Concise Explanatory Statement Chapter 173-201A WAC Water Quality Standards for Surface Waters of the State of Washington: Salmon Spawning Habitat Protection Rule

Summary of Rulemaking and Response to Comments

Washington State Department of Ecology
Olympia, Washington

March 2022, Publication 22-10-003

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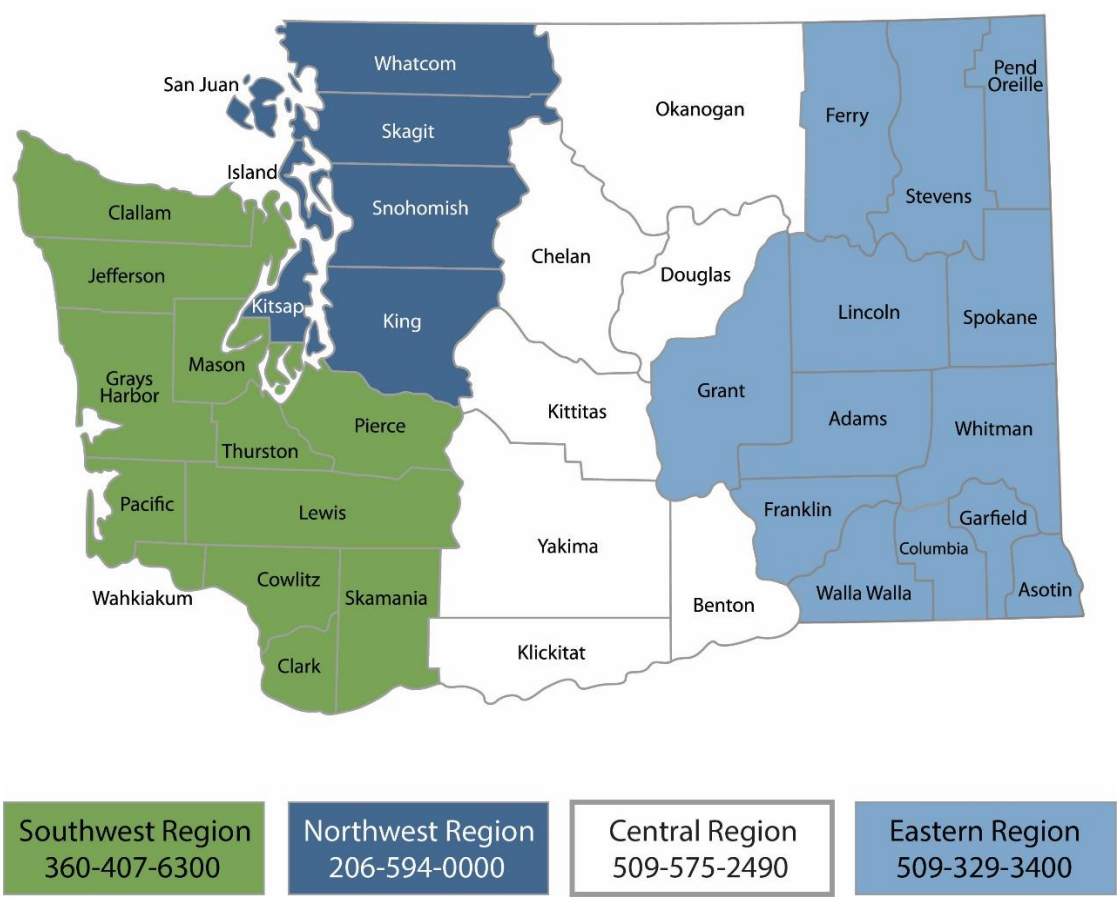

Region	Counties served	Mailing Address	Phone
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Concise Explanatory Statement

Chapter 173-201A WAC
Water Quality Standards for Surface Waters of the State of Washington: Salmon Spawning Protection Rule

Water Quality Program
Washington State Department of Ecology
Olympia, WA

March 2022 | Publication 22-10-003

DEPARTMENT OF
ECOLOGY
State of Washington

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Introduction

The purpose of a Concise Explanatory Statement is to:

- Meet the Administrative Procedure Act (APA) requirements for agencies to prepare a Concise Explanatory Statement (RCW 34.05.325).
- Provide reasons for adopting the rule.
- Describe any differences between the proposed rule and the adopted rule.
- Provide Ecology's response to public comments.

This Concise Explanatory Statement provides information on The Washington State Department of Ecology's (Ecology) rule adoption for:

Title:	Water Quality Standards for Surface Waters of the State of Washington
WAC Chapter(s):	173-201A
Adopted date:	March 22, 2022
Effective date:	April 22, 2022

There is more information available related to this rulemaking and other Ecology rulemakings[2] on our website.

[2] https://ecology.wa.gov/About-us/How-we-operate/Laws-rules-rulemaking

Reasons for Adopting the Rule

Salmon and steelhead populations have been declining in Washington State for more than a decade (State of the Salmon Report).[3] Since 1991, the federal government has declared 14 species of salmon and steelhead in Washington as at-risk of extinction under the Endangered Species Act. Salmonids play a pivotal role in the structure and health of our fresh and marine water ecosystems. Chinook salmon, for example, are the primary food for the endangered Southern Resident Orca, and the decline of Chinook is one of the main factors attributed to the decline of this orca population, according to the 2018 Southern Resident Orca Task Force Final Report.[4] Migrating salmon and steelhead bring essential nutrients from the ocean back to rivers, streams, and surrounding habitat. These nutrients are a significant part of the freshwater food web. Salmonids represent one of the most sensitive aquatic life species in Washington and therefore form the basis for protecting all aquatic life uses, as defined in the Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A).

This rulemaking will improve rules that protect salmonid spawning habitat in lakes, rivers, and streams. Both dissolved oxygen and the amount of fine sediment in substrate are key factors in ensuring early life stages of salmonids survive and properly develop. Dissolved oxygen and fine sediment are interrelated in that the delivery of oxygen to gravel is dependent on the size and permeability of the sediment. The changes provide additional protection to ensure that there are sufficient dissolved oxygen levels in spawning gravels and to ensure the physical structure of salmonid nests (called redds) are conductive to spawning success.

This rulemaking revises "WAC 173-201A-200 Fresh water designated uses and criteria" to provide additional water quality and habitat protection for early life stages of salmonids—including salmon, steelhead, and trout—and their spawning gravel. Ecology considers two general revisions in this rule:

- Revising the freshwater dissolved oxygen criteria to increase protection of early life stages of salmonids in spawning gravel.
- Adding fine sediment narrative criterion to provide additional protection for spawning gravel habitat.

Differences Between the Proposed Rule and Adopted Rule

RCW 34.05.325(6)(a)(ii) requires Ecology to describe the differences between the text of the proposed rule as published in the Washington State Register and the text of the rule as adopted, other than editing changes, stating the reasons for the differences.

We note that there were several editing changes made to correct format and typographical errors that were found during the rulemaking. These minor changes do not require a description of the

[3] Library | State of Salmon (wa.gov) https://stateofsalmon.wa.gov/about-report/library/
[4] Southern Resident Orca Task Force | Governor Jay Inslee (wa.gov)
https://www.governor.wa.gov/issues/issues/energy-environment/southern-resident-orca-recovery/task-force

differences between the text of the proposed rule and the final rule as adopted and are not included in the descriptions below.

There are some differences between the text of the proposed rule filed on October 18, 2021 and the text of the adopted rule filed on March 22, 2022. Ecology made these changes for all or some of the following reasons:

- In response to comments we received.
- To ensure clarity and consistency.
- To meet the intent of the authorizing statute.

The following content describes the changes and Ecology's reasons for making them. For comparison purposes, the proposed rule language is shown, followed by changes made to the final rule language using strikethrough and underlined text.

Change to WAC 173-201A-020: New definition for intragravel dissolved oxygen

Added the word "dissolved" to the proposed definition to clarify that the definition pertains to dissolved oxygen and not atmospheric oxygen.

Proposed rule language

> "**Intragravel dissolved oxygen"** means the concentration of oxygen in the spaces between sediment particles in a streambed.

Final Rule Language

> "**Intragravel dissolved oxygen"** means the concentration of <u>dissolved</u> oxygen in the spaces between sediment particles in a streambed.

Change to WAC 173-201A-020: New definition for spatial median:

The language "intragravel D.O." was deleted from proposed definition in order to generalize the definition, making it more applicable to all water quality standards in the future.

Proposed rule language

> "**Spatial median**" is the middle value of multiple ranked intragravel D.O. measurements taken within the sampling area.

Final Rule Language

> "**Spatial median**" is the middle value of multiple ranked ~~intragravel D.O.~~ measurements taken within the sampling area.

Changes to WAC 173-201A-200(1)(d)

The language "one or more of the D.O. criteria" was deleted from the proposed language and replaced with language to clarify that compliance may be demonstrated through either the water column or intragravel dissolved oxygen criteria.

Proposed rule language

(d) Aquatic life dissolved oxygen (D.O.) criteria. The D.O. criteria are measured in milligrams per liter (mg/L) or percent oxygen saturation. Table 200 (1)(d) lists the D.O. criteria for each of the aquatic life use categories. Compliance may be demonstrated through one or more of the D.O. criteria.

Final Rule Language

(d) Aquatic life dissolved oxygen (D.O.) criteria. The D.O. criteria are measured in milligrams per liter (mg/L) or percent oxygen saturation. Table 200 (1)(d) lists the D.O. criteria for each of the aquatic life use categories. Compliance may be demonstrated ~~through one or more of the D.O. criteria~~ through either the water column or intragravel criteria in Table 200(1)(d).

Changes to WAC 173-201A-Table 200(1)(d): Format

Changes were made to the format of the proposed table, which included an additional column for intragravel dissolved oxygen (D.O.) criteria that would apply to those use categories that are associated with salmonid spawning. We received feedback that the proposed table was confusing and difficult to follow. To simplify the table, formatting changes were made to remove the final column containing the intragravel D.O. criteria, placing the information in the note to the table. Changes to the table also included identifying where the intragravel criteria apply by placing an asterisk beside each of the applicable aquatic life use categories associated with salmonid spawning habitat protection.

Proposed rule language

Category	Water Column (1-Day Minimum)		Intragravel* (1-Day Minimum)
Char Spawning and Rearing	10 mg/L or 90% oxygen saturation		8.0 mg/L
Core Summer Salmonid Habitat	10 mg/L or 90% oxygen saturation		8.0 mg/L
Salmonid Spawning, Rearing, and Migration	10 mg/L or 90% oxygen saturation		8.0 mg/L
Salmonid Rearing and Migration **Only**	6.5 mg/L or 90% oxygen saturation	**OR**	-
Nonanadromous Interior Redband Trout	10 mg/L or 90% oxygen saturation		8.0 mg/L
Indigenous Warm Water Species	6.5 mg/L or 90% oxygen saturation		-

* Intragravel D.O. must be measured as a spatial median (see WAC 173-201A-020 Definitions).

Final Rule Language

Category	Water Column (1-Day Minimum)		~~Intragravel*~~ ~~(1-Day Minimum)~~
Char Spawning and Rearing*	10 mg/L or 90% ~~oxygen~~ saturation		~~8.0 mg/L~~
Core Summer Salmonid Habitat*	10 mg/L or ~~90~~ 95% ~~oxygen~~ saturation		~~8.0 mg/L~~
Salmonid Spawning, Rearing, and Migration*	10 mg/L or 90% ~~oxygen~~ saturation	~~OR~~	~~8.0 mg/L~~
Salmonid Rearing and Migration **Only**	6.5 mg/L ~~or 90% oxygen saturation~~		~~-~~
Nonanadromous Interior Redband Trout*	10 mg/L or 90% ~~oxygen~~ saturation		~~8.0 mg/L~~
Indigenous Warm Water Species	6.5 mg/L ~~or 90% oxygen saturation~~		~~-~~

*Note: Intragravel D.O criteria for these aquatic life use categories may be used for compliance purposes. When intragravel D.O. is used for compliance, the intragravel D.O. (1-day minimum) concentration must be 8.0 mg/L or greater, and the D.O. water column (1-day minimum) concentration must be 9.0 mg/L or greater. Intragravel D.O. must be measured as a spatial median within the same habitat area ~~(see WAC 173-201A-020 Definitions)~~.

Changes to WAC 173-201A-Table 200(1)(d): Note

As noted above, in order to increase readability, the intragravel D.O. 1-day minimum criteria in the column of proposed Table 200(1)(d) was moved down to the note below the table. In addition to moving intragravel D.O. criteria into the note, we added an associated minimum water column concentration of 9 mg/L (as a 1-day minimum) that must be met when intragravel D.O. is measured for compliance purposes. This change was based on comments received, in order to ensure full protection for water column dwelling salmonids at other life stages. The note was further edited by moving language that was proposed to be added to WAC 173-200(1)(d)(iv)(C) to the last sentence in the note, to provide more clarity on sampling needed for intragravel D.O. measurements and to make the information easier to find.

Proposed rule language (excerpt from proposed Table (1)(d))

Intragravel* (1-Day Minimum)
8.0 mg/L
8.0 mg/L
8.0 mg/L
-
8.0 mg/L
-

*Intragravel D.O. must be measured as a spatial median (see WAC 173-201A-020 Definitions).

Final Rule Language (Column deleted and information added to Note)

*Note: Intragravel D.O criteria for these aquatic life use categories may be used for compliance purposes. When intragravel D.O. is used for compliance, the intragravel D.O. (1-day minimum) concentration must be 8.0 mg/L or greater, and the D.O. water column (1-day minimum) concentration must be 9.0 mg/L or greater. Intragravel D.O. must be measured as a spatial median within the same habitat area ~~(see WAC 173-201A-020 Definitions)~~.

Changes to WAC 173-201A-Table 200(1)(d): Water column percent saturation

Changes were made to the water column percent saturation component that apply to the different use categories found in Table 200(1)(d). These changes were made based on comments received and to correct what uses the percent saturation component of the water column criteria apply. Changes to percent saturation:

1. The percent saturation component for the Core Summer Salmonid Habitat use was changed from 90% to 95%. We received comments questioning whether the 90% saturation component for the Core Summer Salmonid Habitat use category in the proposed Table 200(1)(d) was protective of early life stages during the summer months. After review of the scientific literature and discussion with staff scientists, we agreed that the Core Summer Salmonid Habitat use should be changed to 95% because early life stages are present during the summer months for water bodies assigned this use. The 90% saturation coupled with the maximum temperature criteria for the Core Summer Salmonid Habitat use (16 or 13 degrees Celsius) would not provide full protection for spawning or early life stages. The 95% saturation criterion provides equivalent protection compared with the protective concentration-based D.O. criterion of 10 mg/L.
2. Changes were made from the proposed rule language to remove the percent saturation component from the Salmonid Rearing and Migration Only and Indigenous Warm Water Species use categories. The proposed rule inadvertently included a percent saturation for these uses. However, the focus of this rulemaking is on protection of early life stages of salmonids. These two uses do not include the protection of early life stages of salmonid as it relates to spawning and emergence; thus, the percent saturation component was removed in the final language. In essence, the D.O. criteria for the salmonid rearing and migration use and the indigenious warm water species use was not revised.

Proposed rule language (excerpt from proposed Table(1)(d)

Category	Water Column (1-Day Minimum)
Char Spawning and Rearing	10 mg/L or 90% oxygen saturation
Core Summer Salmonid Habitat	10 mg/L or 90% oxygen saturation
Salmonid Spawning, Rearing, and Migration	10 mg/L or 90% oxygen saturation
Salmonid Rearing and Migration **Only**	6.5 mg/L or

Category	Water Column (1-Day Minimum)
	90% oxygen saturation
Nonanadromous Interior Redband Trout	10 mg/L or 90% oxygen saturation
Indigenous Warm Water Species	6.5 mg/L or 90% oxygen saturation

Final Rule Language (excerpt from final Table(1)(d))

Category	Water Column (1-Day Minimum)
Char Spawning and Rearing*	10 mg/L or 90% ~~oxygen~~ saturation
Core Summer Salmonid Habitat*	10 mg/L or ~~90~~ 95% ~~oxygen~~ saturation
Salmonid Spawning, Rearing, and Migration*	10 mg/L or 90% ~~oxygen~~ saturation
Salmonid Rearing and Migration **Only**	6.5 mg/L ~~or 90% oxygen saturation~~
Nonanadromous Interior Redband Trout*	10 mg/L or 90% ~~oxygen~~ saturation
Indigenous Warm Water Species	6.5 mg/L ~~or 90% oxygen saturation~~

Changes to WAC 173-201A-200(1)(d)(iv)

Language proposed to be added to this subsection was moved to the last sentence in the note of Table 200(1)(d) to provide better clarity on sampling needed for intragravel D.O. measurements and to make the information easier to find. In essence, the final language in this sub-section remains unchanged from the prior rule.

Proposed rule language

(iv) D.O. measurements should be taken to represent the dominant aquatic habitat of the monitoring site. This typically means samples should:

(A) Be taken from well mixed portions of rivers and streams;

(B) Not be taken from shallow stagnant backwater areas, within isolated thermal refuges, at the surface, or at the water's edge; and

(C) Be taken within the same aquatic habitat area when measuring intragravel D.O.

Final Rule Language

(iv) D.O. measurements should be taken to represent the dominant aquatic habitat of the monitoring site. This typically means samples should:

(A) Be taken from well mixed portions of rivers and streams; and

(B) Not be taken from shallow stagnant backwater areas, within isolated thermal refuges, at the surface, or at the water's edge~~; and~~

~~(C) Be taken within the same aquatic habitat area when measuring intragravel D.O.~~

Changes to WAC 173-201A-200(1)(h): Narrative fine sediment

Language for the proposed narrative fine sediment criteria was changed as a result of comments received and to provide clarification on the intent of the narrative criteria. The narrative criteria was divided into two subsections for easier reading. We received comments questioning whether there is available science to determine relationships between fine sediment and adverse effects on aquatic life. We added "excess" to the text to clarify that current methods to determine impairments focus on statistically or biologically significant changes in fine sediment-based metrics. This change was needed to clarify that small undetectable changes in fine sediment may not be identified in a fine sediment assessment due to natural fluctuations in environmental conditions of a water body. We deleted language associated with "anthropogenic sources at levels that cause adverse effects on aquatic life" because relationships between fine sediment-based parameters and adverse effects on aquatic life have not been established by the available science. We have revised the text to link excess fine sediment to impaired designated uses. We revised the text to better align with the intent of the rulemaking. Language in the proposed rule describing the use of reference sites to demonstrate compliance with the narrative fine sediment criteria was edited to provide clarity on the intent of how reference site values should be used. We revised the language to be more inclusive of the multiple methods that may be used to assess a fine sediment impairment and to provide clarity on what similarities should be considered for reference locations.

Proposed rule language

(h)(i) Aquatic life fine sediment criterion. The following narrative criterion applies to all existing and designated uses for fresh water:

(ii) Water bodies shall not contain fine sediment (<2 mm) from anthropogenic sources at levels that cause adverse effects on aquatic life, their reproduction, or habitat. When reference sites are used, sediment conditions shall be compared to sites that represent least disturbed conditions of a neighboring or similar water body.

Final Rule Language

(h)~~(i)~~ Aquatic life fine sediment criteria. The following narrative criteria apply to all existing and designated uses for fresh water:

(~~i~~i) Water bodies shall not contain excess fine sediment (<2 mm) from human-caused sources that impair designated uses ~~from anthropogenic sources at levels that cause adverse effects on aquatic life, their reproduction, or habitat~~.

(ii) When reference ~~sites~~ values are used to demonstrate compliance with the fine sediment criteria, measured ~~sediment~~ conditions shall be compared to those from reference sites or regional data that represent least disturbed site conditions of a comparable water body or ecoregion ~~neighboring or similar water body~~. Reference locations should be comparable in hydrography, geology, ecology, and habitat to that of the water body evaluated.

List of Commenters and Response to Comments

List of entities that submitted a comment

We accepted comments from October 18 through December 16, 2021. Ecology received comments from 16 entities. The table below identifies each commenter with an identification code.

Commenter/Affiliation	Submitter	Identification Code
Frissell & Raven Hydrobiological & Landscape Sciences	Christopher Frissell	1
Fryt, Marc	Self	2
James, Alan	Self	3
Jamestown S'Klallam Tribe	Robert Knapp	4
Klickitat County	N/A	5
Moran, Bridget	Self	6
Naiman, Robert	Self	7
National Council for Air and Stream Improvement, Inc.	Camille Flinders	8
Northwest Environmental Advocates	Nina Bell	9
Snohomish County	Steve Britsch	10
Snoqualmie Indian Tribe	Matthew Baerwalde	11
Triverus, LLC	Tyler Foley	12
US EPA Region 10	Lindsay Guzzo	13
Washington Association of Sewer and Water Districts	Judi Gladstone	14
Washington Forest Protection Association	John Ehrenreich	15
Willis, Steve	self	16

Organization of comments

We arranged the comments alphabetically by commenter/affiliation and assigned an identification code. Under each commenter's identification code, we have included individual comments taken verbatim from written submittals, except in cases of spelling errors or to provide clarification of the comment. Comments taken from testimony at the public hearings are summarized. Ecology responses are directly below each comment. The full written comment submittals can also be viewed via our online ecomments system[5].

[5] http://wq.ecology.commentinput.com/?id=RFGDN

Comments and Responses

1 – Frissell & Raven Hydrobiological & Landscape Sciences

Comment 1.1

Ecology defines the beneficial use as providing habitat conditions sufficient to fully support the recovery of threatened, endangered, and declining salmonid populations. Conversely, to provide for clarity and precision in developing protective criteria, a clear and concise definition of impairment is also needed. I suggest that appropriate language would be as follows: *Impairment is any human-caused change in habitat conditions that reduces the capability of threatened endangered, and declining populations to recover to stable, self-sustaining and status sufficiently productive to support commercial and sport fisheries.* The lack of a clear definition of what condition, action, effect, our outcome is to be governed by the standard and guidance lead to troublesome early confusion in the Science Panel proceedings. I believe my wording accurately captures the consensus that developed among the participating scientists as the discussions progressed, although I cannot speak with certainty about all non-Ecology participants. And I would add that it was not at all clear from their verbal input at the Science panel meetings that Ecology-employed participants would agree with my wording.

Response 1.1

The water quality standards do not specifically define a beneficial use as providing support to the recovery of threatened, endangered, and declining salmonid populations. The water quality standards are intended to fully protect all aquatic species, including the most sensitive species. It is assumed that populations are protected if individual species are protected. If an endemic population was uniquely sensitive to a water quality condition, site-specific criteria could be developed. We conclude that additional text in the rule language that specifically includes threatened and endangered species would not result in increased protection.

Comment 1.2

I would further offer that in my participation in the Science Panel process, I assumed that these criteria for protection and impairment applied broadly to water quality-related actions by Ecology and the state of Washington, including: point source permitting; designation of impaired water bodies; establishing effective targets and implementation plans for TMDLs; and evaluation of effectiveness or "bestness" of so-called best management practices for non-point source pollution control.

Response 1.2

The proposed criteria for dissolved oxygen apply to all fresh waters designated as: Char Spawning and Rearing; Core Summer Salmonid Habitat; Salmonid Spawning, Rearing, and Migration; or Nonanadromous Interior Redband Trout. The proposed criteria for fine sediment apply to all existing and designated uses for fresh waters.

Actions or activities at the state or federal level that require use of the water quality criteria set forth in Washington's Water Quality Standards must incorporate these new criteria in their programs and actions, as applicable to their surface waters. This includes

actions or activities such as new or renewed point-source permits (e.g., NPDES); assessment of water bodies for the Integrated Report (including Clear Water Act 303(d) listings); new or revised TMDLs; and non-point source pollution control programs.

Comment 1.3

With regard to the biological underpinning that determines this specific beneficial use, it is difficult to conceive how density-independent mortality of fish at the egg-to-fry stage, where fine sediment conditions most acutely affect survival, does not impair recovery and productivity of salmonid populations whose status is known to be declining or greatly reduced in abundance. By contrast, density-dependent mortality processes that prevail at other life stages can often be "absorbed" and biologically self- compensated at the population level in several ways (e.g., reduced density of juveniles may increase individual growth and thus per capita survival rates). In support of my point, please see Karieva et al. (2000) and Honea et al. (2009), who modeled life-stage specific survival of spring-run Chinook salmon to evaluate the magnitude of net effect of habitat change on whole-life-cycle survival and population trend. Both studies concluded that survival at the egg-to-fry stage generally is the most consequential stage, or is among the two most consequential stages, at which improvement in habitat conditions could increase population productivity and adult population size. Conversely, therefore, degrading spawning habitat conditions can have or has had the largest magnitude of negative life cycle impact.

Although Ecology has not facially disputed the conclusions in the preceding paragraph, at the same time Ecology's draft guidance is premised on assumptions that plainly contradict those conclusions. In particular, Ecology provides no biological or physical rationale to support the existence of a threshold in terms of acceptable or sustainable egg- to-fry survival or mortality. Nevertheless, in its draft guidance document Ecology advances the implicit assumption that deterioration and impairment of existing streambed sediment conditions in spawning habitat when below 20% fines (<2mm diameter) would not equal impairment. I see no logical basis in available science to assume that fine sediment conditions that currently exist below any given threshold metric are not impaired by any increase in sediment. In other words, there is no reliable evidence that a "safe level" of fine sediment exists (at 20% or any other concentration, and certainly not a concentration greater than 10%), nor that a given addition of human-caused fine sediment to any system, regardless of present state, would be free of harm and not cause impairment. See the next section of my comments for more detailed discussion of this concern.

To establish a threshold of safe and acceptable fine sediment conditions in a scientifically defensible way, Ecology would need to determine the prevailing fine sediment conditions in spawning habitat within streams where previously declining or depleted salmonid populations have been shown to have recovered, or at least to have demonstrated a sustained long-term recovery trend (e.g., survival to adult return increasing over at least three fish generations, or at least *ca*. 12-15 years). To my knowledge, and judging by what I have seen in the record of writing and presentations by Ecology, no such analysis has been conducted.

Response 1.3

Based on this comment and others, we have revised the narrative-based fine sediment criterion. We have removed parts of the narrative statement that was aimed at linking fine sediment to adverse effects on aquatic life, and replaced this text with a narrative

statement that is aimed at identifying water bodies with excess fine sediment that results in impaired water uses.

The thresholds provided in the implementation plan are intended to be screening level values for the identification of high prioritization sites for a fine sediment assessment. The thresholds developed are based on the available scientific literature, other state guidance, ecoregional data, or significant changes from background conditions. We have provided additional clarification in the implementation plan that the thresholds are intended to identify water bodies of concern for fine sediment and not necessarily used for an impairment determination alone.

We are not aware of field studies that have simultaneously examined long-term changes in fine sediment conditions and observed wild salmonid abundance over a 12-15 year period. If such a study were available, that information would be relevant to that water system and its defining characteristics but may not be applicable to all water bodies in the state. Other states have developed fine sediment assessment guidance based on similar methods as we have outlined in the implementation plan. We plan to develop reference values (e.g., ecoregional) that will be used for comparison to water body specific sediment conditions. Reference values will be developed from least disturbed sites of similar hydrography, ecology, habitat, and geology. Additional detail will be available during updates to the impairment listing methodology in Water Quality Policy 1-11, Chapter 1.

Comment 1.4

A key question pertaining to establishment of a fine sediment standard concerns the oft-assumed existence of some threshold concentration fine sediments, below which egg-to-fry survival is not measurably impaired. In regulatory terms, this equates to the assumption that a "safe level" of fine sediments exists; fine sediment increases are presumed to have no effect on survival until this threshold is breached. For example, this assumption is embraced in Ecology's Draft Guidance, e.g. on pp. 31-32. The threshold effect assumption is convenient because if true, it provides some rationale for establishing a fine sediment standard that confers regulatory flexibility to allow increases in fine sediment pollution in streams where spawning gravel conditions are currently excellent. That is, where fine sediment concentrations are well below a presumed "safe" threshold, fine sediment increases could be tolerated, permitted or allocated. However, that level of detail about consequences is seldom voiced to support a threshold-based criterion. Most often, a presumed threshold is simply considered by agencies as a convenient way to dismiss the probability of adverse impacts or injury over a broad sweep of conditions, with the intent of easing or simplifying a regulatory burden.

However, in the present context, as a scientific matter the assumption of a "safe" threshold for fine sediment is wholly untenable. During Science Panel meetings, supported by submitted published material, I contended that data from most available studies do not in fact support the existence of such a threshold, instead indicating a linear or possibly somewhat inflected curvilinear reduction in survival as fine sediments increased, beginning at fine sediment percentages of 10% or less.

Response 1.4

Thank you for the references. We agree with your assessment that single parameter based thresholds cannot be used to determine a fine sediment impairment. The intent is to identify human-caused sediment pollution programs, but not set a criteria for a level of sediment that is allowed when the cause of the sediment sources are natural.

We do not state in the implementation plan nor do we intend to make fine sediment impairment listing decisions based solely on single parameter based thresholds from the scientific literature. We may however, develop ecoregional reference values for some measures based on stream characteristics that will then be used for impairment listings or use background conditions to assess changes in sediment conditions over time. The thresholds values in the implementation plan are intended for use in screening for the prioritization of water bodies for a fine sediment assessment, with the exception of the fine sediment biotic index, which includes ecoregional reference values. The purpose of the screening level thresholds are to determine prioritization of fine sediment assessments when data is collected for only one parameter or data is missing to complete a fine sediment assessment. We state that if fines/sands exceed 20%, then additional fine sediment data should be collected and a fine sediment assessment should be prioritized. Of course, there are caveats to this type of screening level thresholds. For example, 20% fines/sands may be relatively low value in upper headwaters of a glacial fed stream. Stream type and site characteristics will be a key determinant on prioritization of sites for data collection in our environmental assessment program.

The implementation plan is intended to be guidance that may be useful for rule implementation but not all sections of the implementation plan will be directly transferrable to the impairment listing methodology. We have updated the implementation plan to clarify that thresholds are not aimed at making an impairment determination for a water body but rather used as a screening tool to identify high priority sites for a fine sediment assessment.

One avenue we intend to make impairment decisions is based on information collected from least disturbed reference sites that may be used to develop ecoregional reference values. This work will be done in collaboration with our Environmental Assessment Program and be provided in updates to our impairment listing methodology (Water Quality Policy 1-11) after finalization of this rulemaking. We encourage your involvement in the public process for the impairment listing methodologies.

Comment 1.5

Newcomb and Jensen's (1991) meta-analysis and synthesis examining fine sediment impacts across all fishes also identified no generalized "safe level" of fines, rather concluded the general pattern is for cumulative increases in harm with each increment of increase in suspended or deposited fine sediment. Regardless of this science, Ecology's draft guidance document embraces the presumption of a "no effect" threshold of fine sediment for salmonids of 20% fines (<2mm diameter), without citation, and with no response to the input I provided and the sources supporting it.

Perhaps the state-of-art publication on the nature of the relationship between survival of Pacific salmon eggs and fry and fine sediments in stream gravels is the meta-analysis by Jensen et al. (2009).

As I argued in Science Panel meetings, the best-fit curves do not support the notion that a "safe level" of fine sediments exists; instead they suggest decreasing survival with increasing fine sediment percentage across essentially the entire range of the data. In fact, the only clear threshold evident is that *above a value of roughly 30 percent fine sediments, coho and chinook survival declines to effectively zero*.

Of all studies considered in Jensen et al.'s meta-analysis, only one, Tappel and Bjornn (1983), suggests a threshold of no measured impact below about 15-20 percent fines (see Jensen et al., Fig. 2). It appears all others do not suggest such a threshold is present. It is curious that Tappel and Bjornn (1983) remains the most commonly cited paper on survival of chinook eggs and fry in relation to fine sediments, considering it is an extreme high outlier (across all levels of fine sediment) among comparable studies.

What does this all mean for a fine sediment standard? First, in the absence of locally or regionally specific data and a rigorous finding to the contrary, *no protective standard should assume a "safe threshold" of fine sediment exists*. Second, and consequently, *a narrative or quantitative standard should protect against any increase in fine sediment over existing conditions*. Third where and when existing fine sediments appear to be in excess of natural background (e.g., relative to fine sediment conditions measured at least-impacted reference sites in minimally altered watersheds), *a protective standard must mandate a trend of decreased fine sediment concentrations over time in sediment-impaired waters*. There is nothing unusual or impractical about establishing trend-based standards for fine sediment concentrations, especially in impaired waters; for a review and numerous examples, see the state of Idaho's *Guide for Selection of Sediment Targets for Use in Idaho's TMDLs* (Rowe et al. 2003).

Ecology's draft guidance offers no such clarity or direction to inform implementation to inform and enforce the proposed narrative criterion that "Water bodies shall not contain fine sediment (<2 mm) from anthropogenic sources at levels that cause adverse effects on aquatic life, their reproduction, or habitat…" In fact the so-called guidance defers not only the specific methods of implementation, it seems to defer on a vast portion of the general and specific scientific content that the Science Panel provided input on over multiple meetings. More specifically, the inclusion of a threshold value for percent fines in the "weight of evidence" example described in the draft guidance would essentially give all streams in Washington with a fine sediment concentration (fines <2mm diameter) a "free pass." This is so regardless of the fact that a stream with natural low mean concentration of fine sediment of 10 percent, for example, has or is expected to have the concentration of fines doubled to 19 or 20 percent. An examination of panel c in Figure 1 of Jensen et al. will clearly show that an increase from 10 percent fines to 20 percent fines is expected decrease the mean egg-to-fry-survival rate from 50% to roughly 17%. So for this simple example, a 66 percent loss of egg to fry survival would be permitted by Ecology under its suggested guidance. In my opinion, that does not remotely qualify as a protective standard. In fact it's an effective recipe to allocate future man-made sediment inputs and habitat degradation to the streams that are presently those least impacted and most productive. This should help

illustrate why it seems clear to me that Ecology has not adequately or accurately accounted for the available most relevant science in preparing the guidance document.

Response 1.5

Thank you for the references. We agree with your assessment that single parameter based thresholds cannot be used to determine a fine sediment impairment. The intent is to identify human-cause sediment pollution programs, but not set a criteria for a level of sediment that is allowed when the cause of the sediment sources are natural.

We do not state in the implementation plan nor do we intend to make fine sediment impairment listing decisions based solely on single parameter based thresholds from the scientific literature. We may however, develop ecoregional reference values for some measures based on stream characteristics that will then be used for impairment listings or use background conditions to assess changes in sediment conditions over time. The threshold values in the implementation plan are intended for use in screening for the prioritization of water bodies for a fine sediment assessment, with the exception of the fine sediment biotic index, which includes ecoregional reference values. The purpose of the screening level thresholds are to determine prioritization of fine sediment assessments when data is collected for only one parameter or data is missing to complete a fine sediment assessment. We state that if fines/sands exceed 20%, then additional fine sediment data should be collected and a fine sediment assessment should be prioritized. Of course, there are caveats to this type of screening level thresholds. For example, 20% fines/sands may be relatively low value in upper headwaters of a glacial fed stream. Stream type and site characteristics will be a key determinant on prioritization of sites for data collection in our environmental assessment program.

The implementation plan is intended to be guidance that may be useful for rule implementation but not all sections of the implementation plan will be directly transferrable to the impairment listing methodology. We have updated the implementation plan to clarify that thresholds are not aimed at making an impairment determination for a water body but rather used as a screening tool to identify high priority sites for a fine sediment assessment.

Comment 1.6

Employing reference sites to establish an estimated or assumed natural condition as a baseline is a valid approach to measuring and assuring stream resource protection for many physical and biological factors, including fine sediment. This approach is implemented in other states, including Idaho and California, to tailor quantitative criteria regionally and locally to ensure that narrative criteria are appropriate to potential natural conditions (Rowe et al. 2003). On a positive note, the draft guidance provided does acknowledge limitations of Ecology's reference site data for this purpose, and seems to make clear that the limitations need to be explicitly accounted for implanting this approach. That said, no road map or direction is provided to suggest what the limitations of the data might be, and how they might be accommodated and accounted for in an effective analysis. By contrast, in Idaho's guidance (Rowe et al. 2003) includes or refers to numerous examples of *a priori* analysis to systematically stratify streams by ecoregion and

empirically validate potential benchmark fine sediment conditions by stream geographic grouping.

It has been extremely disappointing to me that during the process of development of the narrative standard and proposed draft guidance, Ecology never produced a shred of data from reference sites, let alone a simple example of how such a comparative analysis might be conducted, to offer to the science panel for review. I was extremely frustrated by this lack of an example to validate the concept and provide specifics of a methodology, because in theory it could be a key approach and a cornerstone of a protective standard. However, through other research experience I am familiar with some concerning limitations with Washington's reference site data. These limitations mean that exactly how these data are selected for relevance, screened for quality assurance, then qualified, summarized, and analyzed to establish a benchmark, are all critical to assure accurate assessment of potential conditions, hence effective resource protection, will result. Whether by intent, or through inability to muster the person-hours to follow through, Ecology kept all of these critical questions of reference site data limitations, appropriate analytic design, and other aspects of quality assurance off the table and outside the scope of Science Panel review.

Response 1.6

Our intention with the discussion on reference values in the guidance, provided as part of the Implementation Plan, was to introduce the concept that will be finalized after adoption of the narrative fine sediment criteria. Following adoption of this rule, we will use the information gathered regarding sediment and habitat measures to finalize specific methodologies for determining impairment. The implementation plan presents draft guidance on the tools and methods to be used for future updates to the impairment listing methodologies. Additional details will be provided in the months following finalization of this rulemaking. We have begun collaborations with our environmental assessment program (EAP) to develop reference conditions by region. EAP has already committed resources to this development and will be in contact with the water quality standards and assessment personnel to develop a cohesive and comprehensive approach to reference conditions. The reference value approach will be used in finalizing a fine sediment impairment listing methodology to be incorporated in Policy 1-11. We encourage you to continue your involvement in actions proceeding this rule development if you are interested in impairment listing methodologies and other implementation actions.

Comment 1.7

The "weight of evidence" approach rather loosely proposed by Ecology on p. 21-32 of the draft guidance document suffers from several conceptual and operational problems that in my opinion would very likely result in bad decisions that would fail to be protective, and would allow or permit impairment of salmonid spawning habitat. It almost seems as if the procedure was intended to ease the path toward putative support of decisions that would result in increased fine sediments and impairment of spawning and incubation habitat, especially in higher-quality areas (see discussion above). The problems all partially overlap and interrelate, but they can be enumerated as follows: 1) an unqualified assumption of parity among different categories and sources of information; 2) the lack of any screening process to assess what are sure to be fundamental relevance, veracity, reliability and uncertainty of data from the different categories;

3) the lack of a weighting process to give greater credence to more reliable data sources and types; and 4) built-in incentives to cherry pick what data are included in the assessment, and to include poor quality data to deliberately offset the implications of higher-quality data. That is, data with low sensitivity, reliability and relevance could be introduced to "stack the deck" and cancel out the clear implications of date with high sensitivity, reliability and relevance.

The most likely outcome from applying this scheme as described by Ecology is be doubly concerning, from the standpoint of protecting salmonid spawning and incubation habitat. First, prediction of adverse effects of fine sediment increases can easily be watered down with regard to magnitude of impact and the certainty of the determination. Second, and equally important, the prediction of presumed benefits from actions intended to reduce fine sediments could be greatly inflated and exaggerated. Either of these outcomes would jeopardize the ability of Ecology to implement the narrative standard in a way that ensures protection and (where necessary) restoration of spawning habitat, fish populations, and fisheries. It is easy to anticipate that those outcomes are pretty much the same in process and outcome to the prevailing status quo, which as ESA listings of salmonids abundantly demonstrate, are systematically non-protective.

The literature on environmental assessment offers a number of general logical and practical criteria that should be applied to accurately inform a weight of evidence approach to decision-making (e.g., EFSC Scientific Committee 2017, USEPA 2016, Hull and Swanson 2006). That literature also makes clear the many ways a weight of evidence approach can fail, whether through ignorance or deliberate manipulation, if it is naively or artfully applied. Ecology offers no hint that these lessons and methods to guard against misapplication have been considered or are in place here to ensure the proposed weight of evidence approach is sound.

Response 1.7

We express concern over your opinion that the weight of evidence approach and associated implementation methodologies are intended to ease that path towards decisions that will result in fine sediment increases and impairment of designated uses. Our goal in this rulemaking is to the contrary. We have developed methods to measure fine sediment that are feasible to measure, validated and approved, and have association with sediment conditions. We support the fine sediment based parameters identified in the implementation plan and technical support document, just as other states have done.

In the rulemaking portion of this rule, we have described a narrative criterion for fine sediment that is to be implemented and identified draft methodologies to make an impairment decision. The narrative criterion and associated approaches for impairment listing methodologies are similar to other states but differ in some aspects. The approach detailed in the implementation requires a degree of confidence for decision-making. For example, statistical analysis may be used to compare reference values to measured water body conditions. We are not seeking to predict adverse effects but rather, identify water and sediment conditions of water bodies that will not support the designated uses due to human derived sources of sediment pollution. The measures identified provide data pertinent for making such an evaluation. Details that you seek in regards to implementing

a weight of evidence approach, data requirements, and comparisons between water bodies and reference values will be completed following the finalization of this rule.

Thank you for the information regarding the weight of evidence approach. We will take these thoughts and literature into consideration when finalizing the fine sediment impairment listing methodology. The weight of evidence approach is based on the need to measure multiple fine sediment related parameters from different environmental compartments. Any decision to weight one parameter over another would be a policy decision that is subject to public review. While we remain open to the concept, there are inherent difficulties in weighing parameters based on best judgement. Each parameter considered is important in the assessment of fine sediment. Making a decision on the relative importance of each parameter is an inexact science. This is because relationships between fine sediment based parameters and biological responses and/or impairment of water uses are not fully developed for individual parameters. We have added text to Appendix A of the implementation plan that discusses weighing fine sediment based parameters as an option for impairment listings.

We have selected parameters that are strong indicators of fine sediment conditions and stream health. Many of the selected parameters are used by other states and in fine sediment assessments in environmental programs throughout the nation. The majority of the selected fine sediment based parameters are used by EPA's environmental monitoring and assessment program (i.e., percent substrate, relative bed stability, bioassessment of macroinvertebrates) or recommended in water quality standards (i.e., intragravel dissolved oxygen). The information provided by the selected fine sediment based parameters coupled with background information and reliable reference site information provides the framework to make a determination on sediment conditions.

As discussed in the science advisory group, there is no gold standard method for assessing fine sediment. EPA does not have 304(a) recommendations for fine sediment, and each state implements their fine sediment criterion differently (Berry et al. 2003). We appreciate the information and encourage detailed and valid alternatives to the approach outlined in the implementation plan and future water quality assessment methodologies for fine sediment.

References

Berry, W., Rubinstein, N., Melzian, B. and Hill, B., 2003. The biological effects of suspended and bedded sediment (SABS) in aquatic systems: a review. *United States Environmental Protection Agency, Duluth, 32*(1), pp.54-55.

Comment 1.8

Besides the above-mentioned lack of procedures and criteria for assessing the relative relevance, veracity, reliability and magnitude of impact of information, Ecology's example is tainted by the imposition of arbitrary, undefended and likely indefensible assumptions about cause and effect and biological responses to sediment conditions. The most obvious example is Ecology's invocation in its example of a <20% fine sediment level as a "pass" criterion. As described above, this criterion is not defensible in the face of available scientific research. I am certain had

provision been made for the Science Panel to review this proposal before its publication, this aspect of the proposed approach, among others, would have been roundly criticized. Nevertheless, the example serves as a highly instructive illustration of how a carelessly defined and non-peer-reviewed procedure for a weight of evidence approach can too easily produce outcomes that fail to protect the target beneficial use.

Response 1.8

We do not anticipate that sites that are below thresholds for a given parameter will be categorized as undisturbed or ideal sediment conditions. Rather, if only partial information is available for a given site, the threshold screening approach may help focus limited resources on selected water bodies. The thresholds provided are not intended to be part of the impairment listing methodologies unless they are representative of reference sites or ecoregional reference values.

Comment 1.9

Ecology repeatedly insisted during Science Panel meetings that Ecology was specifically not interested in entertaining independent peer input on specific means of implementing a standard or narrative criterion. Several times various Science Panel members pointed out the problem that this limitation severely constrained the ability of the panel to evaluate and offer comment on the defensibility, feasibility, and potential effectiveness of Ecology's proposed narrative standard for fine sediment. Both the means of measurement of fine sediment and the relationship between fine sediment conditions and biological uses, including fish survival, are clearly matters of scientific endeavor, and the Science Panel members demonstrated extensive and deep expertise in these matters. Preventing the Panel from assessing and providing input on specific implementation guidance essentially equated to disallowing Science Panel members from being able to form opinions on the adequacy of a proposed standard, especially given how vague and general the proposed narrative standard is.

The proposed very general narrative criterion could in theory be protective if adequately implemented—but it could also be wholly non-protective if not adequately and rigorously implemented. The draft guidance piece belatedly document provided by Ecology does little to inspire a presumption of adequate and rigorous implementation, as outlined in my comments above. In sum, I was personally very disappointed in Ecology's management of the science panel process and in particular the deliberate limitations established to prevent the panel from reviewing implementation guidance.

In the its present form—that is, in the absence of rigorous, feasible guidance refined and supported by peer review—the proposed narrative criterion for fine sediment is little more than a tautological restatement of the agency's plain legal imperative. It's as if the Clean Water Act asks, "What will the state of Washington do to protect spawning habitat to support fisheries beneficial uses and meet ESA obligations for listed fish species?" and after one or two years of deliberation (following at least four decades of foot-dragging), the state's reply is "Yes the state of Washington will do something to protect spawning habitat." If this were how one of my students answered an exam question, I would alas be obligated to score it a zero.

Response 1.9

The primary objective of the science advisory group was to discuss the available science regarding freshwater dissolved oxygen protection levels for early life stages of salmonids and discuss viable methods used to characterize fine sediment. The scope of advisory group is determined by Ecology and is not a requirement of rulemakings. While we are very appreciative of the science advisory group efforts, implementation was beyond the scope of setting specific protective biologically based criteria, but rather focused on the most appropriate parameters and methods to characterize excess fine sediment. Our intention in stating that we do not wish to focus on implementation was to make clear difficulties in attaining water quality standards for future permitting or TMDLs should not be involved in discussion of determining biologically protective criteria. Our statements were not meant to limit implementation discussions in regards to what methods are best to determine a fine sediment impairment.

The next step in this process is to finalize detailed methodologies for determining a fine sediment impairment. During this process, stakeholders will be afforded an opportunity to discuss implementation of the narrative criterion. We look forward to additional feedback in the near future.

2 – Fryt, Marc

Comment 2.1

As a resident of Spokane, and professional fly fishing guide on the Spokane River, I support the revisions to the water quality standards. Protecting spawning beds and invertebrates is a crucial step in bringing the numbers of salmon, steelhead, and trout back up. The Spokane River is flooded with debris and silt during the high water months from Hangman Creek, and this devastates trout spawning opportunities. We need these revisions and protections in order to make the Spokane River a vibrant fishery once again.

Response 2.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat.

3 – James, Alan

Comment 3.1

I am a volunteer streamkeeper in BC and involved in a study about the effects of road salt on juvenile salmon. We hope to update Canadian federal water quality standards based on the results of the study. Would you please consider including electrical conductivity standards in your new regulations and let me know if you want me to send you updates on our study.

Response 3.1

Comment noted. We appreciate the suggestion to add electrical conductivity standards into our regulations. This rulemaking covers only proposed changes to fresh water dissolved oxygen and the addition of a fine sediment criterion. Other new or revised

criteria (such as electrical conductivity) would be a future rulemaking effort that is not currently under consideration.

4 – Jamestown S'Klallam Tribe

Comment 4.1

Salmon and shellfish are important to the Tribe's culture and to its ongoing prosperity. Access to treaty protected natural resources is the responsibility of the federal government. EPA has granted Washington State the authority and responsibility to protect water quality. The State and EPA have largely failed to protect water quality and salmon, and this has a very large cost to the Tribe. It is encouraging to see this rule making effort tackling water quality degradation that is damaging salmon habitat and killing salmon.

Response 4.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat.

Comment 4.2

There are many places in the proposed rule where the language should be clarified to improve both the substance of the rule but also the ability to functionally implement the rule. Please see and address the EPA recommendations submitted December 16, 2021, where they have identified several needed changes.

Response 4.2

Comment noted. Ecology's responses to EPA's recommendations are found in Comment 13 of this document.

Comment 4.3

It is great to see the importance of intergravel dissolved oxygen discussed and highlighted in this rulemaking; however, not all salmon life stages happen in the gravel, so it is not acceptable to allow only intergravel D.O. concentrations to determine if a water body meets the D.O. standards.

Response 4.3

We agree that intragravel D.O. concentrations are not reflective of protection levels for other life stages in the water column. We have modified the rule language for dissolved oxygen to include a 9.0 mg/L water column protection level requirements when intragravel D.O. concentrations are equal to or greater than 8.0 mg/L.

Comment 4.4

While encouraging, the proposed rule does not go far enough. Governor Inslee recent comments on the urgency and immense challenge that we face recovering salmon and orca are important guidance to this process. It is imperative that WA Department of Ecology enact protective rules to ensure that water pollutants don't kill salmon or degrade the habitat that the State, Federal

Government and Tribes are expending immense resources to restore. Please move quickly to strengthen and clarify the proposed rule and please move quickly put the rule into effect.

Response 4.4

We agree that protection for the state's fresh waters, including for protection of salmon spawning habitat, is a high priority. Ecology has worked expediently and diligently to incorporate the proposed rule into the Washington Administrative Code.

5 – Klickitat County

Comment 5.1

We appreciate that multiple parameters will be available to demonstrate compliance with the more stringent D.O. criteria, including water column D.O., oxygen saturation, and intragravel D.O. This is helpful to local jurisdictions in multiple ways. It will help prevent unwarranted 303-d D.O. listings by accounting for environmental and site-specific conditions that affect D.O. levels, and help us better understand the cause of D.O. impairments (e.g. temperature vs. nutrients) and develop appropriate management responses.

Response 5.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat, which includes use of multiple parameters to demonstrate compliance with the D.O. criteria.

Comment 5.2

However, we request that historical water column D.O. measurements not be used to determine impairment under the new, more stringent water quality standards. The new rule provides multiple criteria to demonstrate compliance, while the old rule utilizes only water column D.O., which Ecology has recognized does not account for the influence of temperature or elevation, or account for site-specific conditions in spawning gravels. Carrying old D.O. water column measurements forward and applying them under the new, more stringent criteria could result in 303-d D.O. listings that are unwarranted. Rather, we request that Ecology utilize only new measurements that evaluate multiple D.O. criteria to determine D.O. impairment.

Response 5.2

We generally evaluate data collected within the last ten years for our water quality assessment. For historic water quality determinations that have no new data within the assessment window, our policy has been to carry forward those water quality determinations, even if the standards for that waterbody have changed. This policy stems from EPA's requirements that a waterbody can only be removed from the 303(d) list if: 1) newer data demonstrates attainment of designated uses; or 2) a total maximum daily load has been developed for that waterbody. Following rule adoption and approval, implementation of this policy in future water quality assessments will not result in any new 303(d) listings based on the previous water quality standards. In future water quality assessments, any past water quality determination with data present within the assessment window will be evaluated based on the updated criteria, and we will update water quality

determinations accordingly. For those impaired waterbodies with no new dissolved oxygen data in future assessment cycles, more data should be collected to update the water quality determination to enable a comparison of more recent data against the new water quality standards.

Comment 5.3

Should Ecology choose to carry forward historical measurements, we request that Ecology allow local jurisdictions time to conduct additional D.O. sampling in advance of the next Water Quality Assessment. It will be important to collect oxygen saturation and/or intragravel D.O. measurements to determine whether 303-d listing is warranted. This applies both to waterbodies previously categorized as Category 5 for D.O. impairment and those at risk of 303-d listing under the more stringent criteria (e.g. Category 2 waterbodies). We request time to complete this supplemental sampling, and where possible, Ecology's technical and/or financial assistance for sampling to ensure that unwarranted 303-d D.O. listings are not advanced.

Response 5.3

Yes, in future water quality assessments we intend to carry forward historic water quality determinations with no newer data. See response to Comment 5.2 for more information.

Once EPA approves a water quality standard, that standard is immediately in place for all Clean Water Act regulatory purposes. Ecology is also required to submit our water quality assessment based on all credible and readily available data to EPA every two years. If EPA approves these standards prior to completion of the next water quality assessment, we are obligated to 1) continue to meet our WQA submittal requirements and 2) utilize these new standards in any future water quality assessments. In such a case, we will utilize any credible and readily-available data relevant to the new standards to update water quality determinations, and we will carry forward historic water quality determinations until newer data are available.

6 – Moran, Bridget

Comment 6.1

I fully support the proposed changes to chapter 173-201A of the WAC. Adding thresholds for IGDO is essential for the maintenance, restoration, and monitoring of suitable juvenile salmonid habitat.

Response 6.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat.

Comment 6.2

A general suggestion that I'd like to make is the inclusion of native lamprey in this chapter. Pacific lamprey, western brook lamprey, and western river lamprey are all native to Washington rivers. Their presence in these rivers benefit salmonids in numerous ways, including their ability to oxygenate fine sediment, decrease sediment hardness, and increase nutrient cycling, and their

contributions to bioturbation. Pacific lamprey and western river lamprey are both state priority species and federal species of concern. While I recognize that there is language stating that "It is required that all indigenous fish and nonfish aquatic species be protected in waters of the state...," I believe that because of their priority and status as native fish, and the benefits that they provide to juvenile salmonid habitat, native lamprey warrant an explicit call out in this chapter. I suggest adding them to the key species listed on page 6 and in the tables thereafter.

Response 6.2

We agree that native lamprey are important to the ecosystem and are key species in the Pacific Northwest. However, modifying the aquatic life designated uses in the water quality standards is beyond the scope of this rulemaking. We encourage additional studies on lamprey sensitivity to water quality conditions and toxics. Such information can be evaluated to determine if the current water quality criteria is adequately protective of lamprey. At this time, we do not have any information that suggests that the water quality criteria should be more stringent to protect lamprey. We encourage additional studies to confirm the assumption that salmonids are the most sensitive species in Washington State and that protecting salmonids results in the protection of lamprey.

Comment 6.3

Additionally, on page 6, under (1)(a)(v), O.mykiss is spelled incorrectly.

Response 6.2

Thank you for pointing out this error. This has been corrected for the final adopted rule.

7 – Naiman, Robert

Comment 7.1

This proposed rule change/addition is vitally important for maintaining salmonid populations in a healthy state. I strongly urge the commission to adopt the rule change/addition designed for maintaining acceptable oxygen levels within stream and river gravels. It is absolutely essential for assuring that the remaining salmonid populations have the conditions needed for successful reproduction.

As a professor at the University of Washington for over 20 years, it was a tenet of my classes in River Ecology and in Watershed Management – as well as in my research program – that adequate oxygen levels needed to be maintained in the gravels for the eggs and the newly hatched fry. Excess fine sediments effectively prevent the flow of surface water to the subsurface (hyporheic) zone and thereby not only compromise the eggs/fry but also the other organisms in that habitat. Excess fine sediments turn the gravels into “dead zones”; a zone that no longer functions as productive habitat for fish, insects, or beneficial microbes. Maintaining gravel substrates in a good ecological state is key to maintaining the overall productivity of streams and rivers.

Response 7.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat.

8 – National Council for Air and Stream Improvement, Inc.

Comment 8.1

1. *Inclusion of percent saturation in D.O. criteria language is important to account for temperature variation*

Ecology's review and discussion of Freshwater Intragravel Criteria Development (Brown and Hallock, 2009) concluded that a percent oxygen saturation criterion may be a more feasible measure of oxygen conditions to protect spawning gravels than raising instream oxygen concentration criteria. This is because percent saturation (D.O.% saturation) accounts for the effect of temperature and barometric pressure (elevation often used as a surrogate) on D.O. concentration. We concur that inclusion of percent saturation in D.O. criteria language is more reasonable than implementing concentration-only criteria given the wide range of environmental conditions that affect D.O. concentration.

Importantly, the inclusion of D.O.% saturation as well as D.O. concentration allows for flexibility in D.O. conditions associated with changes in temperature or barometric pressure that may physically preclude attainment of D.O. concentration criteria. Brown and Hallock (2009) describe that D.O.% saturation may be a more direct approach to identify anthropogenic alterations on oxygen capturing activities that affect aeration rates, addition of nutrients, low-oxygen discharge, or substances with biochemical oxygen demand.

Response 8.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat. We agree that the application of concentration-based D.O. criteria as well as oxygen saturation criteria are needed to account for variable aquatic systems and environments.

Comment 8.2

2. *Achievability of proposed water column D.O. concentration criteria in Washington State reference streams*

Although Ecology has provided background on the motivation for re-visiting existing D.O. criteria, there remains concern as to whether proposed D.O. criteria are achievable even in reference streams. Ecology's analysis indicates that 20.6% (13 of 63) of 'least impacted reference sites' would not meet either the proposed water column D.O. concentration or D.O.% saturation criteria (Table 6 in Preliminary Technical Support Document (TSD)). Importantly, Table 6 identifies the number of sites that do not meet 95% saturation, which is not the proposed saturation limit. No assessment of the number of reference sites that do not meet the 90% saturation criteria is presented in the TSD, but Brown and Hallock's 2009 analysis indicates 34% of ambient stations in Washington would not meet the proposed 90% criteria. It is also unknown whether these streams would meet intragravel D.O. criteria. The underlying data in Ecology's evaluations represent a single timepoint field measurement and is not representative of the actual

minima of these sites, which suggests that more than 20% of their reference sites would fail to meet the proposed water column criteria if diel and seasonal variation were evaluated. Recent temporally-detailed D.O. concentration data available from 9 USGS stream gaging stations in Washington[1] show that, over the course of a year, all 9 sites would be listed as impaired based on the proposed D.O. concentration criteria (Figure 1; D.O.% saturation is not available). Most of these are large rivers ranging in size from 33 km^2 to 14,500 km^2 (drainage area information not available for all sites) likely reflecting a variety of land uses.

[1] https://waterwatch.usgs.gov/wqwatch/map?state=wa&pcode=00300

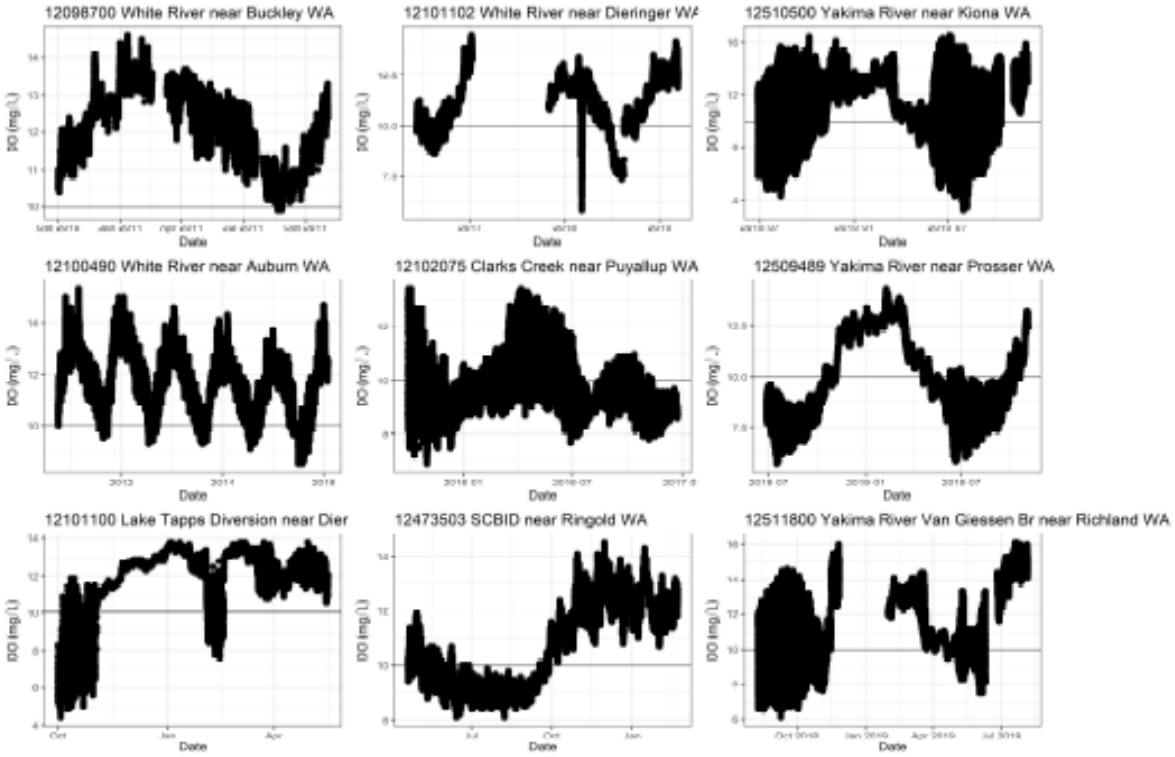

Figure 1. Temporal DO concentration (mg/L) from nine Washington State waterbodies described by USGS gage number and location.

Response 8.2

We have added information to the Technical Support Document that shows the percentage of relatively undisturbed and minimally disturbed reference sites that do not meet 90% saturation. Overall, 4 out of 63 (6.3%) relative undisturbed sites do not meet 90% saturation only, and 13 of 57 (22.8%) minimally disturbed sites do not meet 90% oxygen saturation. Brown and Hallock (2009) indicates that 34% of ambient stations do not meet 90% saturation. However, if you review Table 3 of Brown and Hallock (2009), only 26% of stations are not meeting 11 mg/L or 90% saturation. The percentage of stations not meeting the proposed criteria of 10 mg/L or 90% (or 95% for Core Summer Salmonid Habitat) saturation will likely be less. Furthermore, the proposed criteria offers additional options in that you may measure intragravel dissolved oxygen to determine if protection levels of 8.0 mg/L are met alongside water column levels of 9.0 mg/L. This

option refines the ability to determine if oxygen levels are protective in a water body and may further lower the percentage of ambient stations not meeting dissolved oxygen criteria.

We understand your concern regarding the percentage of sites that do not meet 90% saturation. However, the Brown and Hallock (2009) analysis is based on all ambient stations monitored, including those stations that may be heavily impacted by humans. We cannot make a determination on whether the 34% of ambient sites not meeting 90% saturation should or should not be listed as impaired for dissolved oxygen. This is dependent on natural environmental conditions and human impact. There is a possibility that 34% of the ambient stations measured for dissolved oxygen should be listed as impaired and cleanup plans should be implemented. An analysis of undisturbed and minimally disturbed sites found fewer sites listed as impaired at a 90% saturation criterion. Regardless of impairment rates, our goal is to make a determination on what is protective of salmonids without regard to impairment listing status for water bodies.

Reference

Brown C, Hallock D. 2009. *Washington State dissolved oxygen standard: a review and discussion of freshwater intragravel criteria development*. Washington State Department of Ecology. Publication No. 09-03-039.

Comment 8.3

3. *Listing process for waterbodies that do not meet D.O. criteria is unclear*

Ecology has indicated in their Preliminary Technical Support Document and Preliminary Rule Implementation Plan associated with the proposed Salmon Spawning Habitat Protection Rule that current waterbodies identified through the Water Quality Assessment process as impaired for D.O. may be a result of nutrients or temperature-related D.O. reductions. They follow that the oxygen saturation component will allow the focus of a TMDL to shift towards addressing temperature issues to resolve D.O. limitations, where needed, and that the addition of an oxygen saturation component to the D.O. criteria allows for a more accurate list of D.O. impairments for nutrients rather than temperature. Under the current Technical Support Document and Implementation Plan, it is unclear how waterbodies that fail to meet D.O. criteria will be listed, or how Ecology will determine whether failure to meet D.O. criteria is attributable to elevated temperatures or nutrients. Ecology should update these documents with this information to ensure full transparency to stakeholders.

Response 8.3

We define the methods for determining impairment of designated uses in the water quality assessment in our WQP Policy 1-11 Chapter 1 Washington's Water Quality Assessment Listing Methodology to Meet Clean Water Act Requirements.[6] Methods used to determine water body impairment differs from determining compliance with the water quality standards. Water quality standards are based on magnitude, frequency, and duration, and thus, an exceedance of standards does not always equate to a water body

[6] https://apps.ecology.wa.gov/publications/documents/1810035.pdf

impairment. Water body impairment listing methodology considers historical data, robustness of data, and frequency of exceedances of water quality standards. We anticipate updating our water quality assessment methodology within eighteen months of rule adoption. In the updated methodology, we will detail the process and data requirements necessary for delineating between nutrient and temperature related dissolved oxygen impairments. In future water quality assessments, oxygen saturation data may be used to make the distinction between elevated temperature and nutrient driven impairments. However, some water bodies may not have oxygen saturation data, and thus, the root cause of the impairment determination may not be possible without further analysis of other water quality parameters.

Comment 8.4

4. *Implementation guidance for fine sediment narrative criterion is not sufficiently developed*

Ecology does not currently have rule language that specifically describes a protective fine sediment criterion, nor does it specify when fine sediment is impairing aquatic life. Because a quantitative relationship between fine sediment-based parameters and a biological effect could not be established based on the current scientific literature or from feedback from a Science Advisory Group, and in recognition that a single numeric value cannot adequately describe a dynamic waterbody and the geological processes related to fine sediment inputs, Ecology has proposed a narrative criterion for fine sediment. While we agree that it is inappropriate to establish numeric criteria in the absence of clear cause-effect relationships and indicator thresholds, the proposed narrative criteria are premature because Ecology has not sufficiently developed implementation details to determine waterbody attainment of proposed fine sediment criteria. The Science Advisory Group convened on this topic strongly recommended that Ecology present an analysis of whether their proposed metrics and thresholds, or weight of evidence threshold will identify sediment-impaired waterbodies. This has not been completed, and it is unclear whether the proposed implementation approach will accurately identify sediment-impaired waterbodies or whether these impairments translate to adverse effects on salmon spawning success. We urge Ecology to present these analyses to a Scientific Advisory Group so they may provide data based insight into the appropriateness of rule language.

Response 8.4

We have revised the rule language for the narrative based fine sediment criterion to remove the reference to making a determination and correlation between sediment conditions and adverse effects on aquatic life. The new language clarifies that excess fine sediment from human derived sources shall not impair water uses. This aligns with the water quality assessment impairment listing methodologies we intend to finalize in the future.

The details of the impairment listing methodology will not be complete in this rulemaking process. Once the narrative criteria are adopted into rule, Ecology will then focus on finalizing specific methodologies for interpreting the narrative criteria. The process of first finalizing rule language and secondly finalizing methodologies to implement rules is standard practice for the development of any narrative criteria. The details you seek will be presented through a public process to update the Water Quality

Assessment Listing Methodology (Policy 1-11) within 18 months of the finalized rulemaking. We encourage your comment on future changes to Policy 1-11 for fine sediment and dissolved oxygen criteria.

Comment 8.5

5. *Ecology's protocols for sediment characterization may not adequately measure endpoints described by rule language*

Ecology has emphasized their interest in using existing Ecology protocols for sediment characterization (as outlined in TSD). Maximizing the value of existing data is useful to support an understanding of site characteristics and waterbody-sediment relationships, but Ecology should adapt their methods to meet the objectives of their proposed rule. For example, for visual estimates of percent surface substrate (TSD page 30), Ecology's protocol measures substrate across the bankfull channel (i.e. the stream channel extending to the stage where a stream begins to overtop its banks and spread into the floodplain), and not the wetted channel as recommended by EPA (Bryce et al. 2010). In their own data analysis relating surface fines to macroinvertebrate indices, Ecology acknowledges that this approach is flawed, and notes the importance in following EPA recommendations to focus on the wetted channel. Ecology corrects this issue by simply adding 5.5% to their measurements of percent sand fines (Larson et al. 2019). However, if this measurement will be used as a required metric for determining attainment of fine sediment criteria (as currently outlined in the Implementation Plan), Ecology should follow the best available science (i.e., EPA guidelines, Bryce et al. 2010) and use only wetted channel metrics rather than applying a correction factor to accommodate historic monitoring methods. Ecology protocols for other proposed metrics should also be scrutinized to ensure that they adhere to current, best-available science.

Response 8.5

In the Ecology's Watershed Health Monitoring program protocols, water depth is recorded alongside each sampling station within transects. Therefore, Ecology may choose to use only percent substrate data from the wetted channel for determining impairment listings. This determination will be easily made because percent substrate data without corresponding water depth data may be excluded from an assessment. These details will be explained further in the updates to the impairment listing methodology (Water Quality Policy 1-11). We have updated the implementation plan to add this additional information. We appreciate your concern regarding data collection methods and the appropriate information in a fine sediment assessment.

Comment 8.6

6. *Fine sediment criteria and proposed methods may be unsuitable for large rivers*

Ecology's proposed fine sediment criteria and methods for evaluating fine sediment are inappropriate for large rivers, which are likely to be designated as salmonid spawning, rearing, and migration uses. The methods proposed for fine sediment have been developed for small streams. For example, the Fine Sediment Biotic Index (FSBI) was developed with 1st to 5th order streams (Relyea et al. 2012). The exclusion of larger rivers in index development was likely because macroinvertebrate community composition varies with longitudinal river distance as predicted by the River Continuum Concept (Vannote et al 1980). Similarly, sites in large

rivers are expected to have greater sediment loads than headwater and mid-reach river sites. It is unclear if the FSBI has been validated for large rivers, but Ecology recognized that macroinvertebrate and sediment metrics are distinct in large rivers because these were excluded from a statewide assessment of macroinvertebrates and environmental stressors (Larson et al. 2019). Larson et al.'s analyses included Ecology's 0, 1st, 2nd, 3rd, and 4th + order streams in their site selection process, except those on tribal and federal lands, but state, "We also excluded tidal streams, streams in constructed channels, and great rivers (i.e. the Columbia River and lower Snake River) since samples from these types of sites would likely have contained very different macroinvertebrate communities." In addition to the FSBI, a proposed required metric for fine sediment assessment is a visual estimate of percent substrate. Such evaluations are typically conducted across transects in wadable streams, and more challenging in larger rivers due to water depth or turbidity limiting view of the substrate. Although Ecology has developed "wide" protocols for non-wadeable streams that involve measurements in the wadeable stream margins, these may not accurately reflect sediment characteristics at these sites. This is particularly true during the required sampling period (July 1-October 15) when flows and current velocity are lower, and deposition of water column sediment is likely to occur. Because Ecology has not examined biological and environmental patterns with respect to size or stream order classifications, it is not clear whether there are also differences across spatial scales within Ecology's existing macroinvertebrate and sediment datasets. As such, the application of proposed criteria to all streams would appear premature in the absence of information from large, non-wadeable streams. Ecology should evaluate existing data in the context of stream size to ensure that proposed criteria and assessment approaches are appropriate for all waterbodies.

Response 8.6

We understand your concern regarding data collection on non-wadeable (larger) streams. Stream assessment on non-wadeable streams and analysis of streambeds can be more difficult than wadeable streams. As stated, Ecology has developed "wide" protocols to collect pertinent information for non-wadeable streams. These methods are adapted from EPA methodologies (Kaufmann et al. 2000; USEPA, 2009). Visual assessment of substrate and macroinvertebrate data collected for non-wadeable streams should be consistent throughout the state. Thus, reference sites should be appropriately selected within a given ecoregion that are similar in Strahler order, Rosgen channel type, or stream classification to ensure that similar protocols are being used between site comparisons or ecoregional reference values. Site-specific comparisons to reference values should use data that was collected using similar methods with streams that have similar qualities. However, we must recognize that no two streams or ecoregions are the same and selecting a reference value or location will be associated with some uncertainty. We have added additional information to the implementation plan to reflect these considerations for non-wadeable rivers.

The fine sediment biotic index (FSBI) was developed using data from ≤5th order streams (Relyeah et al. 2012). However, the sensitivity of the taxa to fine sediment is not anticipated to change based on stream size. At this time, there is no indication that the FSBI is not applicable to higher order or non-wadeable streams.

When we finalize the impairment listing methodology for the narrative based fine sediment criteria, more specificity will be provided surrounding applicable approaches to wadeable versus non-wadeable streams.

References

Kaufmann PR. 2000. Physical habitat characterization—non-wadeable rivers. Pages 6.1–6.29 in J. M. Lazorchak, B. H. Hill, D. K. Averill, D. V. Peck, and D. J. Klemm (eds.), *Environmental monitoring and assessment program—surface waters: field operations and methods for measuring the ecological condition of non-wadeable rivers and streams*. U.S. Environmental Protection Agency, Cincinnati, Ohio.

Relyea CD, Minshall GW, Danehy RJ. 2012. *Development and validation of an aquatic fine sediment biotic index*. Environmental Management, *49*(1): 242-252.

USEPA. 2009. *National Rivers and Streams Assessment: Field Operations Manual*. EPA-841-B-07-009. U.S. Environmental Protection Agency, Washington, DC.

9 – Northwest Environmental Advocates

Comment 9.1

Proposed WAC 173-201A-200(1)(h). One primary problem with this proposed criterion is in the last sentence in which it refers to the use of "least disturbed conditions" of reference sites. The concept of "least disturbed" implies, correctly, that reference sites are generally somewhat disturbed by anthropogenic activity. The mandatory ("shall be compared") use of least disturbed conditions as a method of applying a criterion that prohibits ("shall not contain") anthropogenic sources of fine sediment is both illogical and inconsistent. The phrase "shall be compared" is just a process but it does not establish an explicit benchmark or rule; likely Ecology means that the information from the reference sites will inform its decision about whether anthropogenic sources have contribute fine sediment. For these reasons, we propose the following language as a replacement:

> When reference sites are used, benchmark natural sediment conditions shall be determined by reference to measured conditions at sites and within watersheds that represent least disturbed conditions, selected within neighboring or comparable water bodies, and screened to assure that the reference site conditions do not reflect temporary fine sediment increases associated with infrequent natural events, or sustained elevation of fine sediment from past human disturbances.

For an explanation of the need for this additional language regarding the need for screening reference site conditions, please see the comments attached by Dr. Christopher Frissell.

Response 9.1

We appreciate the inclusion of Dr. Frissell's comment letter, and Ecology has responded to those comments separately in this document (*See* Comment 1).

We have modified the narrative based fine sediment criterion to assist in clarifying how reference locations will be evaluated. We added rule language that states that when reference values are used, measured conditions should be representative of least disturbed conditions of a comparable water body or ecoregion. We then state that reference locations should be comparable in hydrography, geology, ecology, and habitat to the water body being evaluated. This modification of the rule language provides guidance for the development of reference conditions.

It is important to note that reference values are not the only method to determine a fine sediment impairment. Changes in background or trend information may be applicable where historical data is present. Furthermore, ecoregional reference values rather than site-specific reference locations are another option that will be considered. Details on the development of ecoregional reference values will be provided in the update to the impairment listing methodology.

Comment 9.2

Additionally, for the reasons explained in Dr. Frissell's comments, the following language should also be added: "All methods of evaluating the impacts of fine sediment shall be demonstrated to be reliable indicators of salmonid-egg-to-fry survival." The ambiguity inherent in the narrative criterion combined with the "weight of evidence" approach Ecology includes in its draft and incomplete implementation guidance for this narrative criterion demonstrates Ecology's clear intention to allow the use of fine sediment measurements that are *not* reliable for the purpose of assessing the effect of fine sediment on the egg-to-fry life cycle stages of salmonids, and to allow those measurements to override others that do provide an indication of unacceptable fine sediment. The example of the weight of evidence approach offered by Ecology fails to weigh evidence according to its scientific veracity and the reliability of inference that can be drawn from it. Thus, it implies that several categories of poor data or indicators that only weakly relate to salmonid-egg-to-fry survival could be used to override one or more categories of far more inherently scientifically reliable data or indicators of well-established consequence to salmonid survival. For this reason, it is essential that the narrative criterion explicitly prohibit the use of fine sediment measures that are not sensitive to the impacts on the very existing and designated uses the narrative criterion seeks to protect.

Response 9.2

Scientific studies and analyses are not available to establish a relationship between salmon egg-to-fry survival and a single fine sediment based parameter. This is supported by the literature and members of the science advisory group. We removed the statement in the rule language regarding the link between fine sediment and adverse effects to fine sediment and replaced it with language that states that excess fine sediment from human derived sources shall not impair water uses. This will align the narrative based fine sediment criterion with the impairment listing methodology.

The selection of multiple parameters for use in a fine sediment assessment is a common theme among other states such as New Mexico, Idaho, Colorado, and Montana. Several of the selected parameters are considered or used in fine sediment assessments in other states and represent the best characterization and relation to fine sediment conditions that

provide information on habitat, aquatic life, stream health, and impairment of water uses. Several the parameters selected for fine sediment assessment were developed by EPA. We have added text to Appendix A of the implementation plan that discusses weighing fine sediment based parameters as an option for impairment listings. However, it should be noted that there is no exact science to weighing one parameter over another. The available science has not established definitive relationships between fine sediment based parameters and impairment of aquatic life.

We encourage suggested alternative parameters that may be more sensitive to identifying excess fine sediment and related impairments. However, we cannot objectively review alternatives if they are not provided. We support the use of the selected parameters to assess fine sediment conditions in waterbodies until more representative and implementable parameters are identified.

Comment 9.3

The narrative criterion refers to prohibiting "levels that cause adverse effects." Ecology is hiding the ball here. What are these levels that cause adverse effects? If there is one level, why are there multiple levels? Assuming that Ecology does not know what these levels are, or it would propose numeric criteria, the narrative criterion must link the prohibition on such adverse effects to the methods set out in the guidance. For this reason, we propose the addition of a new subsection (iv) to read "All methods of evaluating the adverse effects of fine sediment shall be demonstrated to be reliable indicators of salmonid-egg-to-fry survival." In order to make the rule more clear, we suggest moving the discussion of reference sites to its own subsection.

Response 9.3

We have revised the rule language to remove the reference to making a determination and correlation between sediment conditions and adverse effects on aquatic life. Scientific studies are not available that demonstrate a direct link between fine sediment based parameters and different protection levels for early life stages of salmonids. The new language clarifies that excess fine sediment from human derived sources shall not impair water uses. This aligns with the water quality assessment impairment listing methodologies we intend to finalize in the near future.

Comment 9.4

Finally, we propose that Ecology explicitly address the greater need for protection of the most sensitive designated uses, namely those threatened and endangered species whose population numbers are on a downward trend. We propose that the following language be added to modify the protection of the beneficial uses: "taking into account the population status of threatened and endangered species." The currently precipitously small population sizes for these species amplifies the harmful effects that fine sediment has on the species' remaining populations and critical habitat. As Ecology is well aware, Puget Sound Chinook salmon continue to be in significant decline and are today at greater risk of extinction than when the species was first listed. The total Puget Sound Chinook run size in 2021, including both hatchery and wild fish but not including spring Chinook, is down 11 percent from the 2020 forecast of 233,000 fish and two percent below the recent 10-year average of that run. The most recent 10-year average for wild Puget Sound Chinook is 28 percent below the 10-year average for this species in 1999, when it

was first listed as threatened pursuant to the federal Endangered Species Act. *See, e.g.*, Washington Department of Fish and Wildlife, *Chinook Historical Run Size—Puget Sound, available at* https://wdfw.wa.gov/fishing/management/puget-sound-management-plan#status (last visited December 15, 2021).

Puget Sound Chinook are in crisis with a future status predicted by the Washington Department of Fish and Wildlife to be less than 25 percent of the recovery goal. Washington Department of Fish and Wildlife, *Status and Trends Analysis of Adult Abundance Data, Prepared in Support of Governor's Salmon Recovery Office 2020 State of Salmon in Watersheds Report* (January 31, 2021), *available at* https://data.wa.gov/Natural-Resources-Environment/FINAL-WDFW- Status-and-Trends-Analysis-Report-Packa/7ir3-4v4j (last visited December 15, 2021) at 16. Similarly, Lake Ozette sockeye, Snake River spring/summer Chinook, Puget Sound steelhead, and Upper Columbia spring Chinook, are in crisis, with populations projected to reach less than 25 percent of the recovery goal in the near future. Id. Other populations are deemed to "not keeping pace" include Lower Columbia River coho, Lower Columbia River Chinook, Upper Columbia River steelhead, and Middle Columbia River steelhead. Id. Bull trout populations are also decreasing. U.S. Fish and Wildlife Service, *Bull Trout (Salvenlinus confluentus) 5- Year Review: Summary and Evaluation* (2008) at 44 (identifying a "decreasing trend" in bull trout abundance).

Southern Resident killer whales continue to be significantly affected by pollution problems including those that affect their essential prey, Chinook salmon. Today there are only 73 Southern Resident killer whales, down from 78 individuals in 2016 when NMFS completed its last five-year review. NOAA, Southern Resident Killer Whale *(Orcinus orca) available at* https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/southern-resident-killer-whale-orcinus-orca (last visited December 15, 2021) (identifying Southern Resident killer whale abundance for 1996); NMFS, *Southern Resident Killer Whales (Orcinus orca) 5-Year Review: Summary and Evaluation* (December 2016) at 16 (identifying abundance for fall 2016); Orca Network, Births and Deaths, *available at* https://www.orcanetwork.org/Main/index.php?categories_file=Births%20and%20Deaths (last visited December 15, 2021) (reporting Southern Resident killer whale abundance as 73 individuals as of September 20, 2021). As the primary food source for Southern Resident killer whales, the continued decline in Chinook populations directly affect the whale's continued decline. *See* Lacy, R.C., Williams, R., Ashe, E. *et al. Evaluating Anthropogenic Threats to Endangered Killer Whales to Inform Effective Recovery Plans*, 7 *Sci Rep* 14119 (2017), *available at* https://doi.org/10.1038/s41598-017-14471-0.

These species' continued declines make them more vulnerable to the effects of fine sediment. Small populations have disproportionately higher chances of going extinct because environmental and biological forces function differently in these smaller populations and may result in positive feedback loops driving them towards extinction. The forces acting on small populations in "extinction vortices" include increased vulnerability to stochastic impacts, Allee effects on population dynamics, genetic deterioration from inbreeding and genetic drift, increased vulnerability to environmental stressors, such as pollution, and synergistic impacts. *See* Michael *Gilpin and Michael E. Soulé, Minimum Viable Populations: Processes of Species Extinction in CONSERVATION BIOLOGY: THE SCIENCE OF SCARCITY AND DIVERSITY 13-34 (M. E. Soulé ed., 1986*; Barry. W. Brook, Navjot S. Sodhi, and Corey J.A. Bradshaw, *Synergies among extinction drivers under global change*, 23 Trends in Ecology and Evolutionary Biology 453, 455 (2008); Anna-Marie Winter, Andries Richter, and Anne Marie Eikeset,

Implications of Allee effects for fisheries management in a changing climate: evidence from Atlantic cod, 30 Ecological Applications (2020); Priyanga Amarasekare, *Allee Effects in Metapopulation Dynamics*, 152 The American Naturalist 299 (1998); Marty Kartos, *et. al, The crucial role of genome-wide genetic variation in conservation*, 118 Proc. Nat. Acad. Sci. (2021). The continued declines and increasingly low abundances of these species put them at a disproportionately greater risk of extinction than they would be if their populations were abundant, making protection of these designated uses more sensitive than they would be otherwise. Criteria to protect these species must be adjusted accordingly.

Response 9.4

The water quality standards are intended to fully protect all aquatic species, including the most sensitive species. It is assumed that populations are protected if individual species are protected. If an endemic population was uniquely sensitive to a water quality condition, site-specific criteria could be developed. We conclude that additional text in the rule language that specifically mentions threatened and endangered species would not result in increased protection. We do agree that criteria to protect these species must be aligned with full biological protection and this rulemaking is one step in that direction.

Comment 9.5

Taken as a whole, we propose the following changes in the proposed narrative criterion:

(h)(i) Aquatic life fine sediment criterion. The following narrative criterion applies to all existing and designated uses for fresh water:

(ii) Water bodies shall not contain fine sediment (<2 mm) from anthropogenic sources at levels that cause adverse effects on aquatic life, their reproduction, or habitat, taking into account the population status of threatened and endangered species. ~~When reference sites are used, sediment conditions shall be compared to sites that represent least disturbed conditions of a neighboring or similar water body.~~

(iii) When reference sites are used, benchmark natural sediment conditions shall be determined by reference to measured conditions at sites and within watersheds that represent least disturbed conditions, selected within neighboring or comparable water bodies, and screened to assure that the reference site conditions do not reflect temporary fine sediment increases associated with infrequent natural events, or sustained elevation of fine sediment from past human disturbances.

(iv) All methods of evaluating the adverse effects of fine sediment shall be demonstrated to be reliable indicators of salmonid-egg-to-fry survival.

Response 9.5

Thank you for these suggestions. We have revised the rule language to better align with the intent of identifying water bodies with fine sediment impairments. Rule language, including narrative criterion, are typically written in a succinct manner. Implementation considerations are typically housed in the rulemaking implementation plan. For a narrative based criterion, details on defining an exceedance will be found in the

impairment listing methodology, Policy 1-11. While we appreciate these suggestions, not all details were incorporated. Some additions were made to the implementation plan to clarify that the intent to determine natural versus anthropogenic sources of fine sediment and that natural events and short-term dynamics in water body conditions is not intended to reflect overall water body conditions. The information and methods used to discern anthropogenic derived sources of fine sediment from natural sources will be included in the impairment listing methodology Policy 1-11, Chapter 1.

Comment 9.6

The draft implementation guidance is, in fact, no guidance at all on how it "will interpret and apply its fine sediment criterion, including, but not limited to, its use in establishing Washington's CWA section 303(d) list[.]" Most obviously, this draft guidance fails to explain how Ecology will use the new narrative criterion for the purposes of CWA section 303(d) assessments as is evidenced by its own statements:

> The addition of a narrative fine sediment criterion *will require the development of a methodology to evaluate when the fine sediment standard is being exceeded*. Ecology will provide guidance on the parameters used to characterize fine sediment in a waterbody. Subsequently, the listing methodology to determine a fine sediment-based impairment will be developed by the water quality program through a public process. Appendix A provides sampling recommendations and approaches for making a determination of an exceedance of fine sediment criteria. The final methodology for assessing fine sediment will be in a revision to Water Quality Program Policy 1-11.

Ecology, Preliminary Rule Implementation Plan Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington Salmon Spawning Habitat Protection Rule (October 2021) ("Draft Guidance") at 7 (emphasis added); see also id. at 31 ("The methods to determine a fine sediment impairment for purposes of the Clean Water Act Section 303(d) will be finalized in Ecology's Water Quality Policy 1-11, Chapter 1. However, the following recommendations may be useful in developing an approach to determining a fine sediment exceedance.") (emphasis added). Ecology's use of the future tense in its draft guidance demonstrates that this is, in fact, no guidance at all on how the narrative criterion will be used for the purpose of 303(d) listings or other regulatory actions

Response 9.6

We have added some detail to the existing information in the implementation plan on how we anticipate permits and TMDLs to interpret and implement the narrative fine sediment criterion. Additionally, the permit writers[7] manual has some existing guidance on sediment monitoring for permits. We plan to provide additional information in a separate guidance document that will be finalized within 18 months of rule adoption.

The implementation plan provided in the rule proposal provides draft guidance on the process by which impairment listings may proceed. We have not fully determined

[7] https://apps.ecology.wa.gov/publications/documents/92109.pdf

specific category listing methods, but these efforts would be in haste without collaboration with key partners and experts and would likely be subject to significant changes if completed while simultaneously revising the rule. Additional details of impairment listing methods will be drafted for public comment based on the guidance provided in this rulemaking, and in collaboration with the water quality and environmental assessment teams. A separate public process will be available to comment on the finalized impairment listing methodology for fine sediment in the near future. We encourage your involvement in future updates to these methods.

Comment 9.7

In addition to the lack of a methodology for using the narrative criterion in 303(d) listing, Ecology's draft implementation guidance also fails to address the other regulatory contexts in which it will need to interpret and apply the criterion, namely the following: (1) in the development of total maximum daily loads under CWA section 303(d); in the establishment of best management practices for nonpoint sources under CWA section 319 and the Coastal Zone Act Reauthorization Amendments ("CZARA"), 16 U.S.C. § 1455b(b)(3) (each state shall provide for the "implementation and revision of management measures" for nonpoint sources "that are necessary to achieve and maintain applicable water quality standards under [CWA] section 1313 of Title 33 and protect designated uses"); and in the issuance of National Pollutant Discharge Elimination System ("NPDES") permits pursuant to CWA section 402. The purported draft guidance does none of these things.

Response 9.7

We have updated the implementation plan to reflect how we anticipate the fine sediment narrative criterion will be implemented in future TMDLs and permits. We will provide additional guidance on implementation of the narrative fine sediment criterion at the same time that we propose updates for the water quality assessment listing methodology.

Comment 9.8

[The following table is a list of provided documents in the comment submission.]

Author	Title
Beschta, Robert and William Jackson	The Intrusion of Fine Sediments into a Stable Gravel Bed
Braden, John et al.	Impact Targets versus Discharge Standards in Agricultural Pollution Management
Brunke, Matthias	Colmation and Depth Filtration within Streambeds: Retention of Particles in Hyporheic Interstices
Buendia, Cristina et al.	Detecting the structural and functional impacts of fine sediment on stream invertebrates
Church, Michael et al.	Stabilizing self-organized structures in gravel-bed stream channels: Field and experimental observations
Conroy, E. et al.	Evaluating the relationship between biotic and sediment metrics using mesocosms and field studies
Duerdoth, C.P. et al.	Assessment of a rapid method for quantitative reach-scale estimates of deposited fine sediment in rivers

Author	Title
Gerta von Bertrab, Marta et al.	Is fine sediment deposition a main driver for the composition of benthic macroinvertebrate assemblages?
Graeber, Daniel et al.	Multiple stress response of lowland stream benthic macroinvertebrates depends on habitat type
Greig, S.M. et al.	The impact of fine sediment accumulation on the survival of incubating salmon progeny: Implications for sediment management
Greig, S.M. et al.	A review of factors influencing the availability of dissolved oxygen to incubating salmonid embryos
Hardy, Anthony et al.	Guidance on the use of the weight of evidence approach in scientific assessments
Honea, Jon et al.	Evaluating habitat effects on population status: influence of habitat restoration on spring-run Chinook salmon
Hubler, Shannon et al.	The Biological Sediment Tolerance Index: Assessing fine sediments conditions in Oregon streams using macroinvertebrates
Hull, Ruth and Stella Swanson	Sequential Analysis of Lines of Evidence – An Advanced Weight-of-Evidence Approach for Ecological Risk Assessment
Jackson, William and Robert Beschta	Influences of Increased Sand Delivery on the Morphology of Sand and Gravel Channels
Jensen, David et al.	Impact of Fine Sediment on Egg-To-Fry Survival of Pacific Salmon: A Meta-Analysis of Published Studies
Kondolf, G.M. et al.	Assessing Physical Quality of Spawning Habitat
Lapointe, Michel et al.	Modelling the probability of salmonid egg pocket scour due to floods
Lisle, Thomas	Sediment Transport and Resulting Deposition in Spawning Gravels, North Coastal California
Mathers, Kate et al.	Temporal effects of enhanced fine sediment loading on macroinvertebrate community structure and functional traits
Naden, P.S. et al.	Understanding the controls on deposited fine sediment in the streams of agricultural catchments
Naura, M. et al.	Mapping the combined risk of agricultural fine sediment input and accumulation for riverine ecosystems across England and Wales
Newcombe, C.P. and D.D. Macdonald	Effects of Suspended Sediments on Aquatic Ecosystems
Nimick, David	Fascinating Biogeochemistry: How Diel Cycling Complicates Surface-Water Monitoring
Rieman, Bruce and John McIntyre	Demographics and Habitat Requirements for Conservation of Bull Trout
Rowe, Mike et al.	Guide to Selection of Sediment Targets for Use in Idaho TMDLs
Schalchli, Ueli	The clogging of coarse gravel river beds by fine sediment
Sear, D.A. et al.	Does fine sediment source as well as quantity affect salmonid embryo mortality and development?
Turley, Matt et al.	Developing an improved biomonitoring tool for fine sediment: Combining expert knowledge and empirical data

Author	Title
Turley, Matt et al.	A sediment-specific family-level biomonitoring tool to identify the impacts of fine sediment in temperate rivers and streams
US EPA	Weight of Evidence in Ecological Assessment
Weaver, Thomas and John Fraley	Flathead Basin Forest Practices Water Quality and Fisheries Cooperative – Fisheries Habitat and Fish Populations Final Report
Wildhaber, Y.S. et al.	Effects of river morphology, hydraulic gradients, and sediment deposition on water exchange and oxygen dynamics in salmonid redds

Response 9.8

Thank you for the additional references.

10 – Snohomish County

Comment 10.1

Snohomish County is concerned about the credibility of studies used to support the dissolved oxygen depression values and the lack of specificity around instrument measurement, field, and analytical methods proposed for % saturation and intragravel dissolved oxygen (IGDO) which are influenced greatly by biotic and abiotic factors as described by Fellmen et.al., (2019).

The County encourages Ecology to document how studies referenced in the preliminary technical support document for dissolved oxygen depression values meet credible data requirements for rulemaking outlined by RCW 90.48.580-585.

Response 10.1

Please see the Concise Explanatory Statement, Appendix A[8], for the Citation List that accompanies the rule adoption for this rulemaking. This citation list contains references for data, factual information, studies, or reports on which the agency relied in the adoption for this rule making (see RCW 34.05.370(f)). The development and adoption of Washington's water quality standards meet RCW 90.48.580-585 credible data requirements described in Section 4 of Water Quality Policy 1-11, Chapter 2, *Ensuring Credible Data for Water Quality Management*.[9]

We present different analytical methods in the implementation plan for intragravel dissolved oxygen measurements that can be used as guidance for developing a sampling protocol. Percent saturation is a commonly measured water quality parameter that can be measured using most standard hydroprobes that are used to measure dissolved oxygen concentrations. Several other states have been successful in implementing and measuring percent oxygen saturation and we anticipate that oxygen saturation will become a commonly measured water quality parameter.

We recognize that there were be temporal and spatial variability with any dissolved oxygen measurement in the water column or gravels, whether based on concentration or

[8] https://apps.ecology.wa.gov/publications/summarypages/2210003.html
[9] https://apps.ecology.wa.gov/publications/documents/2110032.pdf

saturation. These environmental variabilities are due to abiotic and biotic factors. These environmental factors are often mediated by robust sampling techniques using a reach and transect approach that includes multiple sampling points within a segment of a stream. The sampling regime can be helpful in determining average conditions and characterizing variability and/or confidence in water quality measurements. Temporal and spatial variability is a concern in measuring any water quality condition or chemical concentration. Continuous monitoring can be one option to provide a more robust data set and to capture temporal variability. Another method is to evaluate water quality during times of the day minima conditions are anticipated. For example, early morning is considered the daily minima for oxygen concentrations due to consumption of oxygen through respiration during dark hours and reduced photosynthetic activity.

Comment 10.2

Additionally, we do not recommend that IDGO be calculated using a spatial median. A spatial median provides a measurement for a point in time which underrepresents oxygen depletion and impacts to salmon redds. Given spatial and temporal variability of IDGO, the County suggests Ecology consider duration of exposure to dissolved oxygen below criteria as the most appropriate metric. Questions remain about the acceptable duration of exposure below criteria and whether depth and spatial extent of measurements should be factors to consider.

Response 10.2

The techniques used to sample water quality can be used to evaluate spatial and temporal variability. The water quality standards and rule language do not recommend a particular sampling technique. Any grab or point sample will be limited to a snapshot in time and will not account for temporal or spatial variability. This shortcoming can be applied to all water quality parameters sampled at a single point or place in time including oxygen concentrations, oxygen saturation, and toxic chemicals. Continuous monitoring of water quality is an option for some parameters but is expensive and can be limited by technology depending on the sample collection methods. Decisions for sample collection methods can be determined by the entity collecting the data and their needs. Methods for IGDO provide guidance on depth and other environmental factors considered when taking measurements. Sampling should target locations where sensitive life stages are anticipated to be located.

Another aspect of variability in water quality sampling is spatial variation. Spatial variation can be remedied by collecting a robust amount of samples over a given area. Sediment is notoriously known for spatial variability in physical and chemical composition, depending on habitat type, groundwater influences, and water flow, to name a few. To address water quality measurements in the subsurface sediment, a sampling approach must be aimed at evaluating spatial variability within a habitat area. The spatial median provides a more accurate evaluation of water quality in a habitat area. Although only three samples are required to develop a spatial median, additional sampling may be necessary to limit sample variability and increase confidence in the data.

The duration or averaging period of criteria can be modified to accommodate protection levels for acute and chronic effects. A longer duration is typically associated with

protection levels associated with chronic effects. A longer duration can allow for fluctuations above and below the chronic criteria but requires that the average condition over the selected duration meet biological protection levels. When a chronic criterion is coupled with an acute criterion, the acute criterion limits fluctuations below chronic protection levels. A chronic criterion is not being proposed in this rule because salmonids are most fragile during early life stages and using the highest level of protection should be considered due to uncertainty and variability in environmental conditions. Rather, we have developed an acute criterion protective of both acute and chronic effects.

We have decided to retain the short duration periods for optimal protection of salmonids, provide a regulatory basis for limiting oxygen fluctuations, and provide consistency with existing D.O. standards.

Comment 10.3

Given concerns described, we request that updates to Water Quality Policy 1-11 contains clear expectations and definitions for each dissolved oxygen measurement method to maintain consistency with requirements found in Chapter 2 of Water Quality Policy 1-11. This includes, but is not limited to:

* allowable measurement methods consistent with Ecology, EPA, USGS, APHA, USACOE, ASTM or the Code of Federal Regulations,

* location and size of habitat reaches where measurements for each method should and should not be collected,

* specific timeframes for measurements relative to life stages of salmonid,

* the number of measurements or duration and spatial extent of exposure necessary for each method,

* statistical tests used to determine impairment,

* methods for determining placement of an assessment unit within water quality assessment categories 1-5 both in and outside of TMDL areas and,

* a description of how quality assessment listing decisions will be made where different measurement methods were used within the same unit but yielded both compliance and non-compliance.

Providing this information in a summary table within Water Quality Policy 1-11 is encouraged.

Response 10.3

We anticipate updating our Water Quality Policy 1-11 assessment methodology within eighteen months of rule adoption. The updated policy will provide guidance on data requirements and aggregation process, thresholds for determining impairment, methodology, category determinations, and any other information necessary for the water quality assessment process.

Comment 10.4

Snohomish County is concerned that Ecology is rushing rulemaking for fine sediment criteria. Ecology has indicated that EPA does not have criteria for fine sediment and that relationships between fine sediment and impacts to aquatic life are not well established or understood. Further, the County is concerned about the inherent subjectivity of visual assessments for fine sediment, the weight of evidence approach, and technical merit of use of relative bed stability (RBS) as a direct measure of fine sediment.

Response 10.4

EPA has not established recommendations for fine sediment criteria. However, Ecology recognizes excess sedimentation is an issue that requires more specific criteria to further improve waters impact by sediment. Furthermore, we are obligated to develop fine sediment criteria based on a 2018 U.S. District Court Stipulated Order of Dismissal between Northwest Environmental Advocates, EPA, and Ecology (NWEA vs. USEPA et al. 2018). EPA has assisted some states in the development of fine sediment criteria, including New Mexico and draft guidance for Oregon.

We considered the subjectivity of visual assessments, particularly percent substrate, when considering appropriate parameters to include in a fine sediment assessment. EPA recommends a visual assessment of substrate in their national rivers and stream assessment programs that have been adopted by states nation-wide (USEPA, 2009). While visual assessments are less precise than quantifiable measurements, there is supporting evidence that visual assessments provide valuable information and that measurements are relatively consistent. Kaufmann et al. (1999) reported 10 of 14 percent substrate composition metrics having a pooled standard deviation of 7% among replicate measurements; more specifically, percent sand/fines had a standard deviation of 7.7%.

Ecology's Environmental Assessment Program is also working on a publication of signal to noise (S/N) ratios for habitat metrics. Signal is based on variation among the random sites (i.e., hundreds) of a given survey region, while noise is based on variation of two visits among 10% of sites. Habitat metrics were categories according to their precision: low reliability (S/N ratios less than 2); moderate reliability (S/N ratio between 2 and 7); and high reliability (S/N ratio greater than 7). Percent sand/fines had a S/N ratio of 27 in the evaluation of assessed sites. In the Puget Sound region, percent sand/fines had a signal to noise ratio of 9 for wadeable streams and 49 for larger rivers (Merritt and Hartman, 2012). EPA found a high signal to noise ratios for percent substrate metrics, with 11 of 22 metrics being greater than 5, and seven metrics with S/N ratios greater than 10 (Kaufmann et al. 1999). Visual assessments of substrate represent one parameter in a weight of evidence approach, and therefore, it is unlikely that a water body will be listed as impaired based on this parameter alone.

In further support, Larson et al. (2019) evaluated 346 sites in Washington and classified their biological health by comparing against regional reference conditions. Larson et al. (2019) reported that percent sand/fines (sediment less than 2 mm) was the stressor metric with the highest attributable risk to invertebrate community health, followed by relative bed stability. In further support, Sutherland et al. (2010) evaluated the relationship

between land disturbance and stream habitat by comparing 25 commonly used sediment parameters and found that 16 metrics significantly related to watershed agriculture, with subsurface percent fines as the best indicator of land use, and visual assessments of percent fines the second best parameter.

Relative bed stability (RBS) is particularly useful for the evaluation of bed stability and its general relationship to human disturbances (Kaufmann et al. 2009). The RBS indicator was developed by EPA as a tool to predict the expected substrate size distribution for streams (Peck et al. 2006). Studies have demonstrated its utility to be a sensitive and useful indicator (Jessup 2009; Kaufmann et al. 2009). Because fluvial site conditions are major determinants of the substrate conditions in stream channels, the critical particle size calculated from fluvial characteristics is a predictor of dominant and stable substrate conditions. RBS can assist in explaining whether a high percentage of fines/sands for a given site were expected or are a result of a disturbed condition (Jessup et al. 2010). An increase in fine substrate particles (and a lower Logarithmic Relative Bed Stability Index) often occurs when the sediment supply to the stream is increased due to land use impacts and streambank erosion (Kaufmann et al., 1999). A poor Logarithmic Relative Bed Stability value (i.e., a low negative value) may be an indication that the sediment supply is exceeding the sediment transport ability of a particular reach.

RBS has been demonstrated to be a valuable metric for stream and aquatic life health in Washington State (Larson et al. 2019). Larson et al. (2019) reported that, in Washington, percent sand/fines (sediment less than 2 mm) was the stressor metric with the highest attributable risk to invertebrate community health, followed by RBS. RBS is a useful metric for describing sediment conditions, specifically related to streambed stability, erosion, and particle transport, and is one line of evidence in determining excess fine sediment. One of the attributes that RBS provides is a catchment level approach of sediment stability rather than direct measures of site-specific fine sediment levels that may not be representative of sediment dynamics within the entire waterbody.

There is precedent for the use of RBS in fine sediment assessments in New Mexico and Montana (Montana uses a similar metric called riffle stability index). We find that RBS may be one of the most important indicators to be used in a fine sediment assessment relative to streambed stability, natural sediment conditions, catchment level analyses of sediment movement, and relationships between sediment conditions and human disturbances.

We conclude that percent substrate and RBS are acceptable parameters for use in a fine sediment assessment based on the available background information that exists for percent substrate for streams in Washington State, with support demonstrated in literature and use in national and statewide assessments of habitat.

References

Jessup B. 2009. *Development of Bedded Sediment Benchmarks for Oregon Streams*. Prepared for Oregon Department of Environmental Quality and U.S. EPA Region 10.

Jessup BK, Eib D, Guevara L, Hogan J, John F, Joseph S, Kaufmann P, Kosfiszer A. 2010. *Sediment in New Mexico Streams: Existing Conditions and Potential Benchmarks*. Prepared for the U.S. Enviromental Protection Agency, Region 6, Dallas, TX and the New Mexico Environment Department, Santa Fe, NM. Prepared by Tetra Tech, Inc., Montpelier, VT.

Kaufmann PR, Levine P, Peck DV, Robison EG, Seeliger C. 1999. *Quantifying physical habitat in wadeable streams (p. 149)*. USEPA [National Health and Environmental Effects Research Laboratory, Western Ecology Division].

Kaufmann PR, Larsen DP, Faustini JM. 2009. *Bed stability and sedimentation associated with human disturbances in Pacific Northwest streams 1*. JAWRA Journal of the American Water Resources Association, 45(2): 434-459.

Larson CA, Merritt G, Janisch J, Lemmon J, Rosewood-Thurman M, Engeness B, Polkowske S, Onwumere G. 2019. *The first statewide stream macroinvertebrate bioassessment in Washington State with a relative risk and attributable risk analysis for multiple stressors*. Ecological Indicators, 102: 175-185.

Merritt, G. and C. Hartman. 2012. *Status of Puget Sound Tributaries 2009. Biology, Chemistry, and Physical Habitat*. Publication No. 12-03-029. Environmental Assessment Program. Washington State Department of Ecology, Olympia, WA.

NWEA v. USEPA and NWP&P et al. 2018. No. 2:14-cv-00196-RSM. Doc. 96. (W.D. Wash. Oct. 18, 2018).

Peck DV, Herlihy AT, Hill BH, Hughes RM, Kaufmann PR, Klemm D, Lazorchak JM, McCormick FH, Peterson SA, Ringold PL, Magee T, Cappaert M. 2006. *Environmental Monitoring and Assessment Program-Surface Waters Western Pilot Study: Field operations manual for wadeable streams*. U.S. Environmental Protection Agency, Washington, D.C. EPA/620/R-06/003.

Sutherland AB, Culp JM, Benoy GA. 2010. *Characterizing deposited sediment for stream habitat assessment*. Limnology and Oceanography: Methods 8(1): 30-44.

USEPA. 2009. *National Rivers and Streams Assessment: Field Operations Manual*. EPA-841-B-07-009. U.S. Environmental Protection Agency, Washington, DC.

Comment 10.5

Ecology indicates that draft guidance for assessment of fine sediment found in Appendix A of the implementation plan is subject to change based upon further technical and public review during updates to Water Quality Policy 1-11. Updates to Water Quality Policy 1-11 are outside the rule-making process. Establishing criteria, which result in regulatory requirements, outside of rulemaking conflicts with the Administrative Procedures Act - Chapter 34.05 RCW.

Response 10.5

The implementation plan contains only guidance for the 303(d) assessment of the proposed water quality narrative criteria. Neither the implementation plan nor Water Quality Policy 1-11 set forth or establish surface water quality criteria. Further, any

future updates to the implementation plan or Water Quality Policy 1-11 will undergo public review where required due to CWA Section 303(d).

Comment 10.6

Should rule be established under these conditions, it's likely that stream segments will be listed as impaired for fine sediment, using less than credible methods or data. Ecology is obligated to act on impaired waters through development of costly Total Maximum Daily Load Water Clean-Up Plans (TMDLs). Programmatic actions in TMDLs have been included as regulatory requirements in stormwater permits issued to municipalities state-wide, without reasonable assurance that actions will result in clean water.

The County recommends that Ecology take the time necessary to ensure criteria are established under rulemaking using credible methods that show clear relationships between fine sediment and impacts to aquatic life such that public resources spent on clean-up actions are protective of aquatic life.

Response 10.6

Please see the Concise Explanatory Statement, Appendix A[10], for the Citation List that accompanies the rule adoption for this rulemaking. This citation list contains references for data, factual information, studies, or reports on which the agency relied in the adoption for this rule making (see RCW 34.05.370(f)). The development and adoption of Washington's water quality standards meet RCW 90.48.580-585 credible data requirements described in Section 4 of Water Quality Policy 1-11, Chapter 2, *Ensuring Credible Data for Water Quality Management*.[11]

Comment 10.7

Snohomish County is concerned about the temporal and spatial disconnect between fine sediment sampling and characterization of risk of impairment to the spawning and incubation IDGO environment.

The Implementation Plan recommends the 11-transect reach-wide approach. This approach includes a variety of habitat types, including those that are not used for spawning and egg incubation. The reasons Ecology adopted this approach is to reduce observer bias and changing location of riffles under various flow regimes during the sampling window.

Our concern with inclusion of other habitat (including pools) in this assessment is that estimates of D50, dominant substrate, and size distributions will not be reflective of the critical habitat type(s) used for egg incubation and rearing. Benthic collections from non-riffle habitat may indicate a lack of fine sediment index sensitive taxa and indicate fine sediment issues in a sampling reach. This may be true for the reach, but not for riffle habitat. The fine sediment sensitivity index was developed with a calibration data set from riffle habitat.

[10] https://apps.ecology.wa.gov/publications/summarypages/2210003.html
[11] https://apps.ecology.wa.gov/publications/documents/2110032.pdf

Response 10.7

The fine sediment based narrative criterion is intended to protect against excess fine sediment from human derived sources that result in the impairment of designated uses (see updated rule language). The narrative based fine sediment criterion is not strictly limited to salmonid spawning uses. While we are concerned about risks to salmonid spawning and incubation, the available science does not provide direct correlation between parameters used to characterize fine sediment and aquatic life effects. Fine sediment parameters do allow for characterization of critical habitat that is conducive to salmonid spawning and rearing success and other aquatic life uses such as macroinvertebrate health that are key prey for salmonid success.

The methods used to characterize fine sediment and habitat used by Ecology and other states are adopted from EPA methods (USEPA, 2009). These EPA methods are aimed at assessing stream health. The stream assessment methods adopted by Ecology include assessment of habitats other than riffles, which are the primary habitat used for salmonid spawning. However, riffles do not represent all aquatic life habitat, and stream assessment methods are aimed at collecting data from a variety of habitats, including riffles. Studies have shown that there is no statistical difference between samples collected from riffles only and those collected from reach-wide designs (Kerans et al. 1992; Rehn et al. 2007). A study by Rehn et al. (2007) found that collection of macroinvertebrates and associated indexes do not differ between reach-wide benthic samples and targeted riffle samples. Rehn et al. (2007) concluded that biological indicators derived from reach wide and targeted riffle samples are generally interchangeable. A reach wide assessment of biological indicators and physical measurements provides a better assessment of average or baseline conditions to characterize a stream, including sediment conditions and aquatic life. For those reasons, we support the existing protocols used in Ecology's Watershed Health Monitoring program and their applicability to a fine sediment assessment.

References

Kerans, B.L., Karr, J.R. and Ahlstedt, S.A., 1992. *Aquatic invertebrate assemblages: spatial and temporal differences among sampling protocols*. Journal of the North American Benthological Society, 11(4), pp.377-390.

Rehn AC, Ode PR, Hawkins CP. 2007. *Comparisons of targeted-riffle and reach-wide benthic macroinvertebrate samples: implications for data sharing in stream-condition assessments*. Journal of the North American Benthological Society, 26(2): 332-348.

USEPA. 2009. *National Rivers and Streams Assessment: Field Operations Manual*. EPA-841-B-07-009. U.S. Environmental Protection Agency, Washington, DC.

Comment 10.8

Snohomish County does not believe that Ecology has adequately demonstrated how sampling for fine sediment based upon the Watershed Health Monitoring (WHM) Program is relevant to spawning suitability or IDGO or that proposed methods allow for a credible assessment of anthropogenic factors.

Ecology emphasized that the fine sediment criteria is intended to protect all aquatic life and the criteria apply to all waters of the state, including but not limited to spawning and rearing habitat. In a response to Snohomish County they stated, that if early life stages of salmonids are protected, all aquatic species are protected. Ecology's recommendation that transect-based monitoring be used, which would include non-spawning habitats, (perhaps predominantly so), would lead to overestimating fine sediment content that is relevant to spawning habitat suitability. Moreover, since all useful guidance from the literature for salmon spawning habitat suitability is with reference to riffles and targeted spawning locations (not reach-wide), it's conceivable that if paired with IGDO sampling (of spawning habitats) that higher reach-scale fines would be correlated with higher site-specific IGDO. In reality, there would probably be little useful correlation between IGDO and fine sediments as IGDO in riffles would likely be more influenced by channel substrate size associated with geomorphological setting and channel size. We recommend Ecology demonstrate how sediment sampling based on the WHM program is relevant to spawning suitability or is related to IGDO and that there is a demonstrated potential for using the methods to assess anthropogenic factors.

Response 10.8

Please see Response 10.7 regarding the applicability of the Watershed Health Monitoring program methods. The Watershed Health Monitoring program also includes protocols to assess human disturbances within sampled reaches of a water body. This information can be used to assess whether there is evidence of human disturbance that can lead to inputs of fine sediment within a water body. Figure A-3 in the Implementation Plan provides an example of the template used to assess human disturbance. Furthermore, the RBS parameter can be used to provide additional information that links fine sediment presence to human disturbance (Kaufmann et al. 2009; see Response 10.4). The methods to make a determination of human disturbances associated with fine sediment inputs will be finalized in the water quality assessment listing methodology for impaired waters (Policy 1-11). We encourage you to engage in the public process of updating our water quality assessment listing methodology (Policy 1-11). Additional details will be available for comment during the public process of updating Policy 1-11.

One method for determining a fine sediment based impairment is a comparison between conditions of a water body and a reference water body or ecoregional reference value. Data collected from each water body should be collected in a similar manner using the protocols established by the Watershed Health Monitoring program. Thus, if fine sediment based parameters are biased high due to sampling protocols, the bias should be biased equivalently high for the data used to develop reference values. Using reference values to determine excess fine sediment and collecting data using similar protocols among water bodies will allow for the comparison of homogenous datasets. In the Implementation Plan, we present preliminary screening level thresholds for fine sediment based parameters; however, these thresholds are not aimed at determining a water body impairment unless representative of ecoregional reference values. The screening level thresholds are indicators that a full assessment of fine sediment may be needed or should be prioritized on a water body.

The scope of the narrative based fine sediment criterion includes determining if excess fine sediment is present from human derived sources but does not quantify the effects to salmonids nor does it evaluate species sensitivity. Scientific literature has not established a direct and consistent relationship between fine sediment based parameters and effects to aquatic life species. The intent of the narrative criterion is to identify when there is an imbalance in fine sediment from human derived inputs that may be detrimental to the habitat of aquatic life, including salmonids. Identifying varying amounts of excess fine sediment for each aquatic species using a multitude of parameters is not feasible. However, we can use a weight of evidence approach that establishes associations between parameters used to characterize fine sediment and poor stream health and habitat that can be used to evaluate risk to aquatic life.

We have revised the rule language for the narrative based fine sediment criterion to remove the reference to making a determination and correlation between sediment conditions and adverse effects on aquatic life. The new language clarifies that excess fine sediment from human derived sources shall not impair designated uses. This aligns with the water quality assessment impairment listing methodologies we intend to finalize in the future. The ability to characterize and identify human sources of fine sediment is determined by the available tools and scientific information available. We are on target to take a similar path as other states (e.g., Colorado, Montana, Idaho) have done but with slight modifications.

Reference

Kaufmann PR, Larsen DP, Faustini JM. 2009. *Bed stability and sedimentation associated with human disturbances in Pacific Northwest streams 1*. JAWRA Journal of the American Water Resources Association, 45(2): 434-459.

Comment 10.9

Snohomish County is concerned about the inherent subjectivity in use of visual assessments and weight of evidence as method for use in determining compliance with fine sediment criteria. We agree that fine sediments are the attributable risk to invertebrate community health across large ranges of sediment conditions or among few land use types and that visual assessment can discern large differences (again between a few land use types), however the ability of visual assessments to discern small differences at sites with intermediate levels of fine sediment (compared to reference locations) or a fraction attributable to anthropogenic factors within the same land use type is doubtful, but would be useful for Ecology to substantiate.

Response 10.9

We agree that a standalone visual assessment of substrate is not adequate for a fine sediment assessment and will not provide the data needed to discern small differences in sediment conditions between sites. A weight of evidence approach that includes multiple fine sediment based parameters is necessary to evaluate excess fine sediment that may lead to impairments of habitat, aquatic life, or water uses. The combination of evidence from multiple parameters from different environmental compartments should provide adequate data to make a fine sediment impairment determination. We do not anticipate that a water body would be listed for a fine sediment impairment based on a visual

assessment of substrate alone. A fine sediment based impairment determination will require the evaluation of multiple parameters and evidence of human derived sources. We anticipate that impairment methods will include comparisons between selected fine sediment parameters and ecoregional reference values or reference sites. Furthermore, analysis of human derived sources from land use practices within the watershed, stream channel, or riparian habitat. The combination of these two factors will be assessed to characterize fine sediment for a water body or water body segment.

Comment 10.10

Snohomish County is concerned that RBS is not a direct measurement of fine sediment, as the input to RBS is based on the entire particle size distribution and therefore will not produce information meaningful to the assessment of fine sediment. The quantitative RBS integrates channel dimensions, an estimated critical streambed diameter derived from the critical shear stress equation. Moreover, RBS can be adjusted due to other bed roughness factors like large woody debris, and therefore could be variable (high or low) based on factors other than fine sediment. See Kaufmann et al. 2008. Whereas RBS may correlate well with stream health, it does not provide an assessment of fine sediment content or quantity.

Response 10.10

Relative bed stability (RBS) is particularly useful for the evaluation of bed stability and its general relationship to human disturbances (Kaufmann et al. 2009). The RBS indicator was developed by EPA as a tool to predict the expected substrate size distribution for streams (Peck et al. 2006). Studies have demonstrated its utility to be a sensitive and useful indicator (Jessup 2009; Kaufmann et al. 2009). Because fluvial site conditions are major determinants of the substrate conditions in stream channels, the critical particle size calculated from fluvial characteristics is a predictor of dominant and stable substrate conditions. RBS can assist in explaining whether a high percentage of fines/sands for a given site were expected or are a result of a disturbed condition (Jessup et al. 2010). An increase in fine substrate particles (and a lower Logarithmic Relative Bed Stability Index) often occurs when the sediment supply to the stream is increased due to land use impacts and streambank erosion (Kaufmann et al., 1999). A poor Logarithmic Relative Bed Stability value (i.e., a low negative value) may be an indication that the sediment supply is exceeding the sediment transport ability of a particular reach.

RBS has been demonstrated to be a valuable metric for stream and aquatic life health in Washington State (Larson et al. 2019). Larson et al. (2019) reported that, in Washington, percent sand/fines (sediment less than 2 mm) was the stressor metric with the highest attributable risk to invertebrate community health, followed by RBS. RBS is a useful metric for describing sediment conditions, specifically related to streambed stability, erosion, and particle transport, and is one line of evidence in determining excess fine sediment. One of the attributes that RBS provides is a catchment level approach of sediment stability rather than direct measures of site-specific fine sediment levels that may not be representative of sediment dynamics within the entire waterbody.

There is precedent for the use of RBS in fine sediment assessments in New Mexico and Montana (Montana uses a similar metric called riffle stability index). We find that RBS

may be one of the most important indicators to be used in a fine sediment assessment relative to streambed stability, natural sediment conditions, catchment level analyses of sediment movement, and relationships between sediment conditions and human disturbances.

References

Jessup B. 2009. *Development of Bedded Sediment Benchmarks for Oregon Streams*. Prepared for Oregon Department of Environmental Quality and U.S. EPA Region 10.

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Kaufmann PR, Levine P, Peck DV, Robison EG, Seeliger C. 1999. *Quantifying physical habitat in wadeable streams (p. 149)*. USEPA [National Health and Environmental Effects Research Laboratory, Western Ecology Division].

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Peck DV, Herlihy AT, Hill BH, Hughes RM, Kaufmann PR, Klemm D, Lazorchak JM, McCormick FH, Peterson SA, Ringold PL, Magee T, Cappaert M. 2006. *Environmental Monitoring and Assessment Program-Surface Waters Western Pilot Study: Field operations manual for wadeable streams*. U.S. Environmental Protection Agency, Washington, D.C. EPA/620/R-06/003.

Sutherland AB, Culp JM, Benoy GA. 2010. *Characterizing deposited sediment for stream habitat assessment*. Limnology and Oceanography: Methods 8(1): 30-44.

11 – Snoqualmie Indian Tribe

Comment 11.1

Fishing in the Snoqualmie River, the Sammamish River, Lake Sammamish, and other streams, rivers and lakes throughout King County and Snohomish County are an integral part of the Tribe's culture. The Salmon Spawning Habitat Protection Rule, Chapter 173-201A WAC Water Quality Standards will support and help to protect many of the resources that are so important to the Tribe. The proposed rule is in keeping with the values that have been handed down from the Tribe's ancestors, and therefore the Tribe supports the proposed water quality rules.

Response 11.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat.

12 – Triverus, LLC

Comment 11.1

Washington Stormwater Center published a study just over one year ago that links a preservative in tires to the death of coho salmon. This preservative is carried into surface waters by storm events in the form of fine sediment. Please consider this study.

Response 12.1

Thank for providing this information. Ecology is tracking the implications of 6-PPD quinone and breakdown products from weathering of tires. This rulemaking is intended to characterize methods used to assess fine sediment content and may lead to more investigation of sediment conditions. Identification of artificial sediment may be inadvertently observed during sediment assessments. In instances where artificial sediment is observed, the use of our general narrative ("shall not be toxic substances in toxic amounts") may be implemented. While discerning artificial from natural sediment is not a primary objective of this rulemaking, fine sediment investigations may lead to additional opportunities to identify breakdown products from tires.

13 – US EPA Region 10

Comment 13.1

The proposed definition at WAC 173-201A-020, "**Intragravel dissolved oxygen**" means the concentration of oxygen in the spaces between sediment particles in a streambed."

EPA recommends providing additional clarity to the proposed definition by adding more specific language, for example "concentration of *dissolved* oxygen in the spaces between sediment particles in a streambed."

Response 13.1

We have modified the definition of intragravel dissolved oxygen to provide additional clarity.

Comment 13.2

The proposed definition at WAC 173-201A-020, "**Spatial median**" is the middle value of multiple ranked intragravel D.O. measurements taken within the sampling area."

Since "spatial median" is a general statistical term, it is unclear if the term will only be used for intragravel dissolved oxygen (IGDO). EPA recommends more specific language to clearly articulate the definition, for example: "**Spatial median for intragravel dissolved oxygen** is the middle value of multiple ranked intragravel D.O. measurements taken within the sampling area."

Response 13.2

We have generalized the definition of "spatial median" to be applicable to any and all future water quality standards that use the statistical term.

Comment 13.3

EPA believes that the proposed language at WAC 173-201A-200(1)(d) and revisions to Table 200(1)(d) indicating that the waterbody must only meet water column OR intragravel D.O. concentrations is not protective of the waterbody.

IGDO alone does not guarantee adequate D.O. throughout the water column, and water column criteria are essential for salmonids and other aquatic life. If there is adequate IGDO, then the criterion in the water column can reasonably be lower. EPA recommends additional clarifying language to the text at WAC 173-201A-200(1)(d), for example "The water column D.O. criteria may not be less than 10.0 mg/L. However, if the minimum intragravel dissolved oxygen, measured as a spatial median, is 8.0 mg/L or greater, then the water column D.O. criterion is 9.5 mg/L."

Response 13.3

We agree with this comment. We have modified the rule language to include a water column based D.O. concentration requirement of 9.0 mg/L when the 8.0 mg/L intragravel dissolved oxygen criteria is met. The 9.0 mg/L protection value in the water column aligns with EPA recommendations for acute criterion while concomitantly ensuring early life stages of salmonids are protected in gravels at protection levels of 8.0 mg/L.

Comment 13.4

The proposed language at WAC 173-201A-200(1)(d) suggests that percent oxygen saturation is always interchangeable with concentration, i.e., "The D.O. criteria are measured in milligrams per liter (mg/L) or percent oxygen saturation."

EPA recommends that percent oxygen saturation not be merely interchangeable with concentration-based D.O. criteria. The concentration-based criteria should be primarily relied upon and Ecology should provide more context for when they intend to rely upon the percent oxygen saturation, such as, the percent oxygen saturation will only be used where conditions of barometric pressure, altitude, and temperature preclude attainment of the concentration-based criteria. Suggest adding language to clarify the context of this point, for example, "Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 10.0 mg/L or 6.5 mg/L criteria, dissolved oxygen levels must not be less than 90 percent of saturation."

Response 13.4

We agree that the dissolved oxygen concentration should be evaluated first in determining compliance with the water quality standards. The majority of hydroprobes and other water quality instruments have the capability to simultaneously measure oxygen concentration and percent saturation. Thus, there is a high likelihood that both measures will be evaluated in future water quality monitoring.

Language that requires oxygen saturation be applicable only when barometric pressure, altitude, or temperature precludes attainment of D.O. concentrations necessitates the need for a site-specific study to apply the oxygen saturation criteria. We do not agree that a site-specific evaluation of atmospheric and water quality conditions should be required for each water body or each location within a water body to apply oxygen saturation criteria. Washington has high gradient streams in which a site-specific study of impacts of barometric pressure and temperature impacts on oxygen concentrations in headwaters would not be applicable to the mouth of the stream. Thus, the language recommended would require an evaluation and determination of oxygen saturation dependent atmospheric and water quality conditions for each sampling location. Furthermore, the statement suggested does not include the impacts that groundwater may have on D.O. concentrations for which oxygen saturation may be the more applicable criteria. We support the concurrent application of the D.O. concentration or oxygen saturation based criteria.

Comment 13.5

The proposed language at WAC 173-201A-200(1)(d)(iv)(C), "Be taken within the same aquatic habitat area when measuring intragravel D.O."

EPA recommends revising the language to provide additional clarity about what is meant by this statement. As written, the intent is unclear and could be interpreted as constraining water column measurements to only IGDO areas.

Response 13.5

We have deleted this rule language because existing rule language provides the same intent. The existing rule language states: "D.O. measurements should be taken to represent the dominant aquatic habitat of the monitoring site." We added language in the footnote of Table 200(1)(d) that intragravel measurements should be measured in the same aquatic habitat area. This is further explain in the implementation plan that measurements should occur within a maximum distance of 200 feet. This aligns with Oregon's policy for implementation of their intragravel D.O. criterion.

Comment 13.6

The proposed water column concentrations and percent oxygen saturations at WAC 173-201A-200(1)(d), Table 200 (1)(d) Aquatic Life Dissolved Oxygen Criteria in Fresh Water, indicate 10 mg/L or 90% oxygen saturation for several aquatic life use categories.

For those specific categories, EPA recommends that Ecology fully consider the potential impacts from the application of a 90% oxygen saturation criterion, particularly for spawning uses. Please note that 11 mg/L is the 304(a) recommended criterion for full use protection for spawning. EPA recommends Ecology further explain why a lower concentration value is appropriate for species and life stages identified in the rule, given the environmental conditions associated with spawning habitats in the state, such as sediment conditions and D.O.

Response 13.6

The technical support document for this rulemaking explains the decision for a 10 mg/L protection level and the uncertainties associated with EPA's 11 mg/L recommendation for the water column. We encourage EPA to consider the latest scientific literature associated with D.O. depression values and the uncertainty associated with the two studies that serve as the basis for the 3 mg/L D.O. depression assumption.

The primary difference between the 11 mg/L D.O. level recommended by EPA and the 10 mg/L D.O. level proposed is the assumed reduction in D.O. from the water column to gravels. The 10 mg/L D.O. protection level was chosen to reflect a maximum 2 mg/L D.O. depression value (discussed below) from the water column to gravels, whereas EPA assumes a 3 mg/L D.O. reduction. The literature summarized in the AquaTerra review (summarized in the technical support document for this rulemaking and Brown and Hallock (2009)) of D.O. depression values in streams indicate a maximum D.O. depression of 2 mg/L in high quality spawning gravels. The studies supporting the 2 mg/L D.O. depression value are commensurate with EPA data requirements of limited influence from environmental variables that influence oxygen in gravels. The majority of qualified studies found that D.O. depression may be much less than 2.0 mg/L in streams without excess fine sediment and in the absence of variables that influence oxygen demand. We support EPA in analyzing D.O. depression with minimal outlying variables. The D.O. depression in high quality spawning gravels may be impacted by other environmental variables that should be addressed through different criteria. In streams with naturally high fine sediment loads, spawning success is likely historically limited due to natural environmental conditions and will never meet a generalized assumption for D.O. depression. Therefore, D.O. depression should be evaluated in streams with high quality spawning gravels. The scientific literature presents several such cases and comparisons between streams with minimal versus high sediment loads and demonstrates the difference in D.O. depression. The streams with moderate to high quality spawning gravels are fully protected by a 2 mg/L D.O. depression value. Streams with naturally high fine sediment loads should not be listed as impaired for dissolved oxygen for natural conditions that preclude attainment of fine sediment conditions. Washington State has other water quality criteria that can be used to address environmental conditions or excess material that may influence freshwater D.O., including fine sediment (included in the proposed rule), nutrients, turbidity, and temperature (See WAC 173-201A).

Washington's D.O. criteria applies year-round and is intended to support characteristic aquatic life uses. Although the criteria applies year-round, the aquatic life uses that define a use category may not apply year-round. For example, the salmonid spawning, rearing, and migration use is defined by spawning and emergence outside of the summer season (September 16 – June 14). While protection levels are applicable year-round, the aquatic life use (e.g., spawning and emergence) may not occur year-round. Therefore, the D.O. criteria needs to account for environmental factors that lower D.O. levels during times when aquatic life uses are not present. The oxygen saturation criteria is one resolution. Setting a 95% oxygen saturation criteria for aquatic life uses defined by spawning and emergence during the cooler seasons (i.e., outside of summer) is not required for full

protection, and at cooler temperatures, is often more stringent than the concentration based criteria of 10 mg/L.

The minimum allowable D.O. concentration at sea level when meeting temperature requirements (max 17.5°C) of the salmonid spawning, rearing, and migration use would be 9.1 mg/L with a 95% oxygen saturation criteria. EPA recommends a water column protection level of 8.0 mg/L for juvenile and adult salmonid life stages. A 95% oxygen saturation criterion would be overly stringent when early life stages are not present and would create an abnormally high amount of impairment listings. Brown and Hallock (2009) state that of 136 ambient stations monitored, a 95% oxygen saturation criteria alone would result in 67% of stations impaired, and a 11 mg/L or 95% oxygen saturation criteria would result in 53% of stations impaired. In evaluating Ecology's minimally disturbed reference sites, over 50% of sites would be listed as impaired during the summer months with a 95% oxygen saturation criterion (see Technical Support Document).

The minimum allowable D.O. concentration at sea level when meeting temperature requirements (max 17.5°C) of the salmonid spawning, rearing, and migration use would be 8.6 mg/L with a 90% oxygen saturation criteria. The 8.6 mg/L minimum value associated with 90% oxygen saturation is more stringent than EPA recommendations for juvenile and adult salmonid life stages of 8.0 mg/L and therefore, should provide adequate protection during summer months when environmental conditions preclude attainment of the concentration based D.O. criteria salmonid spawning is not occurring. Brown and Hallock (2009) found that of the 136 ambient stations monitored, a 90% oxygen saturation criteria alone would result in 34% of stations impaired and a 11 mg/L or 90% oxygen saturation criteria would result in 26% of stations impaired.

Nonetheless, we recognize that some aquatic life uses characterized by salmonid reproduction and rearing during summer may be particularly susceptible to environmental conditions and may require additional protection. Therefore, we have changed the oxygen saturation criterion for the Core Summer Salmonid Habitat use from 90% to 95% oxygen saturation. This reflects the extra protection for early life stages needed during summer months when water temperatures are elevated, river flows are lower, and to account for other environmental factors that may be reducing oxygen levels.

This brings the question as to why 95% oxygen saturation is not applied to the sensitive Char Spawning use. This can be explained by the applicable temperature criteria for the Char Spawning use versus the Core Summer Salmonid use (Table 1). When spawning occurs during late spring, throughout summer, or early fall when water temperature are sometimes elevated compared to other times of the year, the supplemental spawning temperature criteria is applied. The applicable year-round temperature criterion for the Core Summer Salmonid Habitat use is 16°C, whereas supplemental spawning criteria is 13°C. A 90% oxygen saturation criterion at 13°C equates to a D.O. concentration of 9.5 mg/L at sea level. While 9.5 mg/L may be protective in some streams, a 2 mg/L D.O. depression may occur in moderate to high quality spawning gravels and not be adequate for full protection (which is considered 10 mg/L). A 95% oxygen saturation criterion is equivalent to 10 mg/L at 13°C at sea level. Thus, a 95% oxygen saturation value at 13°C

is equivalent to the D.O. concentration protection level of early life stages of 10 mg/L. The applicable year-round temperature criterion for the Char Spawning use is 12°C, whereas the supplemental spawning criteria is 9°C. A 90% oxygen saturation criterion at 12°C is equivalent to 9.7 mg/L at sea level, whereas at the 9°C supplemental spawning criterion, the equivalent oxygen concentration is 10.2 mg/L. Thus, the 90% oxygen saturation criterion is more stringent than the concentration-based D.O. criteria of 10 mg/L needed for early life stage salmonid protection for the Char Spawning use.

In summary, the different temperature requirements for Core Summer Salmonid Habitat and Char Spawning uses influences the applicable oxygen saturation criterion needed for full protection (Table 1). We support the use of 90% oxygen saturation for all uses, except Core Summer Salmonid Habitat use, based on salmonid spawning and rearing timing as well as applicable temperature requirements.

Table 1. Minimum D.O. levels at 90 and 95% oxygen saturation at maximum temperatures for each salmonid spawning use at sea level.

Designated Aquatic Life Use	Maximum Temperature in (°C)	Minimum D.O. level at 90% saturation in mg/L	Minimum D.O. level at 95% saturation in mg/L
Salmonid spawning, rearing and migration	17.5	8.6	9.1
Non-anadromous Interior Redband Trout	18	8.5	9.0
Core summer salmonid habitat	16	8.9	9.4
Core summer salmonid habitat (supplemental spawning)	13	9.5	10.0
Char Spawning	12	9.7	10.2
Char Spawning (supplemental spawning)	9	10.4	11.0

Comment 13.7

The proposed language at WAC 173-201A-200(1)(h)(ii) includes, "Water bodies shall not contain fine sediment (<2 mm) from anthropogenic sources at levels that cause adverse effects on aquatic life, their reproduction, or habitat."

Unless Ecology has some kind of structured approach or translation procedures to address this requirement, "at levels that cause adverse effects on aquatic life, their reproduction, or habitat," it may be difficult to demonstrate compliance. EPA recommends revising the statement to, for example "shall not contain fine sediment derived from human sources."

Response 13.7

We have revised the rule language to remove the reference to making a determination and correlation between sediment conditions and adverse effects on aquatic life. The new language indicates that excess fine sediment from human derived sources may not impair

water uses. This aligns with the water quality assessment impairment listing methodologies we intend to finalize in the future.

Comment 13.8

The second sentence of the proposed language at WAC 173-201A-200(1)(h)(ii) says, "When reference sites are used, sediment conditions shall be compared to sites that represent least disturbed conditions of a neighboring or similar water body."

EPA recommends amending the statement, "least disturbed conditions of a neighboring or similar water body" to ensure that the reference site is appropriate to use. Suggest language clarifying this point, for example "least disturbed conditions of a waterbody of comparable hydrography, (including flow, elevation, stream order, gradient), geology, ecology, and habitat."

Response 13.8

We have revised the rule language to include least disturbed conditions of a comparable water body or ecoregion. This addition allows us to compare site conditions to an individual reference site or an ecoregional reference value compiled from least disturbed sites.

14 – Washington Association of Sewer and Water Districts

Comment 14.1

We appreciate the work that Ecology has done to revise these water quality rules in order to satisfy EPA concerns about fine sediments and meet the requirements of a stipulated order of dismissal of a past litigation against EPA. Ecology staff gave a good presentation explaining how this represents an expansion from strictly water column based dissolved oxygen (D.O.) by adding oxygen saturation and intergravel D.O. We also understand that Ecology has further work to do regarding methodologies for sampling and measurement of these parameters.

Response 14.1

Comment noted. We appreciate the support to adopt regulatory standards that reflect current science to protect salmon spawning habitat.

Comment 14.2

We do have some concerns with the interpretation and implementation of the rule.

Ecology has stated that the oxygen saturation criteria will better allow for distinguishing temperature effects from nutrient effects. Furthermore, it was allowed that warm water conditions that are natural, and therefore allow less oxygen saturation, will not be counted as anthropogenic. This raises several questions: What would be considered natural? How would we know what is natural for a creek if the banks have been cleared of vegetation prior to European influence, such as burning by indigenous peoples? Will this rely strictly on reference sites?

Response 14.2

The oxygen saturation criterion accounts for the influence of naturally warm waters on oxygen levels but does not make a determination of natural conditions. To calculate oxygen saturation, temperature is a required input. As temperature increases, oxygen solubility in water decreases. Thus, oxygen saturation accounts for temperature related impacts to dissolved oxygen levels. We currently do not have a method for distinguishing a temperature driven impairment in oxygen levels from a nutrient driven impairment. If temperature is driving low dissolved oxygen levels, then the numeric temperature criteria established for the waterbody will carry the necessary impairment determination and actions to remediate temperature pollution will follow. A cleanup plan for water temperature should be developed rather than dissolved oxygen levels.

When we make a determination of natural conditions for temperature, we often have to rely on models that incorporate various inputs that be used to estimate shading potential, flows, and other environmental factors that contribute to changes in temperature. Natural condition determinations is beyond the scope of this rulemaking and is conducted outside of the water quality standards program.

Comment 14.3

Ecology spoke of the potential of these rules to impact future permit issuance and renewals, and we understand that this will occur on a permit by permit basis. NPDES stormwater permits largely operate on the use of best management practices, including inspection of construction sites for adequate sediment controls. Do you anticipate any further permit requirements or an increased effort on the part of Ecology regarding inspection of construction sites to control sediment?

Response 14.3

We do not anticipate additional requirements to control sediment for construction stormwater permits. This rulemaking is aimed at characterizing methods for fine sediment assessments in receiving water bodies and making a determination of impairment for water bodies. The fine sediment assessments are associated with evaluating steady state chronic sediment conditions of the water body. However, if a construction site is releasing sediment into a water body that has been determined to be impaired for fine sediment, additional controls could be necessary depending on the cleanup plan or load allocations. Fine sediment is often associated with non-point source pollution; therefore, additional best management practices or other measures may be necessary to meet load allocations for an impaired water body but this will be determined on a water body specific basis.

Comment 14.4

We wonder what the impact of the rule changes will be on Habitat Conservation Plans that have been developed for forest lands across the state as part of endangered species response, and to provide long-term certainty for wood products producers. The courts have already rejected efforts to require NPDES permits for logging roads, so is this intended as another method to regulate those discharges?

Response 14.4

The Habitat Conservation Plans (HCP) have the purpose of protecting endangered species. The HCPs for forest activities in Washington also state that meeting water quality standards is a concurrent objective since water quality standards are designed to meet aquatic life protection. The HCPs are part of the Forest Practices Program in Washington, and the BMPs that are identified in that program are designed to meet water quality objectives. Forest activities are not allowed to pollute under state statutes. This rule will not change that.

Comment 14.5

Finally, it appears that much of the solution for the problems of dissolved oxygen, oxygen saturation and fine sediments will lie in greatly increasing buffers and vegetation along streams and rivers. After decades of resisting establishment of a trading program for a variety of compliance projects, the time is right for Ecology to work with the regulated community to establish one for this project as well as the new Nutrient Permit that was just released. Allowing permittees to participate in plantings and erosion control projects will allow reduction of sediments, nutrients, and provide shade to reduce temperatures and increase dissolved oxygen. Ecology should also provide money and other incentives for private property owners to take actions on their lands, something that local jurisdictions cannot require to be done.

Response 14.5

Comment noted. While the comment is outside the scope of this rulemaking, we agree that cooperative work at all levels, both public and private, are important for working towards water quality improvements. We do want to note that there are numerous funding opportunities at the state and federal level for the types of pollution control projects you suggest. We encourage you to see Ecology's Grants and Loan's website[12] that offers helpful resources for information and support for water quality projects funded by us and federal partners. In particular, we provide resources for grant or loan recipients with the types of projects you suggest that address issues and sources from nonpoint pollution.

15 – Washington Forest Protection Association

Comment 15.1

My concern is that there is not enough information in Preliminary Regulatory Analyses, Publication 21-10-057 and the supporting document Publication 21-10-050 Preliminary Technical Support Document to allow the regulated community to fully assess the potential impacts to our operations.

My understanding is that the assumption is that the new regulations will only apply to impaired waters.

[12] https://ecology.wa.gov/About-us/Payments-contracts-grants/Grants-loans/Find-a-grant-or-loan/Water-Quality-grants-and-loans/General-resources

Question: Who will be taking the measurements to determine impairment? Landowners or DOE staff/contractors?

Response 15.1

Once adopted, the new water quality standards will be effective for all surface waters of the state with designated aquatic life uses. This represents effectively all surface waters of the state. We are legally obligated under the Clean Water Act (CWA) to regularly evaluate and report to EPA waters that are not meeting their designated uses (i.e., water quality standards). Through our water quality assessment process, we routinely gather all credible and readily available water quality data across the state, make water quality determinations for those waterbodies with available data, and provide our results to EPA to satisfy this requirement of the CWA. Data used to determine impairment status may be collected by Ecology, other state agencies, federal agencies, municipalities, Tribes, environmental groups, non-profits, etc. No party is required to collect data to determine impairment. Ecology is only required to evaluate all credible and readily-available data.

Comment 15.2

My understanding is that DOE does not know the extent of impaired waters with respect to DO and fine sediment, so it is unable to directly estimate sector-wide impacts. Instead, they looked at one business in each sector that might have to act in order to comply with the new rules or a TMDL. In the non-point world, this compliance might take the form of simple or complex riparian buffers or fencing to exclude livestock. DOE modeled the costs for each of these example businesses and put the results in an I/O model (REMI) to produce sector-wide impacts. The published impacts included only employment and predicted, for example, a loss of two jobs in forestry and logging and one job in forestry and agricultural support activities.

Question: Is the above paragraph a fair summary of how DOE derived impacts on the regulated community?

Response 15.2

The above paragraph is mostly correct, and we offer this further clarification:

We applied a randomly selected cost range to one business in every identified industry (due to the high degree of uncertainty in the locations and attributes of impacted waterbodies and associated dischargers) and combined them in one model. The higher end of the costs range was applied to "Forestry and logging" sector, which affected the results, showing the strongest impact on this industry.

We use REMI E3+ model to find the impacts on state economy in terms of output and employment. The model consists of thousands of simultaneous equations. There are five major blocks: (1) Output and Demand; (2) Labor and Capital Demand; (3) Population and Labor Supply; (4) Compensation, Prices, and Costs; and (5) Market Shares. The necessity to implement projects to control fine sediments would increase the production costs, decreasing output, and, therefore, employment. If, in our modeling scenario, we chose to apply the highest end of the cost range – "Riparian buffer for a 10 acres site" –

to another industry from the list of potentially impacted, the results would show the strongest impact to that industry.

Overall, modeling results did not indicate significant impacts to industries. Output would decrease by $1.3 million in 2022 over all industries in the state, which in relative indicators shows as a decrease of:

- 0.018% decrease from the baseline for "Forestry and logging";
- 0.004% decrease for "Support activities for agriculture and forestry"; and
- 0.002% for "Other wood manufacturing".

This is due to the capital costs associated with Best Management Practices (BMP) implementation occurring in 2022. The model did not indicate that monitoring costs would impact output, and therefore, revenue of the industries (including pricing). These results are scalable based on the number of dischargers assumed to be impacted in each industry.

Comment 15.3

Question: Can DOE please provide details of the necessary actions and costs for the examples for 1) the forestry and logging, and 2) the forestry and agricultural support activities sectors and the information that was put into REMI?

Response 15.3

In our Preliminary Regulatory Analyses (PRA), to identify actions and costs, we distinguished between point discharges and non-point discharges, rather than costs for different industries. The current uncertainty about future TMDLs makes it impossible to predict what industries in which regions would be affected. To give an example of hypothetical costs, we reference monitoring and sediment control BMPs.

For point discharges, we assume that fine sediment monitoring costs would be similar to monitoring costs for turbidity or TSS. Ecology estimated these costs for sites with 1-5 acres at $1,650 per year, and at $2,721 per year for sites 5+ acres in the *Small Business Economic Impact Analysis*[13] for the *Construction Stormwater General Permit* (2021). The estimated 20-year PV for fine sediments monitoring costs is between $20,271 and $33,429, depending on the size of a site.

It is very likely that a discharger with permit limits for TSS or turbidity already has sediment technology controls in place suitable for fine sediment pollution prevention. For example, TSS effluent limits target the removal of solids less than 0.06 mm while fine sediments are defined as particles < 2 mm in this rulemaking. Sites that would not need to take additional action would not incur these additional costs as a result of the proposed rule amendments.

[13] https://apps.ecology.wa.gov/publications/documents/2010022.pdf

To address nonpoint sources, Ecology develops a list of BMPs for each of the water quality pollution sources identified. Some sites will require very basic erosion and sediment control BMPs (mulch, silt fence, etc.), while others will need extensive treatment technologies (sediment ponds, filters, etc.). BMPs described below are deemed reasonable and feasible, and funding assistance is available to incentivize implementation.

The BMPs for managing fine sediments at nonpoint sources include:

- Reducing erosion (vegetative buffers, conservation-based tillage);
- Reducing runoff-carrying sediment;
- Reducing livestock impacts; and
- Informing and educating watershed residents about water quality issues.

Many of the BMPs address more than one water quality issue (e.g., temperature, addressing bacteria and chemical sediments, etc.). Therefore, it is difficult to identify specific BMPs to address fine sediment and costs associated with implementation. However, we have some estimates for common BMPs used to address sediments. For REMI E3+ inputs, we used an estimate made by Ecology. We provide the ranges, because the costs are likely to vary significantly from real costs of upgrading a particular site depending on the site's specific conditions. Site-specific factors, such as background water characteristics, site constraints, geotechnical conditions, and the condition and layout of the existing control technologies, can have a dramatic impact on the ultimate cost of a nonpoint pollution mitigation project.

We used the following input information in REMI E3+.

Table 15.3 (a). Costs input to REMI E3+ model, thousands $

Industry	Onetime costs 2022	Annual costs for 2023 - 2040
Forestry and Logging	**350**	**2.7**
Other wood product manufacturing	35	2.7
Other fabricated metal product manufacturing	41.75	2.7
Wholesale trade	3.5	1.6

Industry	Onetime costs 2022	Annual costs for 2023 - 2040
Scenic and sightseeing transportation and support activities for transportation	1.6	1.6
Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance	2.7	2.7
Office administrative services; facilities support services	4.175	1.6
Retail trade	35	1.6

We assumed *Forestry and Logging* would incur one-time costs for complex buffers on a large site, and ongoing monitoring costs, per the table below.

Table 15.3 (b). Illustrative costs estimates for non-point dischargers, thousands $

Cost category	Cost per acre	Small site (1 acre)	Large site (10 acres)
Monitoring, annually	-	1.6	**2.7**
Livestock Exclusion Fencing	4,175	4,175	41,750
Riparian buffer (simple)	3,500	3,500	35,000
Riparian buffer (complex)	35,000	35,000	**350,000**

Stakeholders may find some other illustrative cost estimates for nonpoint BMPs made by the Lower White River TMDL Workgroup at Ecology in Table 5 of the PRA.

Comment 15.4

Question: It seems that REMI would predict additional impacts beyond just employment such as overall additional costs, loss in output, etc. Can DOE provide additional impact predictions for at least the forestry and logging and the forestry and agricultural support activities sectors.

Response 15.4

The forestry industry is forecasted to be more impacted than other industries. We have added information about the REMI forecast specific to the forest industry to the Final Regulatory Analyses.

Comment 15.5

Cost Benefit Analyses are meant to be marginal analyses. In this case, the marginal probable benefits that could be expected as a result of the rule should be laid out and discussed and quantified if possible.

Question: Does DOE have an estimate of the additional fish that might be produced as a result of the rule and an estimate of their value?

Response 15.5

We cannot provide any marginal indicators for the benefits part of this rulemaking because we do not know what water bodies and the number of dischargers that would be affected by future 303(d) lists. For each waterbody listed as impaired, a TMDL or clean-up plan would be developed. The goal of a TMDL is to establish a numerical value that represents the highest amount of pollutant a surface water body can receive and still meet water quality standards. Regardless if there is one or multiple dischargers (and thus, if cost of maintaining a TMDL is applied to one or many dischargers), the overall objective is achieve water quality conditions that are protective of all fish species.

Improvements in fine sediment conditions as a result of clean-up actions may result in higher reproductive success for fish. However, we cannot quantify a potential increase in the number of fish because it would require characterization of each individual stream condition, the change in each stream condition, and the relationship between stream condition and fish abundance. This sort of analysis would need to be site-specific and dependent on several other environmental variables that determine reproductive success, making it difficult to make state-wide generalizations on the impact of this rulemaking. The methods developed in the rulemaking will enable us to evaluate stream condition to determine if an improvement in stream condition is necessary that may ultimately improve spawning habitat and fish reproductive success.

Estimate of the additional fish that might be produced

With the implementation of sediment criteria, Ecology will have more efficient methods to determine whether waterbodies are impaired by human-caused sediment sources. The identification of these rivers and streams will assist with implementing clean-up actions,

such as TMDL development and implementation, and enforcement of the state's water pollution control regulations where sources can be identified.

However, as we do not know how many streams are affected by excess sediment, as well as how many systems will be identified for prioritization of clean-up actions, it is difficult to calculate how many fish spawning areas will be improved. Therefore, it is difficult to determine what the rulemaking will result in, in terms of fish survival.

The rule is an improvement in efficiencies that will assist existing programs to prioritize resources for cleanup. However, the resources for cleanup are the limiting factor no matter how more efficient we are with identifying rivers and streams that need improvement.

An estimate of fish value

Fish, particularly salmonids, in Washington are valued for many different ways, as discussed in the Preliminary Regulatory Analyses. In light of your comment, we have added information to additionally flesh out these values, including some quantified values as available and appropriate, as well as contextual information regarding the current state of fish populations, compounding challenges, and future trajectories to the Final Regulatory Analyses.

16 – Willis, Steve

Comment 16.1

Oral testimony was given at the December 8, 2021 Public Hearing. The following is a summary of the comment provided:

Commenter noted that he was a consultant from the University of Washington many years ago. The commenter stated we are taking too much gravel out of the river systems. Gravel builds up and erodes our land and buffer zones along the riverbanks. The commenter stated that he has seen sediment or trees go into the river for the past 30 years. Sediment in the Chehalis River Valley is 15 feet deep. The port is dredging the inner harbor and dumping the sediment into the ocean. The commenter has spoken to people at Ecology for 34 years and has had no satisfactory result regarding prevention of the sediment from going into the rivers. The commenter reached out to the tribes, and they were non-responsive. The commenter filed complaints with the EPA and Ecology and said they would not respond back. The commenter referenced the Oso landslide. For the Lower Satsop: engineered logjams and pulling gravel out and putting it on top of the river bar that was going to force the river into the land, and it eroded a couple acres into the river. The commenter felt like the biggest contributors of sediment is the state and tribal governments' policies that have taken us off the gravel bars and caused erosion. The commenter has seen a lot of gravel dumped into the river in the last 45 days.

Response 16.1

Comment noted. The issues raised are out of the scope of this rulemaking.

Appendix A: Citation List

Chapter 173 – 201A WAC
Water Quality Standards for Surface Waters of the State of Washington
AO # 19 – 05

This citation list contains references for data, factual information, studies, or reports on which the agency relied in the adoption for this rule making (RCW 34.05.370(f)).

At the end of each citation is a number in brackets identifying which of the citation categories below the sources of information belongs (RCW 34.05.272).

Table 2 Citation Categories

	Citation Categories
1	Peer review is overseen by an independent third party.
2	Review is by staff internal to Department of Ecology.
3	Review is by persons that are external to and selected by the Department of Ecology.
4	Documented open public review process that is not limited to invited organizations or individuals.
5	Federal and state statutes.
6	Court and hearings board decisions.
7	Federal and state administrative rules and regulations.
8	Policy and regulatory documents adopted by local governments.
9	Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under other processes.
10	Records of best professional judgment of Department of Ecology employees or other individuals.
11	Sources of information that do not fit into one of the other categories listed.

Adams K. 2010. *Quality Assurance Monitoring Plan, Ambient Biological Monitoring in Rivers and Streams: Benthic Macroinvertebrates and Periphyton*. Publication 10-03-109. Washington State Department of Ecology, Olympia, WA. Quality Assurance Monitoring Plan: Ambient Biological Monitoring in Rivers and Streams: Benthic Macroinvertebrates and Periphyton (wa.gov) [1]

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