures are high (July and August), and annual maximum during the winter months (December and January) (Figure 7). Daily dissolved oxygen concentration is highest around noon when photosynthesis by plants peaks, and lowest in the early morning following the longest duration of nighttime respiration by aquatic plants and organisms. Dissolved oxygen concentrations can vary quickly over space and time by a combination of variables including diffusion and aeration, photosynthesis, respiration and decomposition. Water tends toward an equilibrium of 100% air saturation, which is determined by factors including water temperature, salinity and barometric pressure (Fondriest Environmental, Inc. 2013).

When DEQ adopted the existing dissolved oxygen standards in 1996, the use subcategories for dissolved oxygen were not designated in rule. However, Oregon has applied the standards consistently for many years as described in memos to EPA in 1998 and 2004. These memos identify where and when the various dissolved oxygen criteria are applied to protect aquatic life and have been DEQ's standard practice since 1998. DEQ is proposing to adopt use subcategory designations in rule consistent with these existing procedures and our standard practice where appropriate. The new use designations will amend the basin-specific beneficial use rules in OAR-340-041-101 to OAR-340-041-340.

Unlike the aquatic life use subcategories and criteria for temperature, which are based on identifying the most sensitive individual indicator species, the use subcategories and criteria

for dissolved oxygen are based on protecting broader aquatic communities (Table 3). The dissolved oxygen criteria were developed to protect community assemblages in estuarine, marine, and freshwater systems dominated by warm, cool, and cold-water species with similar dissolved oxygen requirements, but not necessarily exclusive of species from another class. Therefore, use subcategories for the temperature and dissolved oxygen standards are different. Since salmonids are among the most sensitive species in terms of both dissolved oxygen requirements and temperature, the use subcategories for dissolved oxygen overlap with some of the aquatic life use subcategories for temperature.

Because dissolved oxygen concentration varies through time in the natural environment, the water quality standard includes the 7-day mean of the daily minimum and 30-day mean criteria in addition to an instantaneous minimum of dissolved oxygen concentration. These metrics apply only "At the discretion of the Department, when the Department determines that adequate information exists," if DEQ determines on a site-specific basis that adequate DO monitoring data collected through continuous are available for a sufficient period of time during critical time periods[4].

The water quality standards for dissolved oxygen also recognize that dissolved oxygen concentration may not be optimal at all times or in all places for every individual organism. The were developed based on requirements of the most sensitive aquatic species in each community, but allow for a small acceptable level of risk to occur for short periods of time to individual organisms as long as the community is protected (DEQ 1995a). Given these circumstances, the policy objective for the dissolved oxygen standard was to minimize risk to aquatic ecosystems from anthropogenic impacts.

The U.S. EPA approved Oregon's dissolved oxygen criteria in 1999 with the understanding that DEQ would identify where the application of the Cold Water Aquatic Life criterion for dissolved oxygen is necessary to fully protect threatened and endangered species. DEQ identifies where the application of the year round Cold Water Aquatic Life criterion is necessary by designating the Cold Water Aquatic Life use subcategory for dissolved oxygen to waters designated as Bull Trout Spawning and Rearing Habitat and Core Cold Water Habitat under the temperature standards and to waters in coastal and elevated sub-ecoregions where cold water habitats are likely to occur. DEQ also identifies where sensitive adult spawning and early life stages of egg incubation and larval development of salmonids, including threatened and endangered species, are protected through application of the seasonal Salmonid Spawning criteria for dissolved oxygen, regardless of whether a cool-water aquatic life community is also present.

Oregon's cool-water aquatic life criteria for dissolved oxygen are protective of threatened and endangered salmonids given the limited portions of time they are expected to be present in waters designated for the Cool Water Aquatic Life use subcategory and the limited amount of time D.O. would be at the lower concentrations. DEQ's cool water aquatic life criteria for dissolved oxygen meets or exceeds the minimum protection of nationally recommended dissolved oxygen criteria for cold water species and salmonids (EPA 1986a), and is therefore protective of threatened or endangered salmonids in waters DEQ designates for Cool Water Aquatic Life. The nationally recommended criteria indicate a light production impairment at a constant exposure of 6.0 mg/L and a moderate production impairment at a constant exposure of 5.0 mg/L for salmonids. DEQ's cool water aquatic life criterion allows 6.5 mg/L as a 30-day average of the daily means, 5.0 mg/L as a 7-day average of the daily minimums, and 4.0 mg/L as an absolute minimum. This results in slight risk to salmonid production for only the portion of the day when D.O. concentrations approach the minimums allowed by Oregon's criteria. The National Marine Fisheries Service (NMFS) did not expect significant increases in mortality to Threatened and Endangered populations of rearing juveniles or migrating adult salmonids by application of the cool water aquatic life criteria (NMFS 1999).

[4] DEQ Letter to EPA regarding beneficial uses, temperature, dissolved oxygen, and pH standards, June 22, 1998. https://www.oregon.gov/deq/FilterDocs/EPALetter062298.pdf

Table 3 Dissolved oxygen aquatic life use subcategories and criteria metrics. Multiple metrics apply, including a 30-day mean of daily mean concentration (30-D) a 7-day mean of daily mean (7-D), a 7-day mean of the daily minimum (7-Mi) concentration, and absolute minimum (Min) metrics. The 7-day and 30-day metrics are calculated from continuously monitored data sets. Concentrations shown in grey shaded boxes are used as a minimum allowed concentration when evaluating grab or instantaneous samples. Shaded values are implemented as absolute minimum criteria, unless DEQ believes adequate data exists to apply the multiple criteria as statistical metrics. All criteria apply to the water column except for the inter-gravel dissolved oxygen limit (IGDO) for salmonid spawning.

Use Subcategory	Metrics and Concentration (mg/L)			
	30-D	7- D	7- Mi	Min
Salmonid Spawning		11.0[1,2]		9.0 **-OR-** 8.0 (IGDO)
Cold Water Aquatic Life	8.0[3]		6.5	6.0
Cool Water Aquatic Life	6.5		5.0	4.0
Warm Water Aquatic Life	5.5			4.0
Estuarine Waters				6.5
Marine Waters	Narrative - No change from background			

1. When IGDO levels are 8.0 mg/L or greater, D.O. levels may be as low as 9.0 mg/L, without triggering a violation.
2. If conditions of barometric pressure, altitude and temperature preclude achievement of 11 mg/L, then a 90 percent saturation limit applies.
3. If conditions of barometric pressure, altitude, and temperature preclude achievement of 8.0 mg/L, then a 90 percent saturation limit applies.

Figure 7 General patterns in seasonal variation of dissolved oxygen concentration in temperate freshwater systems (black line, left axis) and temperature (blue line, right axis) (Fondriest Environmental, Inc. 2013).

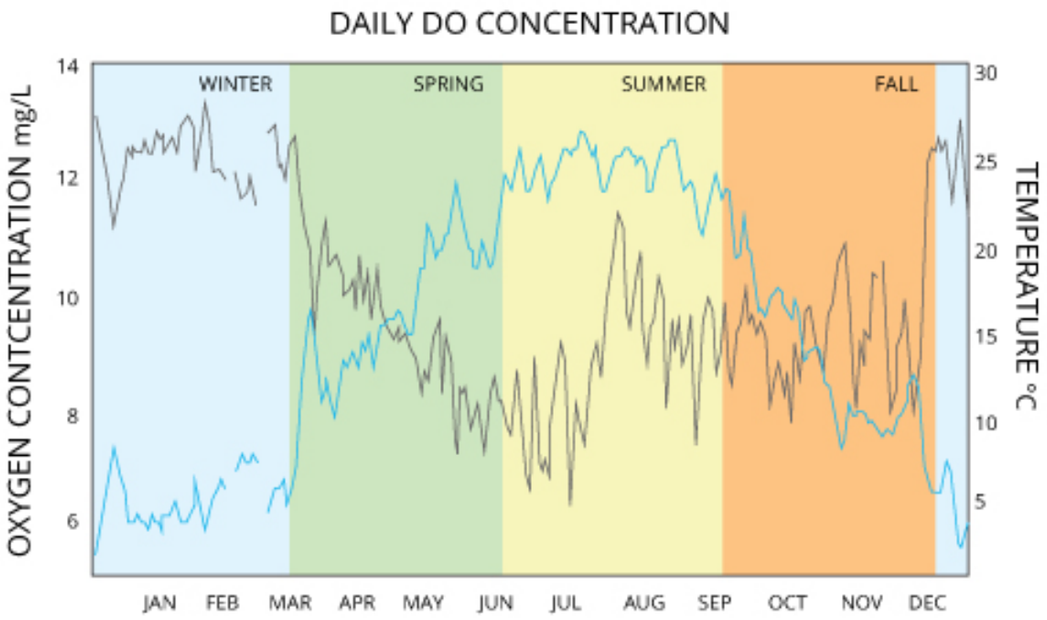
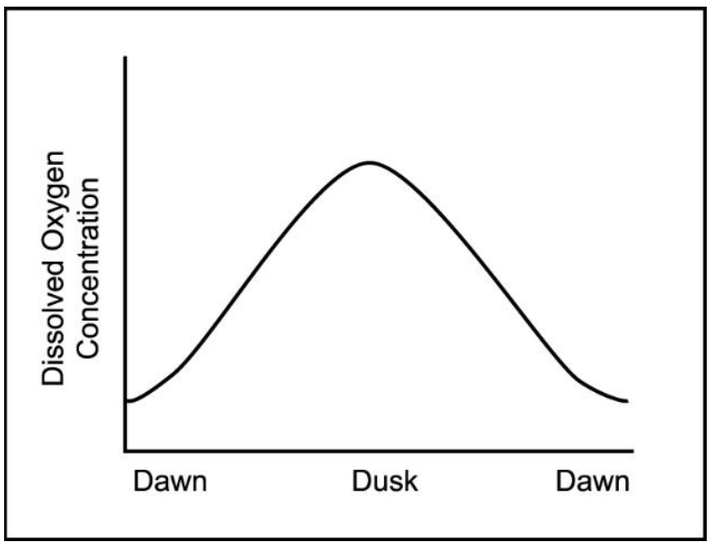


Figure 8 General patterns of daily variation in dissolved oxygen concentration (Francis-Floyd 2003).



1.4 Scope of the Aquatic Life Use Updates

The scope of the project addresses amendments to the 'basin specific rules' section of Oregon's Administrative Rule OAR-340-041-0101 to OAR-340-041-0345 and definitions OAR-340-041-0002. The amendments address three main categories:

1) updates to the designation of waterbodies for aquatic life use subcategories associated with Oregon's temperature standards in the 'basin specific rules'.
2) new designation of waterbodies for aquatic life use subcategories associated with Oregon's dissolved oxygen standards in the 'basin specific rules'.
3) miscellaneous updates and corrections in the 'basin specific rules' and definitions.

1.4.1 Temperature Use Subcategory Updates

1.4.1.1 Statewide update of aquatic life fish use subcategory designations (maps and tables) for temperature standards based on updated data from ODFW

A primary objective of this project is to update and correct Oregon's fish use designations -in maps and tables- statewide based primarily on ODFW's most recent information regarding fish habitat distribution and use throughout the state. These uses are currently designated in the 'fish use maps' in OAR 340-041-0101 to 340-041-0340: Figures 130A, 151A, 160A, 170A, 180A, 201A, 220A, 230A, 271A, 286A, 300A, 310A, 320A, and 340A and 'spawning use maps' in OAR 340-041-0101 to 340-041-0340: Tables 101B, 121B, and 190B, and Figures 130B, 151B, 160B, 170B, 180A, 201A, 220B, 230B, 260A, 271B, 286B, 300B, 310B, 320B, and 340B.

This update incorporates new information about habitat distribution and life stage use of salmon, trout and related species including anadromous and resident species, as well as the distribution of cool water species to the extent information is available.

The Oregon Department of Fish and Wildlife has recently completed a significant update to the statewide fish habitat distribution database. The database now includes more numerous and better data identifying fish presence, life stage use, and habitat than it did when DEQ mapped the current aquatic life use designations for temperature in 2003. DEQ's current fish use designations may no longer be accurate based on the new and improved data.

1.4.1.2 Review Bull Trout use designations and conform to the final federal critical habitat rule adopted in 2010.

The 2003 "Bull Trout spawning and juvenile rearing" use subcategory designations were based on provisional data in the draft Bull Trout critical habitat reaches published for public comment by the U.S. Fish and Wildlife Service in 2002. At the time, DEQ and USFWS agreed that DEQ would need to update its Bull Trout designations after final adoption of the federal habitat rule. The final critical habitat rule was adopted in 2010.

In a 2015 Biological Opinion, the USFWS also included a reasonable and prudent measure (RPM) requesting that DEQ designate an additional 33.5 miles of critical habitat for Bull Trout that were not included in the 2003 use designations. This review of Bull Trout uses will correct current designations to be consistent with this more recent information from USFWS. DEQ will also consider any updated data from ODFW before removing Bull Trout use from any reach.

DEQ shall add the stream reaches specifically identified in the USFWS's 2015 Biological Opinion as well as any other reaches identified in the published final federal critical habitat rule for Bull Trout spawning and rearing to the 'Bull Trout Spawning & Juvenile Rearing" aquatic life use subcategory as part of the statewide temperature use subcategory update.

1.4.1.3 Designate select Columbia River tributaries identified in EPA's Columbia River Cold Water Refuges Plan for the 'Core-cold Water Habitat' use subcategory.

The U.S. EPA identified existing cold-water refuge for Columbia River populations of threatened and endangered salmon and steelhead on the Oregon side of the Columbia River. The EPA Columbia cold-water refuge project team recommended that DEQ provide additional protection for certain cold-water refuge tributaries along the Columbia River not already designated for the Core Cold Water Habitat aquatic life use, based on data showing water temperatures attain the core cold-water numeric criterion (16°C) throughout the summer months and the importance of these habitats as thermal refuge for migrating populations of threatened and endangered salmon and steelhead in the Columbia River.

DEQ shall re-designate Bridal Veil Creek, Wahkeena Creek, Oneonta Creek, Tanner Creek, Eagle Creek, and Herman Creek and tributaries upstream as 'Core Cold Water Habitat.' This action will address Reasonable and Prudent Alternatives from the 2015 National Marine Fisheries Service Biological Opinion on EPA approval of certain temperature standards for Oregon.

1.4.2 New dissolved oxygen use subcategory designations

1.4.2.1 Designate "Cold"/ "Cool"/ "Warm" water aquatic life use subcategories for the dissolved oxygen standard into OAR-340-041-0101 to OAR-340-041-0345, consistent with DEQ's current implementation procedures.

The means to identify waterbodies where "cool water" or "cold water" dominant aquatic communities are located was not identified in Oregon's D.O. standard when adopted in 1996. In 2003 DEQ adopted the temperature maps for the seasonal aquatic life use subcategory of salmon and steelhead spawning through fry emergence by reference into the

salmonid spawning D.O. criteria rules at 340-041-0016 and also included a provision for the protection of active resident trout spawning areas. Procedures and clarifications to apply the Cold, Cool, and Warm Water Aquatic Life criteria for D.O. were subsequently developed and recorded in memoranda from DEQ to EPA, and other DEQ documents, but do not provide the desired regulatory certainty for either DEQ or stakeholders.

In 1998 and 2010, DEQ authored memoranda clarifying where the D.O. criteria apply based on ecoregion maps and previous use designations. However, this information was not adopted into the water quality standards rules. The use subcategories used in the D.O. standard were not assigned to specific waterbodies. This rulemaking will specify where the aquatic life community use designations associated with the D.O. standard are located. The methods rely on the various clarifications, policies and standard practice for implementing the D.O. criteria that DEQ has developed and used since the adoption of the current D.O. standards in 1996, and any additional relevant available information, including updates to the temperature use subcategories.

This update will provide clarity and certainty to other DEQ programs and the public regarding where and when the various D.O. criteria apply. In addition, EPA has requested that DEQ adopt this information into our administrative rules.

1.4.2.2 Identify Resident Trout Spawning Areas

Identify where resident trout spawning use occurs to designate salmonid spawning more completely as an aquatic life use subcategory associated with the dissolved oxygen standards. This will provide clarity and consistency regarding where and when the D.O. spawning criteria apply. Oregon's administrative rules do not identify where and when resident trout spawning occurs.

When salmon and steelhead spawning areas were designated as use subcategories associated with the temperature standard, ODFW and DEQ lacked similar information about the distribution of resident trout spawning habitat. As an interim assumption, DEQ broadly applied salmonid spawning criteria for dissolved oxygen all waterbodies to protect resident trout where trout are resident unless ODFW provided documentation that a stream reach was not trout spawning habitat. In practice this has meant that highly conservative spawning criteria for D.O. (11 mg/l) are applied to nearly every water body in the state from Jan 1 to May 15 or June 15. This default application of the spawning criterion is overly broad and applied the more stringent criterion in many locations where trout spawning is not an existing use, and sometimes where it is not attainable.

This may require the development of a procedure for incorporating new information as it becomes available, rather than mapping, because the data are not currently available in a statewide database. Trout spawning use designations will need to be based on the best available information, including the professional judgement of district biologists. However, the procedure should include an efficient method to update information based on older data or professional judgement when new, improved data become available.

Additionally, various stakeholders have requested during the Triennial Review process that DEQ adopt some form of designation for active resident trout spawning areas into the administrative rules so that it is clear where and when the spawning D.O. criterion applies.

A framework for managing and communicating information for identifying active resident trout spawning areas is discussed in Section 3.3.

1.4.3 Miscellaneous rule amendments

1.4.3.1 Revise auxiliary definitions for "Cold-" and "Cool-water aquatic life":

The definitions for the terms "Cool Water Aquatic Life" and "Cold-Water Aquatic Life" in the general definitions rule of DEQ's water quality standards [OAR-340-041-0002 (9) and (12)], identify fish species classified as cold or cool- or warm-water species. These definitions are not consistent with the way the "aquatic life" terms are used in the D.O. standard (OAR-340-041-0016, Table 21), which refers to aquatic communities dominated by cold or cool species, but not necessarily exclusive of any individuals from a different class.

DEQ proposed to revise the terms in OAR 340-041-0002 (9) and (12) from "cold-" and "cool-**water aquatic life**" to "cold" and "cool" water **species** to be consistent with the definitions, which identify fish species classified as cold or cool and do not refer to aquatic communities with mixed species. The revised terms will not conflict with the aquatic life terms to define the use subcategories associated with the dissolved oxygen standard in OAR-340-041-0016.

1.4.3.2 Revisions to pH Criteria for Crooked River and Trout Creek

Amendments to OAR 340-041-0135, Basin Specific Criteria (Deschutes): Water Quality Standards for this Basin, to correct the pH standard as it applies to criteria for the Crooked River and Trout Creek sub-basins and to make them consistent with other eastern Oregon basins.

The current criteria for these subbasins are the same as the pH criteria for waters in western Oregon and the Cascade Mountains. However, these two basins are more characteristic of the dryer climate and geology found in eastern Oregon. As a result, the natural pH ranges are higher than those found in western Oregon.

DEQ proposes to amend the criteria so that the acceptable maximum pH is extended from 8.5 to 9.0. An action level may be included. Please the justification supporting the pH criteria change in the Crooked River and Trout Creek subbasins, please see the issue paper associated with this rulemaking[5].

1.5 Interagency Coordination

DEQ drew upon existing data sources, information and expertise to complete all aspects of the aquatic life use updates. DEQ relies primarily on ODFW's Fish Habitat Distribution (FHD) database, with some supplemental data collected by other state and federal agencies, tribal organizations, academic researchers, and other organizations to address this project's objectives. DEQ formed a technical workgroup comprised of experts from state, federal, and tribal scientific agencies and organizations.

1.5.1.1 Technical workgroup input and review

The interagency technical workgroup assisted DEQ in identifying, analyzing, and interpreting fish habitat distribution data to correct and clarify the designated aquatic life use subcategories in Oregon's water quality standards. In most cases these organizations are the primary data providers and create or maintain the databases of fish habitat and timing used by DEQ for this rulemaking. DEQ staff coordinated the technical workgroup, which provided expertise not available within DEQ. Workgroup members served as peer-review experts and sometimes provided supplemental data sources to update the use designations with the latest and best available information. Members also referred DEQ to other experts on specific topics to help answer questions.

This technical workgroup reviewed DEQ's data sources, methodology and analysis, and provided guidance, additional information, and expert professional judgement on the quality, uncertainty, and action-ability of this report's conclusions. DEQ consulted with the technical workgroup through a series of virtual meetings between fall 2020 and spring 2022. DEQ also communicated individually with workgroup members as needed on questions related to their specific research or expertise. In addition, the workgroup reviewed documents, decision rules, and this technical support document. After their review, DEQ responded to the panel's comments and incorporated their input into this document.

Table 4 Technical Workgroup Membership

Member	Affiliation	Title
Jon Bowers	ODFW	ODFW GIS Coordinator; Fish Habitat Distribution Data Steward
Anne Hayden-Lesmeister	ODFW	Instream Flow Specialist
Brian Bangs	USFWS	Biologist, Oregon Fish and Wildlife Office
Barbara Adams	U.S. Forest Service	Threatened & Endangered Species Aquatic Biologist

[5] DEQ 2022, Proposed pH Criteria Revisions for the Crooked River and Trout Creek Subbasins, Deschutes Basin, Oregon.

Member	Affiliation	Title
Tom Skiles	Columbia River Intertribal Fish Commission	Fisheries Biologist
Craig Contor	Confederated Tribes of the Umatilla Indian Reservation	Fisheries Habitat Project Leader
Joe Ebersole	U.S. EPA, Pacific Ecological Systems Division	Research Fisheries Biologist
Michelle Maier	U.S. EPA, Region 10	Water Quality Specialist
John Palmer	U.S. EPA, Region 10	Senior Policy Advisor

2 Methodology for designating aquatic life use subcategories

2.1 Section Introduction

This section outlines each proposed decision rule method for designating the fish and aquatic life use subcategories for Oregon's temperature and dissolved oxygen standards. Each subsection identifies where data sources and decision methods used to designate the aquatic life uses have changed from the last rulemaking in 2003, and additional methods or data sources considered during DEQ's technical review. A reference sheet that shows only the proposed decision rule methods is in Appendix A. A more detailed inventory of data sources, including variables used, literature review, and other supporting analyses are documented in Chapter 3, Appendix Band Appendix C.

2.2 Data and Information Sources

DEQ primarily relies on the Oregon Department of Fish and Wildlife (ODFW) Fish Habitat Distribution (FHD) database[6] for information on the distribution of fish species and habitat occurrence and the timing of life-stage activity[7] (aka Timing Tables). The FHD is the authoritative database on fish habitat distribution in Oregon, compiling scientific literature, survey data, and reports dating back to the 1940s, and more recent habitat surveys from multiple sources including state and federal fisheries agencies, federal land management agencies, tribal entities, watershed councils and other interested public or private organizations. It also includes concurrence of professional opinion of biologists from ODFW, federal, tribal and other natural resource organizations that have in-depth knowledge of fish habitat in Oregon. The FHD uses a robust data standard to ensure that fish habitat classification reflects the best available information[8].

The ODFW-FHD represents the most comprehensive information on 'suitable and accessible' fish habitat for native and introduced species in Oregon. The database identifies where habitat for a specific population and life-stage or activity occurs. The Timing Tables identify when specific life-cycle activities occur throughout the year. The two data sources are complimentary and allow DEQ to identify where and when the various aquatic life use subcategories in our water quality standards occur.

DEQ also relies upon the following sources of additional information to identify the proposed designated uses:

1. U.S. Fish and Wildlife Service Final Bull Trout Critical Habitat Designation (September 30, 2010)[9],
2. U.S. Geological Survey Data Release: Occurrence locations and trait data for freshwater fishes, amphibians, and reptile's native to the state of Oregon (2018)[10],
3. U.S. Forest Service NorWeST Stream Temperature Regional Database (Isaak et al. 2019),
4. Oregon statewide temperature database (ODEQ-AWQMS database, 2021)[11].
5. U.S. Environmental Protection Agency, Region 10 Columbia River Cold Water Refuges Plan (EPA-910-R-21-001, January 2021[12])

A full crosswalk of the data sources and variables used in the methodology for updating and designating aquatic life use subcategories is available in Appendix B.

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[6] https://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=fishdistdata

[7] https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=202&XMLname=42654.xml

[8] ODFW, 2020. Oregon Fish Habitat Distribution Data Standard Version 4.0 (March 2020).

[9] https://www.fws.gov/pacific/bulltrout/FinalCH2010.html

[10] Mims, M., & Hockman-Wert, D. P. (2018). *Occurrence locations and trait data for freshwater fishes, amphibians, and reptiles native to the state of Oregon* [Data set]. U.S. Geological Survey. https://doi.org/10.5066/P9F7FYYZ

[11] https://orwater.deq.state.or.us/DataAnalysisIndex.aspx

[12] https://www.epa.gov/columbiariver/columbia-river-cold-water-refuges-plan

The ODFW Fish Habitat Distribution (FHD) database is the product of a multi-year effort by ODFW to develop consistent and comprehensive fish distribution data for native salmonid species. This database was first published in 2003 and has been continuously updated to include all basins or sub-basins in Oregon that have anadromous fish, and the distribution of many resident species. The FHD integrates datasets collected between 1940 and 2021, and concurrence of professional opinion incorporating knowledge about fish distribution from pre-20th century to the present day. This is the most comprehensive data source on current and historic habitat and species distribution for designating the fish and aquatic life uses. The data sources from which the FHD was compiled are fully indexed in the database and traceable.[13] The database records the data sources that support the determination of habitat use for a waterbody. Therefore, the FHD is a compilation of the best available data and information on the current and historic distribution of fish habitat in Oregon.

ODFW periodically compiles fish habitat information from a variety of sources, including state and federal fishery agencies, federal land management agencies, tribal entities, watershed councils and other interested public or private groups. In addition to spatial fish distribution data that describe where a life stage use is known or likely to occur, the ODFW Timing / In Water work database also includes timing information and mapping indicating when each life stage use is known or likely to occur within specific areas of the habitat distribution.

The methodology ODFW uses to develop and update its database is scientifically sound and is authoritative for salmonid use designations. DEQ supplemented the ODFW distribution and timing databases with data from other sources, such as temperature data, for some use subcategory designations. Where DEQ used additional sources of data, they are discussed in the description of the method for each use subcategory below. The ODFW database, together with the additional sources identified below, comprise the best information available upon which to base the fish use designations. The use of both data and professional judgment is appropriate because of the practical limitations of monitoring every stream reach, and because fish distributions may vary year to year for some waterbodies. Use designations are based on information about habitat availability and suitability collected over multiple years.

Published surveys and studies providing direct observation of fish distribution and habitat in the current FHD include data collected between 1940 and 2021, with the greatest number of studies published since 2003. The FHD also incorporates the Critical Habitat Designations for Threatened and Endangered Species published by the U.S. Fish and Wildlife Service and National Marine Fisheries Service. Professional judgement of habitat distribution in the FHD integrates knowledge about fish habitat distribution and historic fish habitat distribution for time periods beyond the range of published studies.

A detailed inventory of the data sources and variables used in DEQ's methods to designate each aquatic life use subcategory, and comparison to the data sources and variables used in the original 2003 aquatic life fish use designations, is shown in Appendix B.

2.3 Beneficial Use Designations for Temperature – Year-Round Uses

Most of Oregon's basins have two maps, one representing year-round uses and the other seasonal spawning use, to represent different fish use subcategories from the temperature standard. This "Fish Use Designation" map identifies species and life stage activity uses of the habitat that occur throughout the year. The uses are based on the criteria necessary to protect the most sensitive species or life stage that uses the habitat during the warmest consecutive seven-day period occurring during the year (Table 2). Due to the natural pattern of stream temperature throughout the year, daily temperatures are expected to be much cooler than these criteria outside the warmest weeks of the year (McCullough et al. 2001) (Figure 6).

To protect downstream uses, for waters that are not identified on the maps referenced in this rule, the applicable criteria for these waters are the same criteria as is applicable to the

[13] https://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=refid

nearest downstream water body depicted on the applicable use designation map or table per Oregon's Unidentified Tributaries provision in OAR 340-041-0028(5).

2.3.1 Salmon and Trout Rearing and Migration

DEQ designates **Salmon and Trout Rearing and Migration** use for waters where any of the following conditions are met:

1. Salmon or steelhead rearing, migration, or presence occurs in July or August.
2. Rainbow Trout, Coastal Cutthroat Trout, Westslope Cutthroat Trout, or Mountain Whitefish rearing, or presence occurs in July or August.
3. Waters upstream of the waters identified above, except those designated for the Bull Trout Spawning & Juvenile Rearing or Core Cold-Water use subcategories. However, this may not be applied to major rivers with large contributing watershed areas.

This use designation identifies waters that provide suitable rearing habitat for salmon, steelhead, rainbow trout, and cutthroat trout, and upstream adult pre-spawn migration for salmon and steelhead. This use subcategory is designated where more stringent uses for Core Cold Water Habitat and Bull Trout Spawning & Juvenile Rearing are not applicable. This use designation also protects other cold-water biota that co-occur with salmonid fishes.

2.3.1.1 Updates to Data Sources

DEQ is updating habitat distribution data based on the most recent data in ODFW's FHD for Coho, Chum, Sockeye, spring and fall Chinook salmon; summer and winter steelhead; Rainbow, Redband, and Coastal Cutthroat Trout rearing. DEQ included 'primarily rearing' and 'resident' uses for these species in the 2023 ODFW-FHD. DEQ is also updating life stage activity timing information for 'juvenile rearing' for these species from ODFW's 2003 life stage activity timing tables to the recently updated 2023 version.

2.3.1.2 Revisions to Decision Rules

DEQ will expand the species used to designate Salmon and Trout Rearing and Migration to include distribution of Westslope Cutthroat Trout and Mountain Whitefish 'primarily rearing' and 'resident' uses from the 2023 ODFW-FHD.

2.3.1.3 Other factors considered

On recommendation of the technical workgroup, DEQ reviewed pacific lamprey as a potential indicator species for designating the Salmon and Trout Rearing and Migration aquatic life use subcategories. DEQ did not find that pacific lamprey is a suitable indicator species for designating Salmon and Trout Rearing and Migration. Please see our detailed analysis in Chapter 3.

2.3.2 Core Cold-water habitat

DEQ designates **Core Cold-Water Habitat** use for waters where any of the following conditions are met:

1. Waters where Spring Chinook salmon spawning occurs early; **begins on or before** September 15.
2. Waters where winter or summer steelhead spawning occurs late; **ends on or after** June 1.
3. Waters having specific sub-adult and/or adult Bull Trout presence during July or August but are not also Bull Trout spawning and rearing streams.
4. Waters upstream of the areas identified in 1-3 above that also support salmon & steelhead rearing or provide cold water to these areas, unless those can be designated for the Bull Trout Spawning & Juvenile Rearing use subcategory. However, this may not be applied to major rivers with large contributing watershed areas.
5. Waters where water temperature data meeting DEQ's data quality requirements indicate that the warmest 7-day average maximum stream temperature is at or below 16.0°C.

This use designation identifies and ensures the protection of colder water habitats to provide thermal habitat diversity and refugia for salmon and steelhead juvenile rearing, adult salmon and steelhead pre-spawn holding, Bull Trout sub-adult and adult foraging, and to protect species that thrive in especially cold water, including certain amphibians and other cold-water biota.

Late steelhead spawning is a new indicator not used in 2003. In addition, DEQ has more continuously monitored temperature data for identifying streams where temperatures stay below 16°C all summer. DEQ used temperature collected by other entities to identify cold streams, but it must meet DEQ quality assurance requirements. DEQ uses temperature data only where multiple years of data were available to account for interannual variability and ensure waterbodies can reliably meet the 16°C 7-day average of daily maximum threshold all year. Temperature data is only used to identify additional waters for designation as Core Cold Water Habitat. It is not used as a basis to re-designate waters currently classified as Core Cold Water Habitat.

The designation of Core Cold Water Habitat using the indicators above will provide beyond optimal protection for salmonid rearing and other cold-water species habitat that is known or likely to occur at this time.

2.3.2.1 Updates to Data Sources

DEQ is updating habitat distribution data for salmon, steelhead, and Bull Trout with data from the 2023 ODFW-FHD. Additional Bull Trout habitat distribution from the USFWS for adult 'foraging, migration, and overwintering' (FMO) from the draft Bull Trout Critical Habitat Rule (67 FR 71236, November 29, 2002) is being replaced with the 'foraging, migration, and overwintering' (FMO) habitat from the Final Bull Trout Critical Habitat Rule (75 FR 63898, October 18, 2010)**.** DEQ is also replacing life stage activity timing information provided by ODFW in 2003 with that from the updated ODFW 2023 life stage activity timing tables.

DEQ's water quality database (AWQMS) provides temperature data collected by DEQ and 3rd party data submitted for the Integrated Report from other federal and state agencies, tribes, academic institutions, or other stakeholders. DEQ will use temperature data evaluated for the 2020 and 2022 Integrated Reports, which includes data from 2008-2020. Additional temperature observations were acquired from the USFS-NorWeST stream temperature weekly summaries database for the western U.S. collected from 1993-2014.

2.3.2.2 Revisions to Decision Rules

Late Steelhead Spawning

DEQ is proposing to add late steelhead spawning as an additional biological indicator for identifying Core Cold Water Habitat. The new indicator functions like the indicator for early Spring Chinook spawning in that it is likely to identify waters that remain cold throughout the summer. Late onset of steelhead spawning indicates waters that are especially cold and do not warm sufficiently to initiate spawning by steelhead populations until later in the season. Late steelhead spawning would be considered waters where ODFW's timing for peak periods of adult spawning use occurs later than June 1.

EcoTrust Anchor Habitat

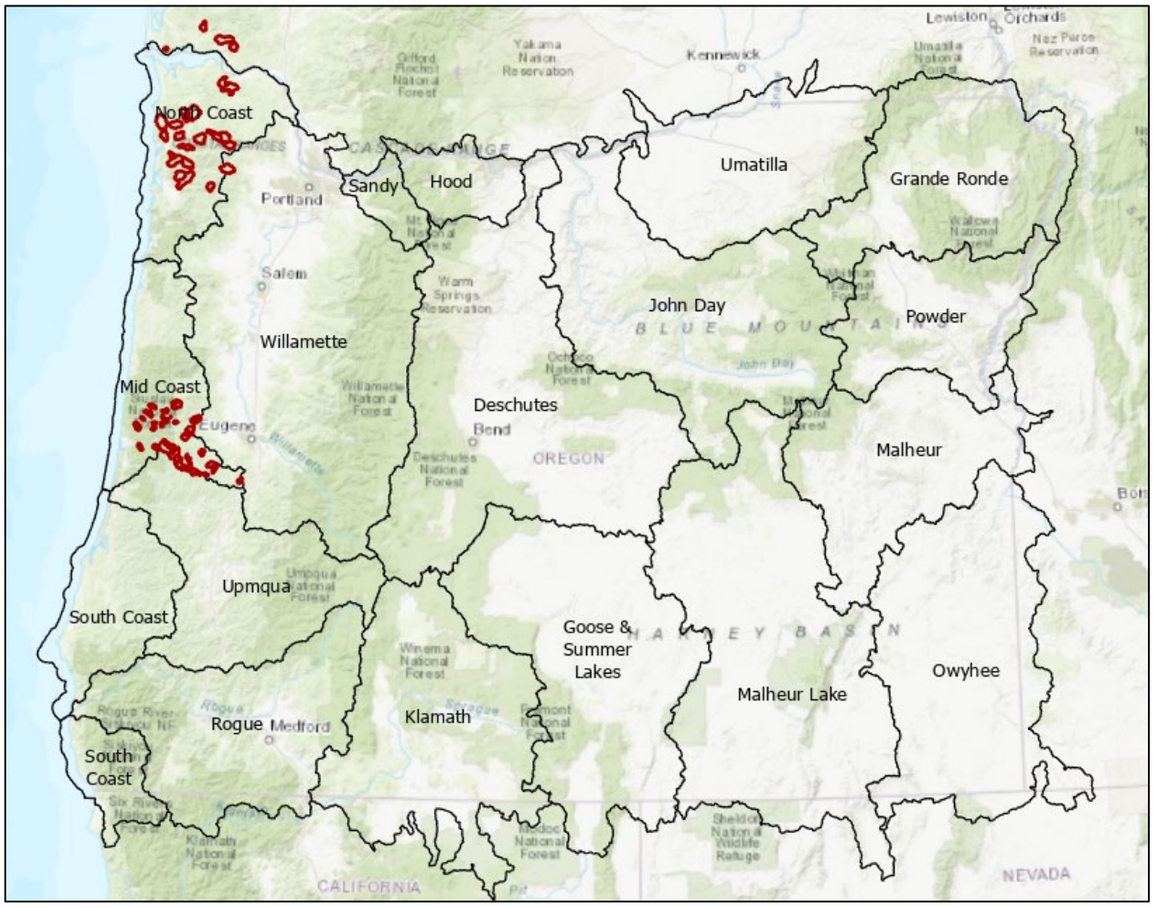
DEQ also re-evaluated the use of EcoTrust "anchor habitat" to designate the Core Cold Water Habitat use subcategory. In 2003, DEQ used habitat identified by EcoTrust and the Wild Salmon Center: "A salmon conservation strategy for the Tillamook and Clatsop State Forest"(Ecotrust 2000), referred to as the "Anchor Habitat Study", to assign the Core Cold Water Habitat use subcategory to waters in the North Coast and Mid Coast Basins. During the initial designation of aquatic life use subcategories in 2003, there was little data available on salmonid uses in these basins. As a result, DEQ classified the 32 catchments identified as anchor habitat by the study on state forest land in these basins (Figure 9).

The Anchor Habitat Study identified highly productive waters through snorkel surveys of juvenile for Coho Salmon, Steelhead and Chinook Salmon with a focus on the Tillamook and Clatsop State Forests. EcoTrust also provided DEQ with a dataset of similar habitat in the Siuslaw State Forest. The purpose of the EcoTrust study was to identify critical areas for production of salmon in the State Forests. The habitat identified in the EcoTrust study is based on high productivity that support salmonid rearing. These characteristics are not consistent with DEQ's decision rules for core cold water use that use early Spring Chinook spawning or summertime Bull Trout habitat use as biological indicators of especially cold habitats. Neither thermal condition nor thermal potential of these waters was part of

EcoTrust's habitat evaluation. Therefore, DEQ no longer considers these anchor habitats to be consistent with identification of Core Cold Water Habitat.

Since 2003, ODFW has collected more information about salmonid life stages in the North Coast and Siuslaw River basin, and DEQ has acquired temperature monitoring data for many streams in the region. Therefore, DEQ proposed to evaluate whether these watersheds based on the core cold water designation methodology, and not use the Anchor Habitat Study for this purpose. In waters classified based on the EcoTrust Anchor Habitat Study, but where neither ODFW's database demonstrates that early Chinook or late steelhead spawning occurs, or the 16℃ criterion is attainable, DEQ is proposing to revise the designation for Core Cold Water use to Salmon and Steelhead Rearing and Migration use.

Figure 9 Location of EcoTrust salmon "anchor habitat" (Ecotrust 2000).



2.3.2.3 Other factors considered

In response to concerns that DEQ's aquatic life use designations are too narrowly focused on salmonids, DEQ reviewed information about indicator species that could serve as additional indicators of cold-water habitats, because the thermal requirements of the species are consistent with the core-cold water designation (maximum temperatures of 16°C or less). Based on these concerns and the advice of the technical workgroup, DEQ considered several native amphibians, pacific lamprey, and native freshwater mussels, to see if they would serve as indicator species for the 'core cold-water habitat' use designation.

Upon review, DEQ did not identify any candidates among these species as suitable indicators for designating the cold-water aquatic life use subcategory, either because their thermal needs do not require temperatures below 16°, because they are not stream-obligate, or because they tend to occupy colder microhabitats and are not a good indicator of the thermal conditions of the whole stream. Please see Section 3.6 for literature reviews and detailed analysis of these additional species.

2.3.3 Bull Trout Spawning and Juvenile Rearing

DEQ designates **Bull Trout Spawning and Juvenile Rearing** use for waters where any of the following conditions are met:

1. Waters where ODFW's FHD indicates "Primarily Spawning" habitat use for Bull Trout.
2. Waters identified by the USFWS 2010 final Critical Habitat Rule[14] as Bull Trout spawning and rearing habitat (SR), including 33 miles of habitat USFWS asked DEQ to add in their 2015 Biological Opinion on Oregon's temperature standards[15];
3. Waters identified as **potential** Bull Trout spawning and juvenile rearing habitat that is necessary for long-term health and viability of Bull Trout populations consistent with recovery plans and restoration goals; and
4. Waters upstream of any reaches identified above, which support Bull Trout spawning by providing cold water to the habitats where the Bull Trout Spawning & Juvenile Rearing use occurs. However, this may not be applied to major rivers with large contributing watershed areas.

In 2003, Bull Trout juvenile rearing and spawning use was designated based on DEQ's Bull Trout Habitat Designation Report: Technical Work Group Recommendations (2003) and USFWS' proposed critical habitat for Bull Trout juvenile rearing and spawning. DEQ included areas identified as existing and as potential Bull Trout rearing and spawning habitat (identified in the above reports) because Bull Trout habitat in the State has been greatly reduced and fragmented, and because Bull Trout are listed under the federal Endangered Species Act. To protect Bull Trout populations in Oregon and allow for their recovery, additional habitat must be protected beyond that currently occupied.

The purpose of identifying potential habitat in the 2003 report was to protect additional habitat to allow local populations to grow to the point that they (1) are reconnected with other local populations and with foraging habitats, (2) are large enough to withstand losses due to natural stresses and events (e.g., drought); and (3) have the genetic diversity to support healthy reproduction.

DEQ proposes to align the Bull Trout designations with the most recent critical habitat designations and fish distribution datasets from USFWS and ODFW, which were updated since 2003. The potential habitat necessary for long-term health and viability of Bull Trout populations identified in 2003 will be retained unless ODFW and Bull Trout experts provide updated information to revise the potential habitat needed to be consistent with current recovery plans and restoration goals.

2.3.3.1 Updates to Data Sources

The current designation is the spawning and sub-adult rearing distributions for Bull Trout from the *Bull Trout Habitat Designation Report: Technical Work Group Recommendations (2002*). DEQ is using updated habitat distribution data from the ODFW FHD (2023) for Bull Trout identified by the distribution of 'Primarily Spawning' habitat.

In addition, to review the "potential Bull Trout spawning and juvenile rearing habitat that is necessary for long-term health and viability of Bull Trout populations consistent with recovery plans and restoration goals," DEQ is consulting with ODFW and the USFWS, which coordinate a statewide working group for experts in Bull Trout conservation. Pending the input of this group, the potential habitat reaches from the DEQ 2002 (BTHD3) Technical Work Group Recommendations continue to be included. This potential habitat coincides with some Bull Trout 'Historical' and 'Resident" Bull Trout habitats from the ODFW-FHD (2023). DEQ may propose adjustments if recommended by the statewide working group.

DEQ is also replacing the distribution of 'Spawning and rearing' (SR) habitat from the USFWS draft Bull Trout Critical Habitat Rule (67 FR 71236, November 29, 2002) with the 'Spawning and rearing' (SR) habitat from the USFWS Final Bull Trout Critical Habitat Designation (75 FR 63898, October 18, 2010)**.** DEQ is also including some specific additions of waterbodies or portions of waterbodies specified by the USFWS Biological Opinion on Oregon's Temperature and Dissolved Oxygen Standards (USFWS 2015) for designation in the Bull Trout Spawning and Juvenile Rearing subcategory.

[14] https://www.fws.gov/pacific/bulltrout/crithab/FinalCH2010.html

[15] USFWS 2015m USFWS Biological Opinion, Concurrence and Conference Concurrence on USEPA Approval of 11 Oregon Water Quality Standards for Temperature and Intergravel Dissolved Oxygen. 01EOFWO0-2014-F-0087.

2.3.3.2 Revisions to Decision Rules

DEQ is adding 33 stream miles of Bull Trout spawning and rearing habitat specifically identified as a reasonable and prudent alternative (RPA) by the USFWS in their 2015 Biological Opinion/Letter of Concurrence/Conference Proposed Approval of Revised Oregon Water Quality Standards for Temperature and Intergravel Dissolved Oxygen.

2.3.3.3 Other factors considered

No additional factors were considered.

2.3.4Redband and Lahontan Cutthroat Trout

DEQ designates **Redband and Lahontan Cutthroat Trout** use in waters:

1. for Redband trout (*Oncorhynchus mykiss gairdneri*) where:
    a. ODFW's FHD indicates Redband Trout or resident *O. mykiss* occur within part, or all, of the following basins but steelhead are not also present due to a natural or permanent passage barrier.
        - Goose and Summer Lakes Basin
        - Malheur Lake Basin
        - Powder Basin
        - Burnt Basin
        - Malheur River Basin
        - Owyhee Basin
        - Klamath Basin
        - Umatilla Basin
        - Walla Walla Basin
2. for Lahontan Cutthroat Trout (*Oncorhynchus clarkii henshawi*) where:
    a. ODFW's FHD indicates Lahontan Cutthroat Trout habitat occurs.

Redband Trout are a resident sub-species of Rainbow Trout found in arid and semi-arid interior portions of Oregon east of the Cascade Mountains. They have enough physiological differences from Coastal Rainbow Trout that they are considered a distinct subspecies of *Oncorhynchus mykiss*. Lahontan Cutthroat Trout are a separate species of resident trout located in isolated reaches in portions of the Interior Great Basin area of southeastern Oregon. Only a small portion of the species range is within the state of Oregon.

Redband and Lahontan Cutthroat Trout are the most sensitive use in basins and sub-basins where anadromous steelhead, which have lower thermal tolerance, are absent. Due to uncertainty about admixture between populations of coastal and interior subspecies of *O. mykiss*, Redband Trout use is designated only for portions of interior basins that do not contain steelhead populations.

2.3.4.1 Updates to Data Sources

DEQ is updating habitat distribution data based on the most recent data in ODFW's FHD, which includes updated Lahontan cutthroat distribution data provided by the USFWS to ODFW. DEQ included Redband trout, or Lahontan Cutthroat Trout for 'Resident- Multiple Uses', 'Foraging', 'Migration and Overwintering', 'Primarily Rearing with some Migration', and 'Primarily Spawning with some rearing' life-stage activities from the ODFW fish habitat database compiled in 2003 to the 2023 ODFW-FHD.

2.3.4.2 Revisions to Decision Rules

No revisions to the decision rules are being considered at this time.

2.3.4.3 Other factors Considered

As an additional source of data, DEQ reviewed a large USGS database of occurrence locations for native freshwater fishes, amphibians, and reptiles (Mims and Hockman-Wert 2018). While the USGS database contains records for Coastal Cutthroat Trout (*Oncorhynchus clarkii*), mainly in the coast range and Columbia basin, it contains no data specific to Lahontan Cutthroat Trout (*Oncorhynchus clarkii henshawi*).

2.3.5 Salmon and steelhead Migration Corridors

DEQ designates **Salmon and Steelhead Migration Corridor** use to waters with multiple lines of evidence approach that includes consideration of the following characteristics:

1. Migration corridor reaches previously designated in 2003.
2. Where ODFW's FHD indicates a reach is "Primarily migration" for an anadromous salmon or steelhead species.
3. Where ODFW's life-stage activity timing tables indicate no peak salmonid rearing, adult migration, spawning, holding, or egg incubation & emergence use in July-August, inclusive of resident trout species.
4. There is evidence indicating that the reach naturally exceeds 18°C 7-dADM.

The "Salmon and steelhead Migration Corridor" use is applied to waters that might be seasonally cold but not optimal salmonid rearing or holding habitat during the warm summer months. Anadromous or adfluvial species migrate through or use some of these reaches, primarily during other times of the year. There may be some cold-water fish use during the summer, such as juvenile rearing or out migration, but these are not typically natal streams and do not provide optimal juvenile rearing conditions during the summer. The presence of native cool water species also supports a migration corridor designation. It is important to protect existing habitat heterogeneity and cold-water refuges in these reaches.

In this review, DEQ evaluated methods to consider whether additional reaches might qualify for the migration corridor criterion designation. Waters considered for a designation change to Salmon and Steelhead Migration Corridor must meet parts 2-4 of the decision rules above. A full evaluation of the multiple lines of evidence including specific data and information considered for designating this use for additional waterbodies is detailed below in Section 3.1.6. DEQ considers the migration corridor use to represent the highest attainable use for reaches approved as Salmon and Steelhead Migration Corridors during the 2003 rulemaking process.

2.3.5.1 Updates to Data Sources

DEQ is updating habitat distribution data based on the most recent data in ODFW's FHD showing where 'Primarily migration' habitat for Coho, Spring / Fall Chinook, Chum, and Sockeye Salmon and Summer / Winter steelhead; or 'primarily rearing' habitat for Rainbow Trout, Redband Trout, Coastal Cutthroat, West Slope Cutthroat, and Lahontan Cutthroat Trout, Bull Trout, and Mountain Whitefish occurs.

DEQ is also clarifying the application of multiple lines of evidence to indicate reaches for the Migration Corridor designation. Candidates must naturally exceed 18°C as a 7dAM in the summer and therefore are not optimal juvenile rearing or adult holding habitat in July or August. Additional lines of evidence considered shall specifically include HEATSOURCE model results from OR-DEQ TMDLs, temperature models published by Federal agencies, and other published studies that estimate natural thermal potential or fully restored thermal conditions.

2.3.5.2 Revisions to Decision Rules

DEQ is introducing data on fish habitat identified as "Primarily migration" in the ODFW-FHD (2023) for Coho, spring and fall Chinook, Chum, Sockeye salmon, and summer and winter Steelhead to refine identification of potential migration corridors.

DEQ is also using the timing and location of 'peak juvenile rearing' and 'egg development through fry emergence for Coho Salmon, Spring and Fall Chinook, Chum, Sockeye Salmon, and Summer and Winter Steelhead; Rainbow Trout, Redband Trout, Coastal Cutthroat, West Slope Cutthroat, and Lahontan Cutthroat Trout, Bull Trout, and Mountain Whitefish, from the 2023 ODFW life stage activity timing tables to identify where reaches are not optimal juvenile rearing or adult holding habitat in July or August.

2.3.5.3 Other Factors Considered

No additional factors were considered at this time.

2.3.6 Cool Water Species

DEQ designates the **Cool Water Species** use for waters:

1. not identified by ODFW's FHD as primary migration or rearing habitat for any resident or anadromous salmonid fish in July or August according to the ODFW Life Stage Timing Tables.

   UNLESS

2. ODFW's FHD identifies a reach as having salmon or steelhead "primary migration" use. Then the waterbody is designated as Salmon and Steelhead Migration Corridors.
3. Waters upstream of any reaches identified above, which support cool water species. However, this may not be applied to major rivers with large contributing watersheds.

The Cool Water Species use subcategory, as used in the temperature standard, includes aquatic organisms that either have a wider temperature tolerance range than cold-water organisms or are physiologically restricted to cool waters, including but not limited to, native sturgeon, Pacific lamprey, suckers, chub, sculpins and certain other species of cyprinids (minnows). DEQ uses the absence of cold water species, such as salmonids, during July or August to indicate cool waters reaches. In addition, DEQ may also use the presence of other cool water dependent fish, amphibians, or invertebrate species to support the designation for cool water species use.

2.3.6.1 Updates to Data Sources

DEQ is updating habitat distribution data based on the most recent data in ODFW's FHD showing sub-basins where no life-stage habitat use is indicated for salmonids, including steelhead, trout, and char, in the 2023 ODFW-FHD.

DEQ is also replacing information for reaches where no salmonid life stage activities, including salmon, steelhead, char, or resident trout, occur in July or August from ODFW's 2003 life stage activity timing tables to ODFW's updated 2023 timing information.

2.3.6.2 Revisions to Decision Rules

No changes to the decision rules at this time.

2.3.6.3 Other Factors Considered

DEQ evaluated the suitability of using Foothills Yellow-Legged Frog (YLF) as an additional biological indicator supporting designation of the cool water species or salmon and steelhead migration corridor use rather than Salmon and Trout Rearing & Migration use. YLF require a warmer thermal range for reproduction than salmonids. Therefore, they are not expected to be the most sensitive use where they co-occur with salmonids. However, DEQ may point to YLF occurrence data to further support designations of the migration corridor or cool water uses based on salmonid absence in the summer.

2.3.7 Borax Lake Chub

DEQ designates the Borax Lake Chub use subcategory for:

1. State waters in Borax Lake, in the Alvord Lake sub-basin of the Malheur Lake Basin supporting the Borax Lake chub.

The Borax Lake Chub use subcategory, as used in the temperature standard, protects the only native warm-water species of Oregon from excessively low water temperatures that are detrimental to this species.

No changes to the current data or decision rules for this aquatic life use subcategory are proposed at this time.

2.4 Beneficial Use Designations for Temperature – Seasonal Use

2.4.1 Salmon & steelhead Spawning

DEQ designates seasonal use for **Salmon and Steelhead Spawning** for the following locations and dates:

1. In reaches identified by ODFW as “Primarily Spawning” habitat for populations of Coho, Spring Chinook, Fall Chinook, Chum, and Sockeye salmon, and summer or winter Steelhead trout.
2. Spawning through emergence use shall be applied **starting** on the following dates:
    a. in reaches with fall spawning populations (Chinook, Coho, sockeye, or chum salmon), on the date specified by ODFW if it begins with a period of peak use, and 2 weeks after the date specified by ODFW if it begins with a period of lesser use. On no occasion shall spawning through emergence use for salmon be applied starting later than November 1.
    b. in reaches with only spring spawning populations (i.e., steelhead), on January 1st.
    c. in reaches designated as ‘Salmon & Steelhead Migration Corridor’ use, on the date specified by ODFW if spawning begins with a period of peak use, and 2 weeks after the date specified by ODFW if it begins with a period of lesser use specified in ODFW’s timing tables.
3. Spawning through emergence use shall be applied **ending** on the following dates:
    a. On May 15 in reaches where spring spawning species (steelhead) occur.
    b. On June 15 in reaches designated as “Core Cold-water habitat” use where spring spawning species (steelhead) occur.
    c. On April 30 in reaches where only fall spawning species (salmon) occur.
    d. On May 15 in reaches designated as ‘Salmon & Trout Migration Corridor’ use unless site-specific dates are designated.

The ODFW life-stage activity-timing tables show salmon or steelhead spawning through emergence for each species and each timing unit, sometimes resulting in more than 30 different spawning date ranges for one administrative basin. Because this approach seems overly complex, DEQ continues to reduce the number of date ranges by applying spawning criteria no later than Nov. 1. This simplification procedure was developed by the Interagency Team in 2003 to designate spawning use for a more generalized and conservative protection rather than more site-specific dates (DEQ 2003b, 2003a).

2.4.1.1 Updates to Data Sources

DEQ is updating the salmon and steelhead spawning use locations based on the updated distribution data for ‘primarily spawning’ habitat indicated for Coho, spring and fall Chinook, Chum, Sockeye salmon, and summer or winter steelhead trout in the 2023 ODFW fish habitat distribution (FHD) database.

DEQ is also updating the spawning timing information based on ODFW’s 2023 life stage activity timing tables.

2.4.1.2 Revisions to Decision Rules

<u>Revised spawning “no later than” start date</u>

Currently, salmon spawning use begins on the first period of peak ‘Adult Spawning’ use or two weeks after the first period of lesser ‘Adult Spawning’ use, whichever is earlier according to ODFW's life stage activity timing tables, but no later than October 15. The October 15 date was based on information about Fall Chinook spawning available in 2003. Given the limited data about timing for other salmon species, DEQ assumed that most salmon populations would begin spawning before this date and, that most waterbodies in Oregon could attain the spawning criterion by this date (DEQ 2003b). The increase in accurate data on spawning timing and on fall water temperatures since 2003 has shown that both assumptions were incorrect.

To leverage increased accuracy and availability of information on the start of spawn activity for salmon, DEQ's current proposal changes the “no later than” spawning start date from October 15 to November 1. For populations with spawning that starts before Nov. 1, DEQ used the same decision rules as in 2003.

Spawning end date for fall spawning populations

DEQ specified the end of salmon & steelhead spawning use as May 15, or June 15 for reaches designated for the Core Cold-Water Habitat year-round use. However, using ODFW's improved habitat distribution data and life-stage timing information, DEQ has identified multiple reaches that have only fall spawning populations. The current spawning use dates extend weeks to months beyond the end of egg incubation and fry emergence for the fall-spawning salmon in these reaches.

Therefore, DEQ is proposing to apply a spawning use end date of April 30 for reaches with only salmon spawning. Analysis of egg incubation through fry emergence timing from ODFW's 2023 timing tables showed final fry emergence for all but 5 of 1433 distinct populations (>99%) of fall-spawning salmon species (Chinook, Chum, Coho, and Sockeye Salmon), concludes by April 30. As the spawning criteria are based on thermal requirements of the more sensitive spawning adults and egg incubation stages, assigning a default spawning end date of April 30 is conservative and sufficient to protect egg incubation through emergence in these species.

2.4.1.3 Other Factors Considered

DEQ considered, alternatively, to eliminate the "no later than" spawning start date and use the timing data from ODFW's timing tables for all populations. Unlike 2003, there is now timing data for all anadromous salmonid populations in ODFW's timing tables. This alternative would be more accurate but more complicated to monitor and implement. This method would add nine spawning date ranges, with start dates of Nov. 15, Dec. 1, or Dec. 15 combined with end dates of May 15 or June 15. DEQ proposes that the increase in accuracy of timing does not outweigh the increased complexity in implementing the criteria.

2.5 Beneficial Use Designations for Dissolved Oxygen– Year-Round Uses

This section describes the data sources and decision methods used to designate the aquatic life use subcategories associated with the dissolved oxygen standard. DEQ has applied the dissolved oxygen standard using established interpretation methods since 1998. The following decision rules are proposed to designate the aquatic life use subcategories for dissolved oxygen that occur year-round, including throughout the summer. The use subcategories include Cold Water Aquatic Life, Cool Water Aquatic Life, Warm Water Aquatic Life, Estuarine Waters, and Ocean Waters. These are described more fully below. There are no unique dissolved oxygen criteria for lakes or wetlands. Unless otherwise specified, these are designated with the same uses as through-flowing streams.

To protect downstream uses, the applicable criteria for waters that are not identified on the maps referenced in this rule but are within the same ecoregion, have the same use as the nearest downstream water body designated on the maps or tables.

2.5.1 Cold Water Aquatic Life

The most sensitive fish and aquatic life use subcategory for dissolved oxygen is for protection of Oregon's native cold-water communities as described in **OAR-340-041-016 Table 21**. These communities are identified as waters dominated by populations of cold water fish that may include native salmon, steelhead, mountain whitefish, char (Bull Trout), and native resident trout. The criteria for this use subcategory present no measurable risk to cold-water native fish and invertebrate species. These criteria are also intended to protect cold water amphibians.

2.5.1.1 Decision Rules

DEQ designates the **Cold Water Aquatic Life** use if any of the following conditions are met:

1. Where the designated use subcategory for temperature is "Core Cold Water Habitat"
2. Where the designated use subcategory for temperature is "Bull Trout Spawning and Juvenile Rearing"
3. Where the waterbody is not otherwise designated for Cool Water or Warm Water Aquatic Life based on site-specific information, and where the designated use subcategory for temperature is:

a. Redband or Lahontan Cutthroat Trout; **or**

b. Salmon and Trout Rearing and Migration, **and**

c. the waterbody is located within NHD-PLUS catchments that intersect the following EPA Level III and Level IV Ecoregions listed in Table 5:

Table 5 'Cold Water' Community Ecoregions of Oregon.

EPA Level III Ecoregion:	EPA Level IV Ecoregions:
Coast Range	All
Cascades	All
Klamath Mountains	All
Willamette Valley	Willamette Valley Foothills
Eastern Cascades Slope and Foothills	Ponderosa Pine/Bitterbrush Woodland
	Pumice Plateau Basins
	Fremont Pine/Fir Forest
	Southern Cascade Slope
	Grand Fir Mixed Forest
	Pumice Plateau
Blue Mountains	John Day/Clarno Highlands
	Maritime-Influenced Zone
	Melange
	Wallowas/Seven Devil's Mountains
	Canyons and Dissected Highlands
	Continental Zone Highlands
	Mesic Forest Zone
	Subalpine-Alpine Zone
	Cold Basins

All streams designated for the 'Core Cold Water" and "Bull Trout Spawning & Juvenile Rearing" use subcategories for temperature are designated for Cold Water Aquatic Life for dissolved oxygen, regardless of Ecoregion. DEQ will use the updated use designations for these temperature subcategories as the basis for the cold water aquatic life designation for dissolved oxygen.

Since 1998, DEQ has applied the cool- and cold-water aquatic life use subcategories using EPA Level III and Level IV Ecoregions. Ecoregions are delineated based on multiple factors related to geology, landforms, soils, vegetation, climate, land use, wildlife, and hydrology (Omernik 1987, EPA 2007). The Ecoregion boundaries are not hydrologically based and do not generally align well with NHD watershed and catchment boundaries. This ecoregion geometry creates undesirable edge effects when divide streams are oriented longitudinally to the ecoregion boundaries. DEQ proposes to smooth the boundaries used to classify cold- and cool-water aquatic life by placing entire NHD-PLUS "catchments" in the ecoregion where it is primarily located.

The use of ecoregion boundaries to designate waterbodies as 'Cold' and 'Cool' is provides a useful method when site-specific data about the community composition is not available. Within the 'Cold' ecoregions, there can be waterbodies that are characterized by cool water aquatic life communities that fit the designation for Cool Water Aquatic Life. For example, low elevation and gradient valley-bottom mainstems or tributaries. Within the 'Cool' ecoregions there can be waterbodies that support cold water communities. For example, high elevation headwaters or colder mainstems that support cold water communities, such as streams designated under the temperature standards for Core Cold Water Habitat or Bull Trout Spawning and Juvenile Rearing.

2.5.1.2 Updates to Data Sources

DEQ is updating the "Cold Water Aquatic Life" designations based on the 2023 ODFW-FHD and life stage activity timing tables. These are incorporated through updates to the 'Core Cold-Water Habitat' and "Bull Trout Spawning & Juvenile Rearing" aquatic life uses for temperature and ODFW life stage timing information that shows where salmonid life stage activities occur in July or August.

2.5.1.3 Revisions to Implementation Methods

DEQ is making two relatively minor revisions to the established methods for identifying waters as "Cold Water Aquatic Life." First, smoothing the ecoregion boundaries using NHD catchments as described in Section 2.5.1.1 above. Second, using FHD habitat distribution for cool water species to indicate where "Cool Water Aquatic Life" is the appropriate use within an ecoregion identified as cold water as described in Section 2.5.2.2, below.

2.5.1.4 Other Factors Considered

DEQ considered the possibility of delineating 'Cold' versus "Cool" aquatic life based on distribution of cold-water aquatic invertebrate communities. DEQ has developed a large database of aquatic invertebrate taxa distribution and abundance to address assessment of waters for impairments of biocriteria. There is potential to refine or confirm the distribution of cold-water communities using this information (Richards et al. 2018), (Huff et al. 2006), and (Hubler et al. 2016). However, at this time the methods for establishing thresholds for taxa type and abundance that would indicate a 'Cold' aquatic community are still in development and have not been peer reviewed. Therefore, a list of taxa and community composition that reliably identifies 'Cold' vs "Cool" aquatic invertebrate communities is not yet advisable but may be considered for future use updates.

2.5.2Cool Water Aquatic Life

The cool water aquatic life use subcategory recognizes that there are waters in Oregon dominated by cool water communities, particularly in the summer months, even though there may be limited cold-water species use as described in **OAR-340-041-016 Table 21**. The cool-water aquatic life use is defined as mixed populations of native cool-water species, such as sculpin, sucker, smelt, chub, and minnows (cyprinids). Salmon, trout, and other cold-water biota may be present during part or all the year but do not form a dominant component of the community structure. The cool water aquatic life DO criteria present no risk to non-salmonid native fish or invertebrate species and slight risk of production impairment to salmonid fish, if they are present (EPA 1986b, DEQ 1995a).

DEQ designates C**ool Water Aquatic Life** use for waters where any of the following conditions are met:

1. The designated use subcategory for temperature is "Cool Water Species" and the waters are **NOT** specifically identified as "Warm Water Aquatic Life" (see Warm Water Aquatic Life below).
2. The designated use subcategory for temperature is "Salmon and Steelhead Migration Corridors".
3. Waterbodies that contain cool water species according to ODFW's fish habitat distribution database (FHD) (see **Table 8** in Appendix A, below).
4. If a waterbody is not otherwise designated for Cold Water or Warm Water Aquatic Life based on site-specific information as above, where the designated use subcategory for temperature is:
    a. 'Redband or Lahontan Cutthroat Trout'; **or**
    b. 'Salmon and Trout Rearing and Migration'; **and**
    c. the waterbody is located within NHD-PLUS catchments that intersect the following EPA Level III and Level IV Ecoregions listed in Table 6:

Table 6 Cool Water Community Ecoregions of Oregon

Level III Ecoregion:	Level IV Ecoregions:
Columbia Plateau	All
Snake River Plain	All
Northern Basin and Range	All
Willamette Valley	Willamette River and Tributaries Gallery Forest
	Prairie Terraces

Level III Ecoregion:	Level IV Ecoregions:
	Portland/Vancouver Basin
Eastern Cascades Slope and Foothills	Oak/Conifer Foothills
	Klamath/Goose Lake Basins
	Klamath Juniper Woodland
Blue Mountains	John Day/Clarno Uplands
	Canyons and Dissected Uplands
	Continental Zone Foothills
	Blue Mountain Basins
	Deschutes River Valley

2.5.2.1 Updates to Data Sources

DEQ is updating the temperature “Cool water species” designations based on the 2023 ODFW-FHD. The 2023 ODFW-FHD indicates there are waters where there is no salmonid habitat, including steelhead, resident trout, and char. ODFW’s 2023 timing information also shows where no salmonid life stage activities occur in July or August. The FHD now includes more data on the distribution of known habitat for non-salmonid species of concern that are indicators for cool water communities of aquatic life.

2.5.2.2 Revisions to Implementation Methods

Therefore, where site-specific information is available, DEQ shall delineate waterbodies for Cold Water Aquatic Life or Cool Water Aquatic Life, even when these waters occur within a contrasting ecoregion area. To differentiate waterbodies with a 'Cool' community that are within a 'Cold' Ecoregion, DEQ considers the distribution of habitat supporting cool-water species from the ODFW FHD. This requires development of a candidate list of cool water indicator species.

According to DEQ's 1996 dissolved oxygen rulemaking issue paper, species that could characterize a cool water community include:
"Waterbodies whose community structure is characterized by native cool-water species believed by the department to have dissolved oxygen requirements similar to the salmonids, including but not limited to cottidae [Sculpin]*,* osmeridae [Smelt], clupeidae [Shad], acipenseridae [sturgeon]*, sensitive* centarchids[bass/sunfish] *such as small-mouth bass, and several invertebrates."* (DEQ 1995a)

DEQ's 1995 temperature standards issue paper also identified various non-salmonid species in Oregon as members of Cool, Cold, or mixed Cool/Cold aquatic communities (**Table 7**) (DEQ 1995a).

Table 7 List of non-salmonid fish species and their thermal guild classification from the DEQ water quality standards review for temperature (DEQ 1995b).

Table 2-3: Non-Salmonid Fish Species Present in Oregon

Family, Genus or Species	Native or Introduced	Temperature Classification
Lamprey	Native	Cold
Sculpins (Cottids)	Native	Cool (2 species)
		Cold (8 species)
Squawfish	Native	Cool/Cold
Cyprinids (Minnows): Dace, Redshide Shiners	Native	Cool/Cold
Chub	Native	Cool
Suckers	Native	Cool
Sandroller	Native	Cool
Sturgeon	Native	Cool
Borax Chub (Near Hot Springs)	Native	Warm
Cyprinids: Goldfish, Carp, Fathead Minnows	Introduced	Warm
Centrarchids: Small-Mouth Bass	Introduced	Cool
Centrarchids: Bluefill, Crappie, Large-Mouth Bass	Introduced	Warm
Catfish	Introduced	Warm
Striped Bass	Introduced	Cool
Walleye	Introduced	Cool

The 2023 update of ODFW's FHD database contains habitat distribution data for many of the native species identified as characterizing waters with a 'Cool' community or mixed 'Cool/Cold' community structure (**Table 8**, below). DEQ proposes to use this list of species and their habitat distribution from the FHD to differentiate waters where the designated use subcategory for temperature is 'Redband or Lahontan Cutthroat Trout' or Salmon and Trout Rearing and Migration' between the subcategories of 'Cool Water Aquatic Life' and 'Cold Water Aquatic Life' for purposes of designating the dissolved oxygen use subcategories. If site-specific information is not available, the subcategory shall continue to be assigned based on the ecoregion.

Table 8 Species list of non-salmonid cool water community indicator species in the FHD.

Family	Common Name	Genus	Species
Acipenseridae	Green sturgeon	*Acipenser*	*medirostris*
Acipenseridae	White sturgeon	*Acipenser*	*transmontanus*
Centrarchidae	Smallmouth bass	*Micropterus*	*dolomieu*
Clupeidae	American shad	*Alosa*	*Sapidissima spp. Clupeidae*
Cottidae	Columbia mottled sculpin	*Cottus*	*hubbsi*
Cottidae	Klamath Lake sculpin	*Cottus*	*princeps*
Cottidae	Klamath marbled sculpin	*Cottus*	*klamathensis*
Cottidae	Malheur mottled sculpin	*Cottus*	*bendirei*
Cottidae	Margined sculpin	*Cottus*	*marginatus*
Cottidae	Mottled sculpin	*Cottus*	*bairdii*
Cottidae	Paiute sculpin	*Cottus*	*beldingii*
Cottidae	Pit sculpin	*Cottus*	*pitensis*
Cottidae	Prickly sculpin	*Cottus*	*asper*
Cottidae	Reticulate sculpin	*Cottus*	*perplexus*
Cottidae	Slender sculpin	*Cottus*	*tenuis*
Cottidae	Torrent sculpin	*Cottus*	*rhotheus*
Cyprinidae	Tui chub	*Siphateles*	*bicolor*
Catostomidae	Goose Lake sucker	*Catostomus*	*Occidentalis spp.*

Family	Common Name	Genus	Species
			lacusanserinus
Catostomidae	Klamath largescale sucker	*Catostomus*	*snyderi*
Catostomidae	Klamath smallscale sucker	*Catostomus*	*rimiculus*
Catostomidae	Largescale sucker	*Catostomus*	*macrocheilus*
Catostomidae	Lost River sucker	*Deltistes*	*luxatus*
Catostomidae	Modoc sucker	*Catostomus*	*microps*
Catostomidae	Mountain sucker	*Catostomus*	*platyrhynchus*
Catostomidae	Shortnose sucker	*Chasmistes*	*brevirostris*
Catostomidae	Tahoe sucker	*Catostomus*	*tahoensis*
Catostomidae	Warner sucker	*Catostomus*	*warnerensis*
Osmeridae	Eulachon	*Thaleichthys*	*pacificus*
Percopsidae	Sand roller	*Percopsis*	*transmontana*
Pogonichthyinae	Speckled Dace	*Rhinichthys*	*osculus*
Pogonichthyinae	Longnose Dace	*Rhinichthys*	*cataractae*
Pogonichthyinae	Leopard Dace	*Rhinichthys*	*falcatus*
Pogonichthyinae	Klamath Speckled Dace	*Rhinichthys*	*osculus spp. klamathensis*
Pogonichthyinae	Umpqua Dace	*Rhinichthys*	*evermanni*

2.5.2.3 Other Factors Considered

DEQ is proposing to refine the boundaries of the EPA Ecoregions using hydrological catchments from the NHD-PLUS dataset. Availability of the much finer-scaled NHD-PLUS catchment boundaries was a preferred alternative to align the 'Cool' and 'Cold' Ecoregion areas with hydrologically relevant boundaries. Use of HUC-12 boundaries from the NHD-High Resolution dataset was considered, but these boundaries were too coarse.

2.5.3Warm Water Aquatic Life

The "Warm-Water Aquatic Life" use subcategory applies to aquatic communities that are adapted to warm-water conditions and do not contain cold-water species as described in OAR-340-041-016 Table 21. The warm water community is characterized by native or introduced warm-water species (see examples in **Table 7**,above). The criteria that protect this use are based on a level that presents no measurable risk, (i.e., production impairment) to warm-water native fish and invertebrate species. These communities occur in waterbodies that would not naturally support cold water species and where salmonids are absent.

DEQ designates the **Warm Water Aquatic Life** use subcategory for waters:

1. With a designated use subcategory for temperature of “Borax Lake Chub”
2. The following waters:
    a. Malheur River – Namorf Creek to Mouth
    b. Willow Creek – Brogan Creek to Mouth
    c. Bully Creek - Reservoir to Mouth
    d. Owyhee River - River Mile 0 to 18
    e. Malheur Lake Basin - Natural lakes; water associated with Borax Lake and Lower Borax Lake
    f. Goose and Summer Lakes Basin - Highly alkaline and saline lakes

No revisions to the current implementation procedures for identifying this use subcategory are being considered at this time.

2.5.3.1 Updates to Data Sources

DEQ did not have a standard waterbody polygon layer for lakes and reservoirs in the 2003 rulemaking. A more accurate and complete waterbody polygon layer delineating lakes, reservoirs, and other impoundments is available from the NHD- High Resolution waterbody dataset. This dataset can more accurately identify natural lakes in the Malheur Lake Basin and highly alkaline and saline lakes in the Goose and Summer Lakes Basin for designation of waters for "Warm Water Aquatic Life". Natural lakes will be identified as the NHD waterbodies coded with the feature type (FType) for lake/pond (390). Highly alkaline and saline lakes will be identified as the NHD waterbodies coded with the FType for lakes/ponds and identified by the Oregon Lakes Atlas[16] as saline or highly alkaline or identified as NHD waterbodies coded with the FType for playa (361).

2.5.3.2 Revisions to Decision Rules

No revisions to the established implementation procedures currently used for identifying this subcategory of dissolved oxygen are being considered at this time.

2.5.3.3 Other Factors Considered

No additional factors were considered at this time.

2.5.4Estuarine Waters

A numeric dissolved oxygen criterion applies to estuarine waters, according to **OAR-340-041-0016 (5)**. Estuarine waters are defined as mixed fresh and oceanic waters in estuaries or bays from the point of oceanic water intrusion inland to a line connecting the outermost points of the headlands or protective jetties in **OAR-340-041-0002 (22)**.

DEQ uses the estuary classification implemented by the Oregon Department of Land Conservation and Development (DLCD) Oregon Coastal Management Program[17] to delineate estuarine waters[18]. **Estuarine waters** include waters within the Estuarine Coastal, Estuarine Open Water, and Estuarine Open Water Subtidal classes of the Oregon Department of Land Conservation and Development's Oregon Estuary and Shorelands Habitat Atlas.[19] The estuary delineation from the DLCD classification for the purposes of applying Oregon's water quality standards is available in a web-based GIS tool[20].

No revisions to the established implementation procedures currently used for dissolved oxygen are being considered at this time. Use of the CMECS boundaries to identify estuarine waters has been used in implementation of the dissolved oxygen standard since 2017.

2.5.4.1 Updates to Data Sources

No data sources updated at this time. Use of the Oregon Coastal Atlas CMECS boundaries to identify estuarine waters has been used to implement the dissolved oxygen standard since 2017.

2.5.4.2 Revisions to Decision Rules

No revisions to the established implementation procedures currently used for dissolved oxygen are being considered at this time.

2.5.4.3 Other Factors Considered

No additional factors were considered at this time.

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[16] https://oregonlakesatlas.org/

[17] Oregon Coastal Management Program https://www.oregon.gov/LCD/OCMP/pages/index.aspx

[18] DEQ 2017, Water Quality Program Memorandum: Methods for Delineating Estuarine Water Type for Mapping Beneficial Uses and Applying Criteria

[19] https://www.coastalatlas.net/estuarymaps/

[20] https://hdcgcx2.deq.state.or.us/HVR291/?viewer=wqsa

2.5.5 Ocean Waters

Aquatic life is a designated use for ocean waters, and there is a specific narrative criterion for ocean/marine waters in the DO standard. "Ocean Waters" or marine waters are defined as all oceanic, offshore waters outside of estuaries or bays and within the territorial limits (3 nautical miles) of the State of Oregon in **OAR-340-041-002 (34)**. Ocean waters are interpreted to begin immediately offshore of designated estuarine waters and open coastline.

No revisions to the established water body or aquatic life use definitions or implementation procedures are being proposed.

2.5.5.1 Updates to Data Sources

No data sources updated at this time.

2.5.5.2 Revisions to Decision Rules

No revisions to the established implementation procedures currently used for identifying this subcategory dissolved oxygen are being considered at this time.

2.5.5.3 Other Factors Considered

No additional factors were considered at this time.

2.6 Beneficial Use Designations for Dissolved Oxygen–Seasonal Uses

2.6.1 Salmonid Spawning locations

The "Salmonid Spawning" use for dissolved oxygen (OAR-340-041-0016 (1)) is a seasonal use that applies to spawning habitat of native anadromous salmon, steelhead and char, and to "**active spawning areas"** used by resident trout species.

For the proposed **salmonid spawning use** designations for dissolved oxygen, DEQ identifies where and when **salmon** and **steelhead**, and **Bull trout** (**char)** populations spawn as stated in the rule:

1. Salmon & Steelhead Spawning is designated following the procedures for designating use subcategories for temperature as amended for this rulemaking. These subcategories are designated on the following sub-basin maps set out at OAR 340-041-0101 to 340-041-0340: Tables 101B, and 121B, and Figures 130B, 151B, 160B, 170B, 220B, 230B, 271B, 286B, 300B, 310B, 320B, and 340B.

DEQ also identifies **active spawning areas used by resident trout** where:

2. The ODFW FHD indicates "Primarily spawning" for a resident trout species.

3. The ODFW FHD indicates "Resident- Multiple Uses" or "Present – Unknown Use" for a resident trout species where the water is also designated for salmon, steelhead, or native char spawning, as in number 1, above.

4. The ODFW FHD indicates waters "Resident- Multiple Uses" or "Present – Unknown Use" for a resident trout species that is upstream of waters designated for salmon, steelhead, or native char spawning, as in number 1, above.

5. By site-specific determination of active resident trout spawning habitat made in accordance with procedures in the most current version of the Stewardship Plan for the Oregon Fish Habitat Distribution Database Bioscience Framework Appendix A[21]

[21] https://www.oregon.gov/geo/FIT%20Documents/OFHDDS_Stewardship_Plan_Version_One_20200604.pdf

and the Oregon Fish Habitat Distribution Data Standard Appendix D[22] and with concurrence by ODFW.

The spawning criteria are applicable during the part of the year when spawning and incubation of embryos occurs. The criteria established to protect this use provide a level of low to no risk of impairment to spawning, egg development and incubation for sensitive native fish species, other native fish, and for invertebrates. ODFW identifies 'primarily spawning' habitat on the fish habitat distribution database through a combination of direct observation of spawning behavior and suitable habitat characteristics (substrate, flow, gradient, accessibility). This is the best available data for identifying active spawning habitat and DEQ uses that data to identify and designate waters where it shall apply the DO salmonid spawning criteria. However, there are still significant data gaps for identifying spawning habitat for resident trout species across the state in the ODFW-FHD.

Under OAR-340-041-0016 (1) the salmonid spawning criteria apply to waters with active spawning use by resident trout species, which includes waters that may be undesignated in rule. The Antidegradation Policy in OAR-340-041-0004 also requires protection of existing uses whether they have been officially designated or not. Therefore, DEQ will continue to document where ODFW determines additional resident trout spawning areas are located. DEQ shall maintain a publicly available **Inventory of Resident Trout Spawning Habitat** that documents additional site-specific determinations identifying “active spawning areas used by resident trout” and DEQ will apply the salmonid spawning criteria for DO to protect resident trout spawning in these areas. This will address data gaps where the spawning use is not yet designated in rule.

Following this rulemaking DEQ will add site-specific determinations of active resident trout spawning habitat (Part 6., above) to the inventory as available. Such determinations include:

1) consultation with ODFW district biologists which results in a concurrence of professional opinion determining a waterbody does or is highly likely to support resident trout spawning habitat.
2) data from a survey, study, or report that documents spawning habitat for resident trout species in a specific waterbody.
3) data or information submitted by third parties and reviewed for accuracy and reliability in consultation with ODFW.

2.6.1.1 Updates to Data Sources for Resident trout spawning

DEQ is updating habitat distribution for salmonid spawning habitat based on the 2023 ODFW-FHD and supplemental data provided by ODFW. The 2023 FHD includes expanded information about distribution of habitat where native trout are resident, where multiple life stage uses occur that may include spawning.

The data on total distribution of resident trout in ODFW's FHD is much more comprehensive than was available previously. ODFW estimates it may have identified as much as 95% of the distribution of resident trout species within Oregon in the current database. This includes all known distribution and federally designated Critical Habitat for listed resident trout species Bull Trout (char) and Lahontan Cutthroat Trout. In some waters, ODFW has also specifically identified where 'Primarily Spawning' habitat occurs in the FHD. However, most of the habitat is identified for "Resident- Multiple Uses" where multiple life stage activities occur. In most streams, there is not data specifying where resident trout spawning habitat is located.

To help fill in a large data gap in spawning habitat for Redband Trout, ODFW’s district biologists provided DEQ with additional information on waterbodies where resident trout spawning habitat is highly likely to occur based on species demographic distribution and professional judgement. DEQ is incorporating these areas into the proposed designations of resident trout spawning habitat.

To further supplement the FHD data on resident trout spawning, DEQ searched scientific literature and reports for documented identification of specific waterbodies providing resident trout spawning habitats. DEQ reviewed all available studies or reports from the following

[22]https://www.oregon.gov/geo/OGIC%20Documents/OregonFishHabitatDistributionDataStandard_Draft_v4_20200303.pdf

databases that might have information identifying where spawning by resident salmonid species occurs. If a source positively identified spawning use in a specific waterbody, it was included in the proposed designation of seasonal salmonid spawning uses for dissolved oxygen. A list of the studies and reports reviewed is in Appendix D.

1. Oregon State's Native Fish Investigations Program https://odfwnfi.forestry.oregonstate.edu/reports
2. ODFW'S Salmon and Trout Enhancement Program (STEP) https://www.dfw.state.or.us/fish/step/
3. ODFW Clearinghouse ODFW - ODFW Data Clearinghouse - View All Records (state.or.us)
4. Forest and Rangeland Ecosystem Science Center Publications https://www.usgs.gov/centers/forest-and-rangeland-ecosystem-science-center/publications
5. Forest and Rangeland Ecosystem Science Center Datasets https://www.usgs.gov/centers/forest-and-rangeland-ecosystem-science-center/data
6. Oregon State University Oregon Explorer Natural Resources Digital Library https://oregonexplorer.info/

DEQ is also updating life stage activity timing information for reaches where "adult spawning" and "egg development through fry emergence" life-stage activities from ODFW timing tables from 2003 to the recently updated 2023 version. The latest version now includes specific timing information for each resident trout population in Oregon.

2.6.1.2 Revisions to Implementation Methods

The spawning criteria in the dissolved oxygen standard apply to "any active spawning area used by resident trout species" [340-041-0016(1)]. However, there is a lack of data about which waterbodies do and do not support resident trout spawning. For the new salmonid spawning aquatic life use designations for dissolved oxygen, DEQ is proposing to designate the use for resident trout populations where spawning habitat has been positively identified and follow a framework for the **Inventory of Resident Trout Spawning Habitat** where additional sources of data can be readily adopted and appropriate criteria implemented in Clean Water Act programs. DEQ will continue to work with ODFW to identify additional sources of data, and professional judgement of district biologists, to refine whether specific waterbodies are or are not active spawning habitat for resident trout species. A framework for this policy is outlined in Section 3.3.

2.6.1.3 Other Approaches Considered

Oregon DEQ identified three alternatives approaches for designating resident trout spawning habitat into the basin specific water quality standards rules, though the Department did not necessarily consider all options to be viable. In the end, we modified alternative 1 below into the approach described in Section 2.6.1, above.

The alternatives considered were:

1. Designate only known spawning habitat identified in the ODFW FHD and commit to gather more information to fill data gaps.
2. Postpone designation of resident trout spawning to a later rulemaking and attempt to address data gaps first.
3. Designate all resident trout habitat as "presumed" spawning habitat and apply criteria until site specific determinations can be made.

Alternative 1 is similar to the final proposed decision rules for designating salmonid spawning for resident trout described above. However, DEQ modified this approach to use the best available information to fill some of the data gaps even though that data had not yet been incorporated into the FHD. DEQ designated known or likely resident trout spawning habitat at the time of this rulemaking based on the best available information from the ODFW and USFWS. DEQ will also continue to gather more data and information to close the data gaps. DEQ modified this option because the scientific literature indicates that resident trout often spawn upstream of habitat used by anadromous salmon and steelhead and agency biologists agree. Resident trout spawning is a *highly likely* use in these waters, and the criteria are also likely to be attainable in these sorts of waters. Therefore, the proposed policy will reduce the size of the data gap by making a conservative but reasonable extrapolation of the salmonid spawning use to upland

headwater tributaries with resident trout habitat already upstream of nearby salmon and steelhead spawning habitat.

Under Alternative 2, DEQ would delay designating salmonid spawning habitat for resident trout in the administrative rules until such time as it could gather more data and information in order to do a more comprehensive rulemaking. DEQ does not consider this a viable alternative. DEQ would have to initiate an additional rulemaking process, with associated effort and time commitment, rather than make use of the rulemaking already in progress. This could postpone other standards work and delay designation of the habitat known to support resident trout spawning. Delay would carry both administrative and legal risks. In addition, it is unclear when such data would become available. Finally, DEQ felt it was important to use the data that is already available rather wait for a more complete dataset.

Under Alternative 3, DEQ would apply a precautionary principle as in the current implementation procedures by presuming spawning occurs in all waters where resident trout are present. EPA notified DEQ that designation of “presumed” spawning areas in the regulations would have to be interpreted the same as a designation of those waters for the salmonid spawning use. DEQ does not consider this option to be viable because the Department views the designation of resident trout spawning habitat throughout the entire range of resident trout distribution as overly conservative, and not scientifically defensible. Under EPA’s interpretation that the designation of “presumed” resident trout spawning habitat would be a de facto designation of the use, a full Use Attainability Analysis and rulemaking process would be required to correct the designations once more accurate data and information is available. This would create both administrative and regulatory burdens in Oregon, and the designations would be inaccurate.

2.6.2 Salmon and steelhead Spawning Period Start Dates

Currently, salmon spawning use begins on the peak spawning use start date or two weeks after the start of lesser use, whichever is earlier according to ODFW's updated timing table information. However, in 2003 DEQ used a “no later than” start date of October 15 to simplify the number of spawning date ranges shown on the maps, assuming the temperature spawning criterion could be met in all waters by that date. To leverage increased accuracy of information on the actual start of spawn timing for salmon populations since 2003, however, DEQ proposes to change the “no later than” spawning start date to November1. In addition, the assumption that the 13°C criterion would be met in all waters by Oct. 15 proved to be incorrect.

An alternative proposal under consideration is to dispense with a start-date cutoff and rely on the dates from ODFW's timing tables for all populations. Unlike 2003, there is specific timing data for all anadromous salmonid populations in ODFW's timing tables. This alternative would be more accurate, however, this method would add nine spawning date ranges, with start dates of Nov. 15 – Dec. 15 combined with end dates of April 30, May 15 or June 15. DEQ decided against the added complexity of adding additional date ranges to the use maps and that the assumption spawning criteria can be met by November 1 is reasonable.

2.6.2.1 Other Factors Considered

See discussion of default start date considerations under Alternative 3 in Section 2.6.1.3 above.

2.6.3 Resident Trout Spawning Period Start Dates

The dates when "Salmon & Steelhead Spawning” are designated for the temperature standard also apply for the dissolved oxygen standard to protect spawning and egg incubation. Both the temperature and dissolved oxygen criteria for spawning are derived from studies of requirements for salmonid spawning and egg incubation.

DEQ used the following procedures to determine when the resident trout spawning use occurs:

Designate resident trout spawning use **starting** on the initial date of peak use according to ODFW's timing tables, but no later than January 1.

2.6.3.1 Updates to Data Sources

DEQ is updating life stage activity timing information for reaches identified in the 2003 ODFW-FHD as ‘Primarily spawning’ and using the “adult spawning” life-stage activities from

the 2023 ODFW's life stage activity timing tables. The tables contain much expanded information about timing for resident trout species than was available in 2003.

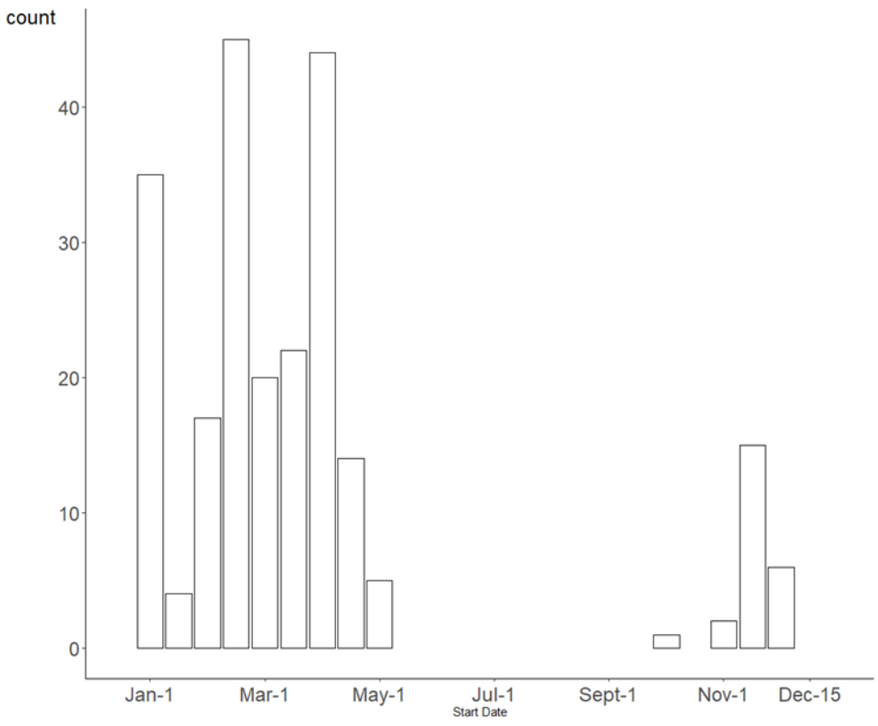
2.6.3.2 Revisions to Implementation Methods

Since 2004, the Department of Environmental Quality (DEQ) has consistently applied January 1 as the start date for resident trout spawning. This is based on the assumption that resident trout begin spawning on or after this date, and that the 'Salmonid Spawning' criteria for dissolved oxygen should be attainable throughout Oregon waters on Jan. 1. Therefore, it is a simplifying yet conservative approach and also aligns with the method used for determining the start dates for Steelhead Spawning.

ODFW's 2023 timing tables include significantly more comprehensive data about the timing of resident trout species compared to the data available in 2003. The data shows that 98% of resident trout populations begin spawning between November 1 and April 15. January 1 to April 1 are the most common start dates for resident trout spawning (**Figure 10**).

Only 22 out of a total of 1,433, or (1.5%), of resident trout populations identified by species and timing unit initiate spawning before January 1 (**Figure 10**). However, DEQ proposes a slight modification to the current dissolved oxygen standard implementation methods by applying the DO salmonid spawning criteria starting at the first period of peak 'Adult Spawning' use, or the second period after the start of lesser use, whichever is earlier, to protect these early spawning populations. For all other populations, the existing spawning start date of no later than January 1 will be maintained.

Figure 10 Temporal distribution of start dates for peak spawning of resident trout (not including Bull Trout).



2.6.4 Resident Trout Spawning Period End Dates

DEQ is using the same method to identify resident trout spawning use as we use for Steelhead spawning for temperature in 2003. Steelhead, Rainbow and Redband Trout are all subspecies of *Oncorhynchus mykiss*, which are spring spawners. Lahontan cutthroat trout are a unique species with limited habitat distribution in Oregon and therefore have separate, site-specific spawning dates.

DEQ proposes to apply resident trout spawning and egg incubation use **ending** on the following dates:

1. On May 15 in waters where the year-round designated use subcategory for temperature is “Salmon and Trout Rearing and Migration” or “Salmon and Steelhead Migration Corridors”.
2. On June 15 in waters where the year-round designated use subcategory for temperature is “Core Cold-water habitat”.

2.6.4.1 Updates to Data Sources

DEQ is updating life stage activity timing information for reaches where “adult spawning” and “egg development through fry emergence” life-stage activities occur using the recently updated 2023 version of ODFW’s life stage activity timing tables.

2.6.4.2 Revisions to Implementation Methods

No revisions to the established implementation procedures currently used to identify resident trout spawning end dates are being considered at this time. The method for applying spawning criteria is the same as for the 'Salmon & Steelhead Spawning' use subcategory for temperature and dissolved oxygen. End dates for resident trout species are the same that apply to steelhead, which are also spring spawners and a subspecies of Oncorhynchus mykiss along with Rainbow and Redband trout.

2.6.5 Spawning Date Ranges for Bull Trout Spawning

The date ranges necessary to protect spawning by Bull Trout are basin-specific and determined by the specific spawning and incubation timing of each population. The date ranges below were developed in 2003 with assistance from the USFWS and are consistent with the timing information in ODFW’s 2023 timing tables.

In waters where the designated year-round use subcategory for temperature is 'Bull Trout Spawning & Juvenile Rearing,' salmonid spawning for dissolved oxygen will apply on the following dates in the administrative basins indicated below[23]:

1. August 15 - May 15 - Deschutes, Hood, Powder
2. August 15 - May 30 - Klamath, Willamette, Malheur River
3. August 15 - March 31 - Grande Ronde- Wenaha sub-basin
4. August 15 - May 31 - Grande Ronde - Imnaha sub-basin
5. September 15 - April 30 - John Day, Umatilla, Walla Walla
6. September 15 - April 15 - Grande Ronde – Upper Grande Ronde sub-basin
7. September 15 - May 15 - Grande Ronde – Wallowa sub-basin

2.6.6 Spawning Date Range for Lahontan Cutthroat Trout

In waters the ODFW FHD indicates are occupied by Lahontan Cutthroat Trout, the spawning date range necessary to protect spawning is April 1 – July 15. This date range was developed in 2003 with assistance from the USFWS, and is consistent with the timing information in ODFW’s most current 2023 timing tables.

[23] DEQ Letter to EPA Region 10 of February 4, 2004. https://www.oregon.gov/deq/FilterDocs/standardsclar.pdf

3 Analyses and Information Supporting Decision Rules Revisions

This section provides additional background, analysis, and discussion of changes to methods proposed in Chapter 2, above. The first section includes detailed supporting analyses, literature review, and information on GIS procedures for the proposed decision rule methods. The second section details alternatives considered but not ultimately proposed as new methods for the decision rules.

3.1 Supporting Analyses for Proposed Decision Rules

3.1.1 Salmon and Trout Rearing and Migration

No additional analyses at this time.

3.1.2 Core Cold-Water Habitat

DEQ has received comments that the aquatic life use designations are too narrowly focused on salmonids. In response, DEQ reviewed information about the potential for identifying additional cold-water species as indicators of core cold-water habitat. DEQ also considered whether any of these indicator species might also need thermal protection consistent with the core-cold water designation and associated criteria. New indicator species would act as additional lines of evidence for identifying core cold-water habitats. Based on these comments and with input from members of the technical workgroup, DEQ considered and populations of late spawning steelhead, as additional indicator species for applying the 'core cold-water habitat' use designation. DEQ reviewed information about several native amphibians, pacific lamprey, native freshwater mussels, as potential indicators but did not ultimately include these in the methods. See Section 3.6.1 below.

DEQ also applied two updated temperature databases to identify cold water streams that can attain the core cold-water criterion of 16.0°C in the summer. See analysis and procedures for applying data from the NorWeST temperature observations data set and DEQ-AWQMS assessment database in sub-sections below.

3.1.2.1 Early Chinook/Late Steelhead spawning

In discussion with the Technical Workgroup, representatives of the U.S. EPA suggested that DEQ consider using late steelhead spawning as an additional indicator for Oregon's core cold-water habitat. Washington Department of Ecology uses this species and habitat use as an indicator for designating the State of Washington's similar "Core Summer Salmonid Habitat" aquatic life use subcategory. In Washington, they refer specifically to early dates for the start of adult spawning activity and do not include egg incubation through fry emergence. The presence of late steelhead spawning indicates that a waterbody remains cold long enough to delay the start of spawning, relative to other steelhead populations, until water temperatures warm sufficiently in the spring.

DEQ's 'Core Cold-Water' use is currently identified partially by early spring Chinook spawning that occurs prior to September 15, as well as Bull Trout adult and sub-adult use in July – August as biological indicators. In addition to the biological indicators, DEQ uses current temperature records (10-20 years) that demonstrate waterbodies can maintain the 16°C 7-DADM criterion throughout the summer to designate the 'Core Cold Water' aquatic life use.

WA Ecology's "Core summer salmonid habitat" designation uses the same spring Chinook spawning date ranges as DEQ, but also considers late steelhead spawning as that ending after June 1 – (U.S.EPA 2007) as a biological indicator.

DEQ shall evaluate the effect of modifying the decision rules for designation of 'core cold-water habitat' with the inclusion of:

1. Waters where ODFW identifies Chinook spawning use starting **on or before** September 15.
2. Waters where ODFW identifies peak steelhead spawning use ending **after** June 1.

3.1.3 Application of temperature data to core cold-water designations

This section explains the data and analysis used to generate geographic points for sampling locations that indicate temperature monitoring stations where maximum summer temperatures reliably stay below 16.0°C as a 7-day average maximum temperature for purposes of designating rivers and tributaries to the Core Cold-Water aquatic life use designation for purposes of applying Oregon's water temperature standards and criteria. Temperature data is only used in this context to identify additional waters for designation as Core Cold Water Habitat. It is not used as a basis to reclassify waters currently designated as Core Cold Water Habitat to a less stringent use.

3.1.3.1 NorWeST Temperature Observations Database

Data was retrieved from the USDA-Forest Service NorWeST database weekly summaries of temperature data for observation sites. These data span years 1993-2011 and include data from Federal and State Agencies, Oregon DEQ, tribes, and third parties. https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST/StreamTemperatureDataSummaries.shtml

The NorWeST weekly temperature data summaries provide weekly maximum temperatures (non-rolling 7 day maximums) see week assignments at: http://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST/downloads/ObservedStreamTemperatureMaps/NorWeST_ObservedStreamTemp_WeekAssignment.zip

The following data conditioning procedures were applied to identify sites within this database that reliably indicate rivers and tributaries water temperature conditions that are likely to attain and remain below 16.0°C throughout the summer. Because the NorWeST database is extensive, but many stations were only monitored for one year, stations with at least 3 years of data were included in the analysis to provide a means to account for inter-annual variability and the possible effect of a particularly cold summer on meeting the 16°C threshold. If the maximum weekly maximum temperature at a site was below 16°C with at least 3 years represented, we could be reasonably assured that sites could maintain 16°C regularly.

1. **Select** observations which were collected during the summer critical period (July 1 – September 30).) Monitoring data should be collected during the critical warm period (July 1 to September 30) to adequately capture peak temperatures, according to DEQ's most current assessment methodology: https://www.oregon.gov/deq/wq/Documents/ir2022AssessMethod2022DF.pdf
2. **Group** observations by site with at least 10 weeks of observations. Nearly all stations had at least 10 weeks of observations in years sampled.
3. **Filter** for stations with a maximum weekly maximum temperature that did not exceed 16°C.
4. The resulting GIS Shapefile is used to indicate the downstream extent of waters that meet the temperature threshold for classification as Core Cold-Water Habitat. Where these stations are representative of upstream waters, all waters upstream are included in the designation, unless a more stringent use applies. Sites on mainstem rivers where the contributing area is exceedingly large and the observation point could not be reasonably considered representative of upstream waters are designated for the main channel only to the confluence of the next major tributary or waterbody, such as a lake or reservoir.

NorWeST weekly observation database	**n=**
Observations of weekly maximum temperature	659,601
Observations in critical **period**	428,225

NorWeST monitoring sites in Oregon	1,497
Sites with at least 10 observations	1,464
Sites achieving 16.0°C or less 1993-2011	643

3.1.3.2 DEQ-AWQMS Assessment Temperature database

Data was retrieved from the DEQ 2018/2020 assessment database for the Integrated Report. This database is comprised of all continuous temperature data meeting quality assurance criteria stored in the DEQ AWQMS database, and provided by third parties, including state, federal, and tribal agencies for the 2018/2020 Integrated Report Call for Data covering years 2008-2020 (Figure 11). Temperature data is provided as the maximum 7-dADM temperature for a monitoring site.

The 7-dADM metrics are calculated from continuous data and must be collected to reliably capture the daily maximum temperature for at least seven consecutive days. At a minimum, monitoring data is collected during the critical warm period (July 1 to September 30) that adequately captures peak temperatures. The length of deployment varies by data provider and observation, and this metadata was not readily available.

The assessment database provides 7-dADM rolling averages of daily maximum temperatures directly comparable to Oregon's temperature criteria. The following data conditioning procedures were applied to identify stations within this database that reliably indicate rivers and tributaries water temperature conditions that are likely to attain and remain below 16.0C throughout the summer.

Extract 7-dADM metrics and monitoring location information from the assessment database and select observations which were collected during the summer critical period (July 1 – September 30).) Monitoring data should be collected during the critical warm period (July 1 to September 30) to adequately capture peak temperatures, according to DEQ's most current assessment methodology https://www.oregon.gov/deq/wq/Documents/ir2022AssessMethod2022DF.pdf

Group observations by monitoring location with at least 10 observations of the rolling 7-day average. Nearly all stations in the critical period had at least 10 observations.

1. Identify the maximum 7-dADM metric for each monitoring location.
2. Filter for monitoring locations with a maximum 7-dADM temperature that did not exceed 16°C.

DEQ-AWQMS database	n=
Total 7-dADM obs.	952,952
Total obs. in critical period	474,630
Total number of stations in Oregon	1,767
Stations with at least 10 obs.	1,749
Stations with obs. in critical period	1,738
Stations reliably achieving 16.0°C or less 2008-2018	324

The resulting GIS Shapefile is used to indicate the downstream extent of waters that meet the temperature threshold for classification as Core Cold-Water Habitat (Figure 12). Waters upstream of these points are included in the designation, unless a more stringent use applies.

The intent of the core cold-water designation is to protect large areas of habitat used by cold water fish, and not manage individual patches of cold water that may occur throughout the state's waters. DEQ applied a minimum stream order for adding reaches to this designation based on temperature.

It was not the intent of the core cold-water use to be applied to identify individual or isolated reaches of cold water where the fish populations and life stage activity supported do not indicate core rearing habitat for native salmon and steelhead. It does intend to protect extensive areas of cold-water habitat that currently meet the temperature criterion and thus could support this aquatic life use. To ensure a significant drainage area served by perennial flowing streams are classified based on temperature, only temperature sites on reaches of Strahler 3rd order and above were included.

The 2003 Temperature Rule Technical Advisory Committee found that for downstream waters to achieve the 18°C "Salmon and Trout Rearing & Migration" criterion in the summer, colder water temperatures upstream would necessarily need to exist. They did not suggest, however, that these upstream waters also needed to be classified as core cold water to achieve the desired protection. The protecting cold water narrative (OAR-340-041-0028(11)) also does not allow significant warming of these upstream waters if they are currently colder than the criterion (DEQ 2003b).

Figure 11 Location of temperature monitoring sites evaluated for attainment of the core cold water habitat criteria.

	Originator	Data Set
	U.S. Forest Service	NorWeST Observed Temperature Regional Database
	Oregon DEQ	2020 & 2022 Integrated Report

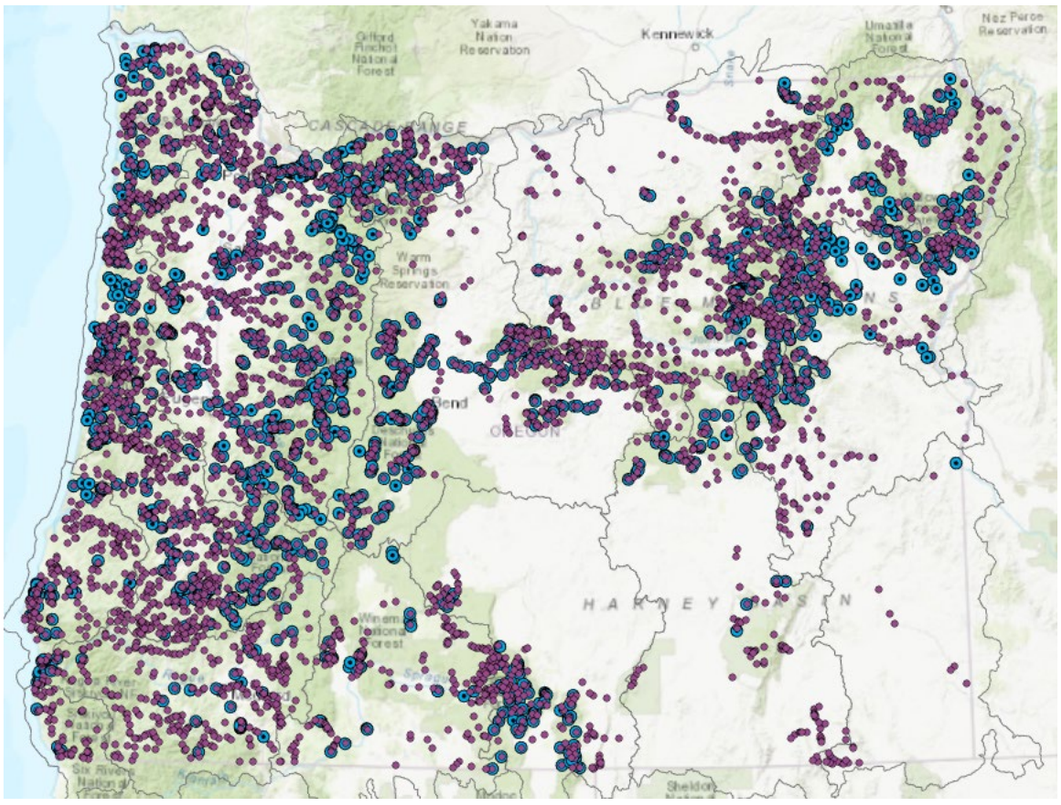
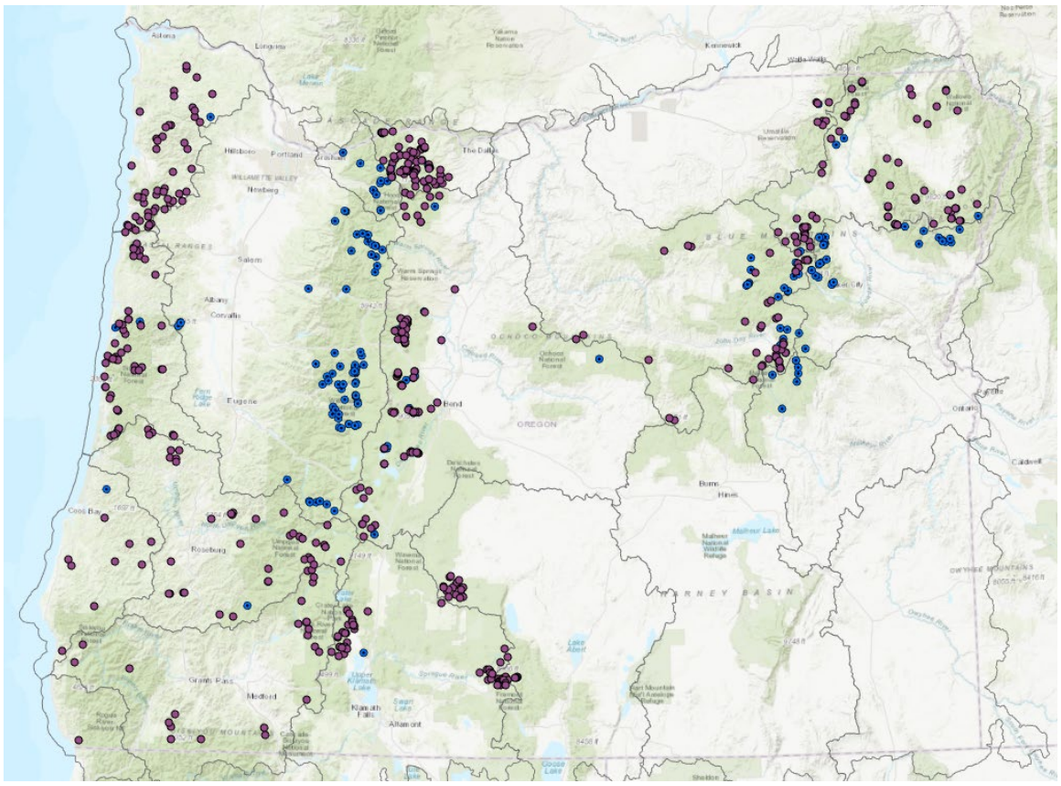


Figure 12 Temperature monitoring stations that meet DEQ's data requirements for 'Core Cold Water Habitat'.

	Originator	Data Set
	U.S. Forest Service	NorWeST Observed Temperature Regional Database
	Oregon DEQ	2020 & 2022 Integrated Report



3.1.4Bull Trout Spawning and Juvenile Rearing

In 2003, DEQ designated additional spawning habitat beyond that identified in the USFWS draft critical habitat designation. DEQ believed it was necessary to designate additional areas as potential bull trout rearing and spawning habitat beyond where current spawning habitat occurs to protect and recover the Threatened & Endangered Bull Trout populations in Oregon. Identifying potential Bull Trout spawning habitat allows for DEQ to protect additional habitat necessary for reconnection of local populations, increase resilience to natural disturbance, and enhance genetic diversity to support healthy reproduction.

For this rulemaking, DEQ engaged with the Statewide Bull Trout Working Groups to review the potential habitat identified in 2003 and provide input based on the current state of the science and conservation goals. The statewide working groups are organized jointly by ODFW and the U.S. Fish and Wildlife Service and coordinated for the agencies by Stephanie Gunckel. They are comprised of Bull Trout biologists from state, federal, tribal, academic, and private institutions.

The working groups reviewed the Potential Bull Trout Spawning Habitat that was identified by a Bull Trout Technical Committee organized by DEQ for the original 2003 rulemaking process (DEQ 2003c). They provided input on what potential habitat DEQ should still consider high potential for restoration and reintroduction or high value for connectivity to existing habitat, what potential habitat they would no longer consider as having high potential for restoration or reintroduction, and any additional habitat that should be added for consideration as potential spawning habitat.

Working Group	Meeting Date	Participating Agencies
Klamath Basin	February 7, 2022	ODFW, USFWS, USGS, USFS, TNC, NPS, Klamath Tribe, Green Diamond Resource Company, Klamath Watershed Partnership
Upper Willamette	April 14, 2022	ODFW. *Not discussed at a formal working group meeting. Conference of ODFW district and research biologists only.
Clackamas	February 23, 2022	ODFW, USFWS, USFS, PGE, TU
Hood	March 7, 2022	ODFW, USFWS, USFS, CTWSR, MFID, HRWC, Meridian Environmental
Upper & Lower Deschutes	January 31, 2022	ODFW, USFWS, USFS, CTWSR, PGE, Mt Hood Environmental
Odell Lake	March 8, 2022	ODFW, USFWS, USFS, Native Fish Society
John Day	February, 2022	ODFW, USFWS, BLM, CTUIR, USFS, CTWSR
Umatilla – Walla Walla	December 6, 2021	ODFW, USFWS, USFS, CTUIR, BOR, ACOE, WDFW, OSP, Tri-State Steelheaders, OWRD, SRSRB
Grande Ronde – Imnaha	January 12, 2022	ODFW, USFWS, USFS, PGE, CTUIR, Nez Perce, IPC
Powder – Pine	January 11, 2022	ODFW, USFWS, USFS, BOR, IDFG, IPC
Malheur	April 14, 2022	ODFW, USFWS, USFS, Burns Paiute Tribe, BPA, BOR

For the aquatic life use updates, DEQ worked with Stephanie Gunckel (ODFW/USFWS) the coordinator of statewide working groups of Bull Trout biologists from ODFW and USFWS. The working groups reviewed DEQ's 2003 'Potential Bull Trout Spawning Habitat' and advised DEQ on changes to consider. Their review identified which habitats are still consistent with near-term restoration goals and recent feasibility studies and should be retained, any habitats that should be added, and any habitat that will not support bull trout spawning and should be removed as potential spawning habitat. The additional potential spawning habitat identified by the working groups includes newly occupied spawning habitat from reintroductions and restoration that are not included in the federal critical habitat designation.

Habitat identified in 2003 as Potential Bull Trout Spawning that was subsequently classified in the Final 2010 Federal Critical Habitat Rule for Bull Trout as Spawning-Rearing (SR) or Foraging, Migration, and Overwintering (FMO); or classified as Primarily Spawning, Primarily Rearing, or Foraging, Migration, and Overwintering (FMO) Habitat in the 2023 ODFW-FHD is no longer considered potential habitat. Those habitat uses are integrated into DEQ's Bull Trout Spawning and Juvenile Rearing use subcategory designation as determined by the decision rule methodology. Because the potential habitat was used to designate the Bull Trout Spawning and Juvenile Rearing use in 2003, areas that are no longer considered potential spawning habitat, and are not indicated as spawning habitat in the Federal Critical Habitat Rule or ODFW's database, would be reclassified to a subcategory with less stringent criteria. The rationale and supporting information for any changes resulting in application of less stringent criteria are detailed in the Use Attainability Analysis accompanying this rulemaking.

Table 9 Summary of the conclusions on Potential Bull Trout Spawning Habitat from the statewide Bull Trout working groups.

Administrative Basin	Retain	Add	Remove
Malheur River	• Deadhorse Creek • McCoy Creek • Bosenberg Creek • Upper Summit Creek	• Spring Creek – downstream of Flat Creek • Corral Basin Creek	• North Fork Malheur River • Upper Malheur River to confluence of Big Creek • Lake Creek
Umatilla	• Meacham Creek • East Fork Meacham Creek • Umatilla River	• Shimmiehorn Creek (Buchanan et al. 1997) • Spring Creek	
Walla Walla	• All from 2003		
Powder River	• All from 2003		
Grande Ronde	• All from 2003	• HooDoo Creek • Little Minam River downstream of critical habitat to confluence with Minam River • BC Creek upstream for 400m from mouth	
John Day River	• All from 2003	• Strawberry Creek • Slide Creek • Junkens Creek	
Hood River Basin	• All from 2003		
Deschutes River Basin	• Lake Creek – Blue Lake and Link Creek • Upper portion Big Marsh Creek • Fall River • Crystal Creek • Maklaks Creek	• Spruce Creek • Hemlock Creek • Refrigerator Creek • Tumalo Creek upstream of Shevlin Park • Cold Creek • Cultus River	• Suttle Lake • Lower portion Big Marsh Creek • Crescent Creek and Lake • Whitefish Creek • Upper Deschutes River including Wikiup Reservoir, Lava Lake and Big Lava Lake • Crane Prairie • North Davis Creek
Lower Willamette		• Clackamas River at Big Bottom • Pinhead Creek • Clackamas River above Cub Creek	

Administrative Basin	Retain	Add	Remove
		• Cub Creek • Hunter Creek • Rhodedendron Creek	
Upper Willamette	• Lost Creek • Salmon Creek above Black Creek • Upper Middle Fork Willamette River	• Upper McKenzie River to Tomlitch Falls • McKenzie River Trail Bridge Dam to Belknap Springs • Anderson Creek to FR 830 • Separation Creek mouth to Rainbow Creek to • South Fork McKenzie River from Augusta Creek to Elk Creek • Elk Creek • Fisher Creek to 7km from mouth • Furnish Creek mouth to FR 248 • Eagle Creek • Swift Creek upstream of FR21	• Salmon Creek between Wall Creek and Black Creek • Smith River and Reservoir • Wall Creek • North Fork Willamette River including Waldo Lake • Salt Creek • South Fork Salt Creek
Klamath Lake	• North Fork Sprague River • Boulder Creek • Sheepy Creek • Leonard Creek • Coyote Creek • Callahan Creek	• Unnamed creek upstream of Corral Creek • Annie Creek • Rock Creek • Sevenmile Creek to confluence with Short Creek • Short Creek	• South Fork Sprague River

Figure 13 Updated 'potential Bull Trout spawning habitat' as revised by the statewide Bull Trout working groups.

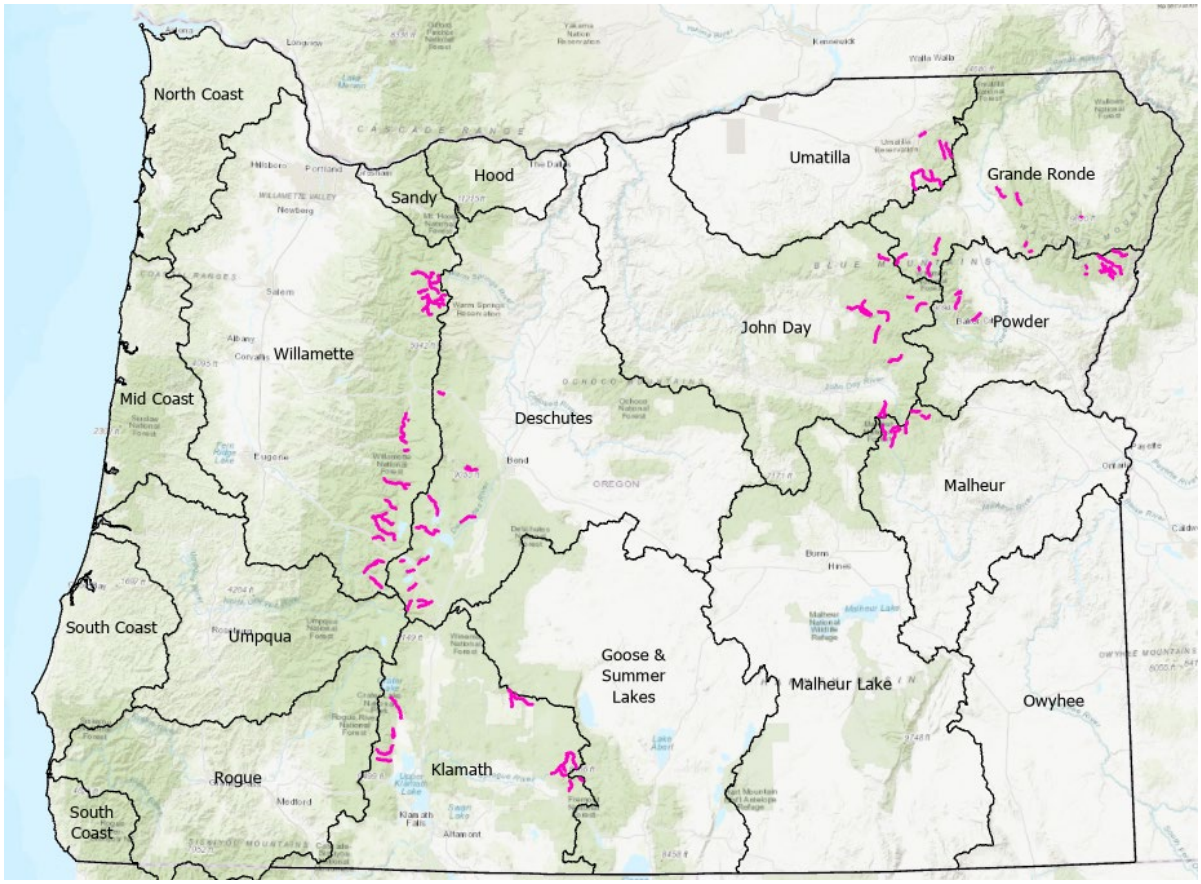
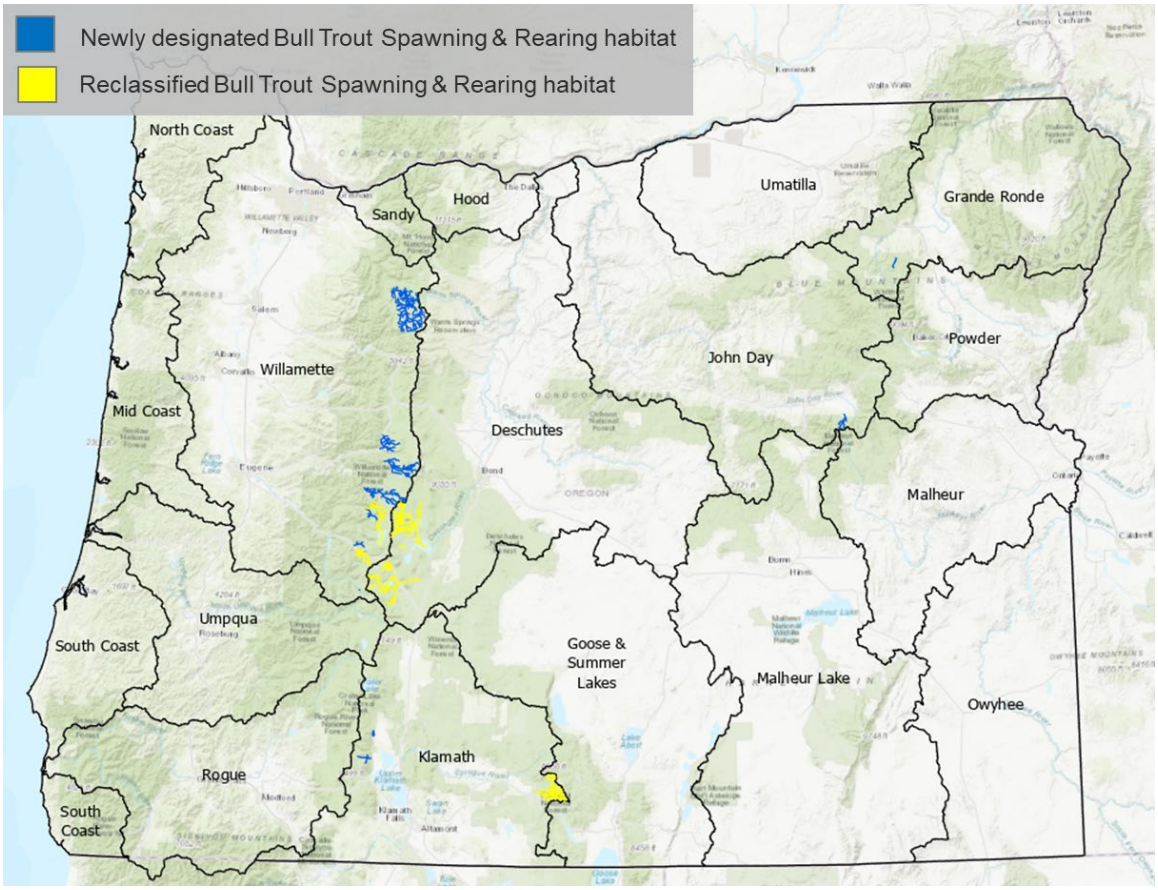


Figure 14 Habitat added and removed from 'Bull Trout Spawning & Juvenile Rearing' designation based on the input of the Bull Trout working groups.



3.1.4.1 Site-Specific Adjustment

To protect highest attainable uses, DEQ made the following site-specific adjustment for designating Bull Trout Spawning & Juvenile Rearing habitat.

John Day Basin – Canyon Creek and Pine Creek Sub-basins

Bull Trout Spawning and Juvenile Rearing habitat was designated in these sub-basins in 2003 because they were included in the draft USFWS Critical Habitat Rule for Bull Trout. Upon further evaluation, the USFWS did not include this stream in the Final Critical Habitat Rule (2010). These waters do not meet any of the decision rules for Bull Trout Spawning & Juvenile Rearing habitat designation in the current update. However, temperature data and habitat suitability modeling[24] indicate the upper portion of these reaches currently attain the Bull Trout Spawning criteria. Therefore, DEQ is proposing to retain the current Bull Trout use designation in the upper portion of these waters as the highest attainable use. See additional discussion and analysis in the Use Attainability Analysis for this rulemaking.

[24] https://www.fs.usda.gov/rm/boise/AWAE/projects/ClimateShield.html (Isaak et al. 2015)

3.1.5 Redband and Lahontan Cutthroat Trout

No additional analyses at this time.

3.1.6 Salmon and Steelhead Migration Corridors

3.1.6.1 Methods

Waters that are candidates for the 'Salmon and Steelhead Migration Corridor Use" are those used primarily for migration of anadromous salmon and steelhead species, with limited rearing use at other times of the year, especially during the summer.

To identify these waters, DEQ applied the methods outlined in Section 2.3.5, above to habitat for anadromous salmon & steelhead to the ODFW FHD:

1. Migration corridor reaches designated and approved in 2003.
2. Where ODFW's FHD indicates a reach is "Primarily migration" for an anadromous salmon or steelhead species.
3. Where ODFW's life-stage activity timing tables indicate no peak salmonid rearing use or peak salmonid spawning or emergence use in July-August, inclusive of resident trout species.
4. There is evidence indicating that the reach naturally exceeds 18°C 7-dADM.

3.1.6.2 Data Analysis

Primarily Migration Reaches

To evaluate waters for designation under the Migration Corridor use, DEQ extracted waters with habitat use of "Primary Migration" from the ODFW-FHD for at least one of the five anadromous salmonid species native to Oregon: Chum Salmon, Coho Salmon, fall Chinook Salmon, spring Chinook Salmon, Sockeye Salmon, summer steelhead and winter steelhead.

Use the ODFW timing tables (2023) to extract a list of timing units that contain peak habitat use for adult upstream migration, adult holding, adult spawning, or egg incubation and fry emergence, by the anadromous or resident salmonid species native to Oregon that occurs during July 1- August 31. Create a layer of timing units that have peak use by these salmonid species in July and August.

The reaches identified "Primary Migration" were then overlayed with the timing units showing no use in July or August to extract the migration reaches where there is no peak use for salmonids in July and August.

Overlay these reaches with data from the USDA-FS current temperature data to identify reaches that are currently attaining temperatures of 18°C or less.

3.1.6.3 Temperature Evidence for reaches achieving current summer maximum temperatures of 18°C or less

Average maximum August stream temperature data from the USDA-Forest Service NorWeST stream temperature observations database (1993-2011) was cross-referenced with the distribution of waters classified as Primarily Migration to identify migration reaches that can currently attain temperatures of 18°C or less.

Potential migration waterbodies that currently do not exceed 18°C in the summer and are therefore disqualified:

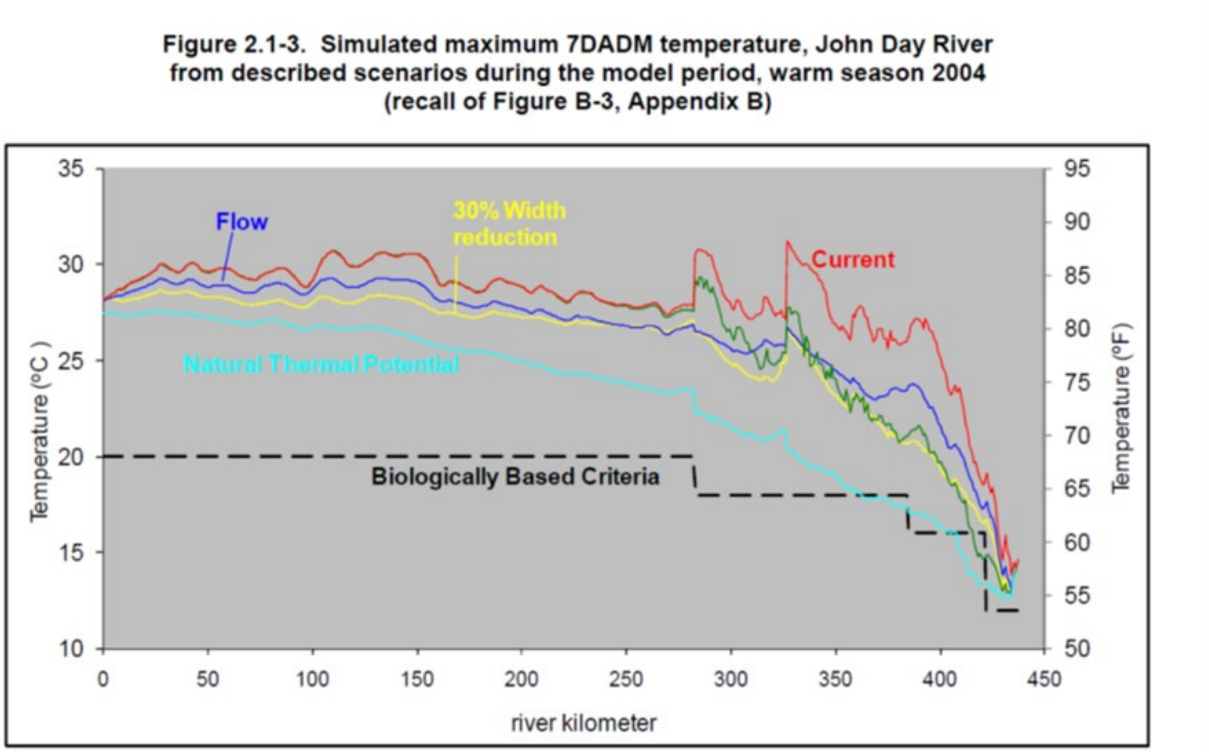
- Alsea River
- Beaver Slough
- Camas Creek
- Clackamas River
- Clatskanie River
- Millicoma River
- Eightmile Creek (near The Dalles, OR)
- Fivemile Creek (near Siltcoos Bay, OR)
- Fivemile Lake (Fivemile Lake)
- Leitel Creek (Fivemile Lake)
- Bell Creek (Fivemile Lake)
- Tahkenitch Lake
- Mill Creek (Salem)
- Salem Ditch
- Siltcoos Bay
- Siltcoos River
- Maple Creek (Siltcoos Bay)
- Siltcoos Lake
- Fiddle Creek
- Miller Creek
- Sidney Power Ditch (Ankeny National Wildlife Refuge)
- South Scappoose Creek (near Scappoose, OR)
- Westport Slough (near Clatskanie, OR)
- Willamette River (from above Harrisburgh to Eugene)

3.1.6.4 Evidence for natural conditions exceeding 18°C as a summer maximum

John Day River (RM 0 ~184 / Rkm 0~296)

This waterbody has a TMDL, and the natural thermal potential is expected to exceed 18°C for the entirety of the potential primary migration reach. This reach is currently designated as a Migration Corridor and DEQ expects to maintain the current designation.

Figure 15 Natural thermal potential of the John Day River



Willamette River RM 0-50 (Rkm 0 – 80.4)

This migration corridor reach contains some adult holding and juvenile rearing use by Spring and Fall Chinook Salmon. A TMDL has been issued and natural thermal potential for this reach has been determined to exceed 18°C in July and August. This reach is currently designated as a Migration Corridor and DEQ expects to maintain the current designation.

Figure 16 Natural thermal potential of the Willamette River showing maximum 7-dadm temperature sin July (top) and August (bottom).

Figure 4. July 2001 Willamette River natural thermal potential and biological criteria temperatures.

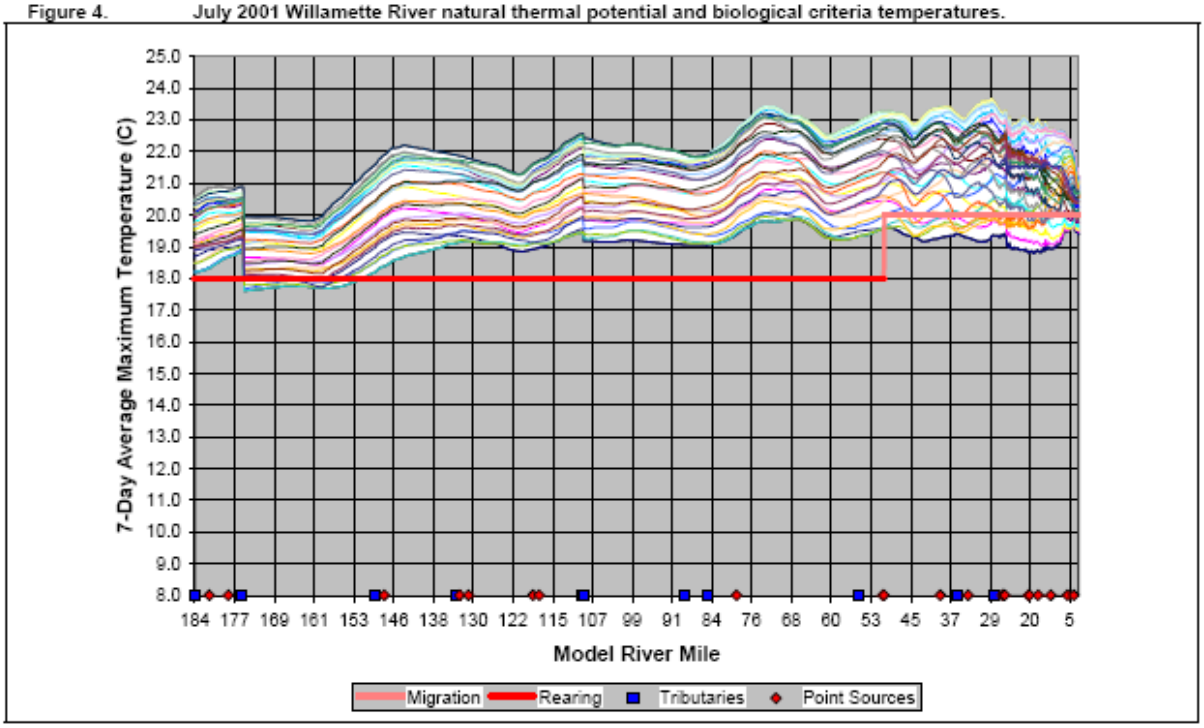
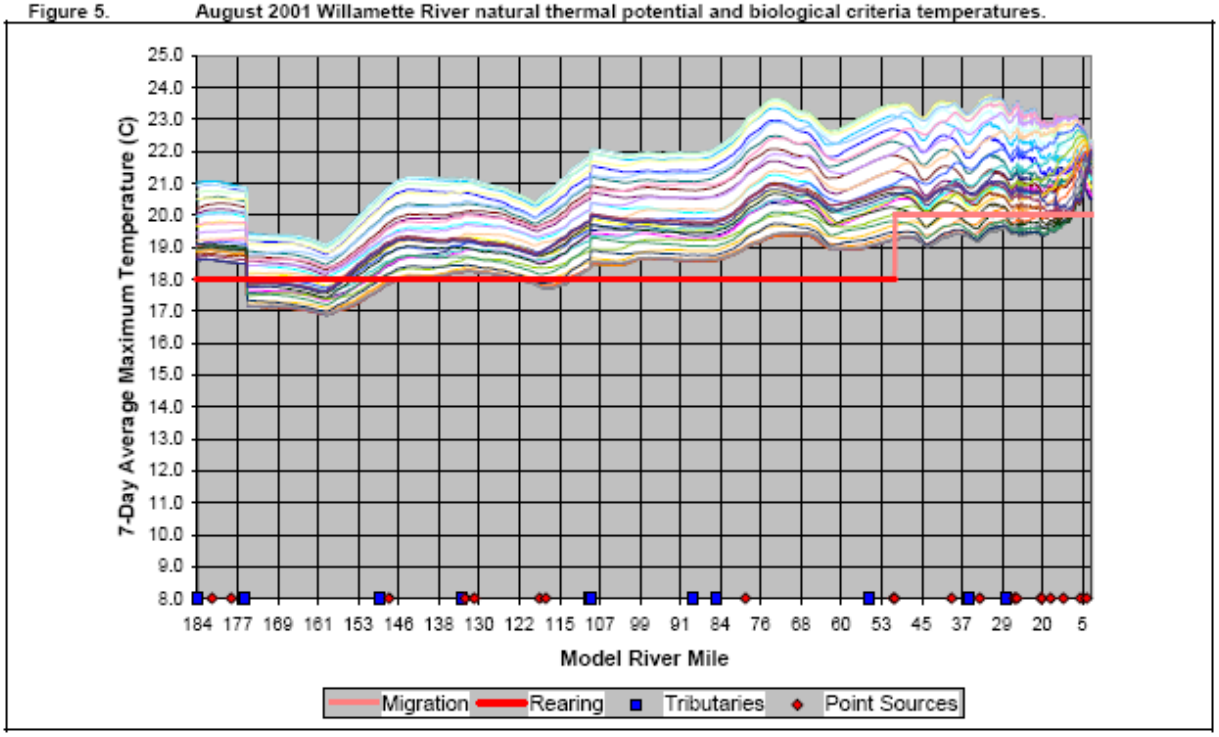


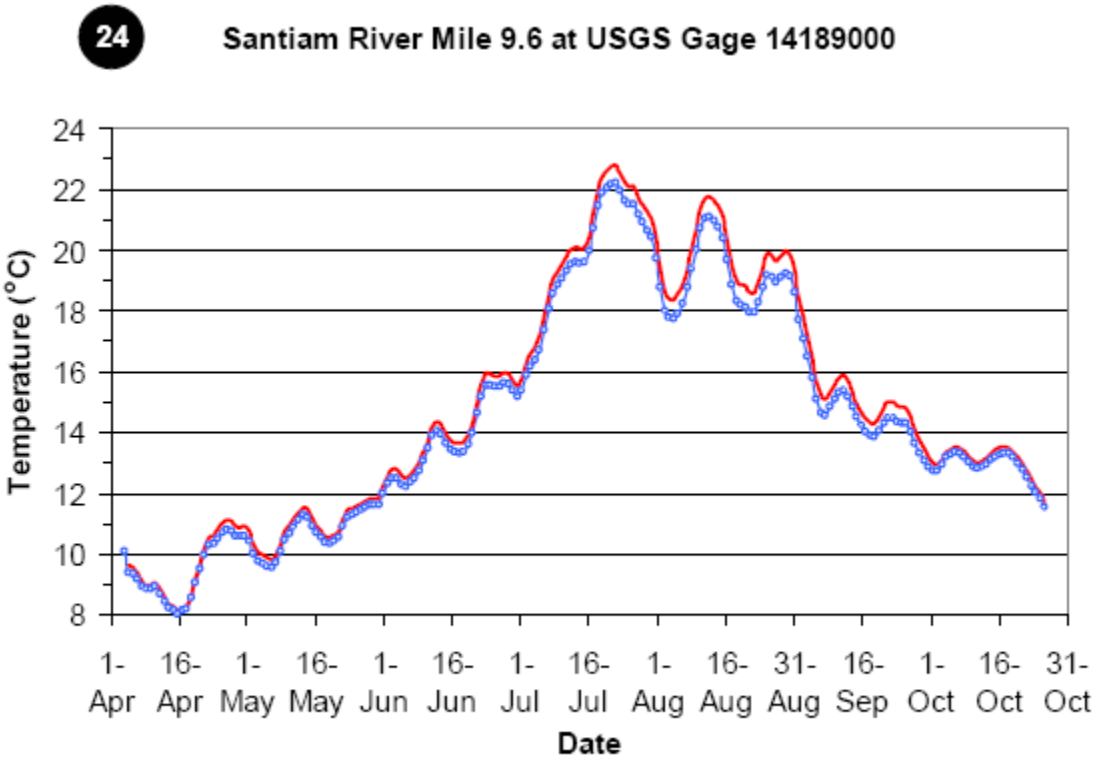
Figure 5. August 2001 Willamette River natural thermal potential and biological criteria temperatures.



Santiam River from the Willamette River to near Jefferson, OR (RM 0 ~ 10 / Rkm 0~16).

Natural thermal potential for this reach of the Santiam River was conducted for the Willamette Basin TMDL. This modeling determined the reach naturally exceeds 18°C in July and August up to river mile 9.8. The TMDL results are corroborated by modeling from the USGS (Sullivan and Rounds 2004, Rounds 2010).

Figure 17 Natural thermal potential of the Santiam River at RM 9.6. Current temperature (2003, red) system potential (blue). Willamette Basin TMDL Chapter 4 p.4-160.



D River near Lincoln City, OR.

Current NorWeST temperature observations indicate the reach exceeds 18°C as an August mean and the reach contains no salmonid holding, migration, spawning, or egg incubation through fry emergence use in July and August. No TMDL for this area exists and no third party models or restored thermal potential were identified at this time.

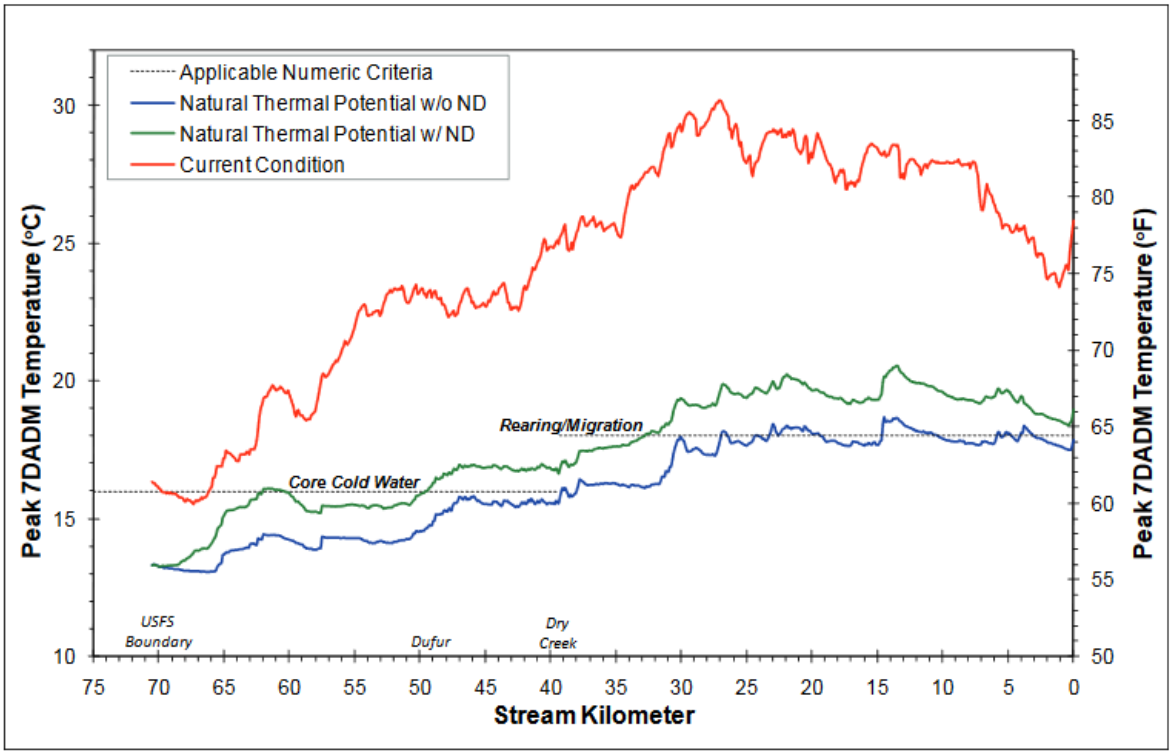
Fifteenmile Creek near The Dalles, OR.

Current NorWeST temperature observations indicate the reach currently exceeds 18°C as an August mean. The lower reach contains no salmonid holding, migration, spawning, or egg incubation through fry emergence use in July and August. The reach is currently

designated as salmon and trout rearing and migration and was identified as a minor (providing refuge >18°C) cold-water refuge by the U.S. EPA.

Fifteenmile Creek is included in the Hood-Mid-Columbia Miles Creek TMDL and its restored thermal potential was modeled in 2005. Results of the TMDL indicate that temperatures of approximately 18°C are attainable with restoration. Given these results and the importance of this reach as providing cold water refuge to fish migrating in the Columbia River, DEQ shall retain the designation as Salmon & Trout Rearing and Migration.

Figure 18 Natural thermal potential of Fifteenmile Creek from river kilometer 0-75.



Multnomah Channel and Scapoose Bay, near Scapoose, OR.

Current temperatures exceed 18-20°C as mean August maximum temperatures. EPA Memorandum *Evaluation of the potential cold water refugia created by tributaries within the Lower/Middle Columbia River based on "NorWeST" temperature modeling project*, *February 21, 2017*. These reaches were not modeled in the Lower Willamette basin TMDL and no third party models of restored thermal potential specific to these reaches were identified at this time. However, these reaches are tributary, and receive water from both the Willamette River and Columbia River, which do have evidence supporting natural thermal potential exceeds 18°C in July and August. The water current temperatures of these reaches are the same as the nearby Willamette River and Columbia River.

3.2 Salmon & Steelhead Spawning through Emergence Timing (Temperature and Dissolved Oxygen)

DEQ is maintaining the same general framework for determining applicable spawning start and end dates used since 2003. This framework is consistent with the approach recommended by the Region 10 Temperature Guidance and Technical Support Issue Papers (Poole et al. 2001, U.S. Environmental Protection Agency 2003). The following summarizes the rationale and provides supporting information for determination of spawning start and end dates under the methods carried over from 2003 and newly proposed spawning ends date for reaches where winter spawning species are absent.

3.2.1 Spawning start date selection method justification

DEQ's existing salmon and steelhead spawning designations apply the spawning criteria starting on the first two-week period after the start of lesser spawning use, or the start of peak spawning use, whichever is earlier. The rationale for the two-week delay after the first period of lesser spawning use spawning start date is to account for spatial and temporal variability in the dates for spawning in the timing tables and waterbodies within timing units. ODFW's peak use category represents the time within which approximately 90% of the population spawns. The earliest and latest periods of the spawning season tend to be when the dissolved oxygen and temperature are less likely to be optimal, even under natural background conditions.

The Temperature Technical Advisory Committee (TTAC) (DEQ 2003b) for the 2003 aquatic life use designation rulemaking considered that there is a large amount of spatial and temporal variability in spawning, and in particular interannual variability, in the timing of the onset of spawning. There is also a fair amount of plasticity in when salmon spawn, as they respond to local conditions. Salmon and steelhead wait for cues of temperature drop or rise, within limits, depending on whether they spawn in the fall or spring. When stream temperatures drop varies from year to year, but they tend to drop quickly. The EPA recommended that spawning use apply from the average date that spawning begins to the average date incubation ends (EPA 2003).

The resolution of the data in the ODFW timing tables is two week intervals and applies to a "timing unit," which in many cases is a large catchment. Often spawning starts in colder waters within a timing unit and gradually progresses to the rest of the spawning habitat as the spawning season begins. Consequently, not all waters within the timing unit would be expected to be able to meet the spawning criteria on the first day of spawning.

The two-week delay only applies where the spawning use is identified as "lesser use" by ODFW. Generally, ODFW considers at least 90% of the population to spawn during the "peak use" time. For some populations peak use may apply to as little as 70% of the population if there is extended lesser use before or after the peak, such that each two-week period of lesser use represents 10% or less of activity by the population. To protect at least 90% of the Salmon and Steelhead Spawning use, dates begin no later than the onset of "peak" spawning use.

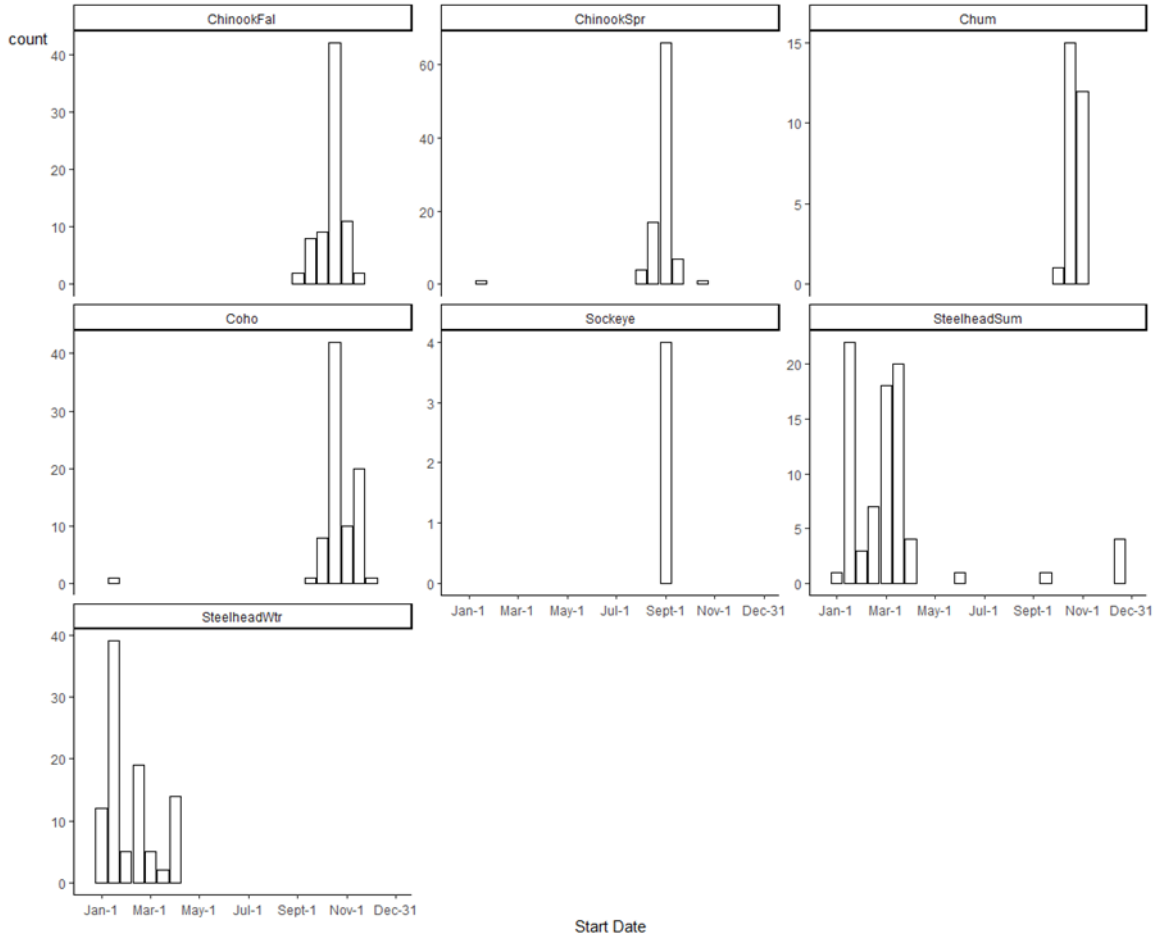
The National Marine Fisheries Service Biological Opinion on EPA's approval of Oregon's water temperature standards (NMFS 2015), found that application of the spawning criteria

for salmon and steelhead after two weeks into the initial period of lesser use was appropriate because the highest water temperatures allowed under the spawning and incubation criterion (13.0°C) were likely to occur during one of the earliest weeks in the spawning periods. Generally, this is between September and November when non-peak spawning usually occurs. Water temperatures are cooling rapidly during the start of spawning season and coincide with the start of autumn precipitation and increased stream flows.

NMFS also determined that temperatures during the day would be cooler than the daily maximum due to daily temperature fluctuations between nighttime and daytime. Therefore, spawning adult fish and embryos are likely to be exposed to temperatures approaching 13°C for only a few hours a day during the warmest week of the entire incubation period.

Finally, NMFS considered the number of fish affected at the start of lesser use was likely to be small. If 10% of the population is represented during a period of lesser spawning use the period at the start of incubation and at the end of each represent roughly 5% of the population. Of the 5% of the population potentially exposed to daily maximum above the criterion, only a small percentage of these were expected to be at risk of mortality (5% or less) if temperatures attained the criterion by the designated start date. The proportion of the population exposed would be even less if divided among more periods of lesser use. This risk was considered similar to natural rates of mortality, because water temperatures likely were not optimal for salmon at all places and times, even prior to human disturbance of the landscape (Reeves et al. 1995, Poole et al. 2001, NMFS 2015 pp. 137–143).

Figure 19 Distribution of spawning activity start dates for salmon & steelhead species.



3.2.2 Rationale for revising the Spawning Start Date Cutoff from October 15 to November 1

To leverage increased availability of information on the actual start of spawn timing for salmon populations since 2003, DEQ is proposing change the latest start date for from October 15 to November 1. DEQ will retain the method used in 2003 for populations that begin spawning prior to Nvo. 1. In these reaches, salmon spawning use begins on the actual start or peak spawning use date, or two weeks after the start of lesser use, whichever is earlier according to ODFW's updated timing table information.

In the 2003 designations DEQ used a cutoff for start of spawning dates no later than October 15. This was an attempt to simplify the number of date ranges for spawning by applying the spawning criteria starting October 15 for all late-fall spawning species. The October 15 date was based on information about dates of Fall Chinook spawning available at the time. In the absence of specific data about timing for other salmon species, this date was assumed to be broadly applicable to spawn timing for other salmon populations statewide. It was assumed that most salmon populations would begin spawning before this

date. There was also an assumption, absent wide availability of temperature data for waterbodies across the state, that most waterbodies in Oregon could readily attain the spawning criterion by this date.

With the increased availability and accuracy of spawning timing available from ODFW, DEQ analyzed actual start timing for spawning of native salmon populations and found the Oct. 15 is approximately the median start date for salmon populations across the state. Many specific populations of salmon including fall Chinook, and especially Coho and Chum, start spawning on or after Nov. 1 (see Fig. Figure 19, above). Additionally, nearly 20 years of implementing the temperature criteria has revealed that many waterbodies that support spawning do not cool to a 7-day average of the daily maximum stream temperature of 13°C by October 15 as assumed. Therefore, using October 15 as a cutoff date is both too conservative and unattainable in many habitats where spawning starts later in the season. Under the new proposal, the spawning start date is first and foremost determined by the actual start of spawning shown in ODFW's timing tables for specific timing units. This revision only occurs in waters where October 15 was applied in place of a later start date shown on ODFW's timing tables.

3.2.3 Rationale for Spawning End Date Method

3.2.3.1 For Salmon and Steelhead Spawning Use (Temperature)

DEQ's framework for determining the dates for spawning periods supports the sensitive early life stages of egg incubation (eggs and larval stages) according to the spawning criterion (DEQ 1995b, EPA 2003). To simplify the number of date ranges for spawning, DEQ applies the spawning criteria until either May 15 or June 15. The later June 15 date is applied to salmon and steelhead spawning habitat in waters designated as 'Core Cold-Water Habitat'. DEQ is not proposing to change this method used in 2003.

The biological endpoint for the numeric salmon & steelhead spawning criterion is based on thermal requirements for egg incubation and embryonic development (DEQ 1995b). Fry survival and fitness at emergence is very high when initial egg incubation occurs at temperatures equal to or less than the threshold adopted as Oregon's numeric criterion (13°C) for salmon & steelhead spawning through fry emergence (McCullough et al. 2001). Water temperatures optimal to fry and juvenile growth occur at 12°C – 20°C and are within the range of the year-round criteria for Salmon & Trout Rearing and Migration and Core Cold Water Use (EPA 2003). Therefore, application of the spawning criteria beyond the stage of egg incubation and larval development is not required to protect fry and early juvenile development.

The Temperature Technical Advisory Committee (TTAC) (DEQ 2003b) for the 2003 aquatic life use designation rulemaking considered that there was a lack of good data on emergence, and high spatial and temporal variability and plasticity in egg incubation and emergence timing. Egg incubation and the majority of fry emergence from the gravels for spring spawning steelhead is expected to conclude by May 15 in most systems and June 15 in typical colder systems. Although steelhead fry may emerge even later than June 15 in some waters, those waters are typically colder, high elevation, or groundwater-fed habitats. To attain the spawning criterion on June 15 in the downstream extent of spawning reaches,

temperatures would necessarily remain colder in the upstream waters. Peak spawning for all populations of salmon & steelhead concludes by May 15, with the median date of November 15 for Chum and Chinook, December 1 for Coho, and May 1 for steelhead. Egg incubation is expected to conclude within approximately 30 days of spawning in cold waters and 20 days of spawning in warmer waters (Rombough 1988, Murray and McPhail 2011), meaning there is high assurance that egg incubation for all populations concludes before the end of spawning dates DEQ uses for regulatory purposes.

Meeting this criterion at the onset of spawning for salmon and at the end of incubation for steelhead trout is expected to provide protective temperatures for egg incubation (6 - 10°C) that occurs over the winter (salmon) and spring (steelhead, resident trout), and subsequent emergence, assuming typical annual thermal patterns (EPA 2003). Some salmon populations naturally adapted to spawning and incubating larvae in warmer temperatures and reduce their potential for exposure to warm water in the spring by accelerating incubation and emergence in warm conditions (NMFS 2015 p. 142). Artificially extending the period when spawning criteria are applied is not necessarily beneficial to all salmon populations, and they do not automatically seek the coldest temperatures for egg incubation. Some salmon seek warmer areas of substrate and may select warmer redd locations to protect eggs from freezing and to ensure earlier emergence from the substrate, giving young a competitive advantage (Geist et al. 2002, 2008, Arntzen et al. 2009) *in* (NMFS 2015 pp. 137–143).

For these reasons, DEQ's original technical advisory committee recommended application of temperature spawning criteria until May or June 15. This methodology was approved by the EPA when Oregon's criteria were adopted and verified through Endangered Species Act consultation with the NMFS and the USFWS. Therefore, DEQ is not proposing to change the method for spawning end date designation in this rulemaking.

3.2.3.2 For waters with only fall spawning populations

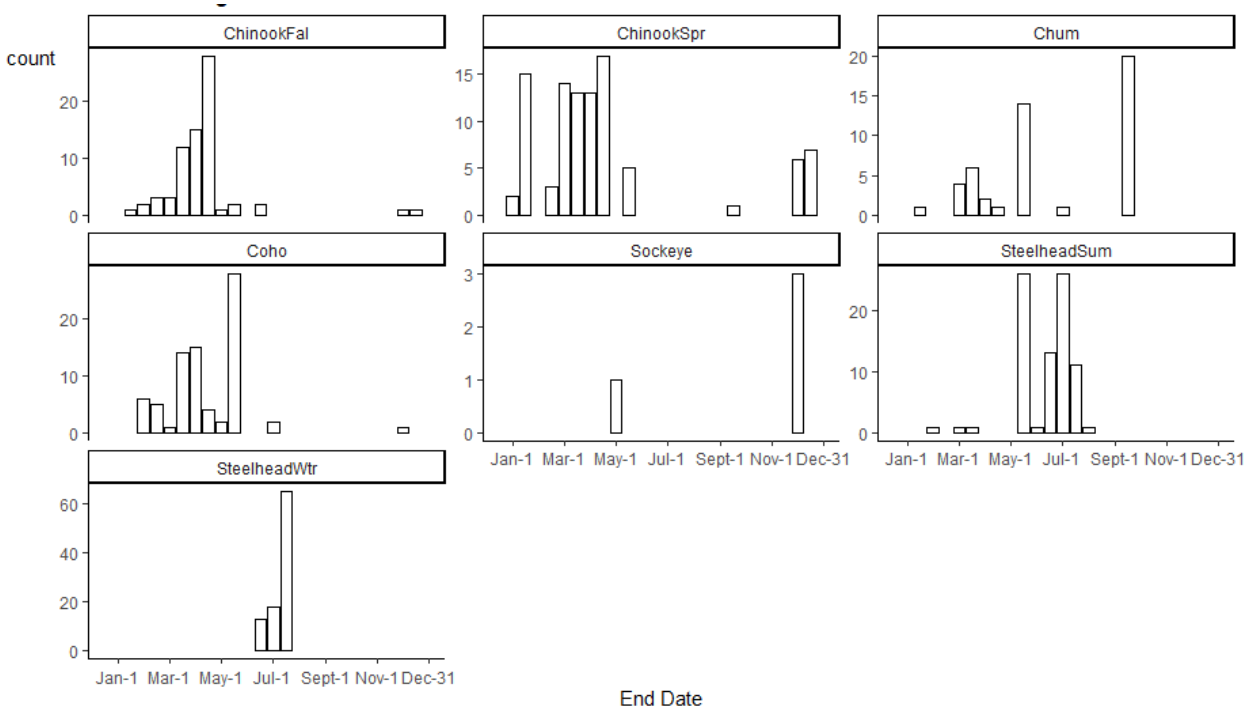
The salmon & steelhead spawning end dates used in 2003 assumed spring spawning populations (winter /summer steelhead) were present. However, using ODFW's current habitat distribution and life-stage timing data, DEQ has identified multiple reaches where only fall spawning populations (salmon) occur. The spawning end dates extend several weeks to months beyond emergence for fall-spawning salmon in those waterbodies.

DEQ analyzed the timing of egg incubation through fry emergence in the ODFW timing tables (2023) (Figure 20). These showed the majority of fry emergence, which can occur many weeks after egg incubation, for fall-spawning salmon species Chinook, Chum, Coho, and Sockeye, are concluded by April 30 or earlier. Even if in some reaches a small number of maturing fry could be present after that date, a default spawning end date of April 30 is more than sufficient to protect the last stages of egg and larval development for these species. Using the 'Egg Incubation through Fry Emergence' timing from ODWF's timing tables as a guide is highly conservative as the criterion of 13°C is only biologically required to support spawning and egg incubation. Even so, as shown in Figure 20, almost all populations of fall spawning salmon have completed emergence by April 30, and all populations have completed emergence by May 15 (Figure 20).

Therefore, DEQ is proposing to apply the seasonal 'Salmon and Steelhead Spawning' aquatic life use for temperature to an end date of April 30, instead of May 15, in waters with

only fall spawning populations (i.e., salmon and not steelhead). This will better match the timing for sensitive life stages of egg and larval development of salmon species when these are the only type of spawning phenology in the reach while still being highly conservative.

Figure 20 Distribution of dates for the end of salmon & steelhead fry emergence activity in ODFW timing units.



3.2.3.3 For Salmonid Spawning Use (Dissolved Oxygen)

Spawning for salmon species occurs in the fall and winter and concludes for all populations in Oregon by March 31. The median end dates are November 30 for Chum and Chinook, and December 15 for Coho (**Figure 21**). All distinct populations of salmon species are more than adequately protected by applying the spawning criteria for dissolved oxygen through May 15 or June 15.

Peak spawning for steelhead and resident trout occurs in the spring. The median end of peak spawning activity is May 31 for steelhead. In timing units with peak steelhead spawning that ends after May 31, 100% of spawning habitat is designated for the year-round use subcategories for temperature of 'Core Cold-Water Habitat' where the dissolved oxygen spawning criterion is applied until June 15. In even colder waters designated for 'Bull Trout Spawning and Juvenile Rearing' habitat criteria are applied from August or September until the following April or May. In timing units with peak spawning that ends after May 1, ~5% of summer steelhead and ~10% of winter steelhead spawning habitat occurs in waters designated for Salmon and Trout Rearing and Migration where the criteria are applied until May 15. Within those populations, most spawning begins by February and less than 10% of the total population is still spawning after May 1.

The National Marine Fisheries Service evaluated the application of DEQ's temperature and IGDO criterion, including the spawning end dates of May 15 and June 15 in their Biological Opinion on EPA's approval of Oregon's criteria and did not determine that it caused jeopardy for steelhead populations (NMFS 2015). They found that during the most critical time of year for IGDO, June 15 to September 15, steelhead are in the last month of an incubation period that started in the winter and that during the majority of their incubation period, the eggs and alevins are exposed to colder water holding more dissolved oxygen circulated more rapidly through redds by higher stream flows.

Later spawning and egg incubation tend to occur in cooler high elevation waters that are more likely to maintain high dissolved oxygen concentrations. In addition, in Oregon the expected seasonal decline in dissolved oxygen after June 15 is gradual (see example in **Figure 26**) and the year-round designated aquatic life use for dissolved oxygen is exclusively 'Cold Water Aquatic Life.' The criterion for Cold Water Aquatic life is 8 mg/L, which is within the optimal range for steelhead alevin. DEQ expects that application of the 'Salmonid Spawning' criteria for dissolved oxygen until June 15 in waters also designated for 'Core Cold-Water Habitat' will adequately support spawning and egg incubation for the small proportion of steelhead that spawn after June 1.

Figure 21 Distribution of end dates of peak spawning activity for salmon & steelhead species

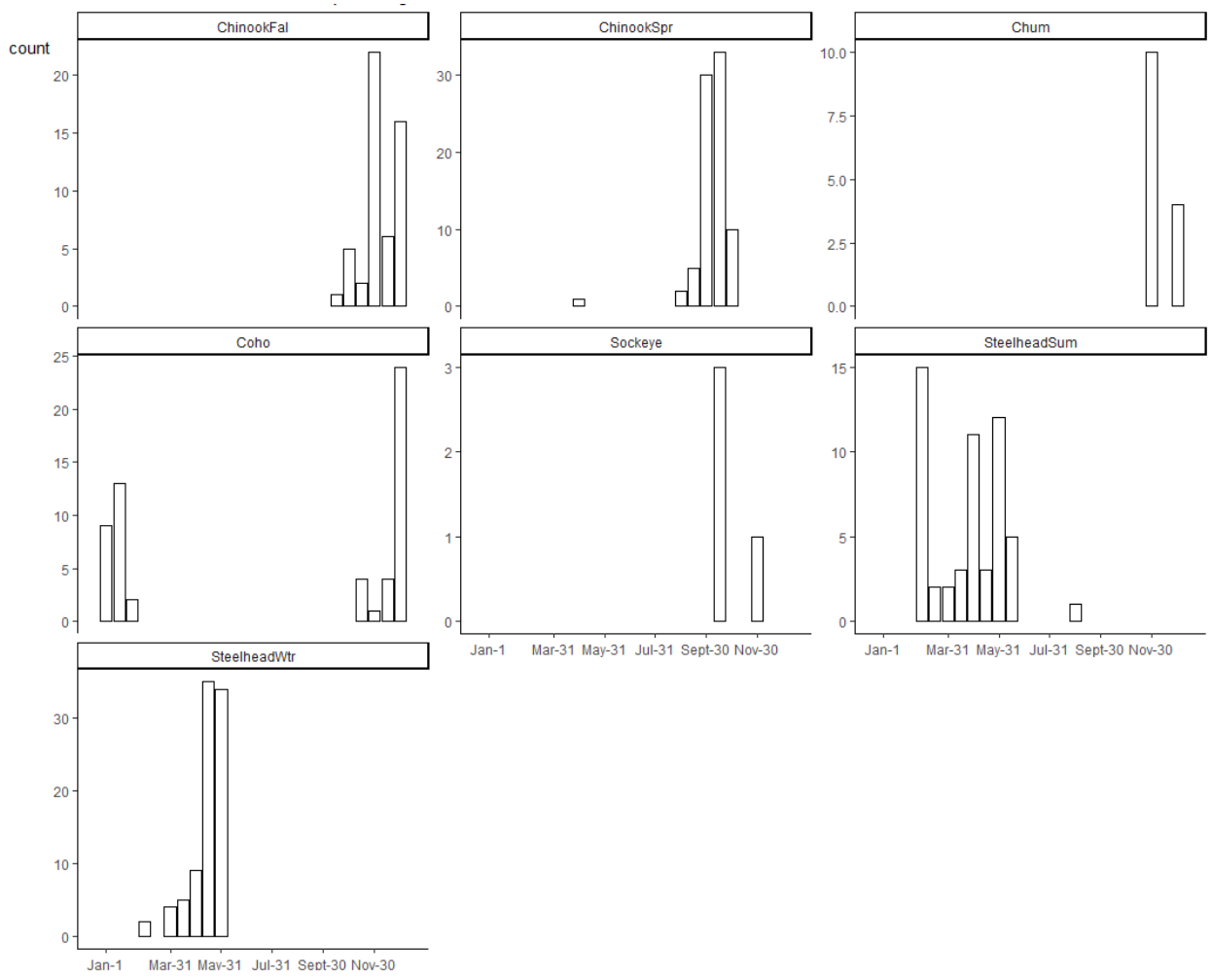
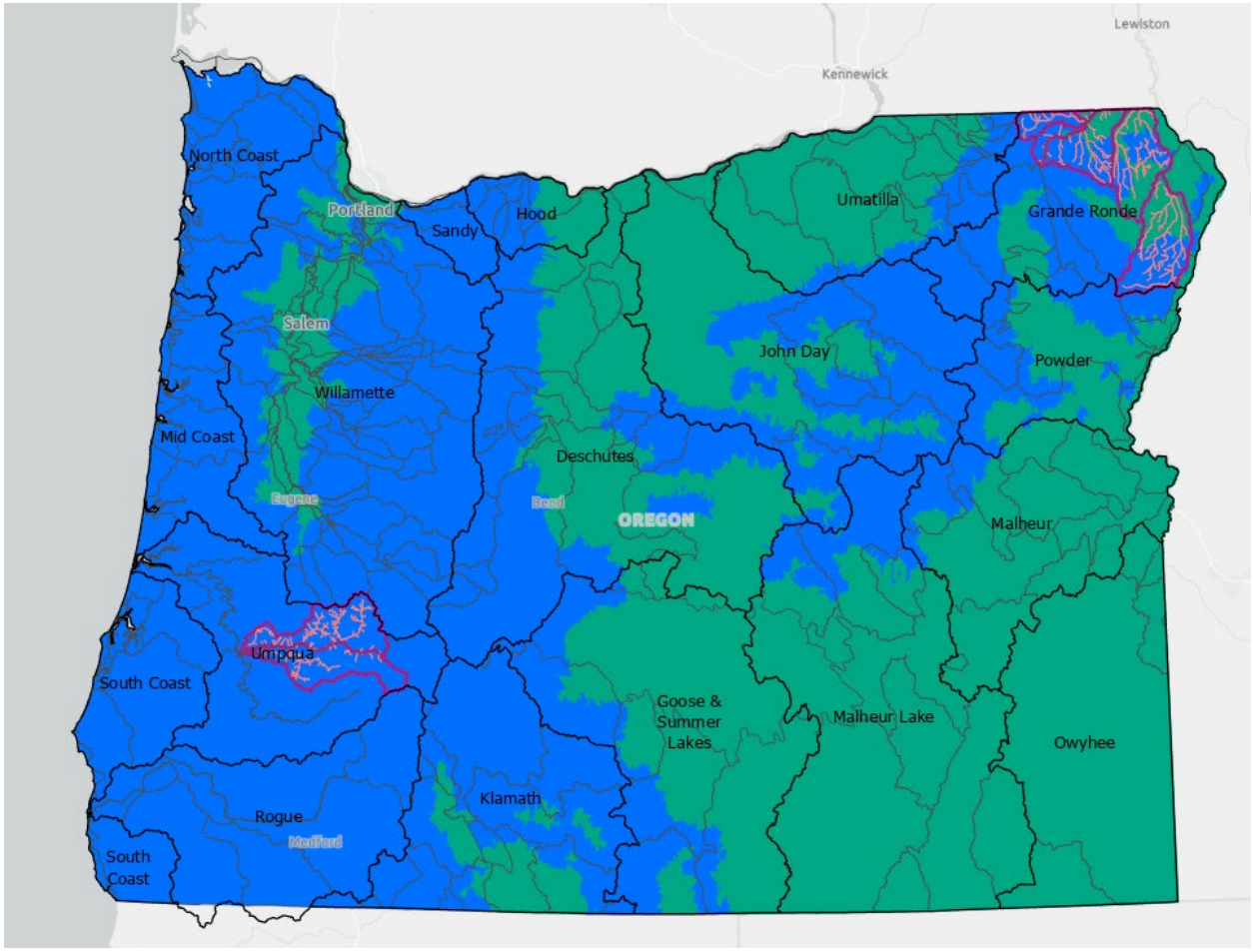


Figure 22 Timing units with peak steelhead spawning activity ending after May 31 (red outline) overlayed with ecoregion boundaries used for applying year-round dissolved oxygen criteria for cold- (blue) and cool- (green) water aquatic life. Steelhead spawning habitat within these timing units is shown (pink lines).



3.2.4Site-Specific Adjustments

To protect existing uses, DEQ made the following site-specific adjustment for designating Salmon and Steelhead Spawning habitat or the start and end dates for applying spawning criteria.

John Day River

ODFW identifies the mainstem John Day River below John Day, as well as the Middle Fork and North Fork John Day River below Hwy 395 as "primarily rearing" habitat in the FHD. These reaches are currently designated by DEQ for the Salmon & Steelhead Spawning use subcategory. ODFW considers some incidental spawning use occurs in these portions of the John Day at a very low level, but not by a portion of the population large enough to consider it primarily spawning habitat. Even though these reaches did not fit the methodology for classification as salmon and steelhead spawning habitat,

DEQ could not demonstrate that the spawning use currently designated is not attainable. As DEQ currently designates this reach for ‘Salmon & Steelhead Spawning,’ even though the FHD does not classify it as a "primary spawning" reach, no reclassification of this reach to a less stringent aquatic life use subcategory is proposed at this time.

Snake River

A specific date range for Fall Chinook spawning in the Snake River mainstem was developed in conjunction with the National Marine Fisheries Service and is included in the Snake River TMDL. DEQ designated this spawning date range, October 23 to April 15, in 2003. These dates specifically consider fall chinook spawning and development in that system. DEQ is not proposing to revise the currently effective site specific steelhead spawning date range.

Historical spawning habitat above man-made barriers

It is the policy of the State of Oregon to provide for the upstream and downstream passage for native migratory fish, and the state has active fish passage plans with the eventual goal to eliminate man-made barriers to fish passage. Many road culverts in headwater areas block spawning habitat but can be modified or removed. Therefore, DEQ will not propose to reclassify currently designated spawning uses upstream of culverts. Where salmon and steelhead spawning use is currently designated and the ODFW-FHD indicates it is ‘historical’ habitat upstream of ‘primarily spawning’ and it is not accessible due to culverts as identified on the ODFW Oregon Fish Passage Barriers database, DEQ shall retain the current salmon and steelhead spawning designation. Waters where this designation are retained will deviate from the decision rules for designation of salmon and steelhead spawning habitat outlined in Section 2.4.1.

3.2.5GIS Processing Methods for assigning spawning timing

DEQ applied the following GIS processing steps to derive the spawning start and end dates from ODFW's timing tables. This timing information was applied to the extent of spawning habitat for anadromous salmon and steelhead populations contained in ODFW"s FHD database.

1) Using Arc GIS Pro (Esri Inc. 2021) the extent of 'Primarily Spawning' habitat for Chum, Coho, Fall and Spring Chinook, Sockeye, and Summer and Winter steelhead salmon was extracted from the ODFW FHD database.
2) The reaches from the DEQ Fish Use maps that coincide to these extents were extracted and formed the basis for a new DEQ spawning use layer.
3) Using the intersect tool, the DEQ spawning use layer was re-segmented along the ODFW Timing Unit boundaries. This identifies the timing unit to which each segment in the DEQ spawning use layer belongs.
4) Using an iterative selection by location, the identity of each species with spawning habitat was assigned to each segment of the DEQ spawning use layer. This identifies whether spawning habitat for only one or multiple species occurs within each segment of the DEQ spawning use layer.

5) The identity of species present in each segment was concatenated to create a key that identifies the timing unit + species present in each segment of the DEQ spawning use layer.
6) Using R (R Core Team 2021), the ODFW timing table database was analyzed to provide the start date of spawning for each species within each timing unit, following the decision rule methodology for spawning timing described above in Section 2.4. The start date that applies to protect the earliest species in each possible combination of species was calculated and assigned a timing unit + species key the match the DEQ spawning use layer key created in the previous step.
7) Using a table join on the keys, the protective spawning use start date from the timing database was assigned to each reach in the DEQ spawning use layer.

3.3 Framework for Designating Salmonid Spawning Uses for dissolved oxygen.

The salmonid spawning criteria for dissolved oxygen (OAR-340-041-0016(1)) apply to spawning areas used by anadromous salmon, steelhead and char, and to **active spawning areas** used by resident trout species. DEQ shall designate **salmonid spawning use** in the basin specific rules (OAR-340-041-0101 to OAR-340-041-0345) where spawning habitat used by anadromous salmon and steelhead, char, resident trout, or whitefish has been identified by ODFW or another authoritative source. More information on how resident trout spawning habitat is identified is provided in Section 3.4, below.

Because there is often a lack of data about habitat specific to resident trout spawning, DEQ is proposing a two-part framework for designating and identifying additional resident trout spawning habitat. The framework for protecting resident trout spawning has two components: the designation of salmonid spawning habitat in the basin specific rules (OAR-340-041-0101 to OAR-340-041-0345), and an inventory to publicly track and communicate where DEQ determines additional resident trout spawning habitat occurs as that information become available. See **Figure 23** below. The department will apply the DO spawning criteria to protect salmonid spawning use for resident trout until it can be designated in rule.

3.3.1 Designated salmon, steelhead, and char spawning use

DEQ designates "**salmonid spawning use,"** the subcategory used in the dissolved oxygen rule, for the "Salmon and Steelhead Spawning" and "Bull trout spawning and rearing habitat" use subcategories designated in OAR 340-041-0101 to 340-041-0340: Tables 101B, 121B, and 190B, and Figures 130B, 151B, 160B, 170B, 180A, 201A, 220B, 230B, 260A, 271B, 286B, 300B, 310B, 320B, and 340B. These are based on the 'primarily spawning' habitat identified in ODFW's-FHD for each species.

3.3.2 Designated resident trout spawning use

DEQ shall also designate **salmonid spawning use** in the basin specific rules (OAR-340-041-0101 to OAR-340-041-0345) where spawning by resident trout or whitefish has been identified by ODFW or another authoritative source as indicated in Section 2.6.1.1.

ODFW has identified some areas of 'primarily spawning' habitat for populations of cutthroat and rainbow trout in the ODFW-FHD. However, there remain gaps in the data on where resident trout spawning habitat is located within their total range of distribution. In the decision rules in Section 2.6.1 DEQ identifies some readily available data sets that are used to indicate that resident trout spawning is not an active or supported use in specific waterbodies.

3.3.3 Inventory of resident trout spawning habitat

DEQ will develop and maintain a publicly available **inventory of resident trout spawning habitat** to be updated as new data becomes available. The inventory will be used to identify waters where additional resident trout spawning habitat has been identified and needs to be protected until such time as the designation can be adopted in the water quality standards rules. DEQ will apply the salmonid spawning criteria for DO to these waters to protect the use. The inventory may include waterbodies that are not included in ODFW's FHD (e.g. habitat "highly likely to support spawning" based on ODFW district biologist professional opinion).

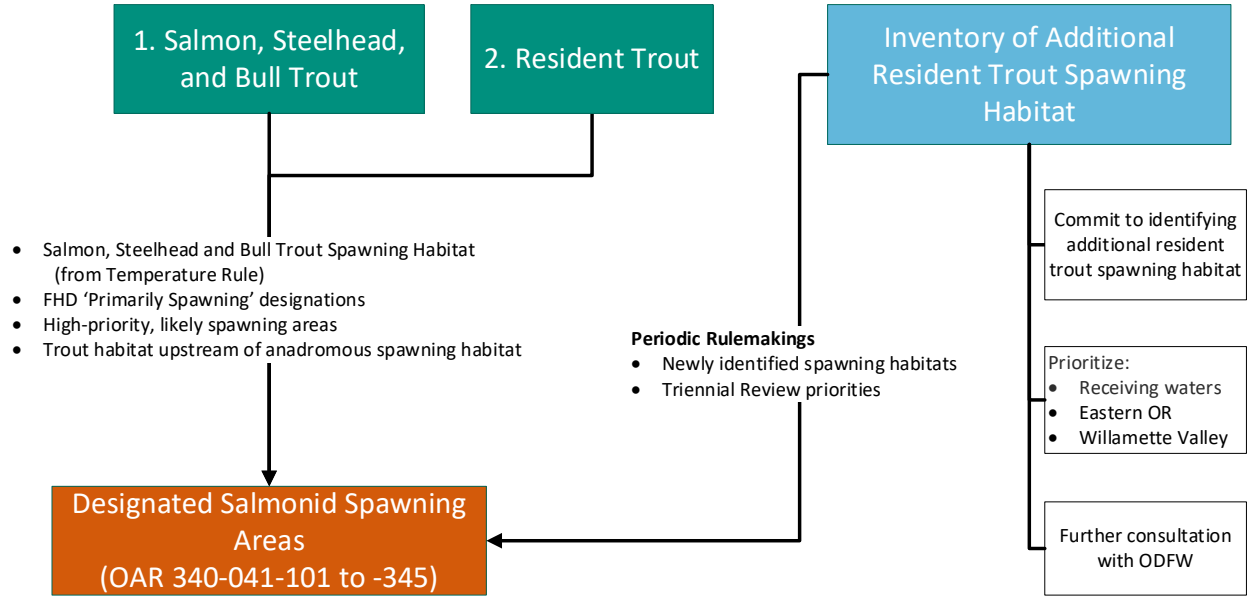
1) When resident trout spawning habitat or spawning use is identified, it shall be documented on the publicly available inventory of resident trout spawning habitat, upon consultation with ODFW. These represent waters where DEQ has identified “active resident trout spawning areas” under OAR-340-041-0016 (1) and as an existing use under DEQ’s antidegradation policy under OAR-240-041-0004.

2) Data quality for making such determinations in the inventory shall be consistent with ODFW's requirements for amending the statewide FHD database according to the Stewardship Plan for the Oregon Fish Habitat Distribution Database Bioscience Framework, Appendix A (Bowers 2020a)[25] and the Oregon Fish Habitat Distribution Data Standard, Appendix D (Bowers 2020b),[26] or where consultation with ODFW district biologists which results in a concurrence of professional opinion that determines a waterbody is highly likely to support resident trout spawning habitat.
3) The inventory of resident trout spawning habitat shall be maintained as a publicly accessible web map or list of waterbodies. It shall be updated as needed, but at least on a bi-annual schedule parallel to DEQ's water quality assessment cycle.
4) The status of waters as active resident trout spawning areas shall be incorporated into the **designated uses** in the basin specific rules during subsequent rulemakings.

[25] https://www.oregon.gov/geo/FIT%20Documents/OFHDDS_Stewardship_Plan_Version_One_20200604.pdf

[26] https://www.oregon.gov/geo/OGIC%20Documents/OregonFishHabitatDistributionDataStandard_Draft_v4_20200303.pdf

Figure 23 Framework for identifying Salmonid Spawning Uses for dissolved oxygen.



3.3.4 Difference between the salmonid spawning use maps and the resident trout spawning inventory.

The **Salmonid Spawning (D.O.) Designated Use Maps** are adopted as figures in the basin specific rules: OAR-340-041-101 to -345. The salmonid spawning use designation is comprised of two elements:

1. Salmon, steelhead, char spawning habitat designated for the Temperature Rule OAR-340-041-101 to -345 Figure A.
2. Known resident trout spawning habitat.

The **Resident Trout Spawning Inventory** will be maintained as a publicly available web map and identifies additional waters where site-specific determinations of resident trout spawning habitat have been made. The resident trout spawning habitat inventory determines where DEQ shall apply spawning criteria to protect early life stages of native trout populations. It will instruct DEQ's water quality program to apply salmonid spawning criteria for D.O. to these waters as the spawning status of the habitat is determined and added to the inventory. This procedure will be added to DEQ's DO standard application procedures document and to the assessment methodology. As ODFW identifies specific waters that support resident trout spawning in the FHD, the status of waters in the inventory can be updated to "Known" spawning or non-spawning habitat. DEQ would periodically update the data in the inventory. For instance, to match the biannual water quality assessment cycle.

Periodically, when DEQ updates the aquatic life use designations in the water quality standards, we will incorporate the new spawning use determinations from the inventory to the designated aquatic life use subcategory maps to reflect those determinations. DEQ will

consult with ODFW about the accuracy of any changes to the spawning status in the inventory and will maintain consistency with data in the FHD.

3.3.5 Pathways to change status of waterbodies in the Salmonid Spawning Inventory

Changes to the inventory require consultation with and concurrence by the ODFW district biologist or FHD database manager (Figure 23). DEQ will maintain documentation supporting inventory changes including survey data/forms and approval letters from ODFW.

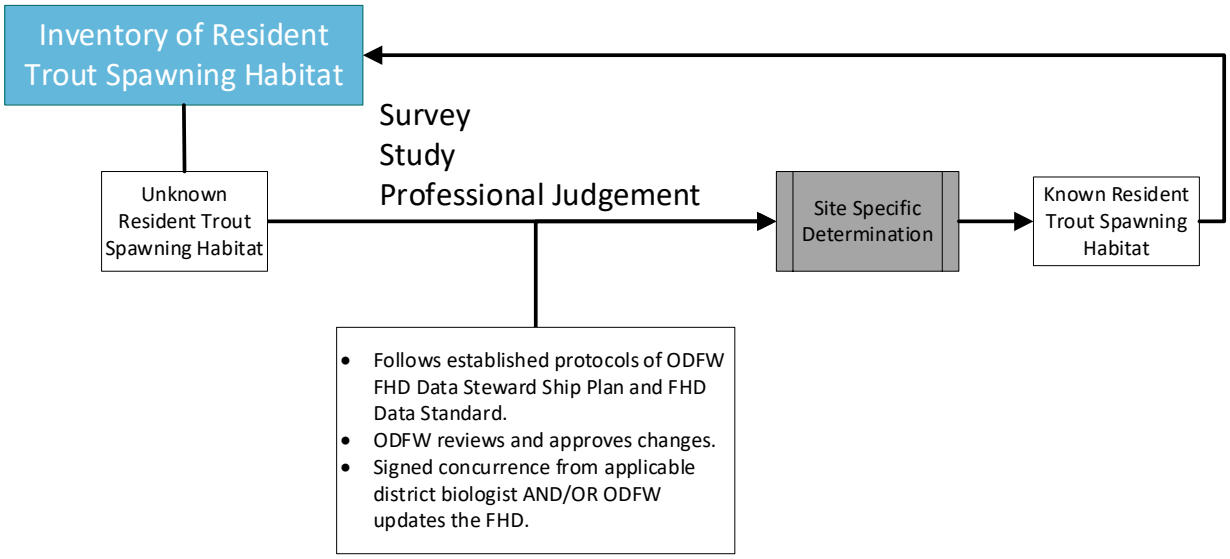
DEQ would consider changes to the resident trout spawning inventory when ODFW adds the ‘‘Primarily Spawning’ designation to waterbodies in the FHD or otherwise publishes a study, survey, or data set that identifies specific waterbodies that support resident trout spawning.

DEQ will also accept studies and surveys conducted or submitted by third parties if they meet quality assurance standards. DEQ requests that the party submit to ODFW through the FHD change form. DEQ and ODFW review the study or survey methods to ensure it was properly conducted and the results are valid. Field work must be done consistent with ODFW’s survey protocols and FHD stewardship requirements for adding/changing a habitat designation in the FHD (see Section 3.3.3 part 2) above).

In this way, the Resident Trout Spawning Inventory can be updated as needed and used to implement criteria accurately before going through rulemaking, based on best available scientific data. Then DEQ will adopt the new designations into the basin-specific rules when a use update rulemaking is identified as a priority through Oregon’s Triennial Review process.

Procedures governing the use and management of the inventory by DEQ staff shall be documented in an Internal Management Directive (IMD) following adoption of these rules.

Figure 24 Framework for changing the status of a waterbody in the Resident Trout Spawning Inventory



3.4 Identification of Active Resident Trout Spawning Areas

3.4.1 Protection of existing uses

Oregon's spawning criteria for dissolved oxygen at OAR-340-041-0016 (1) includes a narrative provision the criteria apply to "active spawning areas used by resident trout species." Therefore, resident trout spawning is included in the "salmonid spawning" use subject to the spawning DO criteria. The data on distribution of resident trout habitat in ODFW's FHD is much more comprehensive than were available previously. ODFW estimates it has identified as much as 95% of the distribution of resident trout species within Oregon in the current database. This includes all known and federally designated Critical Habitat for resident trout species Bull Trout (char) and Lahontan Cutthroat Trout. In some areas ODFW has also specifically identified where 'Primarily Spawning' habitat occurs. However, most of the habitat is identified as "Resident- Multiple Uses" where multiple life stage activities can co-occur. In most streams, there is not data to identify specifically where resident trout spawning habitat is located.

For the Threatened and Endangered populations of Bull Trout, the ODFW FHD and USFWS Critical Habitat Designation provide specific spawning habitat, and salmonid spawning use shall be designated for specific waterbodies to protect this habitat. For the Threatened and Endangered populations of Lahontan Cutthroat Trout, only a small portion of their range occurs in a small number of waterbodies in Oregon. Due to the threatened status, limited distribution of this species in Oregon, and use of different waterbodies throughout the range depending on annual water conditions, DEQ is proposing to designate the entire range of Lahontan Cutthroat Trout as salmonid spawning use.

Many populations of resident trout where there is not site-specific data on spawning habitat, will be protected by the salmonid spawning use designated using three methods.

First, where they co-occur with salmon and steelhead spawning use because these waters will be designated for salmonid spawning use and the DO spawning criteria will apply. The spawning dates designated which protect salmon species (from August-November until May or June) and steelhead species (January to May or June) include the dates necessary to protect the spawning of resident trout species that may be present.

Second, resident trout tend to spawn in smaller waters upstream of salmon and steelhead spawning and waters upstream of dams that block anadromous fish passage. Therefore, DEQ shall also designate resident trout habitat upstream of salmon and steelhead spawning habitat for the salmonid spawning use. This conservative assumption is reasonable because if salmon and steelhead spawning is supported, it is likely that upstream water quality would also be high enough to support resident trout spawning use.

Finally, in waterbodies that have not been designated for salmonid spawning use but resident trout spawning habitat is later determined to occur, the narrative in OAR-340-041-0016 (1)[27] and Oregon's antidegradation policy OAR-340-041-0004 protects "active spawning areas" as a use attained in the waterbody, even if the waters have not been formally designated for salmonid spawning.

3.4.2 Habitat characteristic required for resident trout spawning

Resident trout spawn in accessible freshwaters within a range of suitable substrate, water temperature, and flow conditions during the spawning season **(Table 10).**. The habitat requirements are similar, with some variation, among Oregon's resident trout species. For spawning they utilize headwater and tributary streams from 1-4th order with presence of riffles and pool morphology. Resident trout species dig redds (nests) for eggs in gravel streambeds with substrates between 0.1 to 3 inches in diameter. Averages flows necessary for aeration of redds are in the range of 0.3 to 3 ft/sec. Water depth of spawning habitat is optimally near 1 foot or less. The prevalence of these conditions tends to restrict suitable spawning habitat to upland tributaries or micro-scale habitat such as gravel bars or side channels along larger rivers.

In general, habitat with the characteristics described above are distributed so that resident trout species in Oregon spawn in waterbodies upstream of Coho salmon or steelhead trout spawning zones, accessing streams that are too shallow for the larger salmonids. However, there is some overlap of spawning in the same habitat among salmon and resident trout species (Lowry 1965, Edie 1975, Johnston 1982 *in* (Johnson et al. 1999). The amount of suitable gravel substrate per kilometer suitable for spawning in Oregon's Coast and

[27] "[…] the following criteria apply during the applicable spawning through fry emergence periods set forth in the tables and figures and, where resident trout spawning occurs, during the time trout spawning through fry emergence occurs:"

Cascade Ranges is greatest in 4th and 5th order streams, but varies with stream size (proportional to stream order) and species (Bjornn and Reiser 1991).

Coastal cutthroat trout, a typical resident trout species in Oregon, often spawn in small watersheds with drainage areas under 13 km^2 (Hartman and Gill 1968, Edie 1975, Glova 1978, Moore and Gregory 1988, Jones and Seifert 1997 *in* (Johnson et al. 1999). Cutthroat trout in the Coast and Cascade Ranges do not typically access 1st order streams. They spawn in less than half of second-order streams, and predominantly in 3rd and 4th order streams (Bjornn and Reiser 1991). The pattern of spawning in 1-4th order streams appears true for other resident char, Redband, and Rainbow trout (Platts 1974, 1979). In contrast, anadromous salmon and steelhead spawn in predominantly fourth and fifth order streams (Bjornn and Reiser 1991).

3.4.3 Habitat characteristics restricting resident trout spawning

Unless spawning use of habitat has been specifically identified in a survey, study, report, or concurrence of professional opinion; habitat with one or more of the following characteristics is likely to be unsuitable for spawning by resident trout species:

1. Within timing units where ODFW's timing tables and their referenced reports specifically indicate spawning use by resident trout species does not occur (ODFW 2022).
2. Where 'Cool Water Species' is the designated use subcategory for temperature, indicating limited or no resident trout presence.
3. Within brackish estuarine waters.

   Salmonid eggs and embryos show decreased survival to hatch and developmental abnormalities at salinities between 1-8 ppt (Morgan 1991, Morgan et al. 1992, Weber-Scannell and Duffy 2007, Ban et al. 2022)

4. Within fine-substrate depositional environments of tidally influenced riverine waters.

   Tidally reversing flows prevent the formation of riffles and create depositional sediment conditions. Accumulation of fine sediment prevents adequate aeration of redds and inhibits fry mobility needed to support incubation of resident species such as Rainbow Trout and Coastal Cutthroat trout (Raleigh 1984, Johnson et al. 1999). Tidally influenced areas are generally not active spawning areas used by resident trout, and therefore, the spawning criterion for dissolved oxygen do not apply unless spawning habitat or use is specifically identified. However, freshwater areas subject to tidal backwatering do provide important habitat for the rearing and migration of both salmonids and other resident fishes.

5. Where channel substrate, velocity, or depth inhibit spawning use by resident trout species.

   Spawning is generally restricted in very steep (1st order) and low gradient (more than 5th order) streams that lack suitable gravel substrate or riffle and pool morphology (Raleigh 1984, Pauley et al. 1989, Trotter 1989, Young 1995, Muhlfeld 2002, COSEWIC 2016). Streambeds with fine substrates such as silt and sand, with grain

sizes <0.1 inch diameter, or rocky or bedrock substrate >3 inch diameter, do not generally support spawning by resident trout species in Oregon (Raleigh 1984, Rieman and Apperson 1989, NRCS 2000, 2007, Muhlfeld 2002, Roberge et al. 2002, WDFW 2004). Stagnant or tidally reversing flows less than 0.3 ft / sec are not sufficient to aerate redds. Flow velocities greater than 3 ft/sec scour away redds or wash away suitable substrates. Water depths of spawning habitat are optimally near 1 foot or less. (Raleigh 1984, Rieman and Apperson 1989, Johnson et al. 1999, WDFW 2004) This tends to limit suitability of spawning habitat in steep headwater streams, deep or slow-moving rivers, and tidally influenced rivers and estuaries.

Table 10 Summary of native trout species spawning habitat requirements.

	Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii)*	**Rainbow Trout (*Oncorhynchus mykiss)***	**Redband Trout[28] (*Oncorhynchus mykiss spp. gairdneri*)**	**Westslope Cutthroat Trout (*Oncorhynchus clarkii spp. lewisi*)**	**Mountain Whitefish (*Prosopium williamsoni)***
Spawning Season	December – June (Johnson et al. 1999, ODFW 2022)	November – June (Roberge et al. 2002, ODFW 2022)	November – May (ODFW 2005, 2022)	December – June (Johnson et al. 1999, ODFW 2022)	November – January (ODFW 2022)
Geographic Position of Habitat	Headwater and upland tributary streams (Bjornn and Reiser 1991, Johnson et al. 1999, NRCS 2007)	River, tributaries, and lake inlet and outlet streams (Raleigh 1984, Bjornn and Reiser 1991, NRCS 2000)	Headwater and upland tributary streams (Raleigh 1984, NRCS 2000)	Headwater and upland tributary streams (Bjornn and Reiser 1991, Young 1995, NRCS 2007)	Mountain lakes and streams (Scott and Crossman 2002, Boyer 2016)
Stream morphology	Shallow riffles (Pauley et al. 1989, Trotter 1989)	Riffles, above or below pools (Raleigh 1984)	Riffles below pools, pool tail outs with abundant gravel (Muhlfeld 2002)	Shallow pools with overhead cover (Young 1995, COSEWIC 2016)	Riffles and shallow lake waters (Northcote and Ennis 1994, Scott and Crossman 2002, Boyer 2016)
Substrate	Loose, silt-free gravel (< 3 in. diameter) (WDFW 2004, NRCS 2007)	Silt-free gravel/pebbles (0.5-3.0 inch diameter) (Raleigh 1984, NRCS 2000, WDFW 2004)	Silt-free gravel/pebbles (0.1-3 inch diameter) (Muhlfeld 2002, WDFW 2004)	Loose, silt-free gravel substrate (0.1 - 3 inch diameter) (Rieman and Apperson 1989, WDFW 2004)	Gravels in cobble to boulder sized rubble. (Coker et al. 2001, Roberge et al. 2002, Scott and Crossman 2002)

[28] Redband Trout are a subspecies of Rainbow Trout.

	Coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii)*	**Rainbow Trout (*Oncorhynchus mykiss)***	**Redband Trout[28] (*Oncorhynchus mykiss spp. gairdneri*)**	**Westslope Cutthroat Trout (*Oncorhynchus clarkii spp. lewisi*)**	**Mountain Whitefish (*Prosopium williamsoni)***
Water velocity	1 – 3 ft/sec (Johnson et al. 1999, WDFW 2004)	1.25 – 2.05 ft/sec (Raleigh 1984, WDFW 2004)	0.3–2.3 ft/sec (Muhlfeld 2002, WDFW 2004)	0.25 to 1.05 m/s (Rieman and Apperson 1989, WDFW 2004)	
Water depth	≤1 ft (Pauley et al. 1989, WDFW 2004)	≤ 1.5 ft (Raleigh 1984, WDFW 2004)	<1 ft (Muhlfeld 2002, WDFW 2004)	water depths 0.5–13ft (Rieman and Apperson 1989, WDFW 2004)	Up to 2.5 feet (Boyer 2016)

3.5 Resident Trout Spawning Through Emergence Timing (Dissolved Oxygen)

Since 2004[29], DEQ has used January 1 as the assumed start date for spawning of resident trout species. It is based on the data for steelhead trout, which are a form of Rainbow Trout and spawn in the spring like other native trout species of Oregon. While many trout populations spawn later than January 1, it was considered a simplifying and conservative spawning start date. Also, DEQ assumed, given a lack of information, that waterbodies that support resident trout spawning would be able to attain the dissolved oxygen criterion by this date.

3.5.1.1 Applicability of the spawning criteria for dissolved oxygen

The dissolved oxygen standards recognize the dynamic nature of dissolved oxygen levels in the natural environment, acknowledging that optimal concentrations for cold-water fish might not always be present. In certain locations and times, dissolved oxygen can dip below optimal levels for sensitive organisms, leading to increased risk of sub-lethal effects. Lethal oxygen levels are considered rare under natural conditions. In light of these factors, the policy goal of the dissolved oxygen standard is to minimize risks to aquatic ecosystems from anthropogenic impacts by protecting a natural dissolved oxygen regime (DEQ 1995a).

Oregon's numeric criterion for salmonid spawning is based on the dissolved oxygen needs for egg incubation and embryonic development, with the standard identified as being for the "principal use of salmonid spawning and incubation of embryos" (Rombough 1988; Hammor and Garside, 1976; Sowden and Power, 1985; Phillips and Campbell 1982) *cited in* (DEQ 1995a). EPA's national criteria for dissolved oxygen recognizes that studies have emphasized embryonic development (EPA 1986b). The NMFS also acknowledged that the dissolved oxygen criteria for spawning are relevant to salmonid eggs and larvae (NMFS 1999).

Dissolved oxygen concentration of 8 mg/L is required in the gravels (Intergravel or IGDO). The EPA national criteria and DEQ assumed a conservative 3 mg/l drop in dissolved oxygen concentration between the water column and the spawning gravels. Therefore, Oregon's spawning criterion for the water column is set at 11 mg/L. These criteria are deliberately conservative, based on optimal growth and production. Some states assume a 2 mg/l loss. Spawning habitats in the state are not expected to be able to maintain optimal dissolved oxygen levels for spawning in the summer, even under natural conditions.

The greatest D.O. need for developing eggs occurs just prior to hatching (Rombough 1988, Carlson 1980). Unlike incubating eggs, salmonid alevin and fry are mobile, and able to detect and migrate to areas of higher dissolved oxygen before they emerge from the gravels (Fast and Stober, 1984, Stober et al. 1982) *in* (DEQ 1995a). The rate of egg incubation increases as water temperatures warm. Generally, 30 days is required in waters under 12°C and less than 20 days in waters above 15°C (Rombough 1988, Bjornn and Reiser 1991, Murray and McPhail 2011). Alevins and fry display higher dissolved oxygen tolerance after

[29] DEQ Letter to EPA Region 10 of February 4, 2004. https://www.oregon.gov/deq/FilterDocs/standardsclar.pdf

hatch. Alevins tend to favor dissolved oxygen concentrations of 4 to 10 mg/L, with minimal impacts on alevin growth and survival between 8mg/L and 5 mg/L (Silver et al. 1963, Shumway et al. 1964, Eddy 1971, McMahon 1983, DEQ 1995a).

After hatch, the D.O. requirements for newly hatched alevin and fry decline to levels within the range of DEQ's year-round criteria for Cold- and Cool-Water Aquatic Life, 8–6.5 mg/L or less (**Figure 25**) (Rombough 1988). The lab-based studies informing these criteria values are based on constant long-term exposures. In contrast, DEQ's criteria are applied as minimums or averages, ensuring that in-stream dissolved oxygen levels would be required to surpass the criterion threshold at least 50% of the time, creating an extra margin of safety. Changes in dissolved oxygen also occur gradually and follow seasonal patterns (Figure 26). Water bodies meeting the salmonid spawning criterion on May 15 or June 15 are likely to maintain water quality sufficient to support fry and juvenile development for weeks beyond the last dates of peak spawning activity. Dissolved oxygen levels won't suddenly decline after June 15.

Figure 25 Days to hatch and critical dissolved oxygen requirements under different temperatures for steelhead embryos and alevins (from Rombough 1988).

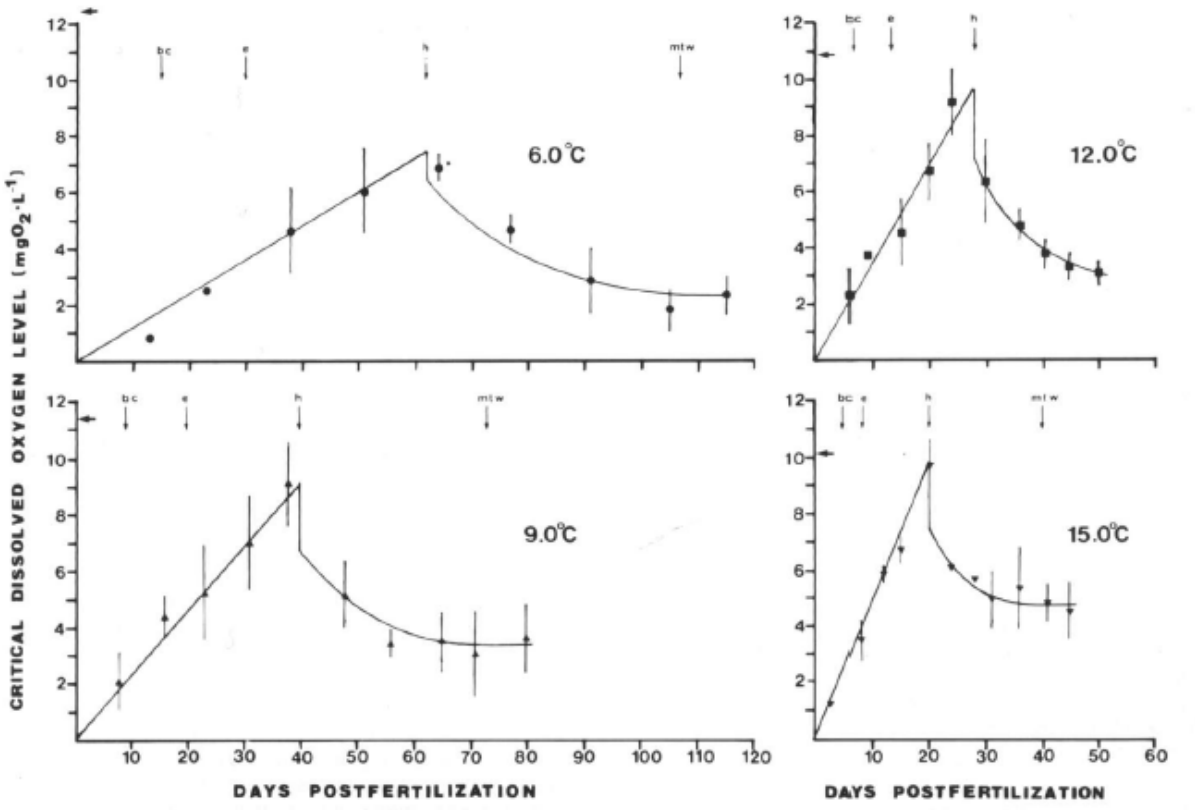
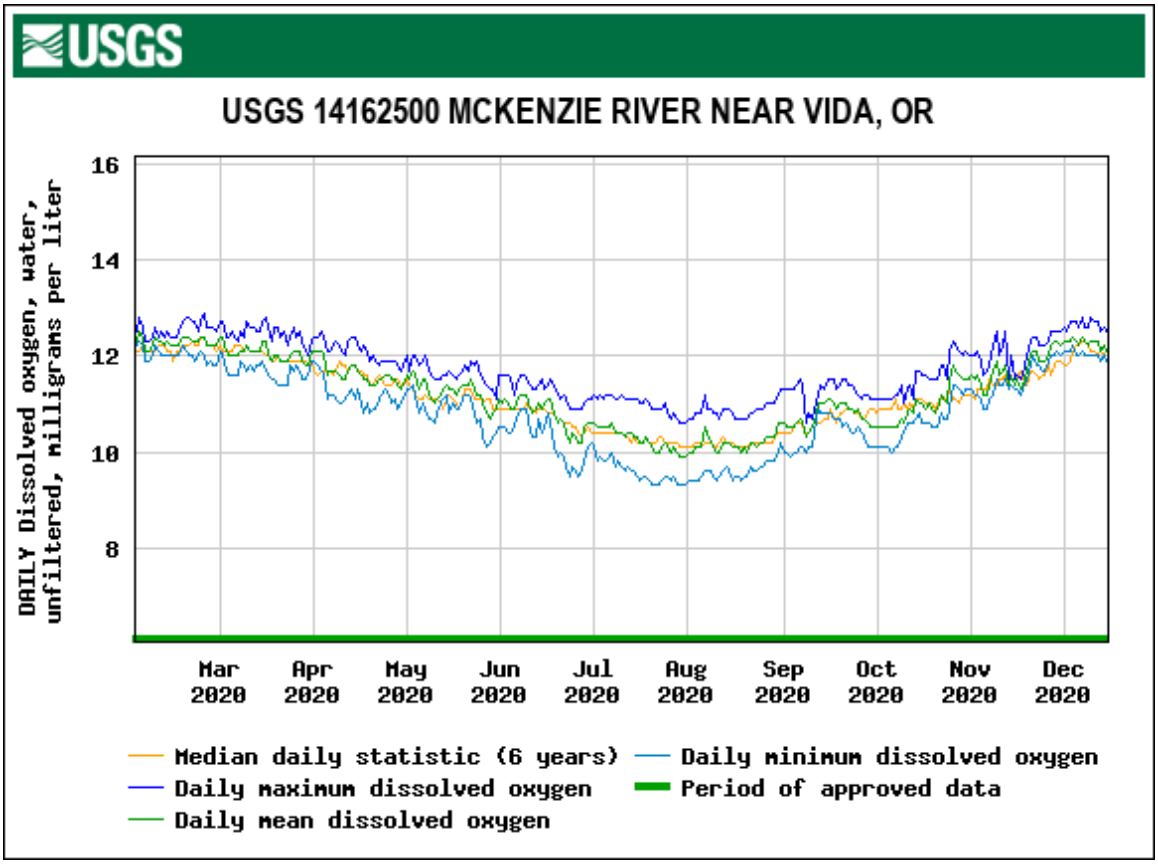


FIG. 7. Critical dissolved oxygen levels (P_c) for steelhead embryos and alevins incubated at 6, 9, 12, and 15°C. *bc*, blastopore closure; *e*, eyed; *h*, hatch; *mtw*, maximum tissue wet weight. Error bars give 95% confidence limits for P_c. Horizontal arrows indicate oxygen concentrations at 100% ASV.

Figure 26 Dissolved oxygen concentration for the McKenzie River, Feb. 1 – Dec 15, 2020 showing general rate of seasonal dissolved oxygen reduction for this river. (U.S. Geological Survey, https://waterdata.usgs.gov/nwis/dv?)



3.5.1.2 Interpreting information from ODFW timing tables

Salmonid species hatch from their eggs in the spring at some time between spawning and final emergence of fry from the gravels. It is also not reasonable to assume the spawning criteria are attainable throughout the summer in Oregon's waters even under natural conditions. Using the end of 'Egg Incubation through Fry Emergence' timing as shown on ODFW's timing tables[30] would be overly conservative as the criterion of 11 mg/L (8 mg/L IGDO) incorporates a high margin of safety and is only biologically required for support of spawning and egg incubation.

Resident trout exhibit high seasonal variability in spawning behavior and many populations have extended periods of low-intensity spawning where few individuals spawn. Peak spawning use as identified by ODFW represents the 90th percentile of population spawning activity and provides sufficient production to sustain robust populations of these species.

ODFW's timing units cover large watersheds or sub-basins that often include warmer lower-elevation streams and colder headwater tributaries. The timing table data is relatively coarse

[30] https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=202&XMLname=42654.xml

in resolution, showing spawning in two-week intervals and the full range of activity timing across the timing unit. Spawning does not occur uniformly within all waters of the timing units, or simultaneously for the entire duration shown on the table. Spawning likely begins as the water warms first at lower elevations on dates near the start of the spawning timing date range and begin in colder waters at higher elevations weeks to months later. The salmonid spawning criteria are applied until May 15 in the warmer lower elevation waters, which are typically designated for the year-round temperature use of 'Salmon and Trout Rearing and Migration' or "Redband and Lahonton Cutthroat Trout." Spawning criteria are applied until June 15 in the colder, higher elevation waters typically designated for the year-round temperature uses of 'Core Cold Water Habitat or 'Bull Trout Spawning and Juvenile Rearing'.

3.5.1.3 Analysis of resident trout spawning timing in Oregon

Almost all resident trout populations, excluding Bull Trout and Lahontan Cutthroat Trout, which have unique timing and are assigned site-specific dates, end peak spawning activity by May 31 statewide. Only 29 of 1,433 distinct resident trout populations (2%) continue peak spawning activity after May 31 (**Figure 27**). Within those populations, peak spawning begins by February or March and less than 10% of the total population spawn late after May 31.

Late resident trout spawning occurs in waters designated for year-round dissolved oxygen uses of Cold Water Aquatic Life (Figure 28). These waters are required to attain the salmonid spawning criteria for dissolved oxygen until June 15 and to meet the year-round dissolved oxygen criterion of 8.0 mg/L after that date. Because there would be a gradual reduction in dissolved oxygen levels after salmonid spawning criteria implementation stops on June 15, and the year-round D.O. criterion would provide for water quality within the optimal range for alevin development after hatching (4-8 mg/L). At 8.0 mg/L there is only a slight risk to egg incubation for a small portion of the resident trout populations that spawn after May 31 (DEQ 1995a).

The National Marine Fisheries Service evaluated DEQ's method for applying the IGDO criterion for spawning until May 15 or June 15 in their Biological Opinion on Oregon's Intergravel Dissolved Oxygen criterion. They found that for June 15 to September 15, spring spawning species (steelhead) are in the last month of an incubation period that started in the winter and during the majority of their incubation period eggs and alevins are exposed to colder water holding more oxygen circulated more rapidly through redds by higher stream flows. These waters tend to be higher elevation, cooler streams that are less likely to have low water-column dissolved oxygen (NMFS 2015). For these reasons NMFS did not find jeopardy with DEQ's method of determining the end date for applying the 'Salmond Spawning' criteria.

Oregon's framework provides 30 or more days post fertilization for hatch to occur for 98% of the populations of native resident trout statewide. The remaining late-spawning populations occur in Core Cold Water Habitat areas where the salmonid spawning criteria are applied until June 15, and the year-round dissolved oxygen criteria are 'Cold-Water Aquatic Life' which provides an additional margin of safety to these populations. Therefore, DEQ is not proposing any changes to the methods for determining dates for applying dissolved oxygen spawning criteria for the protection of salmonid spawning.

Figure 27 Temporal distribution of end dates of peak spawning activity for resident trout species (excluding Bull Trout and Lahontan Cutthroat Trout).

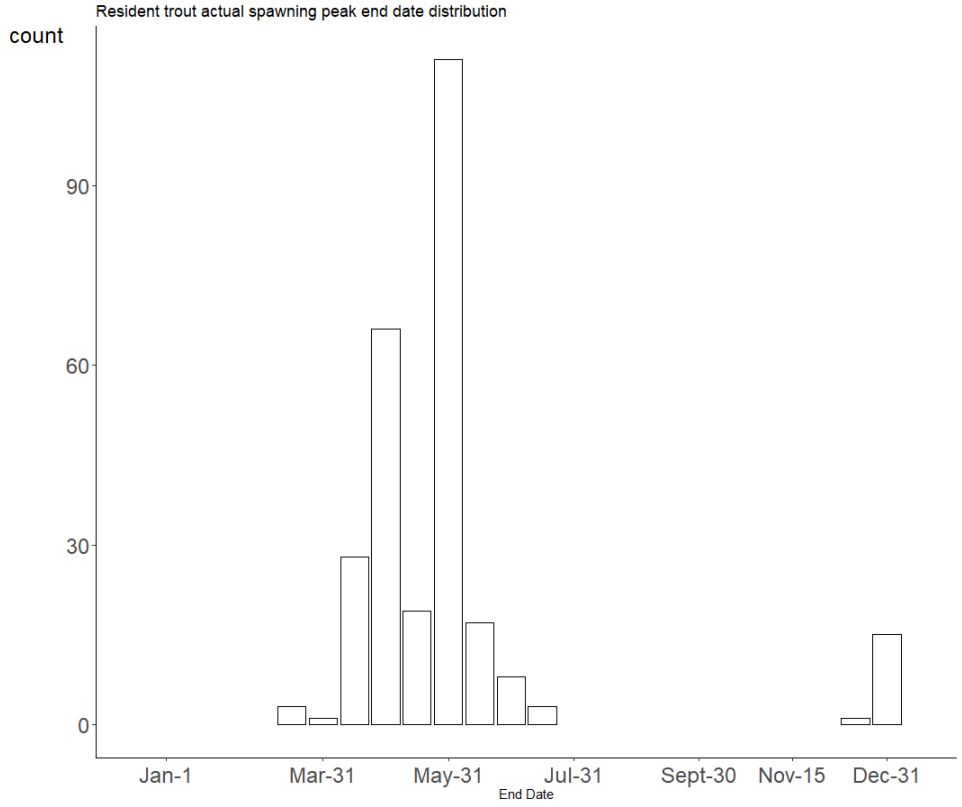


Figure 28 Timing units where peak spawning activity ends June 15 or later. Note: spawning habitat does not occur in all waterbodies within the timing units.

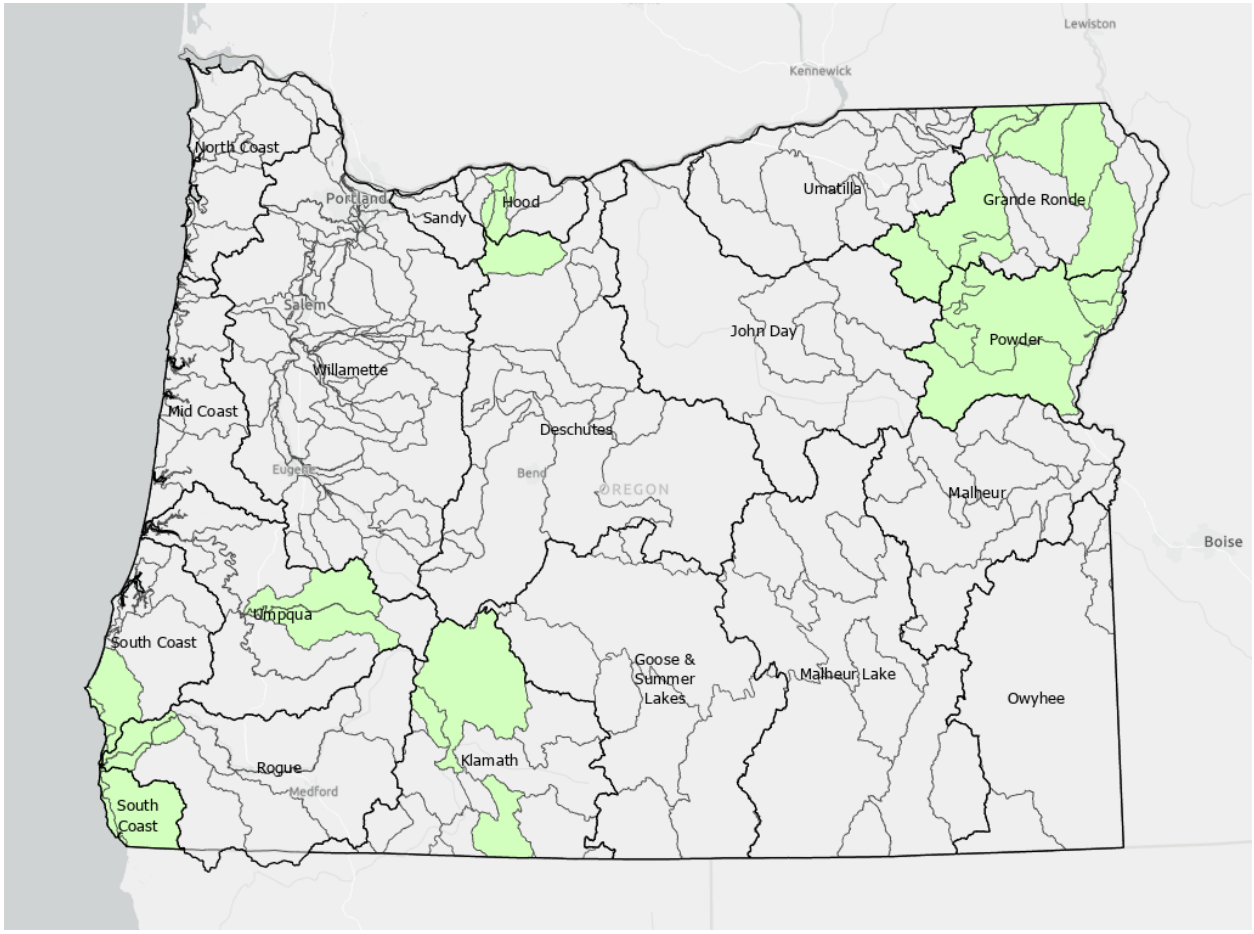
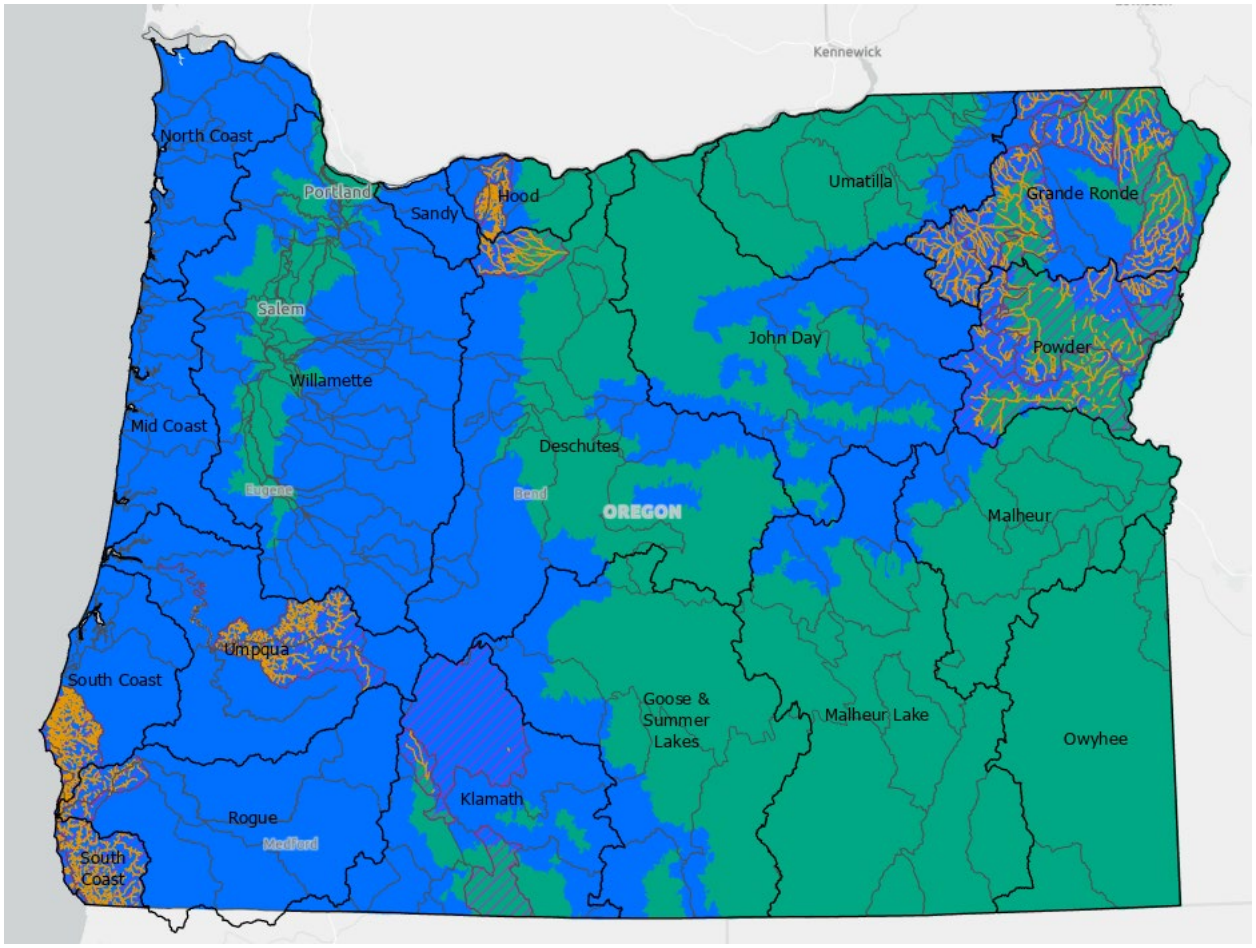


Figure 29 Timing units with peak resident trout spawning activity occurring after June 1 (red hatch) overlayed with ecoregion boundaries for applying year-round dissolved oxygen criteria for cold (blue) and cool (green) water aquatic life. Spawning habitat for resident trout within these timing units is shown as orange lines.



3.6 Other Alternatives Considered but not adopted

3.6.1 Non-salmonid Indicator Species for Core Cold-Water Habitat

3.6.1.1 Native Amphibians

DEQ evaluated the potential of thirteen species of native frogs, salamanders, and turtles to serve as additional biological indicators of Core Cold-Water habitats. Either because their presence would indicate waters that would remain below 16°C throughout the summer, or because they are cold-water obligate species requiring that level of thermal protection.

As many amphibian species are generalists that can inhabit both aquatic and terrestrial habitats, suitability of an amphibian species to serve as an indicator of Core Cold-Water Habitat relies on a few factors. Potential indicator species would be those that are cold water obligate, meaning they require cold aquatic habitats to survive. Their geographic distributions should be limited to, and therefore indicate, presence of high-quality cold-water habitat that could be expected to remain at or below 16°C throughout the summer in a typical year.

Additionally, otherwise thermally suitable stream habitats remain unoccupied by salamanders due to other ecological factors, such as sediment type, presence of predators or competitors, historical dispersal processes, or other disturbances not related to temperature. Many cold-water salamander distributions appear to overlap with areas in Oregon with high concentrations of existing habitats designated for core cold-water or Bull Trout spawning and rearing in the headwater areas where these species are found.

With input from our technical workgroup and additional input from amphibian experts at the ODFW, DEQ identified several candidate species of native stream associated amphibians whose thermal tolerances might indicate conditions likely to maintain temperatures consistent with the 16°C limit of the core cold-water designation (Table 10).

Based on thermal preference data from the literature, DEQ identified four distinct groups of native amphibians with thermal preferences that potentially overlap with the core cold-water use designation. DEQ made a detailed review of the literature and publicly available data about range habitat within Oregon to further evaluate range and thermal requirements of these species. They are:

1. Tailed frogs (genus *Ascaphus*)
2. Torrent salamanders (genus *Rhyacotriton)*
3. Dunn's and Redback salamanders (genus *Plethodon*)
4. Yellow Legged Frogs (genus *Rana)*

3.6.1.2 Tailed frogs

The thermal tolerance of both the Coastal Tailed Frog *Ascaphus truei* are among the lowest known for North American amphibians. Coastal tailed frogs have a preferred thermal range of less than 16°C for adults and larvae approximately 18ºC (Dupuis and Committee on the

Status of Endangered Wildlife in Canada 2012). However, Coastal Tailed Frogs are most commonly observed in terrestrial habitats (Welsh and Lind 2002).

3.6.1.3 Giant and Torrent salamanders

The thermal tolerance of the Giant and Torrent Salamanders (*Rhyacotriton)* are also among the lowest North American amphibians. Species in this genus have a preferred thermal range of 12-16°C (Bury, 2008). However, Coastal Tailed Frogs are generalist species that occupy both stream habitats and terrestrial habitats. They are commonly observed occupying terrestrial habitats. The U.S. Fish and Wildlife Service is conducting a status review of the Cascade and Columbia torrent salamanders (*Rhyacotriton cascadae* and *R. kezeri*) as of 2021.

Despite their often low thermal preferences, tailed frogs and giant salamanders appear to be an unsuitable indicator species for core cold-water habitat. ODFW biologists[31] indicate they typically occupy specific microhabitats and have limited mobility. For example, this species may be found in deep pools that are cold and thermally suitable, but not characteristic of conditions within the stream reach. The coastal giant has a long terrestrial component to its life cycle and is usually observed when in its terrestrial form. Presence of the terrestrial form does not necessarily indicate cold stream conditions.

3.6.1.4 Dunn's and Western Redback salamanders

There is little data on the full range of thermal tolerance of Dunn's and Western redback salamanders. Preferences may include temperatures as low as 10°C. The remaining native species candidates have a broad thermal tolerance: painted turtles, foothill yellow-legged frogs, and northern red-tailed frogs have thermal preferences greater than the 16°C range.

3.6.1.5 Foothills Yellow Legged Frogs

See analysis under the Cool Water Species designation below.

[31] Emily VanWyk, Strategy Species Coordinator, Oregon Department of Fish and Wildlife. Personal communications.

Table 11 Thermal tolerances of native freshwater amphibians

Species	Adult preferred (°C)	Adult critical maximum (°C)	Egg/Larvae Preferred (°C)	Egg/Larvae critical maximum (°C)	References
Cascade Torrent Salamander (*Rhyacotriton cascadae*)	5-16	27.9	N/A	N/A	(Pollett et al 2010) (Bury 2008) (Brattstrom 1963).
Southern Torrent Salamander (*Rhyacotriton variegatus*)	5-16	27.9	N/A	26.7	(Pollett et al 2010) (Bury 2008) (Brattstrom 1963).
Columbia Torrent Salamander (*Rhyacotriton kezeri*)	5-16	27.9	N/A	26.7	(Bury 2008) (Brattstrom 1963).
Coastal Tailed Frog (*Ascaphus truei*)	<16	22-24	5-18	18.5	(Welsh and Lind 2002) (BCME 2015) (COSEWIC 2012).
Rocky Mountain Tailed Frog (*Ascaphus montanus*)	N/A	16-22	N/A	N/A	(Adams and Frissel 2001)
Cope's Giant Salamander (*Dicamptodon copei*)	3-16.2	21	N/A	29.1	(Brattstrom 1963) (Wagner 2014) (Bury 2008).
Northern Red-legged Frog (*Rana aurora*)	"Relatively Low"	"Relatively Low"	N/A	21	(Licht 1971) (Sype 1974).
Coastal Giant Salamander (*Dicamptodon tenebrosus*)	12-18	N/A	N/A	29.1	(Brattstrom 1963) (Wagner 2014) (Bury 2008).

Species	Adult preferred (°C)	Adult critical maximum (°C)	Egg/Larvae Preferred (°C)	Egg/Larvae critical maximum (°C)	References
Foothill Yellow-legged Frog (*Rana boylii*)	17.5-19	N/A	19-24	26.7	(Catenazzi and Kupferberg 2013) (Railsback 2016) (Kupferberg et al 2011)
Painted Turtle (*Chrysemys picta*)	"Broad"	"Broad"	"Broad" 26-30	"Broad"	(Bodensteiner et al. 2019)
Dunn's salamander (*Plethodon dunni*)	7-13	30-31	N/A	N/A	(Dumas 1956) (Brattstrom 1963)
Western Redback Salamander (*Plethodon vehiculum*)	7-10	30-31	N/A	N/A	(Dumas 1956) (Brattstrom 1963)

3.6.1.6 Pacific Lamprey

Pacific lamprey (*Entosphenus tridentatus*) was originally listed as an Oregon State sensitive species[32] in 1993 and were given further legal protected status by the state in 1996 through restriction of harvest and harvest methods (OAR 635-044-0130). The species was again found to be sensitive in the state of Oregon in 2020 (ODFW 2020). Adult lampreys spend up to 7 years in the marine environment (Hess et al. 2022) , and cease feeding and migrate to fresh water between February and June with the period of highest activity in May. Lacking sufficient knowledge on lamprey life histories, Pacific lamprey were thought to be distributed wherever salmon and steelhead occurred and believed to spawn in similar habitats to salmon- in gravel bottomed streams, at the upstream end of riffle habitat (DEQ 1995b).

Table 12 Thermal tolerance of pacific lamprey (*Entosphenus tridentatus)*

Biological Endpoint	Temperature (°C)	References
Adult preference	< 20	(Clemens et al. 2016, Clemens 2022)
Adult critical maximum	> 20-25	(Clemens et al. 2016, Clemens 2022)
Egg preference	10-18	(Meeuwig et al. 2003), Brumo, 2006 and Meeuwig, 2005 *in* (Luzier et al. 2011), Kan, 1975 *in* (Close et al. 1995)
Egg critical maximum	22-25	USFS 2007, (Meeuwig et al. 2003), Brumo, 2006 and Meeuwig, 2005 *in* (Luzier et al. 2011), Mallat, 1975 *in* (Close et al. 1995), (Meeuwig et al. 2005)
Larval preference	17.8 – 21.8	Holmes and Lin 1994 and Meeuwig, 2003 *in* (Close et al. 1995) (Mallatt 1983)
Larval critical maximum	22	USFWS, 2007 Meeuwig, 2003 in (Close et al. 1995), (Close et al. 1995, Meeuwig et al. 2003, 2005)

The thermal tolerance and preference of adult Pacific Lamprey for migration is within the ranges of all criteria applied to protect salmonids in Oregon's temperature standards. These criteria range from 20°C-12°C, corresponding to waters designated as Salmon and Steelhead Migration Corridors or Redband & Lahontan Trout habitat, to waters designated for Bull Trout Spawning and Juvenile Rearing. Pacific Lamprey are only found above dams if there is adequate fish passage or translocation of adults (Ward et al. 2012). However, adult lamprey have potential to access habitat farther upstream than spawning salmonids because adult Pacific Lamprey can climb obstructions such as waterfalls in some situations. The designation of Salmon & Trout Rearing and Migration, Core Cold-Water, and Bull Trout use subcategories are extended to waters upstream of salmon and steelhead habitat unless a more stringent use would apply there. Therefore, it is expected that the criteria applied to protect salmonid habitat would also protect lamprey, even if they are located in waterbodies otherwise inaccessible to adult salmon, steelhead, and trout.

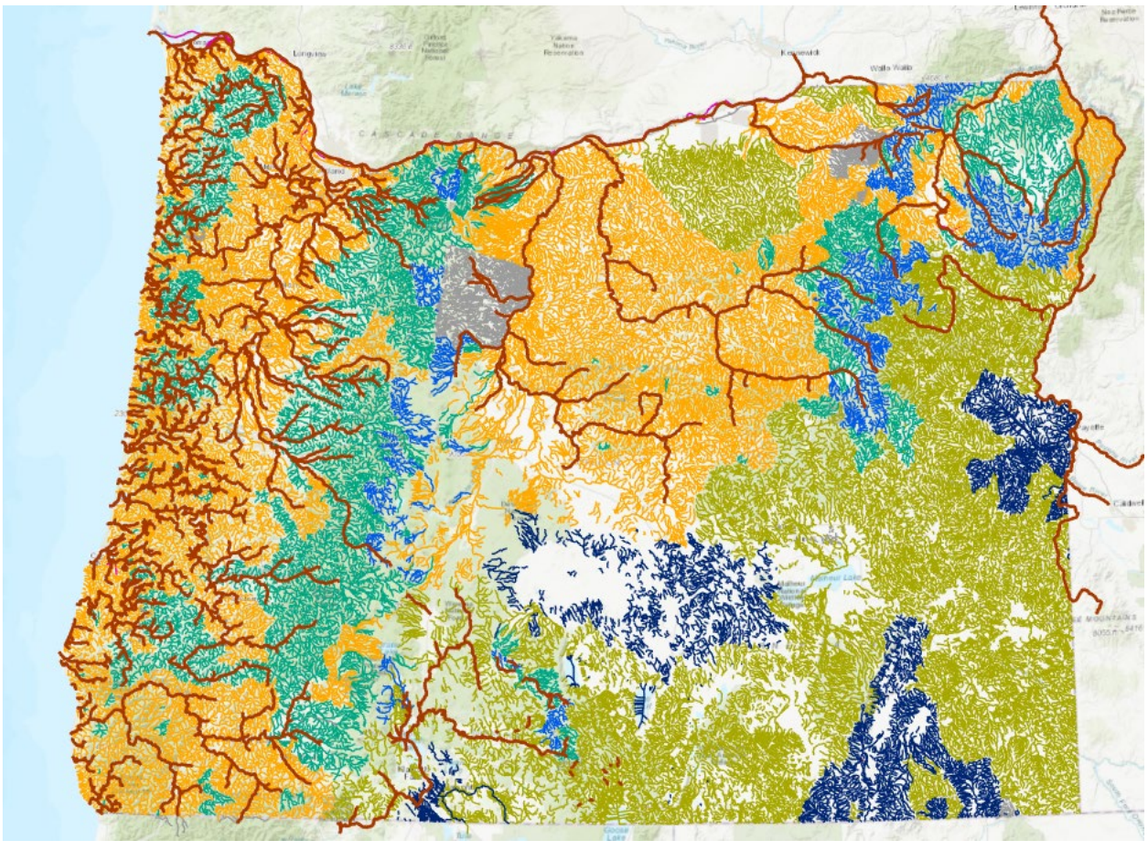
The thermal tolerance and preference for sensitive life stages of spawning, egg incubation, and larval development in Pacific Lamprey (Meeuwig et al. 2005, Clemens et al. 2016, Clemens 2022) are also within the range of temperatures protected by both Oregon's year-round and spawning criteria for salmonids. . The "Salmon and Steelhead Spawning through Emergence" criteria of 13°C is within the lower end of the optimal range for lamprey egg and larval survival and development. Application of the Salmon & Steelhead criteria would protect co-occurring lamprey spawning habitat, where these are seasonally in effect. In addition, the year-round criteria for salmonids of 12-20 °C , though near the upper end of the optimal range for eggs and is within the optimal range for larvae as well as adults. Since the year-round criteria are applied as a summer average of daily maximum temperatures, it is likely temperatures would be several degrees cooler during the lamprey spawning season. As applied, it is likely that both the year-round and seasonal spawning criteria for salmon and steelhead would also be protective of

[32] "Sensitive Species" refers to fish and wildlife that are facing one or more threats to their populations and/or habitats. Consistent with OAR 635-100-0040(2), "Sensitive Species" are defined as having small or declining populations, are at-risk, and/or are of management concern.
https://www.dfw.state.or.us/wildlife/diversity/species/docs/Sensitive_Species_List.pdf

lamprey spawning regardless of the specific timing or location where Pacific Lamprey spawning occurs.

Therefore, DEQ did not find that Pacific lamprey is a suitable indicator species for designating the Core Cold-Water aquatic life use subcategory. Due to a higher thermal tolerance than the most sensitive salmon & steelhead species, suitable protection for lamprey is likely to be provided by any of the proposed fish use subcategory designations for temperature (Figure 29).

Figure 30 Distribution of Lamprey relative to proposed aquatic life use subcategory designations for temperature. Lamprey (brown, bold), Bull Trout Spawning and Rearing (blue), Core Cold Water Habitat (green), Salmon and Trout Rearing and Migration (Orange), Redband and Lahontan Cutthroat Trout (olive), Cool Water Species (dark blue).



3.6.1.7 Freshwater Mussels

Five species of freshwater mussels are native to Oregon: western pearlshell (*Margaritifera falcata*), Oregon floater (*Anodonta oregonensis*), western ridged mussel (*Gonidea angulata*), winged floater (*Anodonta nuttalliana*), and California floater (*Anodonta californiensis)* (Nedeau and Xerces Society 2009, FMCS 2021). All native species but the Oregon Floater are considered vulnerable or near threatened according to the International Union for Conservation of Nature red list (Blevins et al. 2018).

Freshwater mussels of the west coast United States have a wide geographic range of distribution. Data on optimal and lethal thermal tolerance specific to the species native to Oregon is scarce. Most published studies of tolerances for freshwater mussels are for other interior U.S. and Atlantic coast species.

Spawning has been observed at temperatures between 10°C and 18°C for the western ridged mussel (Spring Rivers Ecological Sciences 2007, Fisheries and Oceans Canada 2011, Stanton et al. 2012, Mageroy 2015) and between 7.2°C and 16°C for western pearlshell ((Spring Rivers Ecological Sciences 2007, Murphy n.d.). California floaters have been observed with fully developed glochidia at temperatures between 11°C and 15°C (O'Brien et al. n.d.). Optimal growth temperatures are unknown for these species, but Black et al. documented western pearlshell growth chronologies in western Oregon, where maximum temperature averaged 16.7°C at one site and 25.1°C at another, with annual ranges between 14.7°C and 26.8°C (Black et al. 2010). Because the role of temperature in growth rates is somewhat confounded by discharge, the impacts of temperature on growth or health may be situationally dependent (Black et al. 2010).

There is a lack of specific habitat distribution data for these species within Oregon (Blevins et al. 2018, Blevins 2020). These species also have the capacity to burrow potentially enabling them to occupy cooler micro-habitats or thermal refuges, so they may not be precise indicators of in-stream temperature conditions (Blevins et al. 2019).

DEQ does not find that freshwater mussels are a suitable indicator species for designating the Core Cold-Water aquatic life use subcategory. Due to lack of data about thermal requirements and because of broad latitudinal distribution, the native freshwater mussels are unlikely to be suitable indicators for streams with temperatures consistently below 16°C. Given the broad geographic distribution of native freshwater mussels, it is possible the use subcategories designated to protect salmonid species conserve the native freshwater mussels as well.

3.6.2 Additional indicator species for designating Cool Water Species

Foothill Yellow-Legged Frog (*Rana boylii)* is a Federal 'Species of concern', currently under review for listing under the Endangered Species Act. The species was proposed for 'threatened' status for population segments in California in December 2021, but no critical habitat has been determined at this time. Distinct population segments within Oregon were not proposed for 'threatened' status. The yellow-legged frog is a warm-water dependent species with a relatively high thermal range of 8-27°C preferred (Olson and Davis 2009, Kupferberg et al. 2011, Catenazzi and Kupferberg 2013, Railsback et al. 2016). Breeding occurs in slow-flowing habitats that are < 70 cm deep with water temperatures 16-22°C on average with a preference for 18-19°C (Wheeler et al. 2015). Below-natural temperatures cause developmental delays that reduce overwinter survival (Lind and Wilson 1996, Railsback et al. 2016), therefore this species is a good candidate for a native, sensitive, biological indicator for the Cool Water aquatic life use subcategory. Thermal stress is not listed as one of the threats contributing to the proposed 'threatened' status for California (Hayes et al. 2016).

Foothill yellow-legged frogs are more common in lower headwater streams, approximately 2nd-6th order. They also occupy slow-moving side channels and near-bank habitats, which are likely to be warmer than the deep, fast flowing areas where temperature measurements for assessing Oregon's temperature criteria are typically collected. The species distribution is relativity limited and their range in Oregon is primarily in SW Oregon west of the Cascade mountain range (Olson and Davis 2009). Foothill yellow-legged frogs co-exist with salmonid species, but thermal requirements for frog and salmonid spawning through emergence occur in contrasting habitats. Frogs require warmer conditions than salmonids for reproduction. Foothill yellow legged frog spawning was naturally separated from salmonid spawning in space or time within watersheds (Railsback et al. 2016), with the frogs often migrating downstream to warmer waters around the time salmonids are migrating upstream for cooler waters to spawn. They are also difficult to detect outside the breeding season, which spans approximately late March to May 1st. Detailed habitat distribution and suitability data is available because of the 2021 federal listing review process.

With the assistance of ODFW, DEQ reviewed the available habitat distribution data for the Foothill Yellow-Legged Frog to evaluate the potential for use as an indicator species providing an additional line of evidence for designation of waters as Cool water aquatic life, in waterbodies where salmonid use, especially spawning through emergence use, are not indicated in July and August. The habitat distribution of the yellow-legged frog does not overlap with any waters being considered for the Cool Water aquatic life designation, so no further action regarding aquatic life use designations that account for this species is considered at this time. DEQ is monitoring the results of federal listings for Oregon and whether any specific thermal requirements for the foothills yellow-legged frog emerge that could be addressed through Oregon's aquatic life use designations.

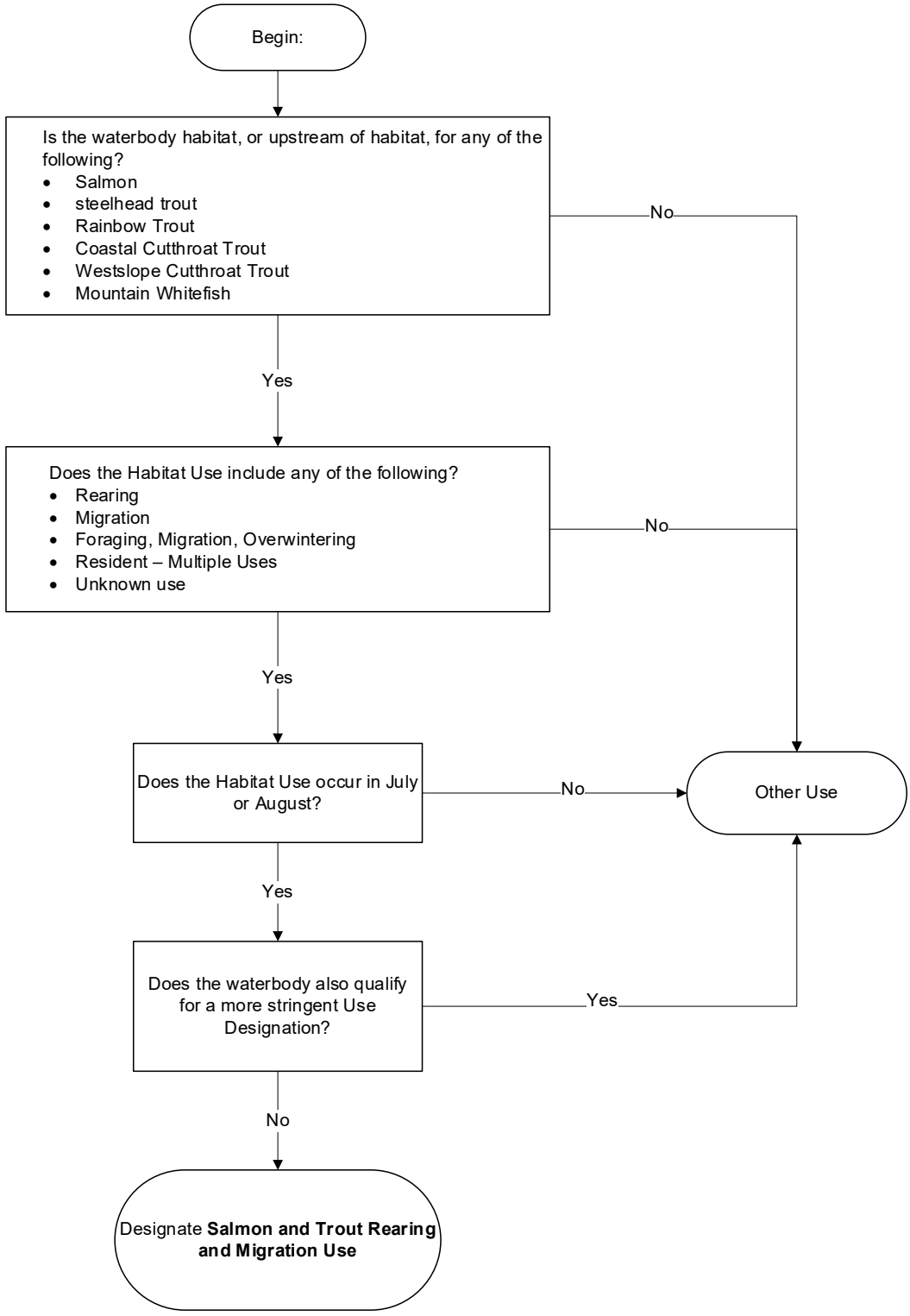
Appendix A

Summary of decision rule methods.

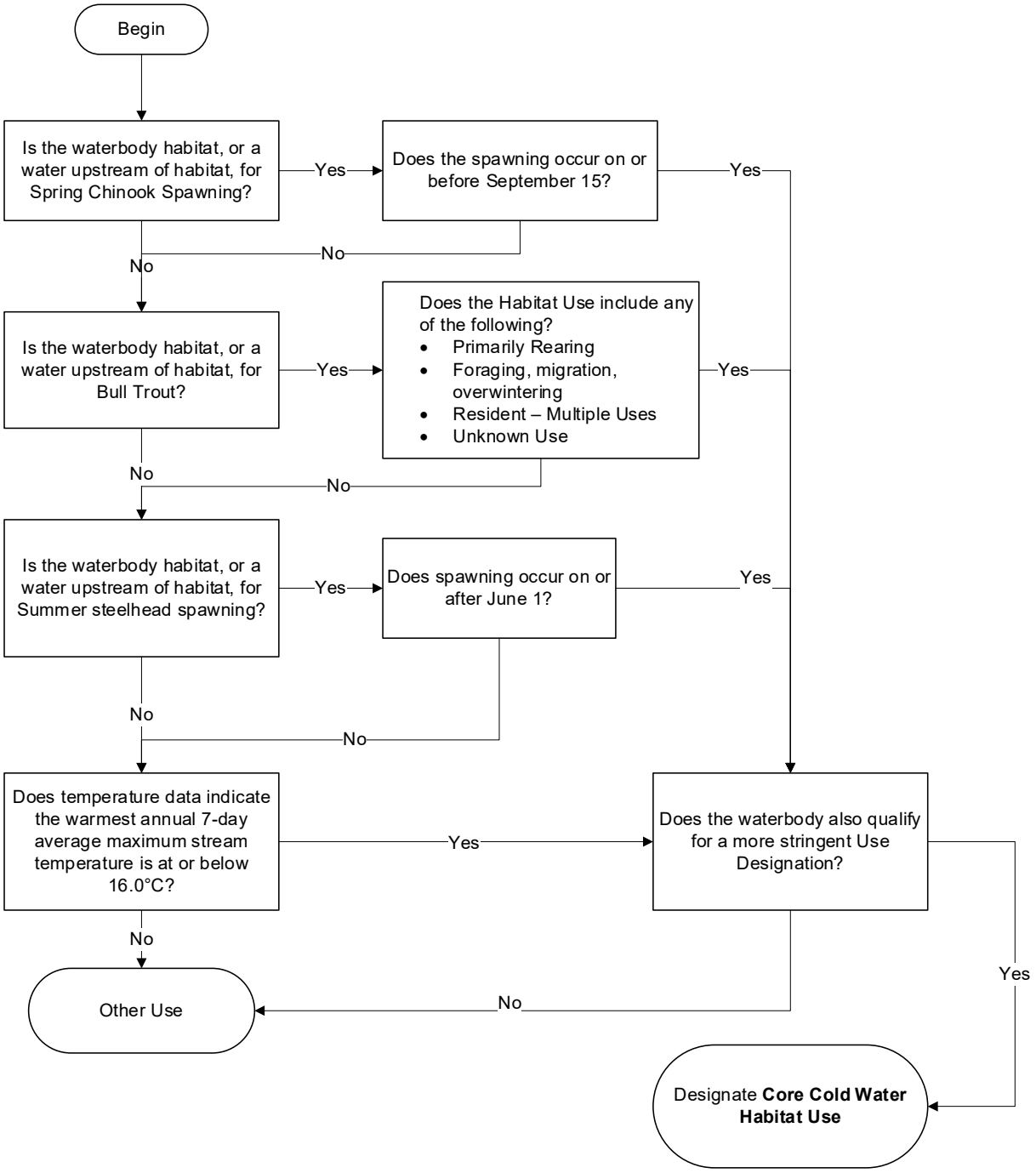
The following flowcharts are provided as guides to illustrate the decision rule methods established in Chapter 2, and applying the data sources identified in Section 2.2. In the case of the dissolved oxygen decision rules, it also refers to the results of the proposed aquatic life use designations for temperature.

Year-Round Temperature Use Designation Methods

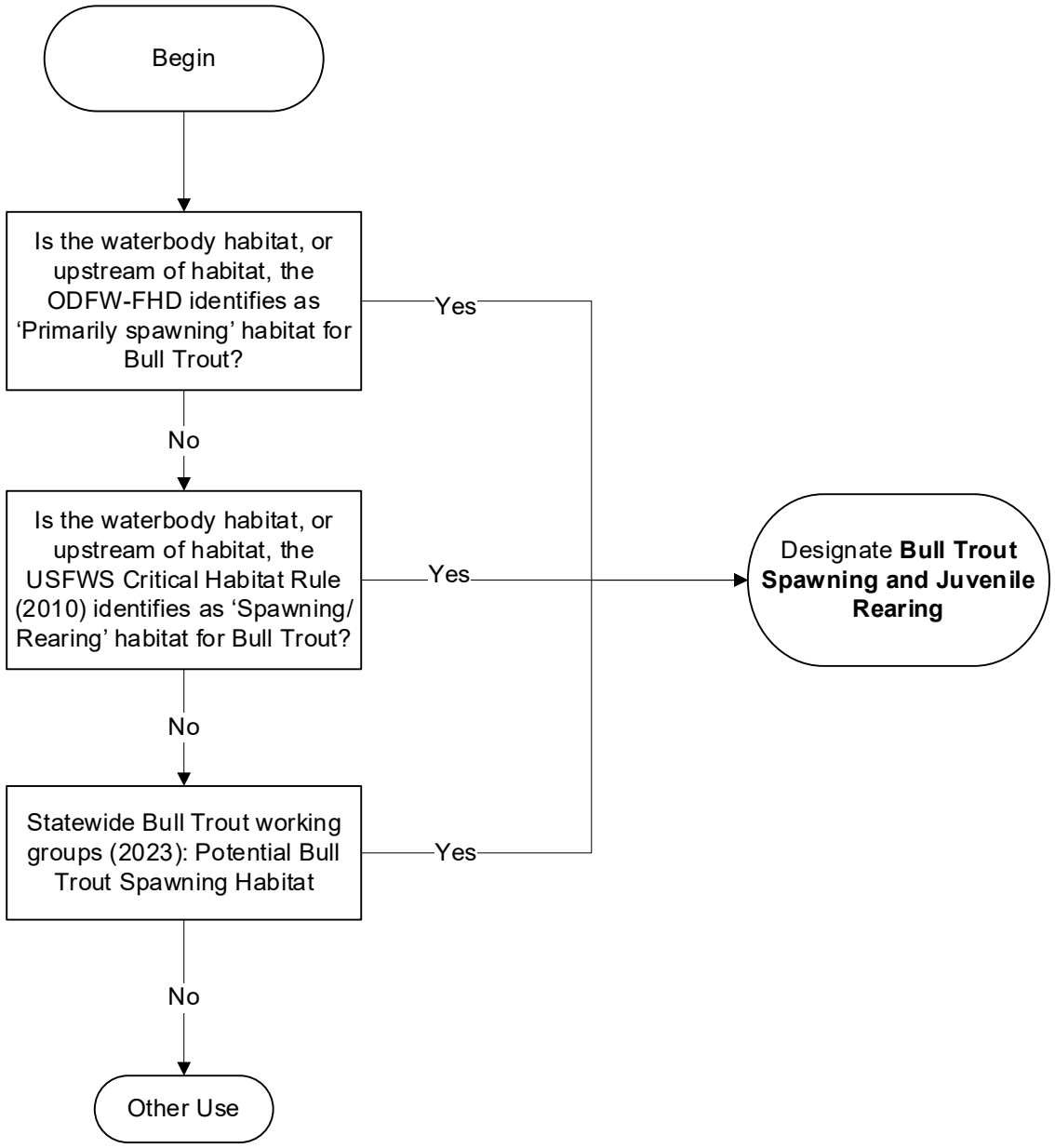
Salmon and Trout Rearing and Migration



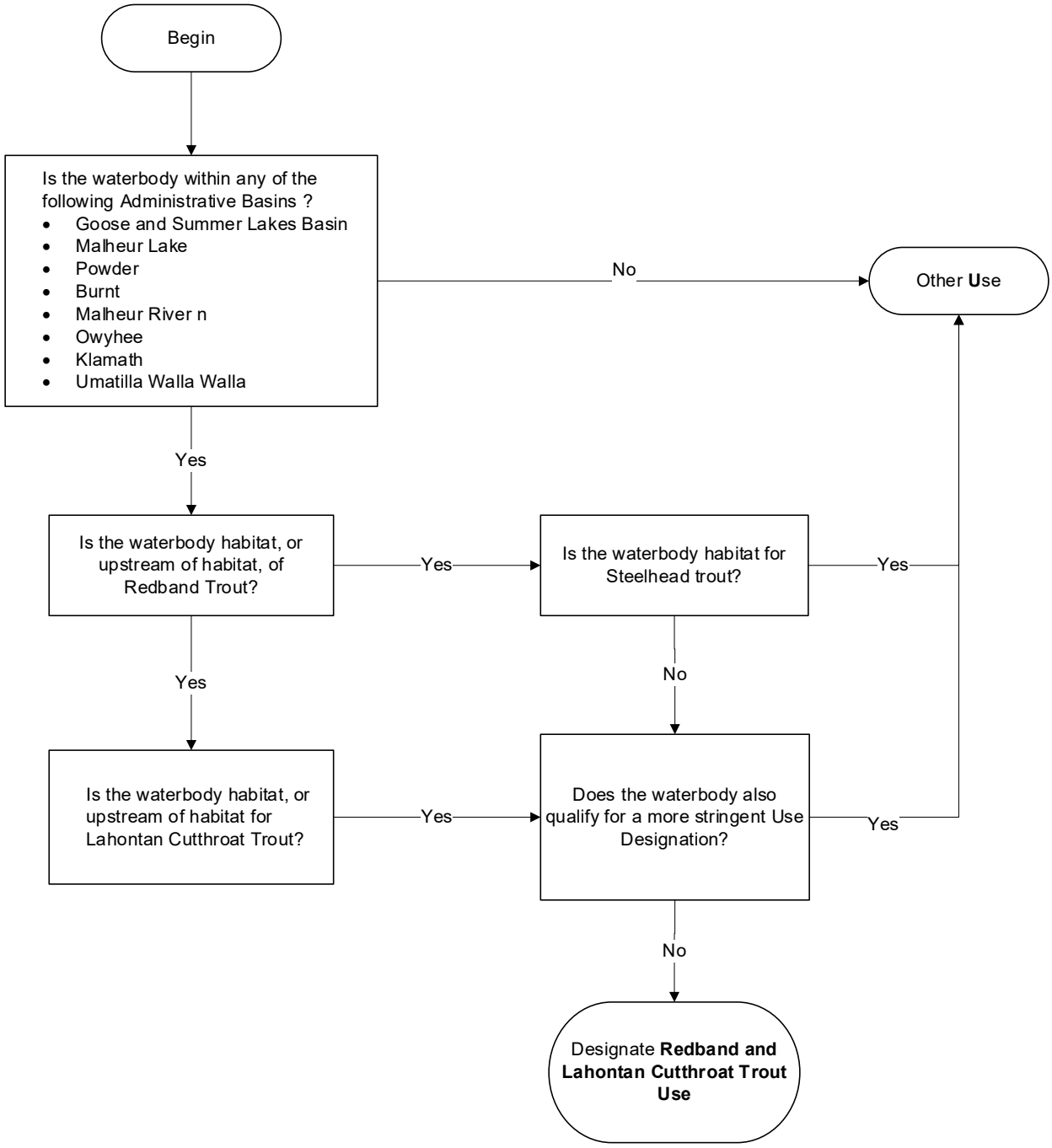
Core Cold-Water Habitat



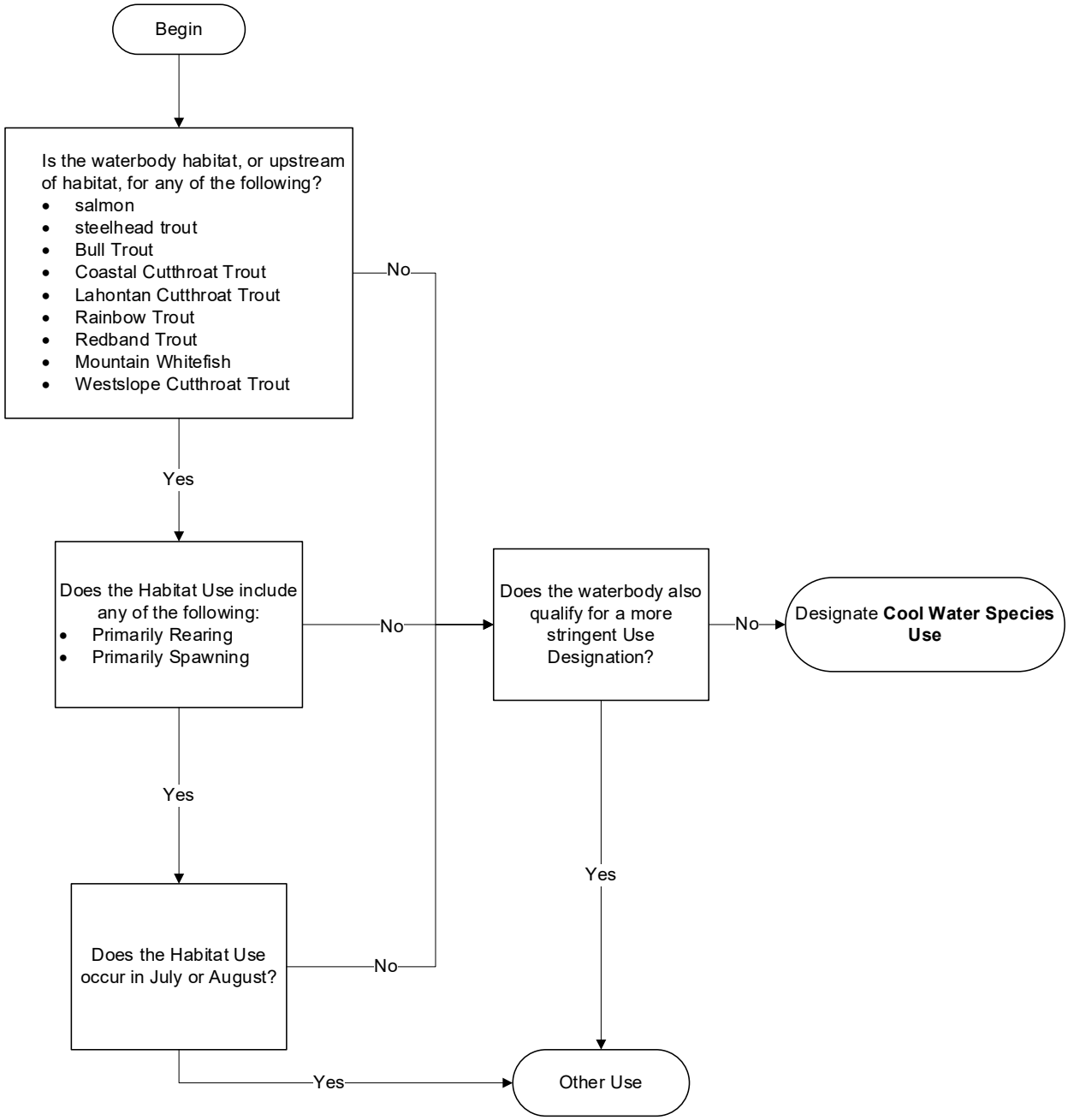
Bull Trout Spawning and Juvenile Rearing



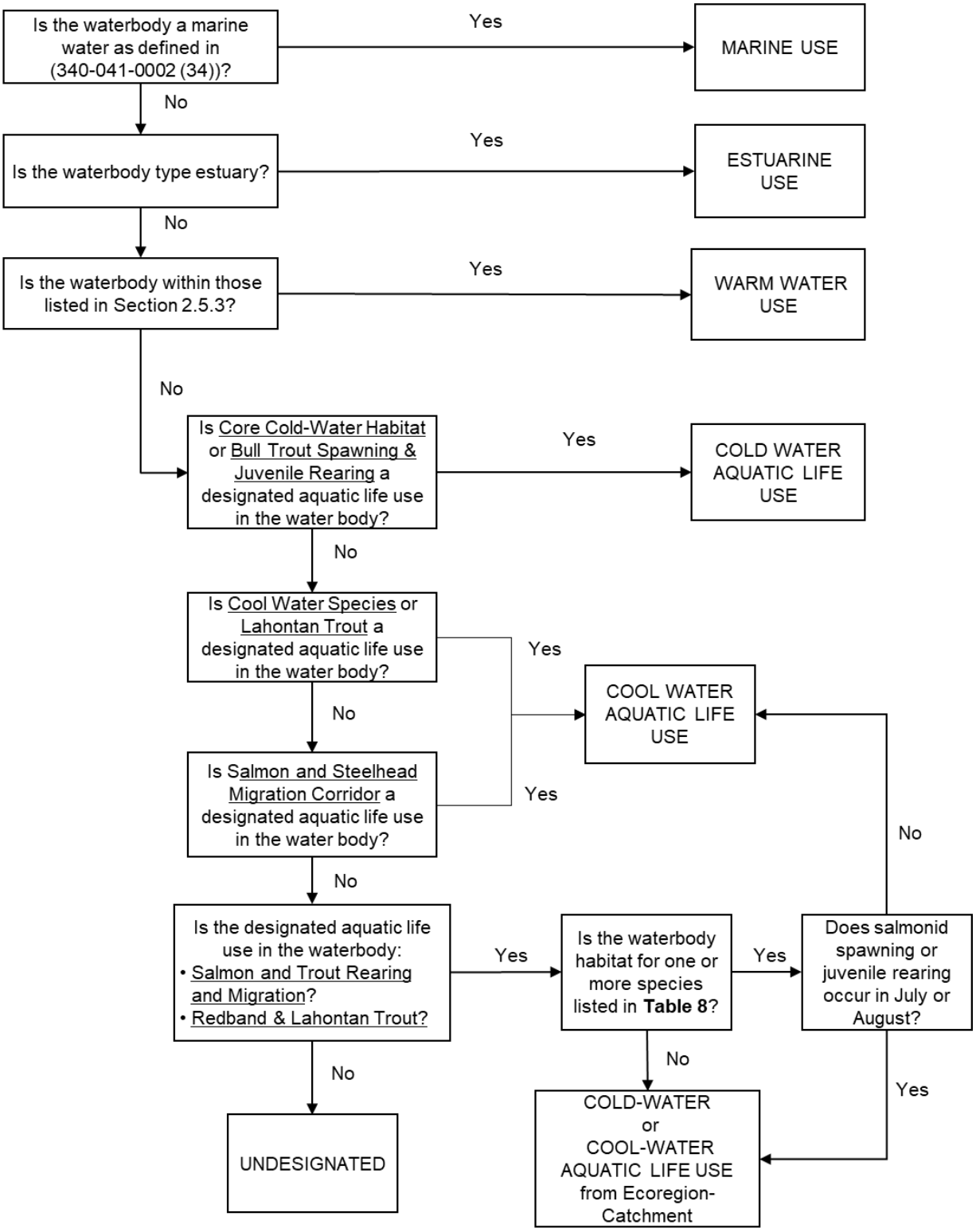
Redband and Lahontan Cutthroat Trout



Cool Water Species



Year-Round Dissolved Oxygen Designation Methods



Appendix B

Inventory and crosswalk of data sources and attributes applied to decision rules 2003 and 2023

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
Salmon and Trout Juvenile Rearing and Migration	Salmon or steelhead rearing occurs in the summer: • ODFW fish distribution database (2003) various salmon or steelhead species **(rearing)** • ODFW (2003) – Timing tables **(rearing occurs July or August)**	• ODFW-FHD (2023) – Coho, Chum, Sockeye, spring and fall Chinook salmon; summer and winter steelhead - **(Primarily rearing)** • ODFW (2023) – Timing tables **(Rearing** or **adult upstream migration** occurs in **July** or **August)**
	-OR-	
	Resident salmonid rearing occurs in the summer: • ODFW database (2003), rainbow or coastal cutthroat trout **(resident, rearing)** • ODFW (2003) – Timing tables **(rearing** occurs **July or August)**	• ODFW-FHD (2023) – Rainbow, Redband, Coastal, West Slope, and Lahontan Cutthroat Trout, and Mountain Whitefish. **(Primarily rearing, Resident)** • ODFW (2023) – Timing tables **(Rearing** occurs **in July** or **August)**
Core Cold-Water Habitat	Waters where Spring Chinook salmon spawn early, i.e., during the late summer months; August 1 to Sept. 15: • ODFW fish distribution database	• ODFW-FHD (2023) – Spring Chinook salmon (**Primarily spawning)** • ODFW (2023) – Timing tables **("Peak" or "Lesser" spawning use that starts on or before September 15)**

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
	(2003) spring Chinook **(Spawning)** • ODFW (2003) – Timing tables **(Spawning August 1** to **September 15)**	
	-OR-	
	Waters having sub-adult and adult Bull Trout presence and foraging during July or August: • USFWS proposed critical habitat (67 FR 71236, November 29, 2002) for sub-adult and adult Bull Trout use - 'Feeding, migration, overwintering reaches- "**FMO**") • 2003 ODFW – Timing tables **(**Bull Trout presence in **July** or **August)**	• ODFW-FHD (2023) - Bull Trout - "Primarily Rearing", "Foraging, migration, overwintering", or 'Resident – Multiple Uses' • USFWS Critical Habitat Designation (2010) – Feeding, migration, overwintering reaches- "**FMO**") • ODFW–Timing tables (2023) (any **"peak" or "lesser" or specific "presence"** Bull Trout use occurs in **July** or **August)**
	-OR-	
	Waters where available water temperature data indicate that the current stream temperature for the warmest week of the year is 16.0°C or below: • ODEQ LASAR database (2003) - Temperature data	• DEQ Assessment Database –temperature (2018/2020) including DEQ-AWQMS and 3rd party data. • USFS-NorWeST (2019)-observed temperature data.
	-OR-	

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
	Waters identified as “anchor habitat”: • EcoTrust (2000) Anchor Habitat Study	• Omitted.
	-OR-	
	N/A	Waters supporting late steelhead spawning: • ODFW-FHD (2023) – summer/winter steelhead **(‘Primarily spawning with some rearing’)** • ODFW–Timing tables (2023) - ‘Late’ spawning steelhead **(“Peak” adult spawning use occurs on June 1 or later)**
Bull Trout Spawning & Juvenile Rearing	Waters where ODFW indicates Bull Trout primarily spawning and early life stage rearing habitat occurs: • *Bull Trout Habitat Designation Report: Technical Work Group Recommendations* (DEQ, 2003), habitat where Bull Trout spawning occurs or where the dominant age classes include 0, 1, year round use (**BTHD1**).	• ODFW-FHD (2023) - Bull Trout - **(‘Primarily spawning with some rearing’)**
	-OR-	

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
	Waters identified as potential Bull Trout spawning and juvenile rearing habitat that is necessary for long-term health and viability of Bull Trout populations consistent with recovery plans and restoration goals: • *Bull Trout Habitat Designation Report: Technical Work Group Recommendations* (DEQ, 2002), habitat with potential to support spawning or rearing *necessary for long-term health and viability of* Bull Trout *populations* **('BTHD3').**	• Includes *Bull Trout Habitat Designation Report* **(**2002) potential habitat **('BTHD3')**, pending review from joint ODFW-USFWS statewide Bull Trout working group to determine which habitats are "potential Bull Trout spawning habitat necessary for long-term health and viability," consistent with recovery plans and restoration goals. • Addition of some ODFW-FHD (2023) - Bull Trout **('Historical') & ('Resident')** habitats if identified by the statewide working groups.
	-OR-	
	• USFWS' proposed draft critical habitat for Bull Trout juvenile spawning and rearing (USFWS, 2002) (**'SR'**) critical spawning and rearing habitat.	Waters identified by the USFWS 2010 final critical habitat rule as Bull Trout spawning and rearing habitat, including 33 miles of habitat USFWS asked DEQ to add in their 2014 Biological Opinion on Oregon's temperature standards: • USFWS Final critical habitat rule (2010) - **spawning** and rearing **('SR')** • USFWS 2015 Biological Opinion – RPA specific additions, if different

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
Redband and Lahontan Cutthroat Trout	*Attachment C2: Summary of the Discussion and Findings of the Temperature Technical Advisory Committee* 1. ODFW fish distribution database (2003) resident *O. mykiss* subspecies "Redband Trout" are resident or present (Redband Trout) 2. USFWS and/or ODFW shows the presence of Lahontan cutthroat trout.	• ODFW-FHD Redband or Lahontan Cutthroat Trout **('Resident- Multiple Uses')**, **('Foraging**, **'Migration and Overwintering')**, **('Primarily Rearing with some Migration')**, **('Primarily Spawning with some rearing'),** and (**'Unknown')** life-stage activities.
	-AND-	
	3. ODFW fish distribution database (2003) - waters that do not currently have anadromous *O. mykiss* (steelhead) populations	• ODFW-FHD (2023) shows no habitat use by anadromous summer or winter steelhead.
	-AND-	
	4. *Oregon Water Resources Department administrative basins* in the following basins: • Goose and Summer Lakes Basin • Malheur Lake Basin • Powder River Basin • Burnt River Sub-Basin • Malheur River Basin • Owyhee River Basin • Klamath River Basin	No change.

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
	• Umatilla River Basin • Walla Walla Sub-Basin	
Salmon and Steelhead Migration Corridors	Migration is primary use. • Professional judgement.	• ODFW-FHD (2023) - Coho, Chum, Sockeye, spring and fall Chinook salmon, or summer and winter steelhead. – (**'Primarily migration'**).
	-AND-	
	Limited juvenile salmon & steelhead rearing in July or August. • ODFW (2003) – Timing tables **(no peak rearing occurs July or August)** • Professional judgment.	ODFW (2023) – Timing tables **-** Coho, Chum, Sockeye, spring and fall Chinook salmon, or summer and winter steelhead (**(no "Peak" juvenile rearing use occurs between July 1 and August 30**); Coho, Chum, Sockeye, spring and fall Chinook salmon, or summer and winter steelhead , Rainbow, Redband, Coastal, West Slope, and Lahontan Cutthroat Trout, Bull Trout, and Mountain Whitefish - **(no "Peak" adult migration, spawning, holding, or egg incubation & emergence use occurs between July 1 and August 30)**
	-AND-	

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
	Some evidence to suggest that temperatures would **naturally reach or exceed 18°C/64°F.** • Multiple lines of evidence • Professional judgement • Typically, lower mainstem rivers.	Estimates of natural or restored thermal potential from: Federal and State agency models OR-DEQ TMDL models (Heatsource) Published studies
Cool Water Species	No salmonid species use. • ODFW Database (2003)	• ODFW-FHD (2023) - Coho, Chum, Sockeye, spring and fall Chinook salmon; summer and winter steelhead; Rainbow, Redband, Coastal, West Slope, and Lahontan Cutthroat Trout, Bull Trout, and Mountain Whitefish. – (**no habitat uses**).
	-OR-	
	No salmonid uses in July – August. • ODFW (2003) – Timing tables **(no uses occurs July or August)**	• ODFW (2023) – Timing tables **-** Coho, Chum, Sockeye, spring and fall Chinook salmon; summer and winter steelhead; Rainbow, Redband, Coastal, West Slope, and Lahontan Cutthroat Trout, Bull Trout, and Mountain Whitefish **(no salmonid use occurs in July or August).**

Aquatic Life Use Subcategory	Original 2003 Data Sources and Attributes:	Equivalent 2023 Data Sources and Attributes:
Borax Lake Chub (Warm Water Species)	**OAR-340-041-0028 (10):** State waters in the Malheur Lake Basin supporting the Borax Lake chub. • Designated for Borax Lake and its outlet.	No change.
Salmon & Steelhead Spawning	In waters designated by ODFW as "Primarily Spawning" for populations of Coho, Spring Chinook, Fall Chinook, Chum, or Sockeye salmon, and summer or winter Steelhead trout. • ODFW Database (2003)	• ODFW-FHD (2023) – Coho, Chum, Sockeye, spring and fall Chinook salmon; summer and winter steelhead; - (**'Primarily spawning'**)
	-AND-	
	Spawning through emergence use shall be applied on the following dates: • ODFW– Timing tables (2003) - (**'adult spawning'**), and **('egg development through fry emergence'**)	• ODFW Timing tables (2023) - Coho, Chum, Sockeye, spring and fall Chinook salmon; summer and winter steelhead; - (**'adult spawning'**), and **('egg development through fry emergence'**)

Appendix C

List of data sources

Originator	Data Set	Type	Source
Oregon Department of Fish and Wildlife	Fish Habitat Distribution Database	Habitat surveys, professional opinion, and habitat suitability models	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=202&XMLname=1167.xml
Oregon Department of Fish and Wildlife	Timing / In Water Work Unit Database	Locations of life stage timing	https://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=timinggisdata
Oregon Dept. of Fish and Wildlife	Life stage Activity Timing Tables	Observed timing of life stage presence and habitat use	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=202&XMLname=42654.xml
U.S. Fish and Wildlife Service	Bull Trout Critical Habitat Designation	Habitat surveys	https://www.fws.gov/pacific/bulltrout/finalcrithab/BT_FCH_GIS_2010.zip
U.S. Forest Service	NorWeST Observed Temperature Data	Observed water temperatures	https://www.fs.fed.us/rm/boise/AWAE/projects/NorWeST/StreamTemperatureDataSummaries.shtml
Oregon Department of Environmental Quality	2020 & 2022 State Final Integrated Report Numeric Databases	Observed water temperatures	https://rstudioconnect.deq.state.or.us/content/0a964958-6ad4-49a4-aca0-54a644b96357/
U.S. Geological Survey	U.S. Geological Survey data release	Occurrence locations and trait data for freshwater fishes, amphibians, and reptiles native to the state of Oregon	https://www.sciencebase.gov/catalog/item/5bbd20f2e4b0fc368eaeb96a

Originator	Data Set	Type	Source
U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center	U.S. Geological Survey data release	Foothill yellow-legged frog (Rana boylii) surveys in Oregon 2019	https://www.sciencebase.gov/catalog/item/5db72623e4b0b0c58b5a48ad

Appendix D

Bibliography of documented resident trout spawning habitat

Authors	Year	Title	Source
Anderson	1982	Catchable Rainbow Trout Studies for the Lostine, Imnaha and Wallowa Rivers Information Report 82-9	
Anderson et al.	2009	Migration and Passage of Redband Trout in the Donner und Blitzen River, 2007-2009.	ODFW Information Report.
Anderson et al.	2011	Seasonal migrations of adult and sub-adult Redband Trout in a high desert basin of Eastern Oregon, USA	Ecology of Freshwater Fish (2011) 20(3): 409-420
Bangs et al.	2008	Distribution and Abundance of Redband Trout Oncorhynchus mykiss in the Malheur River Basin, 2007.	ODFW Progress Reports
Bangs et al.	2015	Effects of US Army Corps of Engineers Willamette Projects Operations on Oregon Chub and Other Floodplain Fishes	https://digital.osl.state.or.us/islandora/object/osl:581627
Bateman et al.	2009	Passive Integrated Transponder Tag Retention Rates in Headwater Populations of Coastal Cutthroat Trout	North American Journal of Fisheries Management (2009) 29: 653–657
Bateman et al.	2021	Fish response to successive clearcuts in a second-growth forest from the central Coast range of Oregon	Forest Ecology and Management (2021) Volume 496: 119447
Bennett et al.	1997	Lower Umpqua Watershed Analysis	default.aspx (state.or.us)
Bohling and Bargen	2017	Evaluation of genetic population structure and effective population size among populations of Redband Trout in the Deschutes River, OR	https://odfwnfi.forestry.oregonstate.edu/sites/default/files/2017%20Bohling%20et%20al.%20USFWS%20-%20Deschutes%20redband%20genetics.pdf
Bohling et al.	2019	Describing Fine-Scale Patterns of Genetic Structure and Introgression of Redband Trout in a Complex River System	North American Journal of Fisheries Management (2019) 39:509–523
Boxall et al.	2008	Landscape Topography and the Distribution of Lahontan Cutthroat Trout	Environmental Biology of Fishes (2008) 82: 71–84
Brooke et al.	2016	Conservation of native Pacific trout diversity in western North America	

Authors	Year	Title	Source
Brophy	1999	Klamath watershed fish district: September 2012. Report of Oregon Department of Fish and Wildlife.	ODFW - ODFW Data Clearinghouse - View Record (state.or.us)
Buchanan et al.	1990	Native Trout Project.	ODFW Annual Progress Report.
Budy et al.	2019	Chapter 7: Distribution and Status of Trout and Char in North America	Book: American Fisheries Society, Trout and Char of the World
Buktenica and Larson	1996	Ecology of Kokanee Salmon and Rainbow Trout in Crater Lake, Oregon	
Buktenica et al.	2007	Variability of kokanee and rainbow trout food habits, distribution, and population dynamics, in an ultraoligotrophic lake with no manipulative management	Hydrobiologia volume 574, pages235–264 (2007)
Byrne	1974	A competition and fish cultural study of rainbow trout (F-94-R Federal Aid Progress Report)	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_1772_2_CompetitionFishCulturalStudyRainbowTrout1974.pdf
Clark and Lamson	2005	Bakeoven Watershed Assessment and Action Plan	Microsoft Word - Bakeoven Watershed Assessment.doc (state.or.us)
Contor et al.	1995	Umatilla basin natural production monitoring and evaluation annual progress report 1994-1995	Unknown (state.or.us)
Cornwell et al.	2010	Life history variability, habitat use, and migratory behavior of coastal cutthroat trout in the Salmon River, Oregon	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_41146_2_Cornwell-SR%20Ct%202009%20Progress%20Report%207-6-10.pdf
Currens	1991	Allozyme and Morphological Characteristics of Rainbow Trout in the Burnt and Powder Rivers and McGraw Creek, Oregon	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_7778_2_AllozymeMorphologicalCharacteristicsRainbowTroutBurnt_PowerRiver.pdf
Currens et al.	1990	Allozyme and morphological divergence of rainbow trout (Oncorhynchus mykiss) above and below waterfalls in the Deschutes River, Oregon	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_5823_2_AllozymeMorphologicalCharacteristicsRainbowTroutBurnt_DeschutesRiver.pdf

Authors	Year	Title	Source
Dambacher and Jones	2007	Benchmarks and Patterns of Abundance of Redband Trout in Oregon Streams: a Compilation of Studies	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_41659_2_dambacher_2007.pdf
Dambacher et al.	2001	The distribution and abundance of Great Basin Redband Trout: an application of variable probability sampling in a 1999 status review.	Stream Populations and Habitat of Great Basin Redband Trout (psu.edu)
Dambacher et al.	2009	Landscape-Level Sampling for Status Review of Great Basin Redband Trout	North American Journal of Fisheries Management 29:1091–1105, 2009
DeHaan et al.	2015	Great Basin Redband Trout Genetic Status Assessment	U.S. Fish and Wildlife Service Final Report
Fessler and Lichens	1978	Research studies of wild rainbow trout in the Lower Deschutes River, Oregon	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_1579_2_ResearchTroutDeschutes.pdf
Fies et al.	1996	Upper Deschutes River subbasin fish management plan	https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=f393256f66b5fb56e7bb69e74537514e3f2193fe
Giger	1972	Ecology and management of Coastal Cutthroat Trout in Oregon	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_1771_2_EcoMangCutthroat.pdf
Golden	1978	The effects of fluctuating temperatures on the lethal tolerance limits of Coastal Cutthroat (*Salmo clarki clarki*) AFS-58-7 Progress Report 1978	
Gresswell and Harding	1997	The role of special angling regulations in management of coastal cutthroat trout	https://pubs.er.usgs.gov/publication/70194165
Gresswell and Hendricks	2007	Population-Scale Movement of Coastal Cutthroat Trout in a Naturally Isolated Stream Network	Transactions of the American Fisheries Society (2007) 136: 238–253
Gunckel and Jacobs	2006	Population Assessment of Lahontan Cutthroat Trout, 2005.	ODFW Progress Reports
Guy et al.	2008	Landscape-scale evaluation of genetic structure among barrier-isolated populations of Coastal Cutthroat Trout, *Oncorhynchus clarkii clarkii*	Canadian Journal of Fisheries and Aquatic Sciences 65.8 (2008): 1749-1762.
Hemmingsen et al.	1992	Native Trout Project.	ODFW Annual Progress Report
Hering et al.	2009	Abundance, distribution, and migratory behavior of coastal cutthroat trout in two lower Columbia River tributaries	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_41138_2_2009LCCutthroat.pdf

Authors	Year	Title	Source
Hess	1981	Cutthroat Trout in Lower Columbia River Tributaries of Oregon, Wild Trout Investigation, Project Number F99R4	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_3987_2_CutthroatColumbia.pdf
Hess	1982	Cutthroat Trout in Lower Columbia River Tributaries of Oregon Information. Report 83-2	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_1678_2_83-2.pdf
Hickman and Raleigh	1982	Habitat Suitability Index Models: Cutthroat Trout	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_1326_2_HSImodels.pdf
Hill et al.	2016	The stream-catchment (STREAMCAT) dataset: a database of watershed metrics for the conterminous united states	JOURNAL OF THE AMERICAN WATER RESOURCES ASSOCIATION (2016) 52(1): 120
Hockersmith et al.	1995	Yakima River Radio-Telemetry Study | Rainbow Trout | Annual Report 1993	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_11012_2_YakimaRadioTelemetryTrout%201993.pdf
Hooton	1997	Status of Coastal Cutthroat Trout in Oregon, Information Reports 97-2	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_7094_2_Information%20Reports%2097-2%20Status%20of%20Coastal%20Cutthroat%20TroutOregon.pdf
Hosford and Pribyl	1983	Blitzen River Redband Trout Evaluation Information Report 83-9	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_35894_2_83-9.pdf
Hughes et al.	2019	Recovery of Willamette River (Oregon, USA) Fish Assemblages: Successes and Remaining Threats	In: "From Catastrophe to Recovery: Stories of Fishery Management Success", Charles C. Krueger, William W. Taylor, and So-Jung Youn, eds. American Fisheries Society Press.
Jacobs et al.	2007	Effects of Impoundments and Hydroelectric Facilities on the Movement and Life History of Redband Trout in the Upper Klamath River: A Summary and Synthesis of Past and Recent Studies.	Symposium: Wild Trout IX – Sustaining Wild Trout in a Changing World (2007).
Jacobs et al.	2021	Climate, Fire Regime, Geomorphology, and Conspecifics Influence the Spatial Distribution of Chinook Salmon Redds	Transactions of the American Fisheries Society (2021) 150: 8-23

Authors	Year	Title	Source
Jones	2019	Estimated contribution of hatchery rainbow trout using a series of high-reward tagging programs; a statewide comparison among stocking sizes (2014-2017), Information Reports 2019-02	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_41536_2_InfoSeries2019-2.pdf
Jones et al.	2007	Effectiveness and Applicability of EMAP Survey Design in Status Review of Great Basin Redband Trout	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_41673_2_jones%202007.pdf
Jones et al.	2008	Feeding Ecology of Cutthroat Trout in the Salmon River Estuary, Oregon	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_41657_2_Cutthroat%20diet%20Jones_et_al_2008.pdf
Keith et al.	2022	Monitoring Framework to Evaluate Effectiveness of Aquatic and Floodplain Habitat Restoration Activities for Native Fish along the Willamette River, Northwestern Oregon	Monitoring Framework to Evaluate Effectiveness of Aquatic and Floodplain Habitat Restoration Activities for Native Fish along the Willamette River, Northwestern Oregon — OFR 2022-1037 (usgs.gov)
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Kinunen and Moring	1976	Status and Origin of Rainbow Trout Brood Stocks in Oregon, 1976. Information Report 76-7	https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?pn=ViewFile&att=ODFW/ODFW_6005_2_76-7.pdf
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ODFW	1968_2	MAP	ODFW - ODFW Data Clearinghouse - View Record (state.or.us)

Authors	Year	Title	Source
ODFW	1969_1	Baker County lakes and reservoirs	ODFW - ODFW Data Clearinghouse - View Record (state.or.us)
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ODFW	1979	Fish management plan Elk Creek	default.aspx (state.or.us)
ODFW	1986_1	Crescent Lake Fish Management Plan	ODFW - ODFW Data Clearinghouse - View Record (state.or.us)
ODFW	1986_2	Marion Lake Fish Management Plan	default.aspx (state.or.us)
ODFW	Fish of the Mckenzie	Fish of the Mckenzie River: Rainbow Trout	https://www.dfw.state.or.us/resources/visitors/docs/mckfish.pdf
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