DEQ Water Quality Division

Methodology for Oregon's 2012 Water Quality Report And List of Water Quality Limited Waters

(Pursuant to Clean Water Act Sections 303(d) and 305(b) and OAR 340-041-0046)

State of Oregon
Department of
Environmental
Quality

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I. Introduction

The federal Clean Water Act (CWA) Section 305(b) requires that states submit a biennial water quality inventory report in April of even numbered years. The report provides information on the water quality of all navigable state waters; the extent to which state waters provide for the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife, and allow recreational activities in and on the water; and how pollution control measures are leading to water quality standards being met.

The CWA Section 303(d) additionally requires that each state identify waters where existing pollution controls are not stringent enough to achieve state water quality standards, and establish a priority ranking of these waters. Section 303(d) requires states to develop Total Maximum Daily Loads (TMDLs) for the identified waters. TMDLs describe the amount of each pollutant a water body can receive and not violate water quality standards. States submit the list of waters needing TMDLs (303(d) list) to EPA and EPA either approves or disapproves the list within thirty days after the submission.

EPA regulations (40 CFR 130.7 and 40 CFR 130.8) specify the process for developing the 303(d) list and the content of the biennial water quality report. EPA guidance recommends that States submit an **integrated report** to satisfy 305(b) and 303(d) requirements.[1] The integrated report presents the results of assessing available data to determine where water quality standards are met or not met, and identifies the pollutants causing water quality limitations or impairments.

EPA regulations require States to describe the methodology, data, and information used to identify and list water quality limited segments requiring TMDLs. The assessment methodology contains the "decision rules" used to evaluate data and information. Oregon Administrative Rules (OAR 340-041-0046) also require the specific evaluation process be identified.

This document, **Methodology for Oregon's 2012 Water Quality Report and List of Water Quality Limited Waters,** describes how DEQ developed Oregon's 2012 Integrated Report for 305(b) and 303(d). The methodology is consistent with key elements of Oregon's water quality standards, including designated uses, narrative and numeric criteria, antidegradation requirements, and standards application procedures, and is the framework DEQ uses to assess water quality conditions.

Oregon's 2012 water quality assessment and integrated report focuses on a statewide evaluation of toxic pollutant data and analysis of dissolved oxygen data for the Willamette and Umatilla River basins. DEQ is focusing on these areas for the following reasons:

[1] October 12, 2006, Memorandum from Diane Regas, EPA Office of Wetlands, Oceans and Watershed Re: Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions http://www.epa.gov/owow/tmdl/2008_ir_memorandum.html

1. EPA's additions to DEQ's 2010 Integrated Report were based on a review of water quality data dated January 1, 2000 through December 28, 2010 and were not finalized until December 14, 2012. Due the length of time it took EPA to publish a final list, DEQ approached the 2012 Integrated Report with objective of focusing on analyses that that EPA did not conduct or where analyses would provide the most benefit to DEQ programs.
2. DEQ completed a major revision of Oregon's toxics water quality criteria that were approved by EPA in October 2011. While EPA added new listings of impaired waters based on these revisions, EPA did not evaluate whether any other revisions should be made to integrated report. The 2012 assessment more fully updates previous 303(d) listings based on the revised and withdrawn human health criteria.
3. DEQ is piloting the rotating basin approach described in EPA's 2009 memorandum. Under this new approach, DEQ is evaluating synchronizing the 303(d) assessment with a watershed approach to evaluate and prioritize water quality issues and actions in each of the state's major river basins over time, focusing on three basins per year. This approach allows for more in-depth evaluation of the current status of water quality and beneficial use support in each basin, in addition to the prioritization of TMDLs. This year, because the Willamette basin is very large, DEQ is conducting basin assessments for two basins, the Willamette and the Umatilla.

The assessment methodology is consistent with the following:

- Water Quality Standards, Beneficial Uses, Policies, and Criteria for Oregon: Oregon Administrative Rules Chapter 340 Division 41. http://arcweb.sos.state.or.us/rules/OARs_300/OAR_340/340_041.html
- Letter from DEQ to EPA, Region 10, Policy clarifications for Oregon's water quality standards interpretation, June 22, 1998.
- Letter from DEQ to EPA Region 10, Oregon responses to EPA questions re: the State's water quality temperature standards, February 4, 2004.
- March 21, 2011, Memorandum from Denise Keehner, Office of Wetlands, Oceans, and Watersheds Re: Information Concerning 2012 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/final_2012_memo_document.pdf
- May 5, 2009, Memorandum from Suzanne Schwartz, EPA Office of Wetlands, Oceans, and Watersheds Re: Information Concerning 2010 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/final52009.cfm
- October 12, 2006, Memorandum from Diane Regas, EPA Office of Wetlands, Oceans and Watershed Re: Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions http://www.epa.gov/owow/tmdl/2008_ir_memorandum.html
- Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b), and 314 of the Clean Water Act: United States Environmental Protection Agency, (July 29, 2005) http://www.epa.gov/owow/tmdl/2006IRG/

- Guidance for 2004 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act: United States Environmental Protection Agency, (July 21, 2003) http://www.epa.gov/owow/tmdl/tmdl0103/index.html
- Federal Water Pollution Control Act Chapter 26 Water Pollution Prevention and Control
- 40 CFR Part 130.7 (Code of Federal Regulations)
- 40 CFR Part 130.8 (Code of Federal Regulations)

II. Statewide Information

Oregon's Water Quality Standards

The objective of the Clean Water Act is to restore and maintain the physical, chemical and biological integrity of the Nation's waters (CWA Section 101(a)). To achieve this objective, States develop and adopt water quality standards. Water quality standards include beneficial uses, narrative and numeric criteria, and anti-degradation and implementation policies. Oregon's water quality standards are adopted in Oregon Administrative Rules (OAR) Chapter 340 Division 41 (http://www.deq.state.or.us/regulations/rules.htm). These rules include policies and criteria that are applicable throughout the state.

Beneficial uses are designated by the Oregon Environmental Quality Commission. Basin-specific beneficial uses and fish uses are designated in OAR 340-041-0101 through OAR 340-041-0340. Fish use designations include explicit water body segment locations and time periods for fish uses and life stages. For example, the beneficial uses protected in the Main Stem Columbia River are designated in OAR 340-041-0101 and shown in Table 101A and Table 101B as follows:

> **340-041-0101**
> **Beneficial Uses to Be Protected in the Main Stem Columbia River**
> (1) Water quality in the main stem Columbia River (see Figure 1) must be managed to protect the designated beneficial uses shown in Table 101A (November 2003).
> (2) Designated fish uses to be protected in the main stem Columbia River are shown in Table 101B (November 2003).

Table 101A
Designated Beneficial Uses
Mainstem Columbia River

Beneficial Uses	Columbia River Mouth to RM 86	Columbia River RM 86 to 309
Public Domestic Water Supply[1]	X	X
Private Domestic Water Supply[1]	X	X
Industrial Water Supply	X	X

Irrigation	X	X
Livestock Watering	X	X
Fish & Aquatic Life[2]	X	X
Wildlife & Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X
Hydro Power		X
Commercial Navigation & Transportation	X	X
1 With adequate pretreatment and natural quality that meets drinking water standards.		
2 See also Table 101B for fish use designations for this river.		

Table produced November, 2003
http://www.deq.state.or.us/wq/rules/div041/dbutables/table101a.pdf

Table 101B
Beneficial Use Designations – Fish Uses
Mainstem Columbia River

Geographic Extent of Use	**Salmon and Steelhead Migration Corridors (20°C)**	**Salmon and Steelhead Spawning through Fry Emergence**	**Shad and Sturgeon Spawning and Rearing**
Mainstem Columbia River			
Beacon Rock to Upstream of Ives Island (RM 141.5 to RM 143.5)		October 15 - March 31	
Columbia River, mouth to WA border (RM309)	X		
Columbia River (RM 147 to RM 203)			X

Table produced November, 2003
http://www.deq.state.or.us/wq/rules/div041/futables/table101b.pdf

Oregon water quality standards include statewide narrative criteria established in OAR 340-041-0007. Narrative criteria include provisions for:

- Less stringent natural conditions to supersede numeric criteria (OAR 340-041-0007(2),
- Prohibitions on fungi or other growths that negatively impact beneficial uses (OAR 340-041-0007(11),
- Prohibitions on tastes, odors, or toxic conditions that negatively impact beneficial uses (OAR 340-041-0007(12), and
- Prohibitions on bottom deposits that negatively impact beneficial uses (OAR 340-041-0007(13).

Oregon water quality standards for specific pollutants are established in OAR 340-041-0009 (Bacteria) through OAR 340-041-0036 (Turbidity). For this assessment, each pollutant is assessed independently. The methodology for each pollutant is discussed in later sections of this document. Oregon's aquatic life criteria for toxic substances (OAR 340-041-0033) were revised in 2004. EPA approved some of the revisions and disapproved others in January, 2013. The aquatic life criteria effective at the time of the 2012 assessment are found on Tables 20, 33A, and 33B (http://www.deq.state.or.us/wq/standards/docs/MemoDOCriteria20100608.pdf). The human health criteria for toxic substances (Table 40) were revised by DEQ in June 2011 and approved by EPA in October 2011. Therefore, the 2012 303d assessment will use the 2011 (Table 40) criteria to evaluate whether Oregon's water quality supports fishing (fish consumption) and domestic water supply (drinking water) uses.

Temperature criteria (OAR 340-041-0028) for temperature-sensitive fish uses, including salmonid life cycle stages, were adopted by Oregon in 2003 and approved by EPA and are applicable for assessment purposes at the locations and time periods when those fish uses are designated. Dissolved oxygen criteria are established for cold, cool and warm water aquatic life communities and for salmonid spawning. These criteria are also applicable where the relevant uses are designated, as described in the dissolved oxygen section of this document.

Rotating Basin Approach

The rotating basin approach follows the principles of adaptive management and the watershed approach. This approach uses the best information available to take action on immediate problems. It also involves using new information to improve practices over time. This "continuous improvement" process allows DEQ to focus its resources in three basins or watersheds a year and regularly assess the situation in each basin to determine in an outcome-based approach what's working and what's not.

The rotating basin approach allows Oregon DEQ to:

- Share its findings with affected stakeholders and residents of the basins, so all parties learn how to better manage our watersheds.

- Prioritize immediate and long-term actions that can be taken in a particular basin or watershed, through DEQ's Water Quality Status and Acton Plan documents. These actions will emphasize working closer with all affected parties to identify goals and measure success.

- Encourage all involved to be flexible and open to new ways of solving problems (including voluntary collaboration where possible) and avoiding duplication of efforts.

For the 2012 Integrated Report the focus is on updating the Integrated Report for the Willamette and Umatilla basins for dissolved oxygen and toxic pollutants. In addition, DEQ evaluated a sub-set of toxic parameters statewide as described in the section below.

Data Sources and Quality

DEQ evaluated existing and readily available data and information consistent with Oregon's standards and assessment methodology. To gather information on water quality for the 2012 assessment, DEQ reviewed water quality data available from agency monitoring activities, solicited data from outside the agency, and reviewed other available data and information. Data and information used for assessment purposes may include water quality, fish tissue, sediment or biological data that is evaluated relative to water quality criteria, maximum contaminant levels (MCLs) or other published benchmarks. It may also include public health advisories for harmful algal blooms (HABs) or fish consumption.

The data and sample requirements for each pollutant or parameter are discussed in the section below titled: **Oregon's Assessment Protocols by Pollutant**. Data at individual sampling sites are evaluated independently according to these requirements to determine if sufficient information is available and, if so, to assign a status to the monitoring site. Results for the monitoring sites are then grouped to determine the status for an assessment unit or segment of the water body. Rules for defining water body segments are discussed in the section on **Segmentation**.

Call for Data

DEQ issued a public call for data for the 2012 Integrated Report evaluation and accepted data submittals from December 15, 2011 through January 31, 2012. The call for data included a description of the requirements for data type, quality assurance/quality control (QA/QC), and data formats. Information for the call for data was available on-line at http://www.deq.state.or.us/wq/assessment/2012DataInfo.htm. Data collected since the last call for data (June 2009) was solicited. Data submitted or obtained by DEQ were reviewed for data quality level and evaluated for inclusion in the 2012 Integrated Report.

Available Data

For the 2012 Integrated Report data evaluation, available data were assembled from three primary sources:

- Oregon DEQ's Laboratory Analytical and Storage Retrieval (LASAR) database,
- USGS Oregon Water Sciences Center (http:/or.water.usgs.gov/), and
- Third party entities (Center for Biological Diversity, City of Canby, City of Gresham, City of Wilsonville, Tualatin Joint Water Commission, City of Salem, and Clackamas County SWCD).

Only data graded quality level A or B were evaluated for the 305(b)/303(d) assessment. All data assessed were collected between January 1, 2000 and December 31, 2011 in the Willamette and Umatilla basins (except for select metals evaluated statewide). Data from continuous sampling temperature data loggers were not retrieved for the 2012 evaluation.

For additional information, please see the section below titled: **Oregon's Assessment Protocols by Pollutant.**

Metadata Requirements

For monitoring data submittals, DEQ requires sampling site descriptions and geographic information for each sampling location. This location information must include monitoring station latitude, longitude, LLID, and river mile, as described below.

DEQ uses a 1:100,000 geo-referenced river reach system compiled for the Pacific Northwest. The river reach system is the hydrography component in a regional rivers and fisheries information system known as StreamNet. Information about this system is available at http://www.streamnet.org/pnwr/PNWNAR.html . A stream based identifier called the LLID (Longitude/Latitude ID) is used to uniquely identify streams and lakes. This attribute consists of the longitude and latitude of the mouth of the stream or the center of a lake. All reaches that make up a given stream are assigned this unique LLID. Longitude precedes latitude to conform to standard x, y ordering. The code is 13 characters long, with 7 for decimal degrees of longitude and 6 for decimal degrees of latitude, with implied decimal points.

Only one LLID exists for a stream. River mile 0 is assigned at the mouth of the stream at the intersection with the next order stream. Lakes and reservoirs can be identified by both a lake LLID, assigned as river mile 0 at the center point if there is no through flowing stream, and a stream LLID with the river mile maximum at the inlet and minimum at the outlet to the water

body when there is a through flowing stream. Some water bodies are not large enough to show up on the StreamNet 1:100,000 river reach system and do not have an assigned LLID. In those cases, other georeferenced base layers such as the Pacific Northwest Hydrography 1:24,000 layer or National Hydrography Data were used to reference a GIS feature and LLID derived according to the general guidelines for determining LLID described above. In a few cases where the feature was apparent on satellite imagery, but not identified on available GIS base layers, DEQ digitized the feature and assigned an LLID using the protocols described above. In earlier assessment cycles, water bodies that did not have a georeferenced LLID were given a placeholder LLID (such as 1111111111111) so that information could be retained in the assessment database even though not available for GIS applications. Where possible, these streams were identified using the most current GIS information available in 2010 and corrected in the database.

QA/QC Requirements

Data must be high quality and meet data quality level A or B requirements to be evaluated for the 305(b)/303(d) assessment. Analytical laboratory data are assessed against current Quality Control (QC) limits established by the referenced analytical method and/or the QC limits established by the laboratory that performed the testing and supplied the data to DEQ. DEQ also utilizes EPA National Functional Guidelines for Data Review as guidance when assessing laboratory data. http://www.epa.gov/superfund/programs/clp/guidance.htm

DEQs Data Quality Matrix (March 2009) provides data validation criteria for water quality parameters measured in the field. http://www.deq.state.or.us/lab/techrpts/docs/DEQ04-LAB-0003-QAG.pdf

2012 Integrated Report Assessment Categories

Assigning a water quality assessment category to Oregon's waters is a significant feature of Oregon's 2012 Integrated Report. EPA continues to recommend using five categories to classify water quality status.[2] The categories represent varying levels of water quality standards attainment and beneficial use support, ranging from Category 1, where all designated uses for a water body are supported, to Category 5, where a water body is impaired and a TMDL is required to return the water to a condition where the water quality standards are met. The category assignments are based on evaluating all existing and readily available data and information consistent with Oregon's standards and assessment methodology. In general terms, the assessment categories are:

Category	Definition
Category 1	All designated uses are supported. (Oregon does not presently use this category.)
Category 2	Available data and information indicate that **some designated uses are supported** and the water quality standard is attained.

[2] Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act: United States Environmental Protection Agency, (July 29, 2005) http://www.epa.gov/owow/tmdl/2006IRG/

Category 3	**Insufficient data** and/or information is available to determine whether a designated use is supported.
	3B: Potential concern: Insufficient data to determine whether a designated use is supported. Available data indicate a potential concern but additional information is needed.
Category 4	Data indicate that at least one designated use is not supported but a TMDL is not needed. This includes:
	4A: TMDLs that will result in attainment of water quality standards have been approved.
	4B: Other pollution control requirements are expected to address pollutants and will result in attainment of water quality standards.
	4C: Impairment is not caused by a pollutant (e.g. stream flow, large wood and other physical habitat features are not considered pollutants).
Category 5	Available data and/or information indicate that at least one designated use is not supported and a TMDL is needed. This category constitutes the Section 303(d) list that EPA will approve or disapprove under the Clean Water Act.

General Policies and Procedures

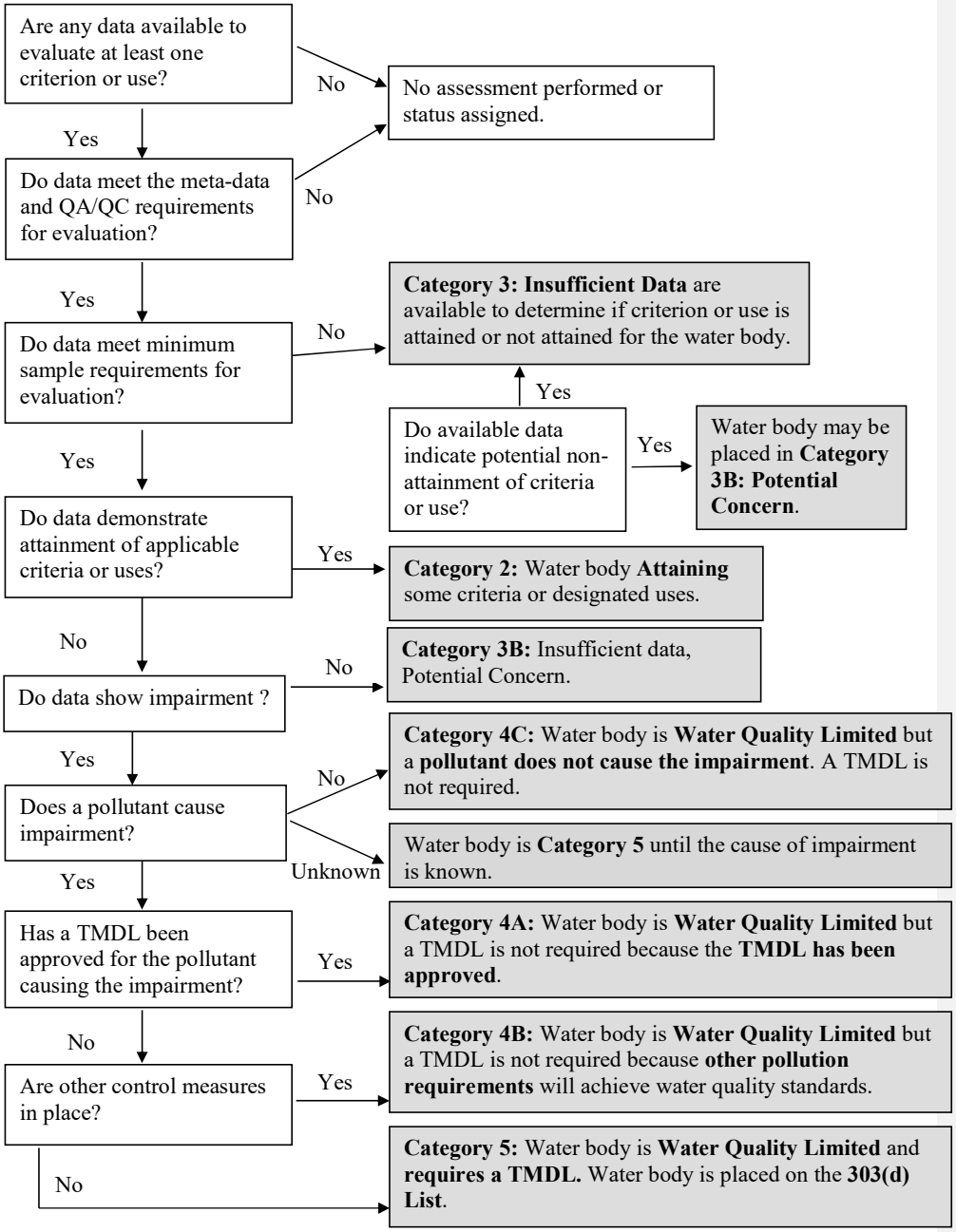
Assessing Water Bodies

Oregon uses the policy of independent applicability to assess attainment of water quality standards, as recommended by EPA.[3] Each water quality standard is evaluated independently and a category is assigned for each standard where sufficient data are available. Since no water body has sufficient data or information on all designated uses and water quality standards, no waters are assigned to Category 1. The following flow chart (Figure 1) summarizes Oregon's assessment process.

The previous section of this report describes the assessment categories generally. Additional detail on how the data are evaluated and assigned to a category for each pollutant or parameter is provided in the section below titled: **Oregon's Assessment Protocols by Pollutant.**

[3] Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d) and 305(b) of the Clean Water Act: United States Environmental Protection Agency, (July 29, 2005) http://www.epa.gov/owow/tmdl/2006IRG/

Figure 1 - Water Quality Report Assessment Categories



Delisting Water Bodies

During the 303(d) assessment, a water body is assigned to an assessment category using available data, the current designated uses and applicable criteria. Water bodies that were placed on a 303(d) Category 5 list in a previous assessment, however, remain on the **2012 list** unless they are delisted. This section describes the procedures by which DEQ will delist water bodies from Category 5 and place the water into another status category.

1. **Current information shows water quality standards are being met**.
    a. A water body may be delisted and assigned to **Category 2: Attaining** if there is sufficient information during the current assessment period to evaluate the pollutant or parameter (i.e. 2000-2011) and that information shows that currently applicable water quality standards are being met. Data for delisting consideration must be of sufficient quality and meet the minimum sample requirements, as described in the "Data Requirements" section for each pollutant.

    b. A water body may be delisted and assigned to **a different category** if data become available that are more relevant to the criterion than the data used for the original listing. In these cases, the more relevant data will be evaluated according to the methods provided in this document and the result of the new evaluation will replace the prior listing.

    c. Additional data are submitted to correct an error in the original assessment. For example, a water body may have been placed on a previous 303(d) list but some data may not have been evaluated if QA/QC requirements were not met. If more recently collected data meet the QA/QC requirements and indicate attainment of the applicable criterion, the water body will be delisted.

2. **Water quality standards have changed or no longer apply in certain water bodies**.

    a. If a criterion was revised, the available information (2000-2011) will be evaluated using the currently applicable criteria and the assessment methodology. For example, if a water body was listed based on a previous standard but the evaluated information shows that the currently effective criteria are being met, the water body is delisted and placed in **Category 2: Attaining**. For example, the human health criteria for the following toxic pollutants approved in October 2011 became less stringent: chloroform, nickel, phenol, and selenium. If the data evaluated for this assessment show that the criteria are attained, the water body status will be changed from category 5 listing to the appropriate category according to this methodology.

    b. A criterion for a family or group of chemicals was replaced by criteria for individual chemicals. Generally, this is because the specific chemicals are the most toxic of that chemical family and/or the most commonly used in industrial processes and/or are prevalent in the environment.

If the evaluated data show the criteria for the individual pollutants are met, the segment will be delisted.

If the evaluated data show the criteria for the individual pollutants are exceeded, the segment will be listed for the individual criteria in place of the former family/group criterion.

If data are not available for the individual criteria, the listing for the family/group will remain until additional information is available.

c. If a criterion is no longer applicable to the water body due to a designated use clarification or change and criteria for the same pollutant related to other beneficial uses are attained, DEQ will delist the water body. If there are no applicable criteria for the pollutant, no data is needed to delist the water body; the basis for a listing has been removed.

   For example, if a water body was listed for temperature in a previous assessment based on salmonid spawning, but the current fish use designation does not include salmon or steelhead spawning use, the water body will be evaluated using the current designated uses and applicable criteria and the temperature listing for salmonid spawning will be removed.

d. If a criterion has been withdrawn because it is not needed to protect the use and there are no other criteria for the same pollutant or data show that all other applicable criteria are being met, DEQ will delist the water body. For example, the manganese criterion for human health was withdrawn for freshwaters. There are no other criteria for manganese and there is no MCL. Therefore, no data evaluation is required to delist manganese in freshwater because there are no applicable manganese criteria; the basis for the listing has been removed.

   If the human health criterion has been withdrawn, but an aquatic life criterion remains, which is the case for iron and silver, data will be evaluated against the aquatic life criteria.

   If an MCL exists for the withdrawn pollutant, DEQ will evaluate the data as described in the toxics section below. This situation occurred in the 2012 assessment for beryllium.

e. Mercury. The human health criterion was changed from total mercury (µg/l water) to a fish tissue criterion for methylmercury. Current Category 5 listings for mercury that are based on fish consumption advisories will remain and be identified as methylmercury listings, unless a fish advisory has been removed or fish tissue data indicate that the methylmercury criterion is attained. In this case, the water body will be delisted and placed in Category 2: Attaining. Total mercury (water column) data will be evaluated against the aquatic life criteria and placed in the appropriate category.

3. **The water body and pollutant are addressed in a TMDL approved by EPA**. Water body segments with an approved TMDL will be removed from the 303(d) list, but will retain their water quality limited status (per OAR 340-41-0002(70)) until they meet water quality standards. The water body will be delisted from Category 5 and placed in **Category 4A: Water Quality Limited TMDL Approved**. If a TMDL is developed for a pollutant on a watershed scale, all water body segments addressed within the watershed will be delisted and placed in Category 4A.

4. **Other pollution control requirements are in place and water quality standards will be achieved in a reasonable period of time**. Examples include point source permits or CWA Section 401 certification conditions for hydroelectric projects that address all the significant pollutant sources on a water body. The measures and conditions are expected to result in attainment of water quality standards. When these control measures are in place, the water bodies will be delisted and placed in **Category 4B: Water Quality Limited Other Control Measures in Place.**

5. **When a pollutant does not cause the water body impairment**, the water will be placed in **Category 4C: Water Quality Limited but a pollutant does not cause the impairment**. EPA defines a pollutant according to Section 502(6) of the Clean Water Act. In Oregon's 1998 assessment, DEQ placed water bodies on the 303(d) list for habitat modification and flow modification. Habitat modification listings were based on information indicating inadequate pool frequency and lack of large woody debris. Flow modification listings were based on inadequate flow to maintain in-stream water rights purchased by Oregon Department of Fish and Wildlife. However, EPA subsequently clarified that flow and habitat modification are not pollutants under the Clean Water Act. In 2002, ODEQ removed these water bodies from the 303(d) list.

   A water body that has been listed for biocriteria or algae or weed growth (based on a HABs advisory or exceedance of the chlorophyll-a action level) will be moved into category 4C if sufficient information is available to conclude that the impairment is not due to a pollutant.

Segmentation

Segment Identifiers

Segments for assessment and listing purposes are identified using the LLID identifier (described above in "Metadata Requirements") and the starting and ending river miles for the assessment unit.

Determining Segments and Segment Status

This process starts with evaluating the available data at a monitoring station to determine if a standard is met at that station. The station is given a status (e.g. Category 2 or Category 5) for the standard evaluated. The extent of the segment is determined following the General Segmentation Rules below and for new segments, relies on the status of the stations evaluated. The status for

the segment is then determined based on the status of the monitoring stations in the segment. A summary table in Appendix 1 illustrates both the determination of segment extent and status.

General Segmentation Rules

The extent of an assessment unit segment is determined as follows:

1. The segment was established in previous assessments or is defined by water quality standards;
2. For a water body with only one monitoring site, the assessment unit segment is from mouth to headwaters; or
3. For a water body with multiple monitoring sites, monitoring stations with sufficient information and the same status are grouped in a segment. If the upstream station is Category 2 and the downstream station is Category 5 a split is made in the segment halfway between the stations and two segments are created. If the upstream station is Category 5 and the downstream station is Category 2 the split is made at the Category 5 station and two segments are created. Monitoring stations with a Category 3 status are not used to define segment lengths.

Assessment unit segment status is determined by:

1. For established segments, if any station in a segment does not meet a water quality standard, the segment is assigned Category 5 status. If one or more stations in a segment meet water quality standards, and no stations exceed the standard, the segment is assigned Category 2 status. If all of the stations on a segment have insufficient data, the segment is assigned Category 3 status.
2. For water bodies with only one monitoring site, the status of the segment is given the status at the monitoring site.
3. For water bodies with multiple monitoring sites, if all the sites have the same status the segment is given that status. If multiple segments were created the split segments are given the status of the station(s) contained in the newly created segment extent. If any stations with Category 3 status are contained in the segment extents they are not used to determine segment status.

Segments associated with designated beneficial use extent (temperature and dissolved oxygen). In 2003, Oregon revised its water quality standards for temperature and clarified fish use designations throughout the state. For the 2012 Integrated Report, assessment unit segments are defined by these fish use designations. Oregon has specific temperature and dissolved oxygen numeric criteria that apply to various fish uses and life stages, including criteria to protect salmon and steelhead and resident trout spawning at designated locations for specified time periods. For assessing temperature and dissolved oxygen, the segment lengths are determined based on specific fish use designations.

Segments for other pollutants. For other pollutants, segment lengths are determined following the General Segmentation Rules above. The following paragraphs and a summary table in Appendix 1 provide the decision rules used for the 2012 Integrated Report to define assessment unit segments and assign a status category to the segment.

Segments for Temperature and Dissolved Oxygen

The following steps are used to determine segments for assessing temperature and dissolved oxygen criteria attainment:

1. Segments are defined for contiguous sections of a water body LLID with the same designated fish use.
2. Segments for fish spawning use are defined for contiguous sections of a water body with the same designated spawning time period. On the same water body, the segments for spawning may be different than the segments for the non-spawning fish uses.
3. The spawning criteria apply during the designated spawning time, and the non-spawning criteria apply at all other times. Available data are evaluated for the applicable criteria and time period in segments defined for those uses. If data at any monitoring station in the segment does not meet numeric criteria for temperature or dissolved oxygen, the entire segment with that fish use is assigned Category 5 status. If data at any point on the segment does not meet numeric criteria for temperature or dissolved oxygen during the designated spawning period, the entire segment designated for spawning in that time period is assigned Category 5 status for spawning use.

For example, the Sandy River (LLID 1224071455697) is designated for salmon and trout rearing and migration from river mile 0 to 26 (Segment "A") and for core cold water habitat from river mile 26 to 55.5 (Segment "B"). The Sandy River also has four reaches designated for spawning use during different time periods (Segments "C" through "F") and one with no spawning, as shown in the following table. Data from four monitoring stations at river miles 6, 19, 30, and 38 were compared to the specific numeric temperature criteria for each fish use. Data were available during the spawning time period at stations located on river miles 30 and 38 within Segment "D". Data exceeded the non-spawning temperature criteria in Segments "A" and "B", and the spawning criteria during the spawning period for Segment "D". These segments are assigned the **Category 5 303(d) list.** (Note: A TMDL was approved for the Sandy River on 4/15/2005 and the current assigned segment status is Category 4A.)

Table 3: Example Fish Beneficial Use Segments – Sandy River

Segment	River Mile Start	River Mile End	Use	Spawning Period	Numeric Criteria (° Celsius)	Status
A	0	26	Salmon and trout rearing and migration		18.0	**Category 5 303(d) list**
B	26	55.5	Core cold water habitat		16.0	**Category 5 303(d) list**
C	0	26	Spawning	October 15 – May 15	13.0	
D	26	48	Spawning	August 15 – June 15	13.0	**Category 5 303(d) list**
E	48	49.1	Spawning	October 15 – June 15	13.0	
F	49	54	Spawning	January 1 – June 15	13.0	
	54	55.4	No spawning			

Tribal Waters

Only those waters that are under the State of Oregon's jurisdiction are subject to the State's 303(d) and 305(b) activities. Oregon's 2010 Integrated Report does not intentionally include tribal waters.

There are two Tribal Reservations in Oregon the Umatilla and Warm Springs. When a water body lies partially within Tribal Reservation boundaries, DEQ will only include the portions that are within Oregon's jurisdiction on Oregon's 303(d) list. DEQ will use a map provided by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to determine which waters were within Umatilla tribal lands (data origin: BIA Geographic Data Service Center, publication date: 1999, title: Diminished Reservation Boundary for CTUIR).

Oregon does not develop TMDLs for tribal waters.

Evaluation Process

The DEQ process to develop Oregon's 2012 Integrated Report included the following steps and timelines:

1. **Data Gathering and Review:** DEQ solicited data from federal and other state agencies, tribes, local governments, watershed councils, private and public organizations and individuals. DEQ issued a public notice seeking data on the condition of Oregon's surface waters and requesting data be submitted during a specified time period using specified formats for electronic data processing. DEQ notified the public using an interested parties mailing list and electronic notice subscription list. Data submittals to DEQ were accepted from December 15, 2011 through January 31, 2012.

Data Gathering:

- Data was obtained from USGS Oregon Water Sciences Center (http:/or.water.usgs.gov/) directly from Leonard Orzol (Database Manager, llorzol@usgs.gov) for the Willamette and Umatilla basins for dissolved oxygen & more than 40 toxics parameters for the period from 1/1/2000 to 12/31/2011. Data was received on April 23, 2012.
- DEQ's Laboratory Analytical and Storage Retrieval (LASAR) database was queried via the Web on October 18, 2012 for 12 toxic metals for the period from 1/1/2000 to 12/31/2011. Dissolved oxygen was queried via LASAR Web on Date, 2012 for the period from 1/1/2000 to 12/31/2011. There are some concerns with the data quality from the LASAR database (Brian Boling pers. comm.), however it was deemed necessary to proceed and perform stringent data review on data extracted from LASAR. The agency is in the process of updating the LASAR corporate database and will be addressing many of the concerns raised during this effort.
- Data was also received through the Call for data process. DEQ received data from the following entities: Center for Biological Diversity, City of Canby, City of Gresham, City of Wilsonville, Tualatin Joint Water Commission, City of Salem, and Clackamas County SWCD. The bulk of the data assessed was for the time period January 1, 2000 through December 31, 2011.

Data Review

- QA review - Data review consisted of initial evaluation of adequate Quality Assurance documentation for data submitted or obtained. Oregon DEQ, USGS and City of Gresham supplied sufficient information to document an adequate quality assurance program. See Appendix 5: 2012 Oregon Integrated Data submission Report QA Review Summary for third party information. The Center for Biological Diversity supplied no water quality data per se, instead they submitted technical articles, EPA guidance and other information concerning Ocean Acidification. The Department will respond to this information after coordinating with EPA Region X.
- Data Assembly & Clean-up - Second phase of data review involved creating an Access database and Excel spreadsheets of the raw data tables (Station information, parameter results, parameter codes, toxics and DO criteria, etc.) from the various data sources so that they could be aggregated into staging tables with common data fields. After assembling the data considerable time was spent cleaning up and insuring that the process was using correct station (assigning LLIDs, confirming use status, etc.) and parameter (correct analyte/criteria) information.
- Data Analyses - Third phase of data review consisted of comparing the data to the correct water quality criteria and compiling the results. For the toxics data this analysis occurred in three distinct steps;
    1. Comparison of the criteria to every valid sample result (Every sample result is coded "meets", "exceeds", or "DNU" (**did not use** for detection limit reasons)),
    2. Aggregating each set of sample results by station, (simple calculation is done to roll up the results for each site yielding a "percent exceeds" and a total sample count) and then,

3. Determining draft 303(d) Status by applying the appropriate parameter rule set (see below). Where there is only one station for a given segment (LLID) the status is straightforward (**station status = segment status**). Where there are multiple stations in a segment, additional evaluation is necessary before making a "status call". In previous assessments, DEQ split segments when additional data stations with differing status were found. For this 2012 assessment, the Department used existing segments and listed a segment if one or more stations were identified as category 5 according to the methods described in this document.

- Merging and reconciliation of lists - Final phase of the review reconciling and/or merging the draft 2012 evaluation with the existing 2010 Integrated Report (including recent EPA additions). This consists of careful alignment of existing segment and parameter status with the 2012 segments and parameter status. In simple terms the tasks involves adding new segments and parameter status where needed, and determining the correct status where the new analysis either indicates a delisting status or confirms the impaired waters status (Category 5, the 303(d) list) or other another assessment category (Category 2, 3, or 4).

2. **Public Review Process:** A draft 2012 Integrated Report and a draft 2012 list of water quality limited waters were available for public review and comment from Month day, 2013 through 5:00 PM PST Month day, 2013. The draft list included updates based on review of data for a set of pollutants and beneficial use impairments that were complete and ready for public review. A public hearing to take comment on the draft list was held on Month day, 2013. No comments were received at the public hearing.

3. **2012 Integrated Report and 303(d) List:** DEQ reviewed public comments and, where appropriate, revised the water quality report and Section 303(d) list of Category 5: Water quality limited waters needing a TMDL. DEQ submitted Oregon's 2012 Section 303(d) list of Category 5: Water quality limited waters needing a TMDL to US EPA Region 10 on Month day, 2013. Along with the Section 303(d) list, DEQ also submitted the 2012 Integrated Report, response to comments, the Assessment Methodology for Oregon's 2010 Integrated Report on Water Quality Status, and a prioritization and TMDL schedule to EPA. Only water bodies in the Category 5: Water quality limited waters needing a TMDL (Section 303(d) list) are subject to EPA's approval.

III. Assessment Protocols by Pollutant or Parameter

For the 2012 Integrated Report, DEQ will evaluate water quality data to determine if the water quality standards set out in Oregon Administrative Rules Chapter 340 Division 41 are being met in Oregon. In the following sections, the assessment protocols used to determine the water quality status and assign an assessment category to a water body are discussed for specific parameters/pollutants, narrative and numeric criteria, and designated uses. The narrative and numeric criteria from Oregon Administrative Rules and federal criteria, where applicable, are cited for each parameter. Each parameter and criterion is evaluated independently. Data are evaluated for each monitoring site, and an overall status assigned to the water body assessment unit segment based on the available monitoring data. Data are not available for all parameters in each water body. Therefore, **Category 1** indicating all designated uses are supported and all criteria are met **is not used** for Oregon's assessment.

PARAMETER: **AQUATIC WEEDS OR ALGAE**

BENEFICIAL USES AFFECTED: Domestic and Industrial Water Supply, Irrigation, Livestock Watering, Fish and Aquatic Life, Fishing, Boating, Water Contact Recreation, Aesthetic Quality

2012 ASSESSMENT: DEQ did not evaluate aquatic weeds or algae for this assessment.

NARRATIVE CRITERIA:

OAR 340-041-0007
Statewide Narrative Criteria
(10) The development of fungi or other growths having a deleterious effect on stream bottoms, fish or other aquatic life, or that are injurious to health, recreation, or industry may not be allowed;

OAR 340-041-0019
See Nuisance Phytoplankton Growth; Chlorophyll-a action level

NARRATIVE ASSESSMENT PROTOCOL:
This protocol will be used to implement the statewide narrative criterion that prohibits deleterious or injurious effects on aquatic and human beneficial uses from biological growths, and will be applied specifically to aquatic weeds or algae. The growth of aquatic weeds or algae does not in itself indicate deleterious or injurious effects on beneficial uses. Nor does it identify whether a pollutant or which pollutant is causing the impairment and should be addressed by point source or other controls through a Total Maximum Daily Load. This assessment protocol identifies the indicators that will be used to determine that beneficial uses have been negatively affected by the presence of excess algal or weed growth.

ASSIGNMENT OF ASSESSMENT CATEGORY:
Category 5: Water Quality Limited, TMDL Needed (303(d) List)

- Aquatic Weeds: Documented reports of excessive growths of invasive, non-native aquatic plants that dominate the assemblage in a water body and have a harmful effect on fish or aquatic life or are injurious to health, recreation, or industry. Plants include aquatic species on the Oregon Department of Agriculture Noxious Weed Policy and Classification System designated as “A”, “B”, or “T” weeds or those covered by a quarantine in OAR 603-052-1200.
- Algae: Health advisories issued by the Oregon Department of Human Services, in conjunction with other federal, state, county, city or local agencies, warning that potentially harmful levels of toxins produced by blue-green algae (cyanobacteria) are present in a water body. Health advisories related to recreational water contact are posted by the Department of Human Services Public Health Division, Office of Environmental Public Health. (See http://www.oregon.gov/DHS/ph/hab/index.shtml)

- Algae: Documented evidence that algae, including periphyton (attached algae) or phytoplankton (floating algae), are causing other standards to be exceeded (e.g. pH, chlorophyll a, or dissolved oxygen) or impairing a beneficial use.

Category 4: Water Quality Limited, TMDL Not Needed

- TMDLs for specific pollutants have been completed and approved to address the excessive or harmful aquatic weed or algae growth in a water body (Category 4A);
- Another control mechanism such as an aquatic vegetation management plan is in place and is being implemented to control plant growth (Category 4B); or
- Adequate information indicates that the algae or weed growth is not due to pollutants or is a natural condition (Category 4C).

Category 3: Insufficient Data
Available data for the water body are not sufficient to determine if the narrative criterion is exceeded.
(See NOTE on Phosphate Phosphorus Benchmark under Toxic Substances.)

Category 2: Attaining
Not applicable.

TIME PERIOD:
Annual

DATA REQUIREMENTS:
Information, data or health advisories since 2001.

POLLUTANT: **BACTERIA - *E. coli (Escherichia coli)***
(Freshwaters and Estuarine Waters Other than Shellfish Growing Waters)

BENEFICIAL USES AFFECTED: Water Contact Recreation

2012 ASSESSMENT: DEQ did not evaluate bacteria for this assessment.

NARRATIVE CRITERION: OAR 340-041-0009(4)

NUMERIC CRITERION: OAR 340-041-0009(1) (a)

340-041-0009
Bacteria

(1) Numeric Criteria: Organisms of the coliform group commonly associated with fecal sources (MPN or equivalent membrane filtration using a representative number of samples) may not exceed the criteria described in paragraphs (a) and (b) of this paragraph:

(a) Freshwaters and Estuarine Waters Other than Shellfish Growing Waters:

(A) A 30-day log mean of 126 *E. coli* organisms per 100 milliliters, based on a minimum of five (5) samples;

(B) No single sample may exceed 406 *E. coli* organisms per 100 milliliters.

(4) Bacterial pollution or other conditions deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propagation, or otherwise injurious to public health may not be allowed;

ASSIGNMENT OF ASSESSMENT CATEGORY:

Category 5: Water Quality Limited, TMDL Needed (303(d) List)
A 30-day log mean greater than 126 *E. coli* organisms per 100 ml based on a minimum of five (5) samples, or more than 10% of the samples exceed 406 *E. coli* organisms per 100 ml, with a minimum of at least two exceedances. The listing will identify the season of impairment if possible.

Category 4: Water Quality Limited, TMDL Not Needed
TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address pollutant and will attain water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

Category 3: Insufficient Data
Less than 5 samples are available to evaluate for the season of interest, or 5 to 9 samples for the season of interest with 1 sample exceeding 406 *E. coli* organisms per 100 milliliters.

Category 3B: Insufficient Data – Potential Concern
Less than 5 samples are available to evaluate for the season of interest, with 2 or more samples exceeding 406 *E. coli* organisms per 100 milliliters.

Category 2: Attaining
The 30-day log mean is equal to or less than 126 *E. coli* organisms per 100 ml based on a minimum of five (5) samples, and, if data from 10 or more samples are available, 90% of the samples are below 406 *E. coli* organisms per 100 ml. If data from 5 to 9 samples are available, no exceedances of 406 *E. coli* organisms per 100 ml.

If data are insufficient to calculate a 30-day log mean, then, for 10 or more samples, 90% of the samples are below 406 *E. coli* organisms per 100 ml; or for 5 to 9 samples, no samples greater than 406 *E. coli* organisms per 100 ml.

TIME PERIOD:
Summer: June 1 through September 30 (period of highest use for water contact recreation). (A summer 30-day log mean is calculated for sampling dates beginning on May 17 through September 16.)
Fall-Winter-Spring (FWS): October 1 through May 31. (A FWS 30-day log mean is calculated for sampling dates beginning September 17 through May 16.)

DATA REQUIREMENTS:
Data collected since 2001. A minimum of 5 representative data points available per site collected on separate days for each time period of interest. The numeric value of results reported as the Minimum Reporting Level (MRL) was used to calculate the 30-day log mean.

NOTES:
DEQ intends to review the assessment methodology for the bacteria standards prior to the 2014 assessment. Under the rotating basin approach, DEQ is not focusing on a coastal basin for the 2012 assessment.

The *E. coli* numeric criteria protect primary recreation (i.e. full immersion body contact) and is therefore of most concern during the summer primary recreation season as defined above. Listings for the summer season will be a higher priority for TMDL development than exceedances that occur only during other seasons.

The *E. coli* numeric criteria are applicable to freshwaters and estuarine waters other than shellfish growing waters. Estuarine waters are defined in OAR 340-041-0002(22) to mean all mixed fresh and oceanic water in estuaries or bays from the point of oceanic water intrusion inland to a line connecting the outermost points of the headlands or protective jetties. For the 2012 review of water quality data, the inland extent of estuarine waters was identified where recorded specific conductivity measurements were above 200 uS/cm. The *E. coli* numeric criteria are not applied in marine waters.

The bacteria standard was changed in 1996 to use *E. coli* as the indicator organism for water contact recreation protection, replacing the previous standard based on fecal coliform. Only the current *E. coli* standard is applied in freshwaters and estuarine non-shellfish growing waters for data reviewed for the 2012 assessment. Listings in previous years may have identified freshwater water bodies as water quality limited using fecal coliform as the indicator. If data evaluated for the 2012 assessment show the current *E. coli* criteria for freshwater are met, the water body will

be delisted for older fecal coliform listings. The listings are retained if no data for *E. coli* are available for the 2012 evaluation, or if *E. coli* is also listed.

Most estuarine waters also meet the federal definition of "coastal waters" and are therefore subject to the federal *Enterococci* criteria for contact recreations, which have been promulgated for Oregon by EPA. In addition, estuarine waters are presumed to be potential shellfish growing waters, and are therefore subject to Oregon's fecal coliform criteria to protect that beneficial use. The assessment methods for *Enterococci* and fecal coliform are specified in the next sections.

POLLUTANT: **BACTERIA - *Enterococci***
(Coastal Recreation Waters including Marine Coastal Waters and Coastal Estuaries)[1]

BENEFICIAL USES AFFECTED: Water Contact Recreation

2012 ASSESSMENT: DEQ did not evaluate bacteria for this assessment.

NUMERIC CRITERION: 40 CFR Part 131.41
EPA promulgated water quality criteria for Oregon marine coastal recreation waters (effective 12/16/2004)

40 CFR Part 131.41
(c) EPA's section 304(a) ambient water quality criteria for bacteria.
(2) Marine waters:

Indicator	Geometric mean	Single sample maximum (per 100 ml)
		Moderate use coastal recreation waters
Enterococci[c]	35/100 ml[a]	158[b]

Footnotes:
a. This value is for use with analytical methods 1106.1 or 1600 or any equivalent method that measures viable bacteria.
b. Calculated using the following: single sample maximum = geometric mean*10^ (confidence level factor*log standard deviation), where the confidence level factor is: 75%: 0.68; 82%: 0.94; 90%: 1.28; 95%: 1.65. The log standard deviation from EPA's epidemiological studies is 0.7.
c. These values apply to enterococci regardless of origin unless a sanitary survey shows that sources of the indicator bacteria are non-human and an epidemiological study shows that the indicator densities are not indicative of a human health risk.

ASSIGNMENT OF ASSESSMENT CATEGORY:
EPA recommends using the geometric mean as the relevant criteria for 303(d) listing purposes.[2] The single sample maximum is a statistical construct to allow decisions for beach advisories based on small data sets. Marine waters in coastal Oregon have not been designated for a specific level of recreational use. The single sample maximum criteria for moderate use coastal recreation

[1] 40 CFR Part 131.41 (b) *Definitions.* (1) *Coastal Recreation Waters* are the Great Lakes and marine coastal waters (including coastal estuaries) that are designated under section 303(c) of the Clean Water Act for use for swimming, bathing, surfing, or similar water contact activities. Coastal recreation waters do not include inland waters or waters upstream from the mouth of a river or stream having an unimpaired natural connection with the open sea.

[2] US EPA Office of Water, EPA-823-F-06-013, August 2006, Water Quality Standards for Coastal Recreation Waters: Using Single Sample Maximum Values in State Water Quality Standards

waters is currently used by the Oregon Department of Human Services Public Health Division, Office of Environmental Public Health's Oregon Beach Monitoring Program to trigger a water contact advisory. (See http://oregon.gov/DHS/ph/beaches/status.shtml)

Category 5: Water Quality Limited, TMDL Needed (303(d) List)
A geometric mean for samples collected over a seasonal sampling period greater than 35 Enterococci per 100 ml based on a sample set of 5 or more samples.

Category 4: Water Quality Limited, TMDL Not Needed
TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address pollutant and will attain water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

Category 3: Insufficient Data
Less than 5 samples are available for evaluation for a seasonal sampling period.

Category 3B: Insufficient Data – Potential Concern
Less than 5 samples are available for a seasonal sampling period, and one or more samples exceeds the single sample maximum of 158 Enterococci per 100 ml, or the Oregon Beach Monitoring Program has issued one or more advisories based on monitoring results for Enterococci in a seasonal sampling period (not including precautionary advisories).

Category 2: Attaining
The geometric mean for samples collected over a seasonal sampling period is equal or less than 35 Enterococci per 100 ml.

TIME PERIOD:
Summer: May 1 through September 30 (period of highest use for water contact recreation)
Winter: October 1 through April 30

DATA REQUIREMENTS:
Data collected since 2001. A minimum of 5 representative data points available per site collected on separate days for each seasonal time period in a given year. For results reported at or below the Minimum Reporting Level (<MRL), the numeric value of the MRL was used to calculate the geometric mean.

NOTES:
DEQ intends to review the assessment methodology for the bacteria standards that apply to estuarine, marine and coastal waters prior to the 2014 assessment. Under the rotating basin approach, DEQ is not focusing on a coastal basin for the 2012 assessment.

To protect water contact recreation as a beneficial use in coastal waters, EPA adopted *Enterococci* criteria for Oregon in 2004. This was determined to be the best bacteria indicator organism to protect water contact recreation in coastal waters. For the 2012 assessment, DEQ will evaluate available *enterococci* data, using the new criterion (see the assessment protocol for Bacteria – *Enterococci* above).

Coastal recreation waters for this assessment are identified as all marine waters and coastal bays and estuaries, but do not include inland waters or waters "upstream from the mouth of a river or stream having an unimpaired natural connection with the open sea." (CFR 131.41)

The Oregon Beach Monitoring Program has identified 92 coastal beaches in Oregon. Each of these beaches is assigned a beach name and beach identification number that are used in reporting to EPA. For the 2010 Integrated Report, the identified coastal beaches were used as the assessment units and defined as segments along the Pacific Ocean or an estuarine river location.

The Oregon Beach Monitoring Program may issue precautionary advisories based on heavy rainfall, flooding, or sewage spills. These advisories are not included in the data summarized in this assessment.

POLLUTANT: **BACTERIA – Fecal coliform**
(Marine Waters and Estuarine Shellfish Growing Waters)

BENEFICIAL USES AFFECTED: Shellfish Growing (fishing/shellfish consumption)

2012 ASSESSMENT: DEQ did not evaluate bacteria for this assessment.

NARRATIVE CRITERION: OAR 340-041-0007(11) and
OAR 340-041-0009(4)

340-041-0007
Statewide Narrative Criteria
(11) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish may not be allowed;

340-041-0009
Bacteria
(4) Bacterial pollution or other conditions deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propagation, or otherwise injurious to public health may not be allowed;

NUMERIC CRITERION: OAR 340-041-0009(1) (b)

340-041-0009
Bacteria
(1) Numeric Criteria: Organisms of the coliform group commonly associated with fecal sources (MPN or equivalent membrane filtration using a representative number of samples) may not exceed the criteria described in paragraphs (a) and (b) of this paragraph:

(b) Marine Waters and Estuarine Shellfish Growing Waters: A fecal coliform median concentration of 14 organisms per 100 milliliters, with not more than ten percent of the samples exceeding 43 organisms per 100 ml.

ASSIGNMENT OF ASSESSMENT CATEGORY:
Category 5: Water Quality Limited, TMDL Needed (303(d) List)
For a datasets of less than 30 samples, a minimum of 2 exceedances of 43 organisms/100 ml. For datasets with greater than 30 samples, 10% of the samples must exceed 43 organisms/100mL. OR, for datasets with a minimum of 5 samples, the median value is greater than 14 organisms/100 ml.

Category 4: Water Quality Limited, TMDL Not Needed

TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address pollutant and will attain water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

Category 3: Insufficient Data
Less than 5 samples available for analysis, or 5 to 9 samples with 1 exceedance and the median is 14 organisms/100 ml or less.

Category 3B: Insufficient Data – Potential Concern
Less than 5 samples available to evaluate, with 2 or more samples exceeding 43 organisms per 100 milliliters.

Category 2: Attaining
A minimum number of 5 samples per site, with 90% of the samples less than 43 organisms/100 ml and the median value of 14 organisms/100 ml or less.

TIME PERIOD:
Annual

DATA REQUIREMENTS:
Data collected since 2001. A minimum of 5 representative samples per site collected on separate days. The numeric values of results reported at or above the Minimum Reporting Level (MRL) were used to calculate the median concentration. Data was evaluated for marine and estuarine waters.

NOTES:
DEQ intends to review the assessment methodology for the bacteria standards that apply to estuarine, marine and coastal waters prior to the 2014 assessment. Under the rotating basin approach, DEQ is not focusing on a coastal basin for the 2012 assessment.

DEQ has determined that fecal coliform water quality criteria should be applied to marine and estuarine waters that support recreational shellfish harvesting as well as commercial shellfish harvesting (Minutes from the Estuary Workgroup Meeting, DEQ, Newport, Oregon, July 13, 2001).

Marine waters are defined in OAR 340-041-0002(34) as all oceanic, offshore water outside of estuaries or bays and within the territorial limits of Oregon. Estuarine waters are defined in OAR 340-041-0002(22) as mixed fresh and oceanic water in estuaries or bays from the point of oceanic water intrusion inland to a line connecting the outermost points of the headlands or protective jetties. For the 2010 review of water quality data, the inland extent of estuarine waters was identified where recorded specific conductivity measurements were above 200 uS/cm. However, coastal lakes were not included as estuarine shellfish growing waters for this assessment.

Fecal coliform data is evaluated to assess protection of shellfish growing as described in this section.

To protect water contact recreation as a beneficial use in coastal waters, EPA adopted an *Enterococci* criterion for Oregon in 2004. This was determined to be the best pathogen indicator organism to protect water contact recreation in coastal waters. For the 2012 assessment, DEQ will evaluate available *enterococci* data, using the new criterion (see the assessment protocol for Bacteria – *Enterococci* above). However, assessments in previous years may have identified marine or estuarine water bodies as water quality limited for water contact recreation using fecal coliform data. These listings are retained unless data for *enterococci* show the new criteria are met. In this case, the water body will be delisted for water contact recreation impairment.

PARAMETER: **BIOCRITERIA**

BENEFICIAL USES AFFECTED: Aquatic Life

2012 ASSESSMENT: DEQ did not evaluate biological data for this assessment.

NUMERIC CRITERION: None

NARRATIVE CRITERION: OAR 340-041-0011

> **340-041-0011**
> **Biocriteria**
> Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.

NARRATIVE ASSESSMENT PROTOCOL:
Detrimental changes in resident biological communities are a form of pollution.[1,2] EPA guidance recommends using biological community assessments as an indicator for aquatic life beneficial use support.[3] This protocol will be used to implement Oregon's narrative standard for Biocriteria for the 2010 Water Quality Assessment. The protocol applies numeric benchmarks to evaluate the integrity of aquatic biological communities. Biological assessments look at conditions in the biological communities, but do not by themselves indicate if changes are related to pollutants, or identify which pollutant should be addressed by point source or other controls through a Total Maximum Daily Load. EPA guidance recommends listing waters with aquatic use impairments as Category 5 even if the pollutant is not known.[4] This protocol outlines the process and assessment category assignment that Oregon will use for the 2010 Integrated Report to apply the narrative criterion.

This protocol is based on biological assemblage information for freshwater macroinvertebrates collected by DEQ at reference sites throughout Oregon. Freshwater macroinvertebrates include insects, crustaceans, snails, clams, worms, mites, etc. DEQ identifies sites in a given region that are least disturbed by anthropogenic activities and uses these as reference sites.[5] Biological assessment tools use information from these reference sites to predict the variety and number of aquatic life species expected in Oregon streams and to make inferences about the biological condition of the waters.[6]

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[1] Federal Water Pollution Act Section 502(19) (33 U.S.C 1362) (Clean Water Act)
[2] Oregon Administrative Rules 340-041-0002(39)
[3] US EPA, July 29, 205, Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act, page 41.
[4] US EPA, July 29, 205, Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act, page 60.
[5] Drake, D., April 2004, Selecting Reference Condition Sites - An Approach for Biological Criteria and Watershed Assessment, ODEQ Technical Report WSA04-002. http://www.deq.state.or.us/lab/techrpts/docs/WSA04002.pdf
[6] Stoddard,J.L., et.al., 2006. Setting Expectations for the Ecological Condition of Streams: The Concept of Reference Condition. Ecological Applications. 16(4): 1267-1276

Assessing Macroinvertebrate Communities
To assess the biological integrity of macroinvertebrate communities, DEQ uses a statistical method called a multivariate predictive model.[7] Using data from reference sites, the model describes the number and types of macroinvertebrates that are expected to be in a water body when the water is in least disturbed conditions. Reference sites are grouped by predictor variable factors that are not affected by human activities (e.g., sampling date, ecoregion, longitude, elevation, precipitation, or air temperature). DEQ has developed a model specifically for Oregon, but similar model approaches are used for bioassessments in the United Kingdom (RIVPACS), Australia (AusRIVas), Canada (BEAST), and in broad areas in the United States (typically called RIVPACS models, though different from the U. K. models).

DEQ has developed the PREDictive Assessment Tool for ORegon, or PREDATOR, to assess the macroinvertebrate communities in Oregon's perennial, wadeable streams. PREDATOR analyzes data from reference sites grouped into three regions in Oregon and models the expected assemblage. Information from a sampling site can be compared to the macroinvertebrate assemblage predicted by the model and an assessment made about how different the observed assemblage is from the expected or reference assemblage. Data collected at a sampling site is used to generate a number for the observed versus expected (O/E) macroinvertebrate taxa. This number represents the "missing" taxa at a site, and can be expressed as "% taxa loss".

For the 2010 assessment, DEQ has selected values of % taxa loss to assign a status category to a water body. The benchmark values are indicators of differences from reference conditions that may indicate detrimental changes to biological communities and an impairment in aquatic life use support that violates the narrative standard. A discussion of the scientific basis for the model development, statistical analysis of reference site data, and selection of numeric benchmark values is given in a separate technical paper.[11]

ASSIGNMENT OF ASSESSMENT CATEGORY:
Benchmark values are expressed in terms of the percent of taxa not found in a site assemblage compared to the expected assemblage predicted by the PREDATOR model. A full discussion of the statistical basis for the specific benchmark values in terms of the reference site distributions in different regions in Oregon is provided in a separate technical paper. [11]

Category 5: Water Quality Limited, TMDL Needed (303(d) List)
Macroinvertebrate sampling data from perennial, wadeable streams evaluated by DEQ using the PREDATOR model showing:

- ≥ 15% taxa loss in the Marine Western Coastal Forest (MWCF) region,
- ≥ 22% taxa loss in the Western Cordillera and Columbia Plateau (WCCP) region, or
- ≥ 50% taxa loss in the Northern Basin and Range (NBR) region.

Category 4: Water Quality Limited, TMDL Not Needed

[7] Hubler, S., July 2008, PREDATOR: Development and Use of RIVPACS-type Macroinvertebrate Models to Assess the Biotic Condition of Wadeable Oregon Streams, Technical Report DEQ08-LAB-0048-TR

In some water bodies, DEQ has information relating specific pollutants to the condition of the biological communities in the water body. Where data are available identifying a specific pollutant as the cause of detrimental changes to biological communities, and a TMDL has been approved with load allocations for the pollutant, the water body will be placed in Category 4 if no additional TMDLs are needed. Water bodies will also be placed in Category 4 for biological criteria if adequate information is available to indicate that detrimental changes to biological communities are not due to a pollutant.

Category 3B: Insufficient Data – Potential Concern
Some macroinvertebrate sampling data from perennial, wadeable streams evaluated using the PREDATOR model are inconclusive and are insufficient to assign a status category until additional information is collected.

Macroinvertebrate sampling data from perennial, wadeable streams evaluated by DEQ using the PREDATOR model showing:

- 8% to 14% taxa loss or > 24% taxa gain in the Marine Western Coastal Forest (MWCF) region,
- 8% to 21% taxa loss or > 23% taxa gain in the Western Cordillera and Columbia Plateau (WCCP) region, or
- 25% to 49% taxa loss in the Northern Basin and Range (NBR) region.

Results showing taxa loss in these ranges could be due to sampling error or modeling error and may be over or under-estimating taxa loss. A large gain of observed taxa over expected may indicate more natural diversity, or may indicate disturbance that has enhanced diversity.[8] Additional samples are necessary to better assess biological conditions. A minimum of 5 replicate samples should be collected to provide sufficient data for status classification. The stream is a potential concern until more information is evaluated.

Category 2: Attaining
Macroinvertebrate sampling data from perennial, wadeable streams evaluated by DEQ using the PREDATOR model showing:

- 0% to 8% taxa loss or 0% to 24% taxa gain in the Marine Western Coastal Forest (MWCF) region,
- 0% to 7% taxa loss or 0% to 23% taxa gain in the Western Cordillera and Columbia Plateau (WCCP) region, or
- < 25% taxa loss in the Northern Basin and Range (NBR) region.

DATA REQUIREMENTS:
Site sample data must be collected during or after 1998 to be comparable to the reference site data (1998 to 2004) that is used in the PREDATOR model. Site samples must be collected within the model season of June 1 through October 15. Field duplicates and seasonal replicate samples are averaged to account for sampling and seasonal variability.

[8] Ward, J.W, and Stanford, J.A., 1983, Intermediate-Disturbance Hypothesis: An Explanation for Biotic Diversity Patterns in Lotic Ecosystems. In Dynamics of Lotic Systems, Ann Arbor Science, Ann Arbor, MI, pages 347-356.

Site sample data must be collected using standard field methods and identified to appropriate taxonomic levels, as described in the DEQ Mode of Operations Manual, or equivalent protocols used throughout the Pacific Northwest.[9] The standard method for macroinvertebrate sampling requires collecting organisms from specific habitats within a specified size reach of a stream. The data are evaluated to generate one sample result in the PREDATOR model.

One sample result is sufficient to evaluate for the assessment using the benchmarks developed from the PREDATOR model. If samples from multiple years are available, the most recent sample result of Category 2 or Category 5 will determine the site status. If the most recent sample result is Category 2 and a previous sample is Category 5, the site status will be Category 3b. Recent Category 2 sample results must outnumber earlier Category 5 sample results for the site status to be considered Category 2.

When results for replicate site samples are collected to clarify inconclusive results (Category 3b), a minimum of 5 samples is required to achieve the target statistical confidence. The site will be assigned a status category if 3 out of 5 replicate samples show results in the Category 2 or Category 5 ranges. Replicate samples must be collected in the same sampling season, in the same reach, or in adjacent and comparable reaches.

DE-LISTING:
Once TMDLs are approved for pollutants that will also improve biological conditions, water bodies may be de-listed for biocriteria. These waters will be placed in Category 4: Water Quality Limited, TMDL Not Needed if no additional TMDLs are needed.

Water bodies may be de-listed for biocriteria based on multiple site sampling events showing results that are attaining benchmarks. A minimum of 5 samples must be collected in the same sampling season and in the same or adjacent and comparable reaches, with 3 out of 5 samples showing results that attain appropriate benchmarks. These waters will be placed in Category 2: Attaining.

SEGMENTATION:
General segmentation protocols will be followed (Appendix 1). The status category from one sampling site will apply to the sampling reach and upstream portions of the wadeable, perennial stream. A minimum segment length of 0.6 miles will be imposed when multiple sample sites are closely located within a small stream reach. Given the sampling design and field protocols, assessment segments less than 0.6 miles are likely to impose artificial divisions that are not true representations of stream conditions.

[9] ODEQ, 2009, Mode of Operations Manual, Version 3.2, DEQ03-LAB-0036-SOP, http://www.deq.state.or.us/lab/techrpts/docs/DEQ03LAB0036SOP.pdf

BENCHMARK SUMMARY:

Table 1. Macroinvertebrate communities assessment benchmarks for perennial, wadeable streams.

PREDATOR Model Region	Impaired Category 5:	Category 3b: Insufficient Data Potential Concern	Category 2: Attaining
Marine Western Coastal Forest	≥ 15% taxa loss	9% - 14% taxa loss or > 24% taxa gain	0% - 8% taxa loss or 0% - 24% taxa gain
	PREDATOR score ≤ 0.85	PREDATOR score 0.86 to 0.91 or > 1.24	PREDATOR score 0.92 to 1.24
Western Cordillera and Columbia Plateau	≥ 22% taxa loss	8% - 21% taxa loss or > 23% taxa gain	0% - 7% taxa loss or 0% - 23% taxa gain
	PREDATOR score ≤ 0.78	PREDATOR score 0.79 to 0.92 or > 1.23	PREDATOR score 0.93 to 1.23
Northern Basin and Range	≥ 50% taxa loss	25% - 49% taxa loss	< 25% taxa loss
	PREDATOR score ≤ 0.50	PREDATOR score 0.49 to 0.75	PREDATOR score > 0.75

PARAMETER: **CHLOROPHYLL A**
(Nuisance Phytoplankton Growth)

BENEFICIAL USES AFFECTED: Water Contact Recreation
Aesthetics
Fishing
Water Supply
Livestock Watering

2012 ASSESSMENT: DEQ did not evaluate chlorophyll-a data for this assessment.

NUMERIC CRITERION: OAR 340-041-0019

340-041-0019
Nuisance Phytoplankton Growth
(1) (a) The following values and implementation program must be applied to lakes, reservoirs, estuaries and streams, except for ponds and reservoirs less than ten acres in surface area, marshes and saline lakes:

(b) The following average Chlorophyll a values must be used to identify water bodies where phytoplankton may impair the recognized beneficial uses:

(A) Natural lakes that thermally stratify: 0.01 mg/1;

(B) Natural lakes that do not thermally stratify, reservoirs, rivers and estuaries: 0.015 mg/1;

(C) Average Chlorophyll a values may be based on the following methodology (or other methods approved by the Department): A minimum of three samples collected over any three consecutive months at a minimum of one representative location (e.g., above the deepest point of a lake or reservoir or at a point mid-flow of a river) from samples integrated from the surface to a depth equal to twice the secchi depth or the bottom (the lesser of the two depths); analytical and quality assurance methods must be in accordance with the most recent edition of Standard Methods for the Examination of Water and Wastewater.

ASSIGNMENT OF ASSESSMENT CATEGORY:
Category 5: Water Quality Limited, TMDL Needed (303(d) List)
The average Chlorophyll a value over three consecutive months exceeds the value referenced in the rule. The average must be calculated with at least one sample in each month.

Category 4: Water Quality Limited, TMDL Not Needed

- TMDLs for specific pollutants have been completed and approved to address nuisance phytoplankton growth and exceedance of chlorophyll a values in a water body (Category 4A);
- Another control mechanism such as a control strategy develop and adopted according to OAR 340-041-0019(2) is being implemented to control phytoplankton growth (Category 4B); or

- Adequate information indicates that phytoplankton proliferation is not due to pollutants or is a natural condition (Category 4C).

Category 3: Insufficient Data
Less than 3 samples available in three consecutive months to calculate an average, or less than one sample available in any month of the three consecutive month period.

Category 2: Attaining
The average Chlorophyll a value over three consecutive months is less than the value referenced in the rule.

TIME PERIOD:
Summer: June 1 through September 30 or three month periods beginning May through August
Fall-Winter-Spring (FWS): October 1 through May 31 or three month periods beginning September through April

DATA REQUIREMENTS:
Data collected since 1999. A minimum of three samples collected over any three consecutive months (at least one per month) at a minimum of one representative location (e.g., above the deepest point of a lake or reservoir or at a point mid flow of a river).

NOTES:
Information on thermally stratified lakes was obtained from the Atlas of Oregon Lakes[1].

Lakes are identified by an LLID assigned to a point at the center of the water body. They may also be identified with an LLID for a stream which flows into or out of the lake, and river miles are assigned at those points on the stream line.

Saline lakes were identified in coastal areas and Oregon Closed Basins where recorded specific conductivity measurements were generally above 200 uS/cm.

[1] Johnson, D.M., Petersen, R.R., Lycan, D.R., Sweet, J.W., Neuhaus, M.E., Schaedel, A.L., 1985, Atlas of Oregon Lakes: Corvallis, OR, Oregon State University Press, 317 p.

POLLUTANT: **DISSOLVED OXYGEN**

BENEFICIAL USES AFFECTED: Fish and Aquatic Life
Salmon and Steelhead Spawning
Resident Trout Spawning
Cold-Water Aquatic Life
Cool-Water Aquatic Life
Warm-Water Aquatic Life
Estuarine Water

2012 ASSESSMENT: DEQ evaluated dissolved oxygen data for the Willamette and Umatilla Basins for this assessment.

NUMERIC CRITERION: OAR 340-041-0016

340-041-0016
Dissolved Oxygen
Dissolved oxygen (DO): No wastes may be discharged and no activities must be conducted that either alone or in combination with other wastes or activities will cause violation of the following standards:
The changes adopted by the Commission on January 11, 1996, become effective July 1, 1996. Until that time, the requirements of this rule that were in effect on January 10, 1996, apply:
(1) For water bodies identified as active spawning areas in the places and times indicated on the following Tables and Figures set out in OAR 340-041-0101 to 340-041-0340: Tables 101B, 121B, 180B, 201B and 260B, and Figures 130B, 151B, 160B, 170B, 220B, 230B, 271B, 286B, 300B, 310B, 320B, and 340B, (as well as any active spawning area used by resident trout species), the following criteria apply during the applicable spawning through fry emergence periods set forth in the tables and figures:
(a) The dissolved oxygen may not be less than 11.0 mg/l. However, if the minimum intergravel dissolved oxygen, measured as a spatial median, is 8.0 mg/l or greater, then the DO criterion is 9.0 mg/l;
(b) Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 mg/l or 9.0 mg/l criteria, dissolved oxygen levels must not be less than 95 percent of saturation;
(c) The spatial median intergravel dissolved oxygen concentration must not fall below 8.0 mg/l.
(2) For water bodies identified by the Department as providing cold-water aquatic life, the dissolved oxygen may not be less than 8.0 mg/l as an absolute minimum. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/l, dissolved oxygen may not be less than 90 percent of saturation. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 8.0 mg/l as a 30-day mean minimum, 6.5 mg/l as a seven-day minimum mean, and may not fall below 6.0 mg/l as an absolute minimum (Table 21);

(3) For water bodies identified by the Department as providing cool-water aquatic life, the dissolved oxygen may not be less than 6.5 mg/l as an absolute minimum. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 6.5 mg/l as a 30-day mean minimum, 5.0 mg/l as a seven-day minimum mean, and may not fall below 4.0 mg/l as an absolute minimum (Table 21);
(4) For water bodies identified by the Department as providing warm-water aquatic life, the dissolved oxygen may not be less than 5.5 mg/l as an absolute minimum. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 5.5 mg/l as a 30-day mean minimum, and may not fall below 4.0 mg/l as an absolute minimum (Table 21);
(5) For estuarine water, the dissolved oxygen concentrations may not be less than 6.5 mg/l (for coastal water bodies);
(6) For ocean waters, no measurable reduction in dissolved oxygen concentration may be allowed.

ASSIGNMENT OF ASSESSMENT CATEGORY:
Category 5: Water Quality Limited, TMDL Needed (303(d) List)
For the time period of interest (spawning or non-spawning), greater than ten percent of data points do not meet the appropriate criterion, and at least two data points do not meet the criterion.

Category 4: Water Quality Limited, TMDL Not Needed
TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address the pollutant and result in the attainment of water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

Category 3: Insufficient Data
Fewer than five separate days of data for the time period of interest, or five to nine data points for the time period of interest with only one data point that does not meet the appropriate criterion.

Category 2: Attaining
For ten or more data points in the time period of interest, greater than 90% of data points meet the appropriate criterion. For five to nine data points in the time period of interest, all data points meet the appropriate criterion.

DATA REQUIREMENTS:
Data collected since 2000. Data points collected on a minimum of five separate days per site per applicable time period (spawning or non-spawning) are required. For the 2012 assessment, all data points, including continuous data (i.e. multiple samples collected over a 24 hour period), will be treated as discreet samples or “grab” samples.

DETERMINING APPLICABLE CRITERIA:

Oregon's water quality standard for dissolved oxygen contains different criteria for several aquatic life sub-categories, as shown in Table 1. The spawning criterion applies during specified spawning dates, discussed further below. During the non-spawning time period, the dissolved oxygen criteria for cold, cool or warm water apply to the various fish use subcategories as shown in Table 2 and described in the section on "cool or cold water criteria" below.

Table 1. The four DO criteria correspond to Aquatic Life Uses.

Aquatic Life Use	**Spawning** Salmon and Steelhead / Resident Trout	**Cold-Water** dominant community	**Cool-Water** dominant community	**Warm-Water**
DO Criteria	**Spawning**	**Cold**	**Cool**	**Warm**
DO (mg/l)	11.0	8.0	6.5	5.0

Table 2. The applicable DO criterion is determined by a water body's Designated Fish Use.

Designated Fish Use	**DO Criteria**	
	Non-spawning time periods	**Spawning** time periods
Bull Trout Spawning & Juvenile Rearing	Cold	Spawning
Salmon & Steelhead Spawning	Cold	Spawning
Core Cold-Water Habitat	Cold	Spawning
Salmon & Trout Rearing & Migration	Cold or Cool[1]	Spawning
Redband & Lahontan Cutthroat Trout	Cold or Cool[18]	Spawning
Salmon & Steelhead Migration Corridors	Cool	Not Applicable[2]
Cool Water Species	Cool or Warm[3]	Not Applicable
Borax Lake Chub	Warm	Not Applicable

[1] Non-spawning DO Criterion (Cold or Cool) is based on Omernik Level III and IV ecoregions of Oregon (2003), and is detailed in a June 8, 2010 DEQ internal memo titled "Application of DO criteria to "salmon and trout rearing and migration" beneficial use and "redband or Lahontan cutthroat trout" beneficial use".

[2] Except for the Columbia and Snake Rivers, see temperature standard, Tables 101B and 121B.

[3] Non-spawning DO Criterion determination (Cool or Warm) is detailed in a June 22, 1998 letter from DEQ to USEPA. See Appendix 2.

Cold or Cool Water Criteria:
During non-spawning time periods, **cold water criteria** for DO are applied to the following designated uses as shown in the tables and figures referenced in OAR 340-041-0101 through OAR 340-041-0340:

- Core cold-water habitat,
- Bull trout spawning and juvenile rearing,
- portions of Salmon and trout rearing and migration, dependent on ecoregion as described in a DEQ Memos dated June 8, 2010[18] and June 22, 1998,[xx] and
- portions of the Lahontan and Redband trout, also dependent on ecoregion.

During non-spawning time periods, **cool water criteria** for DO are applied to the following designated uses as shown in the tables and figures referenced in OAR 340-041-0101 through OAR 340-041-0340:

- Cool water species (non-salmonid use),
- Salmon and trout migration corridors,
- portions of Salmon and trout rearing and migration, dependent on ecoregion as described in a DEQ Memos dated June 8, 2010[1] and June 22, 1998,[3] and
- portions of the Lahontan and Redband trout, also dependent on ecoregion.

Warm Water Criterion:
The warm water criterion is applied to waters identified in OAR 340-041 Table 190B as supporting borax lake chub. Additionally, the warm water criterion is applied to the following water bodies. (DEQ Memo, June 22, 1998 – Appendix 2).

Table 3. Water bodies subject to the warm water DO criterion

Water body	Extent
Malheur River	Namorf to Mouth
Willow Creek	Brogan to Mouth
Bully Creek	Reservoir to Mouth
Owyhee River	River Mile 0 to 18
Malheur Lake Basin	Natural Lakes
Goose and Summer Lakes Basin	High Alkaline and Saline Lakes

Spawning Time Periods
In designated Salmon and Steelhead spawning areas, the DO spawning criterion will be applied during the time periods indicated in tables and figures referenced in OAR 340-041-0016(1).
In areas designated in OAR 340-041-0190 Table 190B for Lahontan trout use, spawning is assumed to occur throughout the trout use range during the time periods indicated in Table 5 for Lahontan cutthroat trout.

In areas designated as bull trout spawning and juvenile rearing in tables and figures referenced in OAR 340-041-0016(1), the spawning criterion will be applied during the time periods set out in a February 2, 2004 letter from DEQ to EPA, Region 10 (Appendix 3) and summarized in Table 4.

Table 4: Bull Trout (Char) Spawning Time Periods

Basin	Subbasin	Bull Trout Spawning Period	Inclusive Bull Trout and resident trout spawning time periods
South Willamette		August 15 – May 30	August 15 – June 15
John Day		September 1 – April 30	September 1 – June 15
Umatilla		September 1 – April 30	September 1 – June 15
Walla Walla		September 1 – April 30	September 1 – June 15
Grande Ronde	Upper Grande Ronde	September 1 – April 15	September 1 – June 15
	Wallowa	September 1 – May 15	September 1 – June 15
	Wenaha	August 15 – March 31	August 15 – June 15
	Imnaha	August 15 – May 31	August 15 – June 15
Hood		August 15 – May 15	August 15 – June 15
Deschutes		August 15 – May 15	August 15 – June 15
Powder		August 15 – May 15	August 15 – June 15
Malheur		August 15 – May 30	August 15 – June 15
Klamath		August 15 - May 30	August 15 -- June 15

Detailed information on spawning locations and spawning time periods is not available for other resident trout species including redband, rainbow, westslope, and cutthroat trout. Therefore, DEQ assumes resident trout spawning occurs in all stream reaches designated for salmon and trout rearing or Redband trout use, unless DEQ has data or documentation from ODFW or the USFWS that a water body or segment is not suitable for spawning. The 2004/2006 Integrated Report states that the Tualatin River from river mile 0 to 62.6 has no resident trout spawning based on documentation from ODFW, which is provided in Appendix 4.

The spawning criterion will be applied for resident trout spawning during the time periods shown in Table 5. See DEQ's policy memo to EPA Region 10 dated February 2, 2004 (Appendix 4) for additional information. Table 5 summarizes the assumed spawning time periods for resident trout in streams with designated fish uses. The existing fish use map layers do not indicate whether a reach is upstream of core cold-water habitat. Therefore, for the 2012 assessment, areas upstream of core cold-water habitat were analyzed based on the designated fish use for the spawning time period.

Table 5: Resident Trout Spawning Time Periods

Designated Fish Use	Resident Trout Spawning
Salmon and trout rearing and migration	January 1 – May 15
Redband trout	January 1 – May 15

Core cold water habitat and upstream trout rearing water. NB: upstream areas NOT implemented in IR 2012, see text.	January 1 – June 15
Bull trout spawning and juvenile rearing (assumes resident trout also present)	January 1 – June 15 (See Table 4 for combined bull trout and resident trout spawning period.)
Lahontan cutthroat trout	April 1 – July 15
Salmon and Steelhead Migration Corridors	Assumed not suitable for resident trout spawning

Spawning time periods for resident trout and bull trout (char) are combined in areas where the designated fish use is bull trout (char) spawning and juvenile rearing (See Table 4). For example, in the John Day basin, the resident trout spawning time period (Table 5: January 1 – June 15) and the bull trout (char) spawning time period (Table 4: September 1 – April 30) are combined such that the spawning criterion applies from September 1 through June 15.

Table 21 Criteria:
For the 2012 assessment, DO was evaluated based on the numeric minimum criteria in the rule language. DEQ had sufficient continuous data (i.e. 30 days) to apply the alternative DO criteria in Table 21 to only four sites. Therefore, the additional complexity needed to do that analysis was not warranted.

Lakes:
Unless designated as salmon and steelhead spawning areas, natural lakes and reservoirs are not considered spawning habitat. The applicable cold or cool water criteria are applied year round.

Estuarine Criterion:
The estuarine water DO criterion applies for samples taken in estuarine conditions. DEQ used specific conductivity measurements as an indicator for estuarine conditions. This indicator was chosen after reviewing specific conductivity measurements collected from coastal waters. As shown in Figures 4 through 6, the measured specific conductivity is generally lower than 200 uS/cm at river locations where salt water is not present.

For DO data collected in the coastal waters of the North Coast, Mid Coast, South Coast, Rogue and Umpqua Basins, the specific conductivity of each sample was also evaluated. For continuous data, the daily mean specific conductivity was calculated. If the recorded specific conductivity was greater than 200 uS/cm, the estuarine DO criterion of 6.5 mg/L was applied. If the recorded specific conductivity was less than 200 uS/cm, the appropriate freshwater criteria were applied. Data collected in non-coastal waters were evaluated using the appropriate freshwater criteria.

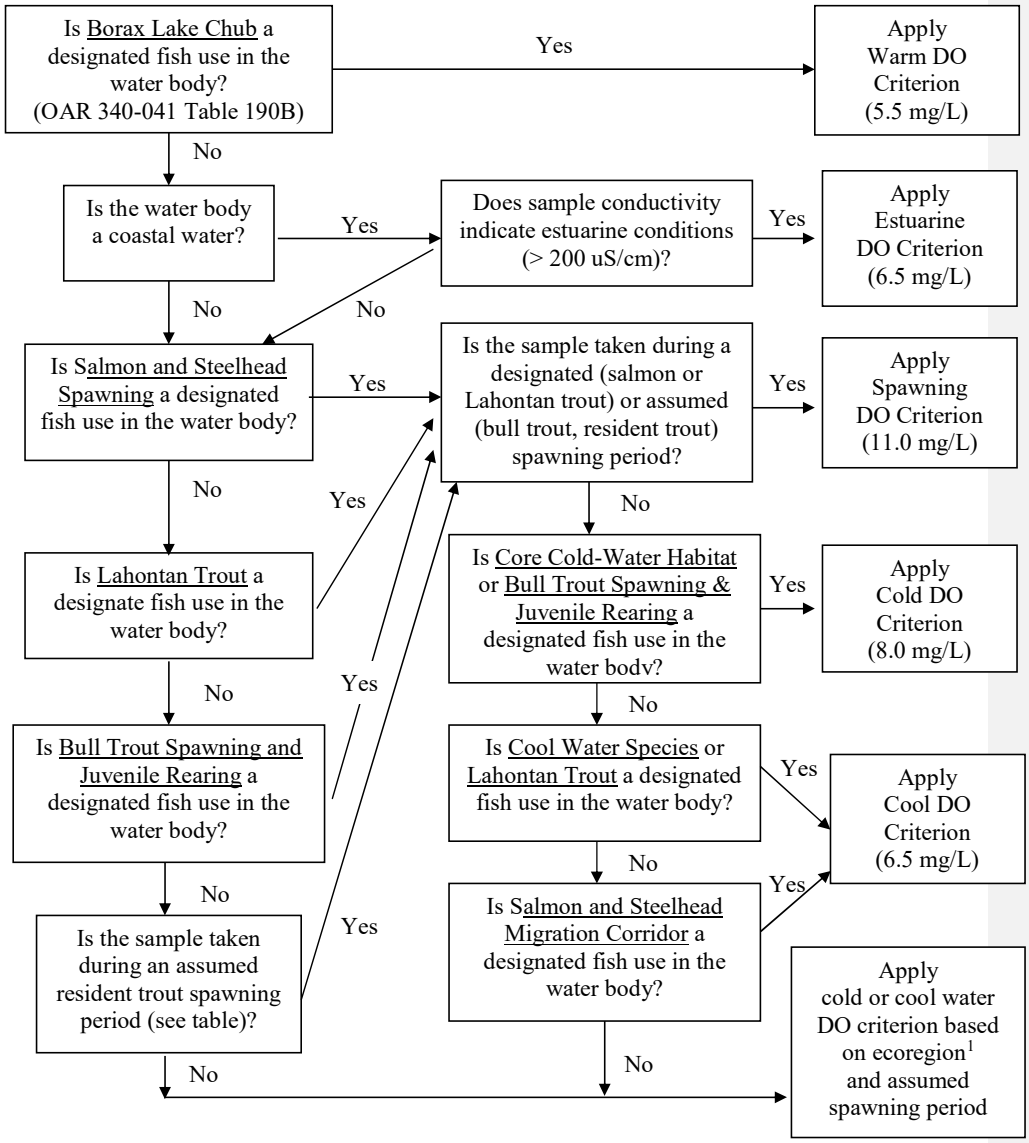
The spawning criterion was not applied in sections of a water body where data indicated estuarine conditions.

Ocean Waters:
There is no numeric dissolved oxygen criterion applicable to ocean waters [OAR 340-041-0016 (6)]. Rather, the criterion for ocean waters is no measurable reduction in dissolved oxygen

concentration. Ocean waters are "all oceanic, offshore waters outside of estuaries or bays and within the territorial limits of Oregon." [OAR 340-041-0002(43)

Summary:
The following flow chart (Figure 1) illustrates the evaluation process for DO data collected from Oregon water bodies.

Figure 1: Evaluation of Dissolved Oxygen Data



POLLUTANT: **pH**

BENEFICIAL USES AFFECTED: Resident Fish and Aquatic Life
Water Contact Recreation

2012 ASSESSMENT: DEQ did not evaluate pH data for this assessment.

NARRATIVE CRITERION: OAR 340-041-0021(2)

NUMERIC CRITERION: Statewide: OAR 340-041-0021
Basin-Specific: OAR 340-041-0101 through OAR 340-0410350

340-041-0021
pH
(1) Unless otherwise specified in OAR 340-041-0101 through 340-041-0350, pH values (Hydrogen ion concentrations) may not fall outside the following ranges:
(a) Marine waters: 7.0-8.5;
(b) Estuarine and fresh waters: See basin specific criteria (OAR 340-041-0101 through 340-041-0350).
(2) Waters impounded by dams existing on January 1, 1996, which have pHs that exceed the criteria are not in violation of the standard, if the Department determines that the exceedance would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria.

Table 6: Summary of pH Basin Specific Criteria (OAR 340-041-0101 through 340-041-0350

	OAR	Water	Criteria Range
General	**340-041-0021(1)(a)**	Marine	7.0 to 8.5
General	**340-041-0021(1)(b)**	Estuarine and fresh waters	See basin specific criteria
Basin or Water Body	OAR	Water	Criteria Range
Columbia River	**340-041-0104(1)**	Main stem Columbia River (mouth to river mile 309):	7.0 to 8.5
Snake River	**340-041-0124(1)**	Main stem Snake River (river miles 260 to 335)	7.0 to 9.0
Deschutes Basin	**340-041-0135(1)(a)**	All other Basin streams (except Cascade lakes)	6.5 to 8.5
	340-041-0135(1)(b)	Cascade lakes above 3,000 feet altitude	6.0 to 8.5
Goose and Summer Lakes Basin	**340-041-0145(1)(a)**	Goose Lake	7.5 to 9.5
	340-041-0145(1)(b)	All other basin waters	7.0 to 9.0*
Grande Ronde Basin	**340-041-0156(1)**	All basin streams (other than main stem Snake River)	6.5 to 9.0*
Hood Basin	**340-041-0165(1)(a)**	Hood River Basin streams	6.5 to 8.5

		(except main stem Columbia River and Cascade lakes)	
	340-041-0165(1)(b)	Cascade lakes above 3,000 feet altitude	6.0 to 8.5
John Day Basin	**340-041-0175(1)**	All Basin streams (other than the main stem Colombia River)	6.5 to 9.0*
Klamath Basin	**340-041-0185(1)(a)**	Fresh waters except Cascade lakes	6.5 to 9.0*
	340-041-0185(1)(b)	Cascade lakes above 5,000 feet altitude	6.0 to 8.5
Malheur Lake Basin	**340-041-0195(1)**		7.0 to 9.0*
Malheur River Basin	**340-041-0207(1)**		7.0 to 9.0*
Mid Coast Basin	**340-041-0225(1)(a)**	Marine waters	7.0 to 8.5
	340-041-0225(b)	Estuarine and fresh waters	6.5 to 8.5
North Coast Basin	**340-041-0235(1)(a)**	Marine waters	7.0 to 8.5
	340-041-0235(1)(b)	Estuarine and fresh waters	6.5 to 8.5
Owyhee Basin	**340-041-0256(1)**		7.0 to 9.0*
Powder/Burnt Basins	**340-041-0265(1)**	All Basin streams (other than main stem Snake River)	6.5 to 9.0*
Rogue Basin	**340-041-0275(1)(a)**	Marine waters	7.0 to 8.5
	340-041-0275(1)(b)	Estuarine and fresh waters (except Cascade lakes)	6.5 to 8.5
	340-041-0275(1)(c)	Cascade lakes above 3,000 feet altitude	6.0 to 8.5
Sandy Basin	**340-041-0290(1)(a)**	All Basin waters (except main stem Columbia River and Cascade lakes)	6.5 to 8.5
	340-041-0290(1)(b)	Cascade lakes above 3,000 feet altitude	6.0 to 8.5
South Coast Basin	**340-041-0305(1)(a)**	Estuarine and fresh waters	6.5 to 8.5
	340-041-0305(1)(b)	Marine waters	7.0 to 8.5
Umatilla Basin	**340-041-0315(1)**	all Basin streams (other than main stem Columbia River)	6.5 to 9.0*
Umpqua Basin	**340-041-0326(1)(a)**	Marine waters	7.0 to 8.5
	340-041-0326(1)(b)	Estuarine and fresh waters (except Cascade lakes)	6.5 to 8.5
	340-041-0326(1)(c)	Cascade lakes above 3,000 feet altitude	6.0 to 8.5
Walla Walla Basin	**340-041-0336**		6.5 to 9.0*
Willamette Basin	**340-041-0345(1)(a)**	All basin waters (except main stem Columbia River and Cascade lakes)	6.5 to 8.5
	340-041-0345(1)(b)	Cascade lakes above 3,000 feet altitude	6.0 to 8.5.

*When greater than 25 percent of ambient measurements taken between June and September are greater than pH 8.7, and as resources are available according to priorities set by the Department, the Department will determine whether the values higher than 8.7 are anthropogenic or natural in origin.

ASSIGNMENT OF ASSESSMENT CATEGORY:
Category 5: Water Quality Limited, TMDL Needed (303(d) List)
Greater than 10 percent of the samples are outside the range of the appropriate criterion and a minimum of at least two samples outside the range of the appropriate criterion for the time period of interest.

Category 4: Water Quality Limited, TMDL Not Needed
TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address pollutant and will attain water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

Category 3: Insufficient Data
Less than 5 samples for the time period of interest, or 5 to 9 samples for the time period of interest with 1 sample outside the range of the appropriate criterion.

Category 3B: Insufficient Data – Potential Concern
Less than 5 samples are available to evaluate for the season of interest, with 2 or more samples outside the range of the appropriate criterion for the time period of interest.

Category 2: Attaining
For 10 or more samples in the time period of interest, greater than 90% of the samples are within the range of the appropriate criterion. For 5 to 9 samples in the time period of interest, all samples are within the range of the appropriate criterion.

TIME PERIOD:
Summer: June 1 through September 30
Fall-Winter-Spring (FWS): October 1 to May 31

DATA REQUIREMENTS:
Data collected since 2001. A minimum of 5 representative data points available per site collected on separate days for each time period of interest.

NOTES:
Cascade Lakes are natural and man-made lakes at elevations over 3,000 or 5,000 feet, as specified in the basin criteria and shown in Table 6.

POLLUTANT: **SEDIMENTATION**

BENEFICIAL USES AFFECTED: Resident Fish and Aquatic Life
Salmonid Fish Spawning and Rearing

2012 ASSESSMENT: DEQ did not evaluate sedimentation for this assessment.

NARRATIVE CRITERION: OAR 340-041-0007(12)

> **340-041-0007**
> **Statewide Narrative Criteria**
> (12) The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry may not be allowed;

NUMERIC CRITERION: None

WATER QUALITY LIMITED DETERMINATION (CATEGORY 5):
Previous water quality assessment methodologies (Listing Criteria for Oregon's 1998 303(d) List of Water Quality Limited Water Bodies) have used stream specific documentation that showed excessive sedimentation was a significant limitation to fish or other aquatic life. This included information indicating beneficial uses impairment (aquatic community status, biomonitoring reference sites, or fishery data) and measurement data for benchmarks such as cobble embeddedness or percent fines.

DEQ is currently reviewing approaches to apply a numeric benchmark based on measurements of stream conditions to implement the narrative criteria.

ATTAINING CRITERION DETERMINATION (CATEGORY 2):
DEQ is currently reviewing approaches to apply a numeric benchmark based on measurements of stream conditions to implement the narrative criteria.

PARAMETER: **TEMPERATURE**

BENEFICIAL USES AFFECTED: Fish and Aquatic Life

2012 ASSESSMENT: DEQ did not evaluate temperature for this assessment.

NARRATIVE CRITERION: OAR 340-041-0028

NUMERIC CRITERION: OAR 340-041-0028(4)

340-041-0028
Temperature
[…]
(4) Biologically Based Numeric Criteria. Unless superseded by the natural conditions criteria described in section (8) of this rule, or by subsequently adopted site-specific criteria approved by EPA, the temperature criteria for State waters supporting salmonid fishes are as follows:

(a) The seven-day-average maximum temperature of a stream identified as having salmon and steelhead spawning use on subbasin maps and tables set out in OAR 340-041-0101 to 340-041-0340: Tables 101B, and 121B, and Figures 130B, 151B, 160B, 170B, 220B, 230B, 271B, 286B, 300B, 310B, 320B, and 340B, may not exceed 13.0 degrees Celsius (55.4 degrees Fahrenheit) at the times indicated on these maps and tables;

(b) The seven-day-average maximum temperature of a stream identified as having core cold water habitat use on subbasin maps set out in OAR 340-041-101 to 340-041-340: Figures 130A, 151A, 160A, 170A, 220A, 230A, 271A, 286A, 300A, 310A, 320A, and 340A, may not exceed 16.0 degrees Celsius (60.8 degrees Fahrenheit);

(c) The seven-day-average maximum temperature of a stream identified as having salmon and trout rearing and migration use on subbasin maps set out at OAR 340-041-0101 to 340-041-0340: Figures 130A, 151A, 160A, 170A, 220A, 230A, 271A, 286A, 300A, 310A, 320A, and 340A, may not exceed 18.0 degrees Celsius (64.4 degrees Fahrenheit);

(d) The seven-day-average maximum temperature of a stream identified as having a migration corridor use on subbasin maps and tables OAR 340-041-0101 to 340-041-0340: Tables 101B, and 121B, and Figures 151A, 170A, and 340A, may not exceed 20.0 degrees Celsius (68.0 degrees Fahrenheit). In addition, these water bodies must have coldwater refugia that's sufficiently distributed so as to allow salmon and steelhead migration without significant adverse effects from higher water temperatures elsewhere in the water body. Finally, the seasonal thermal pattern in Columbia and Snake Rivers must reflect the natural seasonal thermal pattern;

(e) The seven-day-average maximum temperature of a stream identified as having Lahontan cutthroat trout or redband trout use on subbasin maps and tables set out in OAR 340-041-0101 to 340-041-0340: Tables 120B, 140B, 190B, and 250B,

and Figures 180A, 201A, and 260A may not exceed 20.0 degrees Celsius (68.0 degrees Fahrenheit);

(f) The seven-day-average maximum temperature of a stream identified as having bull trout spawning and juvenile rearing use on subbasin maps set out at OAR 340-041-0101 to 340-041-0340: Figures 130B, 151B, 160B, 170B, 180A, 201A, 260A, 310B, and 340B, may not exceed 12.0 degrees Celsius (53.6 degrees Fahrenheit). From August 15 through May 15, in bull trout spawning waters below Clear Creek and Mehlhorn reservoirs on Upper Clear Creek (Pine Subbasin), below Laurance Lake on the Middle Fork Hood River, and below Carmen reservoir on the Upper McKenzie River, there may be no more than a 0.3 degrees Celsius (0.5 Fahrenheit) increase between the water temperature immediately upstream of the reservoir and the water temperature immediately downstream of the spillway when the ambient seven-day-average maximum stream temperature is 9.0 degrees Celsius (48 degrees Fahrenheit) or greater, and no more than a 1.0 degree Celsius (1.8 degrees Fahrenheit) increase when the seven-day-average stream temperature is less than 9 degrees Celsius.

[…]

(6) Natural Lakes. Natural lakes may not be warmed by more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the natural condition unless a greater increase would not reasonably be expected to adversely affect fish or other aquatic life. Absent a discharge or human modification that would reasonably be expected to increase temperature, DEQ will presume that the ambient temperature of a natural lake is the same as its natural thermal condition.

(7) Oceans and Bays. Except for the Columbia River above river mile 7, ocean and bay waters may not be warmed by more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the natural condition unless a greater increase would not reasonably be expected to adversely affect fish or other aquatic life. Absent a discharge or human modification that would reasonably be expected to increase temperature, DEQ will presume that the ambient temperature of the ocean or bay is the same as its natural thermal condition.

(9) Cool Water Species.

(a) No increase in temperature is allowed that would reasonably be expected to impair cool water species. Waters of the State that support cool water species are identified on subbasin tables and figures set out in OAR 340-041-0101 to 340-041-0340; Tables 140B, 190B and 250B, and Figures 180A, 201A and 340A.

(b) See OAR 340-041-0185 for a basin specific criterion for the Klamath River.

(10) Borax Lake Chub. State waters in the Malheur Lake Basin supporting the Borax Lake chub may not be cooled more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) below the natural condition.

[…]

ASSIGNMENT OF ASSESSMENT CATEGORY:

Category 5: Water Quality Limited, TMDL Needed (303(d) List)

Where continuous temperature data are collected, the seven-day-average maximum temperature exceeds the applicable criterion. Seven-day average maximum temperature means a calculation

of the average of the daily maximum temperatures from seven consecutive days, made on a rolling basis.

Category 4: Water Quality Limited, TMDL Not Needed
TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address pollutant and will attain water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

Category 3: Insufficient Data
Where continuous temperature data are collected, insufficient data are available to calculate the seven-day-average maximum temperature.

Category 2: Attaining
Where continuous temperature data are collected, the seven-day-average maximum temperature attains the applicable criterion.

TIME PERIOD:
In designated salmon and steelhead spawning areas, the spawning criterion will be applied during the time periods indicated in tables and figures referenced in OAR 340-041-0028(4)(a). Other applicable criteria will be applied during non-spawning time periods.

DATA REQUIREMENTS:
Temperature was not evaluated for the 2012 integrated report.

PARAMETER: **TOTAL DISSOLVED GAS**

BENEFICIAL USES AFFECTED: Resident Fish and Aquatic Life

2012 ASSESSMENT: DEQ did not evaluate total dissolved gas for this assessment.

NARRATIVE CRITERION: OAR 340-041-0031(1)

NUMERIC CRITERION: OAR 340-041-0031(2)

> **340-041-0031**
> **Total Dissolved Gas**
> (1) Waters will be free from dissolved gases, such as carbon dioxide hydrogen sulfide, or other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such water.
> (2) Except when stream flow exceeds the ten-year, seven-day average flood, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 110 percent of saturation. However, in hatchery-receiving waters and other waters of less than two feet in depth, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 105 percent of saturation.

ASSIGNMENT OF ASSESSMENT CATEGORY:
Category 5: Water Quality Limited, TMDL Needed (303(d) List)
More than 10 percent of the samples exceed standard and a minimum of at least two exceedances of the standard, or a survey that identifies beneficial use impairment due to total dissolved gas such as assessment of fish conditions.

Category 4: Water Quality Limited, TMDL Not Needed
TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address pollutant and will attain water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

TIME PERIOD:
Total dissolved gas was not evaluated for the 2012 integrated report.

POLLUTANT: **TOXIC SUBSTANCES**

BENEFICIAL USES AFFECTED: Aquatic Life – Fresh Water and Marine Water
Human Health – Water and Fish Ingestion, Fish Consumption, Drinking Water

2012 ASSESSMENT: DEQ evaluated a subset of toxics data statewide where data was available for this assessment.

NARRATIVE CRITERION: OAR 340-041-0033(2)

NUMERIC CRITERION: OAR 340-041-0033(3) (4)

The toxics rule language contained in OAR 340-041-0033 (shown below) was adopted by the Environmental Quality Commission on June 16, 2011 and approved by the EPA on October 17, 2011.

340-041-0033
Toxic Substances

(1) Amendments in sections (4) and (6) of this rule (OAR 340-041-0033) and associated revisions to Tables 20, 33A, 33B and 40 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act unless and until EPA approves the provisions it identifies as water quality standards pursuant to 40 CFR 131.21 (4/27/2000).

(2) Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife, or other designated beneficial uses.

(3) Aquatic Life Criteria. Levels of toxic substances in waters of the state may not exceed the applicable aquatic life criteria listed in Tables 20, 33A, and 33B. Tables 33A and 33B, adopted on May 20, 2004, update Table 20 as described in this section.

(a) Each value for criteria in Table 20 is effective until the corresponding value in Tables 33A or 33B becomes effective.

(A) Each value in Table 33A is effective on February 15, 2005, unless EPA has disapproved the value before that date. If a value is subsequently disapproved, any corresponding value in Table 20 becomes effective immediately. Values that are the same in Tables 20 and 33A remain in effect.

(B) Each value in Table 33B is effective upon EPA approval.

(b) The department will note the effective date for each value in Tables 20, 33A, and 33B as described in this section.

(4) Human Health Criteria. The criteria for waters of the state listed in Table 40 are established to protect Oregonians from potential adverse health effects associated with long-term exposure to toxic substances associated with consumption of fish, shellfish, and water.

(5) To establish permit or other regulatory limits for toxic substances for which criteria are not included in Tables 20, 33A, or 33B, the department may use the guidance values in Table 33C, public health advisories, and other published scientific literature. The department may also require or conduct bio-assessment studies to monitor the toxicity to aquatic life of complex effluents, other suspected discharges, or chemical substances without numeric criteria.

Toxics Criteria Applied to the 2012 Water Quality Assessment

On June 16, 2011, the Environmental Quality Commission approved new and revised toxics criteria for human health in Table 40 based on a higher fish consumption rate of 175 g/day (See http://www.deq.state.or.us/wq/rules/div041/table40.pdf). These revised criteria are now effective for all CWA programs in Oregon following EPA approval on October 17, 2011. The status of Oregon waters in the 2012 Water Quality Assessment (303d) and Integrated Report reflects these revised criteria where new data were available or previous data were re-evaluated.

Please refer to the **Delisting Water Bodies** section of this document for information on how DEQ assessed toxics listing status based on changes to the human health toxics criteria.

The Commission adopted revised aquatic life criteria for toxic substances in 2004. EPA took action on the aquatic life criteria on Jan. 31, 2013. EPA approved and disapproved a number of criteria. The 2012 Water Quality Report does not reflect EPA's approval and disapproval actions since the majority of the toxics assessment was already completed before EPA's action date. Therefore, the 2012 Water Quality Report reflects the aquatic life criteria from Table 20 that were previously adopted in the 1980s (See http://www.deq.state.or.us/wq/standards/docs/Table2033A33B.pdf). Note that as part of the human health toxics rulemaking approval, DEQ removed the human health criteria from Table 20 (and Tables 33A and 33B), so that Table 20 only contains criteria for aquatic life, while Table 40 only contains criteria based on human health.

Toxics Data Assessed for the 2012 Water Quality Assessment

Toxic data was assessed on a statewide basis focusing on the following toxics parameters:

- USGS data—key metals, organics, nitrate, and ammonia
- Oregon DEQ LASAR database—key metals
- City of Gresham—metals and organics

The table below provides a list of toxic pollutants that DEQ assessed for each of the data sources above:

Table 1. List of Assessed Toxic Pollutants

OR DEQ	USGS	City of Gresham
arsenic	ammonia	aldrin
beryllium	anthracene	alpha BHC
cadmium	arsenic	copper
chromium	guthion	DDD
copper	benzene	DDE
iron	benzo[a]pyrene	DDT
lead	beryllium	dieldrin
manganese	cadmium	endosulfan
nickel	chlordane	endrin
selenium	chlorpyrifos	endrin aldehyde
silver	chromium	heptachlor
zinc	copper	lead
	DDD	mercury
	DDE	methoxychlor
	DDT	nickel
	dieldrin	nitrate
	fluoranthene	zinc
	heptachlor	
	hexachlorobutadiene	
	hexachloroethane	
	iron	
	lead	
	malathion	
	mercury	
	nickel	
	nitrate	
	parathion	
	PCBs	
	pentachlorophenol	
	pyrene	
	selenium	
	silver	
	tetrachloroethene	
	thallium	
	trichloroethene	
	vinyl chloride	
	zinc	

General Considerations

Oregon's toxics standards for aquatic life and human health protection apply to water column concentrations (µg/l) for each compound, with the exception of the human health criterion for methyl mercury, which is expressed as a fish tissue concentration (mg/kg). The previous criteria were based on total mercury in the water column. Water column-based aquatic life criteria for total mercury remain. For more information on methyl mercury, see the discussion under *Toxics Criteria Considerations*.

Human Health Criteria Revisions Effective in 2010

In 2004, Oregon withdrew its human health criteria for the following toxic pollutants to be consistent with EPA's National Toxics Rule and 2002 nationally recommended criteria [CWA section 304(a) criteria]:

- Beryllium
- Cadmium
- Chromium III
- Chromium VI
- Lead
- Mercury
- Silver
- Trichloroethane 1, 1, 1

EPA subsequently approved these criteria withdrawals in June 2010. The human health criteria for silver were removed because the criteria were developed based on a cosmetic effect impact and not a toxicity endpoint. DEQ withdrew criteria for cadmium, chromium, and beryllium because EPA determined that they are no longer scientifically defensible. EPA may revise these criteria in the future based on relevant data and toxicity. Similarly, DEQ withdrew criteria for lead and 1,1,1, trichloroethane because EPA determined that there was an insufficient basis for calculating human health criteria for these contaminants. In 2001, EPA promulgated a new criterion for mercury based on the amount of methylmercury in fish tissue, rather than in the water column. Consequently, DEQ withdrew the human health criteria for total mercury in the water column.

With the exception of beryllium and 1,1,1 trichloroethane, aquatic life criteria remain in effect for the above chemicals.

Human Health Criteria Revisions Effective in 2011

As part of the 2010-11 human health toxics standards revisions, DEQ re-named or withdrew several additional chemical and metals criteria. Some of the withdrawn criteria were for a family or group of chemicals and were replaced by criteria for individual chemicals. Generally, this is because the specific chemicals are the most toxic of that chemical family, are the most commonly used in industrial processes and/or are prevalent in the environment. Please see additional information on iron and manganese under the "Toxics Criteria Considerations." EPA approved these changes and are therefore effective for the 2012 assessment.

- Dinitrotoluene
- Dinitro-o-Cresol 2,4

- Diphenylhydrazine
- Halomethanes
- Monochlorobenzene
- Polynuclear Aromatic Hydrocarbons (PAHs)
- Endosulfan
- Iron
- Manganese criteria for freshwater

Of the above chemicals, aquatic life criteria remain for endosulfan and iron.

Additionally, despite a higher fish consumption rate, several chemicals became less stringent based on updates to EPA's toxicity data (IRIS database). For arsenic, site specific criteria were adopted for Oregon based on locally appropriate calculation factors following a robust stakeholder review process.

- Arsenic
- Chloroform
- Nickel
- Phenol
- Selenium

Human health criteria for an additional 38 toxic pollutants were also adopted and approved in 2011. Criteria for these pollutants are found in Table 40. Generally, the additional pollutants are based on EPA developing individual criteria for what were formally, chemical group criteria (e.g. PAH criteria withdrawn and individual PAH chemicals criteria developed). Also see information in the "Delisting Water Bodies" section of this document regarding some of the pollutants below.

Table 2. Pollutants for Which DEQ Added Criteria

Acenapthene	**Dimethyl phenol 2,4**
Anthracene	Dinitrophenol 2,4
Benz(a)anthracene	Dinitrophenols
Benzo(a)pyrene	Diphenylhydrazine 1,2
Benzo(b)fluoranthene 3,4	Endosulfan alpha
Benzo(k)fluoranthene	Endosulfan beta
Bromoform	Endosulfan sulfate
Butylbenzyl phthalate	Endrin aldehyde
Chlorodibromomethane	Fluorene
Chloronaphthalene 2	Heptachlor epoxide
Chlorophenol 2	Indeno(1,2,3-cd)pyrene
Chrysene	Methyl bromide
DDD 4, 4'	Methyl-4,6-dinitrophenol 2
DDE 4, 4'	Methylene chloride

Dibenz(a,h)anthracene	Methylmercury (mg/kg)
Dichlorobenzene(p) 1,4	Nitrosodi-n-propylamine, n
Dichlorobromomethane	Pyrene
Dichloroethylene trans 1,2	Trichlorobenzene 1,2,4
Dichloropropane	Zinc

ASSIGNMENT OF ASSESSMENT CATEGORY:

DEQ compared each toxics sample result to the most stringent applicable criterion. For sample results reported as less than a minimum reporting limit (<MRL or equivalent lab reporting limit), DEQ compared the MRL to the most stringent applicable criterion. If the MRL was higher than the most stringent criterion, the sample was not used in this assessment (i.e. the sample result is unknown with regard to the criterion and was not counted as either exceeding or attaining the criteria). See the *Toxics Criteria Considerations* section for more information about how DEQ further evaluated specific toxic pollutants.

Each category below describes data needed in order for DEQ to categorize each sampling site as a Category 5, 4, 3, 3B, or 2.

Category 5: Water Quality Limited, TMDL Needed (303(d) List)
Two (2) or more valid results not meeting the most stringent applicable criterion for concentrations of a specific toxic substance in the water column over a 12-year assessment period;
Or,
For Safe Drinking Water Act Maximum Contaminant Levels (MCLs) that do not have corresponding human health or aquatic life toxics criteria, two (2) or more valid ambient results not meeting a MCL **AND** where that water body is the source water for a Community Water System whose finished water also exceeds the MCL for that pollutant (note that DEQ did not encounter this situation for the 2012 Water Quality Report).
Or,
A fish consumption advisory (established by the Public Health Division of the Oregon Health Authority) has been issued for specific water bodies for the pollutant. (See http://www.oregon.gov/DHS/ph/envtox/fishadvisories.shtml)[1]
Or,
The geometric mean of a minimum of three (3) or more valid results not meeting the fish tissue criterion for **methyl mercury**, if the results are from skinless fillets of individual fish,
Or,
The arithmetic mean of two (2) or more valid results not meeting the fish tissue criterion for **methyl mercury** if the results are from composited skinless fillets from multiple fish of the same species.

[1] New or modified fish consumption advisories for mercury were issued for Brownlee and Phillips Reservoir in 2012.

Category 4: Water Quality Limited, TMDL Not Needed
TMDLs needed to attain applicable water quality standards have been approved (Category 4A), other pollution control requirements are expected to address pollutant and will attain water quality standards (Category 4B), or impairment is not caused by a pollutant (Category 4C).

Category 3B: Insufficient Data – Potential Concern
One (1) valid sample result not meeting the most stringent applicable criterion for a specific toxic substance over a 12-year assessment period,
(See Notes below regarding the alkalinity criterion.)
Or,
Two (2) or more valid sample results not meeting a MCL for which there is no corresponding human health or aquatic life criteria.

Category 3: Insufficient Data
Less than 5 valid samples for the toxic pollutant (unless assigned Category 5 or 3B)
Or,
Less than 3 valid samples for **methyl mercury** in fish tissue when the results are from skinless fillets of individual fish
Or,
Less than 2 valid samples for **methyl mercury** in fish tissue from a composite sample composed of skinless fillets of multiple fish of the same species.

Category 2: Attaining
A minimum of 5 valid samples collected over a 12-year assessment period and all valid results meet the most stringent applicable criterion for a specific toxic pollutant,
Or,
The geometric mean of a minimum of 3 valid samples meeting the human health criterion for **methyl mercury** when the results are from skinless fillets of individual fish
Or,
The arithmetic mean of a minimum of 2 valid samples meeting the human health criterion for **methyl mercury** when the results are from a composite sample composed of skinless fillets of multiple fish of the same species

TIME PERIOD:
Year-round data collected from 2000 - 2011.

DATA REQUIREMENTS:
Data results must be greater than the maximum reporting limit of the most stringent applicable criterion to be considered valid.

NOTES:

Applying Aquatic Life and Human Health Criteria

Oregon's human health criteria were developed to protect Oregonians from long term exposure to toxic pollutants in drinking water and through eating fish and shellfish contaminated with toxics. The "organism only" criteria are established to protect fish and shellfish consumption and apply to waters of the state designated for fishing. The "water + organism" criteria are established to protect the consumption of drinking water, fish, and shellfish, and apply where both fishing and domestic water supply (public and private) are designated uses. The majority of Oregon's waterbodies have been designated for domestic and private domestic water supply and fishing uses. Therefore, human health toxics criteria are widely applicable across the state.

The concentration for each compound listed in Table 20 is a criterion not to be exceeded in waters of the state in order to protect aquatic life. The acute criteria refer to the average concentration for one hour and the chronic criteria refer to the average concentration for 96 hours (4 days). The criteria may not be exceeded more than once every three years (note that this frequency and duration do not apply to approximately eleven pesticides). For the 2012 assessment methodology, DEQ did not have sufficient data to calculate one-hour or 96-hour average values. Instead, DEQ conservatively compared each sample result against the most stringent aquatic life or human health criterion applicable at the sampling site over the most recent 10 year period, rather than over a three year period (see *Assignment of Category* section for more detailed information).

To evaluate site monitoring data, the most stringent aquatic life or human health criterion applicable to the water type was used. DEQ generally applies EPA guidance to determine when freshwater or saltwater (marine) aquatic life criteria for toxic substances were applicable, and additionally considered the human health criteria for each compound.[2] A combination of salinity, conductivity, and geographic information for each sampling site was used to determine whether the freshwater or saltwater (marine) aquatic life criteria were applicable.

Marine Waters:

Marine waters are defined in OAR 340-041-0002(34) as all oceanic, offshore water outside of estuaries or bays and within the territorial limits of Oregon. EPA recommends using saltwater criteria for waters where the salinity is equal to or greater than 10 (approximately equivalent to conductivity 20,000 uS/cm).[3] DEQ applies the more stringent of the marine acute or chronic criteria <u>or</u> the human health criteria for "fish-consumption-only" at each sampling site.

Note that DEQ did not evaluate any marine sites for toxics as part of the 2012 Water Quality Report.

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[2] 2002, National Recommended Water Quality Criteria: 2002, U.S. EPA Office of Water, EPA 822-R-02-047. Page 9.

[3] Monitoring data are more commonly collected for conductivity. A general conversion is salinity 0.1 parts per thousand = 200 microSiemens/cm conductivity at 20°C. data are more commonly collected, and a general conversion is salinity . Conversion from on-line reference table at http://www.envcoglobal.com/files/u5/Envco%20Conductivity%20to%20salinity%20conversion%20table.pdf attributed to equation of P.K. Weyl, Liminology and Oceanography, 9:75 (1964).

In past assessments, monitoring sites in marine waters were identified using geographic information and confirmed using salinity or conductivity data. Ammonia criteria (Acute Criteria CMC and Chronic Criterion CCC) were calculated for these sites using the appropriate equations for saltwater.

Estuarine Waters:

Estuarine waters are defined in OAR 340-041-0002(22) as mixed fresh and oceanic water in estuaries or bays from the point of inland oceanic water intrusion to a line connecting the outermost points of the headlands or protective jetties. DEQ applies the more stringent of the freshwater or marine acute or chronic criteria for aquatic life or the human health criterion for "fish-consumption-only" at each sampling site where the salinity is between 1 and 10.

In past assessments, the inland extent of estuarine waters was identified as the point where recorded specific conductivity measurements were above 200 uS/cm. For the 2012 Water Quality Report, DEQ determined estuarine sites by name (e.g. "bay", "slough") and best professional judgment rather than specific conductivity or salinity data given issues DEQ staff identified related to accuracy and temporal fluctuations of conductivity data and being representative of an estuarine site.

DEQ intends to review the use of 0.1 versus 1 salinity to distinguish between fresh and estuarine waters as part of the 2014 assessment, which will focus on a coastal basin under the rotating basin approach. Ammonia criteria for estuarine waters were calculated for these sites using the appropriate equations for freshwater. In addition, hardness-dependent freshwater criteria for metals were applied to the estuarine sites.

Freshwater:

Waters that are not identified as marine or estuarine are evaluated as freshwater. DEQ applies the most stringent of the freshwater acute or chronic aquatic life criteria or the human health criteria for "fish-consumption-only" or "water-and-fish-ingestion" at each sampling site.

TOXICS CRITERIA CONSIDERATIONS:

The following section describes additional considerations when comparing analytical results for certain toxic pollutants to the applicable criterion. In order to correctly apply toxics criteria in this assessment, an effort was made to correlate toxic pollutants with chemicals identified by their unique CAS registry number using the 1986 guidance document used to develop the criteria and available chemical and CAS registry information.[4, 5, 6, 7]

[4] 1986, Quality Criteria for Water, U.S. EPA Office of Water, EPA 440/5-86-001

[5] National Institute of Standards and Technology web site "Search for Species Data by CAS Registry" at http://webbook.nist.gov/chemistry/cas-ser.html

[6] Agency for Toxic Substance and Disease Registry web site at http://www.atsdr.cdc.gov/

Alkalinity Criterion
The freshwater criterion for alkalinity is "20 mg/L or more as $CaCO_3$ freshwater aquatic life except where natural concentrations are less."[8] Alkalinity should not be below this value in order to protect aquatic life.

Alkalinity is a measure of carbonate and bicarbonate ions and the buffering capacity of water to pH changes. Freshwater systems have natural variations in pH that are related to photosynthetic activity and other inorganic and organic chemical reactions. Applying the alkalinity criterion as an isolated standard to determine where water is water quality limited may lead to incorrect conclusions about overall natural water quality. For Integrated Report evaluations, analytical data indicating alkalinity less than the criterion is flagged as a **Category 3B Insufficient Data – Potential Concern**. Professional judgment should be used during TMDL development or on a case-by-case basis to consider alkalinity information along with information for other related pollutant pollutants such as pH, chlorophyll a, aquatic weeds or algae growth, and dissolved oxygen when addressing beneficial use support. DEQ did not assess alkalinity data for the 2012 assessment.

Ammonia Criteria
Ammonia criteria are established based on the concentration of un-ionized ammonia (NH_3) which is the principal toxic form of ammonia, and are pH and temperature specific.[9] Monitoring data results are typically reported as "total ammonia as N". For the assessment evaluation, criteria are calculated for freshwater and saltwater first for un-ionized ammonia (NH_3), and then converted to criteria for total ammonia as N in order to evaluate monitoring data results. If temperature or pH data were not available, criteria were not calculated and the sample result was not evaluated.

The 2012 Water Quality assessment only reviewed USGS ammonia data from the Willamette Basin. The ammonia calculations assumed salmonids were present at every site.

Ammonia Criteria - Freshwater
Ammonia criteria for freshwater are calculated based on pH, temperature, and the presence or absence of salmonids or other fish with ammonia-sensitive life stages. For this assessment, salmonids are assumed to be present except in water bodies designated for cool water species or Borax Lake chub. Values for freshwater criteria for un-ionized ammonia (NH_3) are calculated first, then converted to criteria for total ammonia as N using the following formulae.[10, 11] EPA recommends criteria calculations not be

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[7] US EPA Substance Registry Services web site "Substance Search" at http://iaspub.epa.gov/sor_internet/registry/substreg/searchandretrieve/substancesearch/search.do
[8] 1986, Quality Criteria for Water, U.S. EPA Office of Water, EPA 440/5-86-001
[9] 1986, Quality Criteria for Water 1986, U.S. EPA Office of Water, EPA 440/5-86-001
[10] 1985, Ambient Water Quality Criteria for Ammonia - 1984, U.S. EPA Office of Water, EPA 440/5-85-001
[11] 1986, Quality Criteria for Water 1986, U.S. EPA Office of Water, EPA 440/5-86-001

extrapolated beyond the pH and temperature limits specified in the following equations.[26, 27]

Freshwater Acute Criterion (CMC = Criterion Maximum Concentration):

Salmonids present:

$CMC_{NH3} = 0.52 / FT / FPH / 2$

Where:

$FT = 1$ when $20 \leq$ Temperature (T) ≤ 30

Or

$FT = 10^{0.03(20-T)}$ when $0 \leq T < 20$

And:

$FPH = 1$ when $8 \leq pH \leq 9$

Or

$FPH = \frac{1 + 10^{7.4-pH}}{1.25}$ when $6.5 \leq pH < 8$

Salmonids absent:

$CMC_{NH3} = 0.52 / FT / FPH / 2$

Where:

$FT = 0.71$ when $25 \leq T \leq 30$

Or

$FT = 10^{0.03(20-T)}$ when $0 \leq T < 25$

And:

$FPH = 1$ when $8 \leq pH \leq 9$

Or

$FPH = \frac{1 + 10^{7.4-pH}}{1.25}$ when $6.5 \leq pH < 8$

Freshwater Chronic Criterion (CCC = Criterion Continuous Concentration):

Salmonids present:

$CCC_{NH3} = 0.80 / FT / FPH / RATIO$

Where:

$FT = 1.4$ when $15 \leq T \leq 30$

Or

$FT = 10^{0.03(20-T)}$ when $0 \leq T < 15$

And:

$FPH = 1$ when $8 \leq pH \leq 9$

Or

$FPH = \frac{1 + 10^{7.4-pH}}{1.25}$ when $6.5 \leq pH < 8$

And:

$RATIO = 16$ when $7.7 \leq pH \leq 9$

Or

$RATIO = 24*(10^{7.7-pH}/1+10^{7.4-pH})$ when $6.5 \leq pH < 7.7$

Salmonids absent:

$CCC_{NH3} = 0.80 / FT / FPH / RATIO$

Where:

$FT = 1$ when $20 \leq T \leq 30$

Or

$FT = 10^{0.03(20-T)}$ when $0 \leq T < 20$

And:

$FPH = 1$ when $8 \leq pH \leq 9$

Or

$FPH = \frac{1 + 10^{7.4-pH}}{1.25}$ when $6.5 \leq pH < 8$

And:

$RATIO = 16$ when $7.7 \leq pH \leq 9$

Or

$RATIO = 24*(10^{7.7-pH}/1+10^{7.4-pH})$ when $6.5 \leq pH < 7.7$

Ammonia criteria calculated above are for the un-ionized ammonia (NH_3) fraction.[12] Criteria for total ammonia as N are calculated using the following equations:[13]

pKa = 0.09018 + (2729.92/(273.15 + Temperature))
Fraction = 1/(10^(pKa – pH) + 1)

$CMC_{(Total\ ammonia\ as\ N)} = CMC_{NH3}$ /Fraction*0.822
$CCC_{(Total\ ammonia\ as\ N)} = CCC_{NH3}$ /Fraction*0.822

Ammonia Criteria – Saltwater

Ammonia criteria for saltwater are established for un-ionized ammonia (NH_3) which is the principal toxic form of ammonia.[14] For this assessment, the saltwater criteria were calculated for marine sites. Marine sites were identified using geographic information and confirmed with salinity or conductivity data. A default salinity value of 10 ppth was used if site specific data were not available.

Saltwater Acute Criterion (CMC^S = Criterion Maximum Concentration):

[12] 1985, Ambient Water Quality Criteria for Ammonia - 1984, U.S. EPA Office of Water, EPA 440/5-85-001. http://www.epa.gov/waterscience/criteria/library/ambientwqc/ammonia1984.pdf
[13] 1999, 1999 Update of Ambient Water Quality Criteria for Ammonia, U.S. EPA Office of Water, EPA 822-R-99-014. http://www.epa.gov/waterscience/criteria/ammonia/99update.pdf
[14] 1989, Ambient Water Quality Criteria for Ammonia (Saltwater)-1989, U.S. EPA Office of Water, EPA 440/5-88-004; http://www.epa.gov/ost/pc/ambientwqc/ammoniasalt1989.pdf

CMC^S_{NH3} = 0.233 mg/L

Saltwater Chronic Criterion (CCC^S = Criterion Continuous Concentration):
CCC^S_{NH3} = 0.035 mg/L

EPA provides a model to approximate the percent un-ionized ammonia in saltwater using the equations below, and to calculate the criteria in terms of total ammonia as N.

% Unionized Ammonia (UIA) =100*[1+10^ (pKaS +0.0324*(298-T) +0.0415*P/T-pH)]$^{-1}$

Where:

S = salinity (g/kg)
T = temperature (ºK)
P = 1 atm pressure (default)

And:

pK_a^S = 9.245+0.116*MIS
MIS = Molal Ionic Strength of seawater = (19.9273*S)/ (1000-1.005109*S)

To calculate the criteria in terms of total ammonia as N:

Saltwater Acute Criterion (CMC = Criterion Maximum Concentration):
$CMC^S_{(Total\ ammonia\ as\ N)}$ = CMC^S_{NH3} /UIA*0.822= 0.233/UIA*0.822

Saltwater Chronic Criterion (CCC = Criterion Continuous Concentration):
$CCC^S_{(Total\ ammonia\ as\ N)}$ = CCC^S_{NH3} /UIA*0.822= 0.0.035/UIA*0.822

Arsenic Criteria

As part of the 2011 toxics rulemaking, DEQ reviewed Oregon's human health water quality criteria for arsenic, a naturally-occurring earth metal present in Oregon waters. On October 17, 2011 EPA approved less stringent arsenic criteria for total inorganic (more toxic form) rather than total recoverable arsenic.[15] The "water + organism" criterion is 2.1 µg/l. The "organism only" criterion for freshwater is 2.1 µg/l, while the "organism only" criterion for saltwater is 1.0 µg/l. The saltwater criterion incorporates the high bioconcentration rates of marine mollusks and is protective of people who consume oysters and clams. The aquatic life criteria for arsenic III continue to apply.

Currently, the majority, if not all, data results for arsenic are for either total recoverable or total dissolved arsenic. DEQ does not have a data set for Oregon to indicate what percent of total arsenic samples are inorganic arsenic; however, Idaho completed a study[16] in March 2010 indicating that the median percent inorganic arsenic in total arsenic samples (n = 40) was 76%. For the 2012 assessment, DEQ applied this inorganic

[15] See associated rulemaking documents at: http://www.deq.state.or.us/wq/standards/metals.htm.

[16] Idaho Department of Environmental Quality. March 2010. Arsenic, Mercury, and Selenium in Fish Tissue and Water from Idaho's Major Rivers: A Statewide Assessment. Found at: http://www.deq.idaho.gov/media/639752-arsenic_mercury_fish_tissue_report_0310.pdf

fraction from Idaho's study and multiplied total recoverable arsenic data results by 76% as an approximate estimate of determining the amount of inorganic arsenic in a water sample. This product was compared to the most stringent applicable criterion for total inorganic arsenic and categorized according to the toxics assessment methodology. This inorganic fraction estimate may over or underestimate the amount of inorganic data in a water sample. In future assessments, if total inorganic arsenic data are available, listings based on total recoverable arsenic will be re-evaluated and categorized accordingly. See the *Delisting Water Bodies* section for information on delisting methodology. For more information about arsenic, see the analytical memo at:
http://www.deq.state.or.us/wq/standards/docs/toxics/Arsenic.pdf

Beryllium
The numeric human health criterion for beryllium was withdrawn. New or existing data were evaluated using the MCL of 4 µg/L. For freshwater water bodies only (to protect domestic water supply use), if new or existing data show that the MCL is exceeded in the water body but all applicable water quality criteria (i.e. aquatic life) are attained, prior Category 5 listings were changed to **category 3B: Potential concern**. If the MCL and all applicable water quality criteria are attained, the water body was delisted and placed in **category 2: Attaining**.

Bis Chloromethyl Ether
Table 40 includes numeric criteria for bis chloromethyl ether (BCME) to protect human health. There are no corresponding aquatic life criteria. Given its rapid hydrolysis in water, there are no recommended analytical methods for BCME in water samples. Therefore, the 2012 Water Quality Assessment does not contain BCME data. For more information about BCME, see the analytical memo at:
http://www.deq.state.or.us/wq/standards/docs/toxics/BisChloromethylMemo.pdf

Chlordane and Heptachlor Criteria
Table 20 and 40 criteria for Chlordane were applied to sample results reported for the technical product (CAS No. 12789036) or non-specific chlordane (CAS No. 57749), or to the sum of isomers, other constituents, and metabolites of chlordane including *cis*-chlordane (synonym α-chlordane) (CAS No. 5103719), *trans*-chlordane (synonym γ-chlordane) (CAS No. 5103742), γ-chlordane (CAS No. 5566347), *cis*-nonachlor (CAS No. 5103731), *trans*-nonachlor (CAS No. 39765805), and oxychlordane (CAS No. 27304138). For the 2012 Water Quality Assessment, DEQ compared technical chlordane data results from USGS to chlordane criteria.

Another known major constituent of chlordane mixtures is Heptachlor (CAS No. 76448). Table 20 and 40 criteria specific for Heptachlor were applied separately for this chemical.

Chlorine
Table 20 includes numeric criteria for chlorine to protect aquatic life. There are no corresponding human health criteria. The aquatic life criteria for chlorine in freshwater are expressed as "total residual chlorine" which is the sum of free and combined chlorine. The aquatic life criteria for chlorine in saltwater are expressed as "chlorine-produced

oxidants", which is the sum of free and combined chlorine and bromine. For more information about chlorine, see the analytical memo at: http://www.deq.state.or.us/wq/standards/docs/toxics/chlorineMemo.pdf.

Chromium Criteria

Table 20 includes aquatic life criteria for two oxidation states of chromium – hexavalent and trivalent. However, analytical results typically report the total of both oxidation states combined (i.e. chromium III + VI). For the 2012 assessment, the more toxic hexavalent chromium (Cr VI) criteria were applied to evaluate total chromium data. Note that the criteria for Cr VI are significantly more stringent (16 and 11µg/l for acute and chronic respectively) than Cr III criteria (1700 and 210 µg/l). Therefore, this methodology is very conservative and may significantly overestimate the number of water bodies exceeding the Cr VI criterion. In addition, because data results are compared to the Cr VI criterion, DEQ did not apply the hardness values to the data results (in contrast, the freshwater Cr III criterion is hardness dependent). Data results representing separate oxidation states will be directly compared to the criteria for Cr III and Cr VI and categorized accordingly. As data for Cr III and Cr VI become available for future assessments, listings based on total chromium will be reevaluated and categorized accordingly. For more information about chromium, see the analytical memo at: http://www.deq.state.or.us/wq/standards/docs/toxics/chromium.pdf

Cyanide

The Table 20 aquatic life criteria for cyanide are for **free** cyanide, while the Table 40 human health criteria are for **total** cyanide. Table 20 does not have a footnote to denote whether the criteria are based on free or total. Therefore, the 1986 Gold Book was referenced and indicated that the cyanide criterion is derived from a MCL which was based on free cyanide. Also note that a footnote for the cyanide aquatic life criteria in Table 33A (though not effective for the Integrated Report) further supports that the criteria are based on free cyanide. For more information about cyanide, see the analytical memo at: http://www.deq.state.or.us/wq/standards/docs/toxics/cyanide.pdf.

DDT Criteria

The Table 20 aquatic life criteria for DDT,-4,4' include separate analyses for DDD,-4,4', DDE,-4,4', and DDT,-4,4'. These results are summed together and compared to the most stringent applicable aquatic life criterion for DDT,-4,4'. Data results for the DDT Table 40 human health criteria are directly compared to the applicable criteria for DDD,-4,4', DDE,-4,4', and DDT,-4,4'. For more information about DDT, see the analytical memo at: http://www.deq.state.or.us/wq/standards/docs/toxics/DDTmemo.pdf.

Demeton Criteria

Table 20 criteria for Demeton were applied to sample results reported as Demeton (CAS No. 8065483), and Disulfoton (CAS No. 298044). The two pesticides are toxicologically similar, and EPA allows use of toxicity data for both compounds. For this assessment, the Demeton criteria were applied to both pesticide products.

1,2 Diphenylhydrazine

Table 40 includes numeric criteria for 1,2 diphenylhydrazine to protect human health. There are no corresponding aquatic life criteria. 1,2 diphenylhydrazine is difficult to analyze given its rapid decomposition rate in water. Instead, azobenzene, which is a decomposition product of 1,2 diphenylhydrazine, is analyzed as an estimate of this chemical. Analytical results from azobenzene analysis are directly compared to the applicable water quality criterion for 1,2-diphenylhydrazine. For more information about 1,2 diphenylhydrazine, see the analytical memo at:
http://www.deq.state.or.us/wq/standards/docs/toxics/diphenylhydrazine.pdf

Dinitrophenols Criteria
Table 40 criteria for dinitrophenols are measured as 2,4 dinitrophenol given the costs and issues of finding standards for all the isomers of dinitrophenol and given the prevalence of 2,4 dinitrophenol in the environment. For more information on this discussion, see the analytical memo for dinitrophenols found at:
http://www.deq.state.or.us/wq/standards/docs/toxics/dinitrolphenols.pdf

Endosulfan Criteria
Table 20 criteria for the group Endosulfan were applied to sample results reported for Endosulfan (CAS No. 115297) or to the sum of sample results reported for the isomers α-Endosulfan (CAS No. 959988), β-Endosulfan (33213659), and the reaction product Endosulfan sulfate (CAS No. 1031078) found in technical grade Endosulfan. Table 40 has individual criteria for alpha endosulfan, beta endosulfan, and endosulfan sulfate. The most stringent criteria are for the Table 20 aquatic life criteria.

Guthion Criteria
Table 20 criteria for Guthion were applied to results for Guthion (synonym Azinphos Methyl) (CAS No. 86500) but not for the metabolic breakdown product Azinphos Methyl Oxygen Analog (CAS No. 961228).

Hexachlorocyclohexane Criteria
Table 20 and 40 criteria for BHC gamma (synonym hexachlorocyclohexane (Lindane)) were applied to sample results reported for that chemical (CAS No. 58899). The pesticide product Lindane is generally > 99% the gamma isomer (synonyms γ-HCH or γ-BHC).

Table 40 human health criteria for the isomer BHC alpha (synonyms hexachlorocyclohexane alpha , α-HCH or α-BHC) were applied to results for that chemical (CAS No. 319846).

Table 40 human health criteria for the isomer BHC beta (synonyms, hexachlorocyclohexane beta, β-HCH or β-BHC) were applied to results for that chemical (CAS No. 319857).

Table 40 human health criteria for the hexachlorocyclo-hexane-technical (CAS No. 608731) apply to the technical grade pesticide which is a mixture consisting of α, β, γ, δ, and ε isomers. For more information about hexachlorocyclo-hexane-technical, see the

analytical memo at:
http://www.deq.state.or.us/wq/standards/docs/toxics/bhcTechnical.pdf.

Iron Criteria
As part of the 2011 toxics rulemaking, DEQ withdrew Oregon's human health water quality criteria for iron, a naturally-occurring earth metal present in Oregon waters.[17] Human health criteria for iron were removed because the criterion was based on EPA's recommended criterion which was derived from data relating to aesthetic (e.g., laundry staining) and organoleptic (i.e., taste) effects, not toxicological effects. In June 2011, EPA approved the withdrawal of the "water and fish ingestion" criterion for iron. A freshwater chronic criterion remains; therefore, for the 2012 Water Quality Report, DEQ compared iron data results to the aquatic life chronic criterion.

Manganese Criteria
As part of the 2011 toxics rulemaking, DEQ revised Oregon's human health water quality criteria for manganese, a naturally-occurring earth metal present in Oregon waters. The rule amendment withdrew the "water and fish ingestion" criterion for manganese and withdrew the "fish consumption only" criterion for manganese as it applies to freshwaters. Similar to iron, the former criteria were based on aesthetic (e.g., laundry staining) and organoleptic (i.e., taste) effects, not toxicological effects. However, the "fish consumption only" criterion for total manganese remains in place only for saltwater in order to protect for the consumption of oysters and other marine mollusks. There are no aquatic life criteria for manganese. EPA approved these changes in June 2011. Although the manganese "fish consumption only" criterion only applies to saltwater, DEQ applied the criterion to estuarine sites because oysters are present in bays and sloughs, as well as saltwater sites, and the criterion is based on bioaccumulation rates in oysters.

Metals Criteria - Evaluation of Total Recoverable Results
Criteria for metals on Tables 20 and 40 are measured as total recoverable concentrations (i.e. total and dissolved forms present in an unfiltered water sample), with the exception of inorganic arsenic (see arsenic criteria above for more information). To evaluate water quality for metals, results for total recoverable analyses were compared to the applicable criteria. If total analysis was unavailable, then a dissolved analytical result was evaluated against the criteria for Category 5 listing purposes. Dissolved metals data were not used for delisting purposes because dissolved metals generally constitute only a fraction of total metal present in ambient samples. If a data set from a particular site and date contained both total and dissolved fractions, only the total fraction result was compared to the criteria. If the data do not identify the analysis as total or dissolved, the result was evaluated as if it were a total analysis.

Metals Criteria - Hardness Dependent Criteria
The freshwater criteria for several metals (i.e. cadmium, chromium III, copper, lead, nickel, silver, and zinc) are expressed as a function of hardness (mg/L) in the water

[17] See associated rulemaking documents at: http://www.deq.state.or.us/wq/standards/metals.htm

column. Because these metals are expressed as total recoverable metals, total recoverable hardness values were used to derive criteria. These criteria are flagged on Table 20 with a "+" notation and notes that the criteria were calculated using a hardness of 100 mg/L. Criteria for these metals are calculated using the following formulae:[18]

Freshwater Acute Criterion: Criterion maximum concentration

$$CMC = e^{(m_a [\ln(hardness)] + b_a)}$$

Freshwater Chronic Criterion: Criterion chronic concentration

$$CCC = e^{(m_c [\ln(hardness)] + b_c)}$$

Metal	Freshwater Acute Criterion CMC		Freshwater Chronic Criterion CCC	
	m_a	b_a	m_c	b_c
Cadmium	1.128	-3.828	0.7852	-3.490
Chromium	0.819	3.688	0.819	1.561
Copper	0.9422	-1.464	0.8545	-1.465
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	3.3612	0.8460	1.1645
Silver	1.72	-6.520		
Zinc	0.8473	0.8604	0.8473	0.7614

If hardness was not measured directly as $CaCO_3$, the following equation was used to calculate the hardness value[19]:

Hardness, equivalent $CaCo_3$ (mg/L) = 2.497 Ca (mg/L) + 4.1189 Mg (mg/L)

For this assessment, DEQ followed EPA federally promulgated water quality standards recommendations in 40 CFR 131[20] to use a minimum of 25 mg/L as calcium carbonate hardness to calculate criteria even if the actual ambient hardness is less than 25 mg/l as calcium carbonate. The maximum hardness value should not exceed 400 mg/L as calcium carbonate, even if the actual ambient hardness is greater than 400 mg/l as calcium carbonate. Additionally, if no hardness data were available, DEQ applied a default hardness of 25 mg/L to calculate the criteria.

Methyl Mercury Criterion

The human health criterion for methyl mercury is expressed as a fish tissue concentration (0.040 mg/kg, organism only) from resident fish. DEQ has historically analyzed fish

[18] 1986, Quality Criteria for Water, U.S. EPA Office of Water, EPA 440/5-86-001

[19] 1998, Standard Methods for the Examination of Water and Wastewater, 20th edition, American Public Health Association, American Water Works Association, Water Environment Federation

[20] 40 CFR Section 131.36(c)(4)(i).

tissue for total mercury, rather than methyl mercury, using EPA method 7473.[21] However, literature indicates that 90 percent or more of mercury in fish muscle (tissue not including skin) is methyl mercury.[22] As a result, DEQ concludes that the available data and continued mercury analysis by EPA method 7473 (or other EPA approved method) is an acceptable basis by which to estimate methyl mercury concentrations in fish tissue.[23]

DEQ's preference is to utilize data from skinless fillets with the belly fat removed, since skinless fillets provide information that can be used to develop bioaccumulation factors and support TMDL development. DEQ also may utilize results from whole body samples if the results also include % lipid content. With this information, DEQ can back-calculate to the fillet-only concentration. The length of fish and weight should be recorded for all fish samples.

For the 2012 Water Quality Assessment, DEQ compared geometric mean concentrations of mercury from skinless fillets in individual resident fish to the human health fish tissue criterion and assigned a category according to the "*Assignment of Assessment Category*" section.

Note that aquatic life criteria continue to be in effect for total mercury in the water column (i.e. organic plus inorganic forms).

Nitrosamines Criteria

Table 40 contains criteria for a class of nitrogen containing chemicals known as "nitrosamines". In addition, Table 40 contains specific criteria for individual derivatives in the nitrosamine class, including:

- Nitrosodibutylamine N- (CAS No. 924163)
- Nitrosodiethylamine N- (CAS No. 55185)
- Nitrosodimethylamine N- (CAS No. 62759)
- Nitrosodi-n-propylamine, N (CAS No. 621647)
- Nitrosodiphenylamine N- (CAS No. 86306)
- Nitrosopyrrolidine N- (CAS No. 930552)

For assessment purposes, instead of analyzing and summing up the individual derivatives of nitrosamine and comparing the results to nitrosamines criteria, results are compared to the Table 40 criteria for nitrosodiethylamine, N. Nitrosodiethylamine, N is considered

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[21] 2007, Method 7473, Mercury in Solids and Solutions by Thermal Decomposition, Amalgamation, and Atomic Absorption Spectrophotometry. U.S. EPA Office of Solid Waste

[22] Ullrich, S.M., Tanton, T.W. and Abdrashitova, S.A., 2001. Mercury in the Aquatic Environment: A Review of Factors Affecting Methylation. Critical Reviews in Environmental Science and Technology, **31**(3): 241-293.

[23] Available mercury data is measured in mg/kg with "significant figures" limited to two decimal places. Thus, any total mercury result exceeding the criterion (0.040 mg/kg) can be reasonably assured to also have a methyl mercury concentration exceeding the criterion.

the most toxic of the nitrosamine derivatives and its numerical criteria is equal to the criteria established for total nitrosamines. For more information on this discussion, see the nitrosamines memo at:
http://www.deq.state.or.us/wq/standards/docs/toxics/nitrosamines.pdf

Parathion Criteria
Table 20 criteria for Parathion were applied to results for Ethyl Parathion (CAS No. 56382).

PCB Criteria
Table 20 and 40 criteria for PCBs (Polychlorinated Biphenyls) were applied to either the sum of sample results reported as Aroclors, or the sum of sample results reported as individual congeners. For the 2012 Water Quality Assessment, DEQ only used PCB data from USGS. The data was reported as "total PCBs"; therefore it is unknown whether the results were based on congener or Aroclor analytical methods.

Pentachlorophenol Criteria
Freshwater aquatic life criteria for Pentachlorophenol (CAS No. 87865) are pH dependent and can be calculated by:[24]

Acute Criterion (CMC = Criterion Maximum Concentration)

$$CMC = e^{(1.005(pH)-4.830)}$$

Chronic Criterion (CCC = Criterion Continuous Concentration):

$$CCC = e^{(1.005(pH)-5.290)}$$

Generally, as pH decreases, the toxicity of pentachlorophenol increases. A pH of 7.8 was used to generate the criteria contained in Table 20. For the 2012 assessment pentachlorophenol (CAS No. 87865) was evaluated using the 1986 guidance[25] for calculating pentachlorophenol national criteria and utilizes the equations shown above. If pH data were not available, DEQ could not calculate freshwater criteria for pentachlorophenol. Human health criteria for pentachlorophenol are not pH dependent and therefore, may be compared to water quality data without associated pH values.

Phosphorus Criterion/Phosphate Phosphorus Benchmark
The Table 20 criterion of 0.1 µg/l applies to elemental phosphorus (P) in marine or estuarine waters. This is based on the EPA criterion to protect marine organisms against toxic effects.[26]

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[25] 1986, Ambient Water Quality Criteria for Pentachlorophenol, U.S. EPA Office of Water, EPA 440/5-86-009.
[26] 1986, Quality Criteria for Water, U.S. EPA Office of Water, EPA 440/5-86-001 for Phosphorus

POLLUTANT: **Turbidity**

BENEFICIAL USES AFFECTED: Resident Fish and Aquatic Life
Water Supply
Aesthetics

2012 ASSESSMENT: DEQ did not evaluate turbidity for this assessment.

NARRATIVE CRITERION: OAR 340-041-0007 (11)

> **340-041-0007**
> **Statewide Narrative Criteria**
> (11) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish may not be allowed;

NUMERIC CRITERION: OAR 340-041-0036

> **340-041-0036**
> **Turbidity**
> Turbidity (Nephelometric Turbidity Units, NTU): No more than a ten percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities and which cause the standard to be exceeded may be authorized provided all practicable turbidity control techniques have been applied and one of the following has been granted:
>
> (a) Emergency activities: Approval coordinated by the Department with the Oregon Department of Fish and Wildlife under conditions they may prescribe to accommodate response to emergencies or to protect public health and welfare;
>
> (b) Dredging, Construction or other Legitimate Activities: Permit or certification authorized under terms of section 401 or 404 (Permits and Licenses, Federal Water Pollution Control Act) or OAR 14l-085-0100 et seq. (Removal and Fill Permits, Division of State Lands), with limitations and conditions governing the activity set forth in the permit or certificate.

ASSIGNMENT OF ASSESSMENT CATEGORY:
Category 5: Water Quality Limited, TMDL Needed (303(d) List)
A systematic or persistent increase (of greater than 10%) in turbidity due to an operational activity that occurs on a persistent basis (e.g. dam release or irrigation return, etc.);
Or,
For impairments to beneficial use as drinking water supply, Public Water System operator indicates that high turbidity days (days with turbidity ≥5 NTU) are causing operational difficulty <u>and</u> source water data validate this impairment. The data are

considered to validate an impairment if more than 45 high turbidity days per year occur for any year for which data are available.

Category 3: Insufficient Data
For beneficial use as drinking water supply, available data are not sufficient to determine if the use is impaired. One or more turbidity shutdowns are documented in the Safe Drinking Water Information System database, but there are not data to show whether shutdown is normal after a large storm event, or indicates a problem and impaired beneficial use.

Category 3b: Potential Concern, Insufficient Data
For beneficial use as drinking water supply, available data are not sufficient to determine if the use is impaired, but indicate a potential concern. The Public Water System operator indicates that high turbidity days are causing operational difficulties, but there are not data available to validate this impairment, or if shutdowns due to high turbidity may be the result of unusual or infrequent weather events.

Category 2: Attaining
For beneficial use as drinking water supply, Public Water System operator indicates that high turbidity days are not causing operational difficulty and/or source water data show water quality is good. Water quality is considered good if there are 45 or less high turbidity days per year for all years for which data are available.

Appendix 1

Rules for Defining Water Body Segments and Assigning Assessment Status Category

Rules for 2004 for Temperature and Dissolved Oxygen

Use segments designated in Oregon Administrative Rules (OAR) Chapter 340 Division 41 as revised in 2003 for designated fish beneficial uses and designated spawning time periods. Assign status as follows:

If		**Then:**	
2004 stations		**2004 Segment**	**2004 Status**
One or more station 303d		Start and end river mile for designated fish use	Cat 5: 303d list
One or more stations 303d	TMDL approved for temperature or dissolved oxygen for stream	Start and end river mile for designated fish use	Cat 4a: WQ limited, TMDL approved
One or more stations 303d, others insufficient data		Start and end river mile for designated fish use	Cat 5: 303d list
One or more stations attaining; others insufficient data		Start and end river mile for designated fish use	Cat 2: Attaining
One or more stations with insufficient data		Start and end river mile for designated fish use	Cat 3: Insufficient data
No data	2002 303d status	Retain previous segment start and end	303d based on previous listing

Other Pollutants

For pollutants other than temperature and dissolved oxygen, if segment was defined in 2004 for pollutant and season, use pre-existing segment river mile start and end.

For **bacteria**, use 2004 segment for matching pollutant and season (example, *e.coli* for summer):

If match for pollutant but not season, use segment for matching pollutant for any season (example, *e.coli* for fall/winter/spring). Assign 2010 status based on evaluation of 2010 data.

If no match for pollutant, use segment for other bacteria pollutant (example, for *e. coli*, use previous fecal coliform segment). Assign 2010 status based on evaluation of 2010 data.

For segments with **matching pollutant and season**, assign status to segment as follows:

If	**And**	**Then:**	
2010 stations	**2004 Segment Status**	**2010Segment**	**2010 Status**
One or more stations 303d	303d	Same	Cat 5: 303d list
One or more stations 303d	TMDL approved	Same	Cat 4a: WQ limited, TMDL approved
One or more stations 303d	Attaining	Same	Cat 5: 303d list
Stations insufficient data	303d	Same	Cat 5: 303d list
One or more stations potential concern (toxics)	303d	Same	Cat 5: 303d list
One or more stations potential concern (toxics)	Potential concern or insufficient data	Same	Cat 3B: Insufficient Data – Potential Concern
One or more stations potential concern (toxics)	Attaining	Same	Cat 3B: Insufficient Data – Potential Concern
Stations insufficient data	Attaining	Same	Cat 2: Attaining
Stations insufficient data	Potential concern	Same	Cat 3B: Insufficient Data – Potential Concern
One or more stations attaining and one or more stations insufficient data	Attaining	Same	Cat 2: Attaining
Attaining and/or insufficient data	303d	Same	Cat 5: 303d list (Check for data equivalency to delist).
Combination insufficient data, 303d, and attaining	303d	Same	Cat 5: 303d list
Stations attaining	Attaining	Same	Cat 2: Attaining
Combination insufficient data, 303d, and attaining	Attaining	Same	Cat 5: 303d list
Attaining	TMDL approved	Same	Cat 2: Attaining

Other Pollutants (con't)

If **NO** segment is defined in 2004 for pollutant and season, define 2010 segment up to the next monitoring station and assign 2010 status to segment as follows:

Commented [dld1]: Isn't this arbitrary? General approach EPA guidance looks for is segmentation that allows for *a priori* knowledge of physical, chemical, biological conditions – Which the fish use is an example of – not sure what this scheme does except split the segments arbitrarily. Mouth to headwaters – where did that come from?

If	**And No 2004 Segment**	**Then:**	
2010 stations		**2010 segment**	**2010 segment status**
One station 303d		Mouth to headwaters	Cat 5: 303d list
One or more stations 303d with upstream data points.		Segment from mouth up to next station that shows other status information	Cat 5: 303d list
One station 303d with downstream station attaining		Define segments start/end at halfway point between attaining and 303d point	Cat 2: Attaining from data point to halfway ; Cat 5 303d list from halfway below data point to next upstream data point showing different status.
One or more station 303d, other insufficient data		Mouth to headwaters	Cat 5: 303d list
One or more station attaining; others with insufficient data		Mouth to headwaters	Cat 2: Attaining
One or more stations with insufficient data		Mouth to headwaters	Cat 3: Insufficient data

Appendix 2

June 22, 1998

Philip Millam
Director, Office of Water, OW-134
U.S. Environmental Protection Agency, Region X
1200 Sixth Avenue
Seattle, Washington 98101

Dear Phil:

This letter is to provide policy clarification of the Oregon water quality standards revisions that were submitted for Environmental Protection Agency's (EPA) approval on July 10, 1996. Specifically, this letter addresses how the Department of Environmental Quality (ODEQ) is interpreting certain language contained in the Oregon Water Quality Standards (OAR 340-41) and responds to questions that EPA has raised in its review of the standards.

The regulatory clarifications included herein will be incorporated into the water quality standards, to the extent possible, during the next triennial review. As there are quite a number of issues that are candidates for review in the next triennial review, we will need to carefully prioritize these issues working with EPA and the next Policy Advisory Committee.

The following comments are organized in the following manner: beneficial use issues, numeric criteria issues and implementation issues.

BENEFICIAL USE ISSUES:

Bull Trout Waters: The language in the rule (OAR 340-41- basin (2)(b)(A)) reads: *"…no measurable surface water temperature increase resulting from anthropogenic activities is allowed: … (v) In waters determined by the Department to support or to be necessary to maintain the viability of native Oregon bull trout, when surface water temperatures exceed 50.0° F (12.8° C)".* [Please note that the specific citation for the temperature criteria for Bull Trout may vary slightly in its numbering depending on the basin, this example and subsequent citations are from the standards for the Willamette Basin (OAR 340-41-445)].

The Department has consulted with the Oregon Department of Fish and Wildlife (ODFW) to make a determination of the current distribution of Bull Trout. Maps have been developed by ODFW as part of an effort to develop plans to protect and restore Bull Trout populations. These maps can be found in the following publication: "Status of Oregon's Bull Trout" (Oregon Department of Fish and Wildlife; October 1997; Buchanan, David, M. Hanson, and R. Hooton; Portland, OR) which is available from ODFW or viewed in the "StreamNet" website (www.streamnet.org). A map showing the most recent Bull Trout distribution (export file dated June 1997) has been sent separately to EPA and a digital version can be provided to EPA.

The Department will use the 1997 Bull Trout distribution maps contained in the 1997 ODFW publication to clarify the phrase "waters determined by the Department to support or to be necessary to maintain the viability of native Oregon Bull Trout." The temperature criteria of 50ºF applies to the stream reaches which indicate that "Spawning, Rearing, or Resident Adult Bull Trout" populations are present. These waters are shown by a solid green line on the maps that are referenced.

The mapping and planning effort is an on-going effort by ODFW. Any changes made to the mapped distribution will represent a change in the standard which would be submitted to EPA for approval. The Bull Trout portion of the standards will be revised to incorporate a reference to the 1997 ODFW publication or identify any other means for determining waters that support or are necessary to support Bull Trout in the next triennial standards review.

Waters supporting spawning, egg incubation and fry emergence: The language in the rule reads:

Temperature (OAR 340-41- basin (2)(b)(A)): "…*no measurable surface water temperature increase resulting from anthropogenic activities is allowed: … (iv) In waters and periods of the year determined by the Department to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55ºF (12.8ºC)".*

Dissolved Oxygen (OAR 340-41- basin (2)(a)(A)): *"For waterbodies identified by the Department as providing salmonid spawning, during the periods from spawning until fry emergence from the gravels, following criteria apply…"*

The Beneficial Use Tables (Tables 1-19 in the Oregon water quality standards) indicate the recognized beneficial uses to generally be protected **in the basin**. In some basins (e.g. Table 15, Malheur River Basin), the information in the Tables has been refined for particular water bodies. In general, salmonid spawning and rearing are shown on the tables to be found in all basins. In order to make the spawning determinations, information on location and timing in a specific waterbody is further developed through consultation with ODFW as spawning does not occur at all times of the year or in all locations in the basin. In addition, timing often varies from year to year depending on seasonal factors such as flow. ODFW, in cooperation with other federal and tribal fishery agencies has begun to map out this information on a species by species basis (StreamNet Project) but this work is still several years from completion.

ODEQ is submitting the attached table that identifies when the spawning criteria listed under the dissolved oxygen and temperature standards will be applied to a basin. This table provides the generally accepted time frame during which spawning occurs. However, spawning periods for Spring Chinook and Winter Steelhead vary with elevation (e.g. Spring Chinook tend to spawn earlier and fry emergence occurs later in the Spring for Winter Steelhead in streams at higher elevations). Therefore, to address differences in actual spawning periods, the Department will consult directly with the ODFW to determine if waterbody specific adjustments (which would be changes to the standards) are necessary.

Furthermore, the Department will apply the antidegradation policy in specific actions, e.g. permits, 401 certification and 303(d) listing, to protect spawning that occurs outside the

identified time frames or utilize the narrative temperature criteria that applies to threatened or endangered species.

Application of the warm water Dissolved Oxygen Criteria (OAR 340-41- basin (2)(a)(F))**:** The language in the rule reads: *"For waterbodies identified by the Department as providing warm-water aquatic life, the dissolved oxygen shall not be less than 5.5 mg/l as an absolute minimum..."*

Warm-water criteria is applied in waters where Salmonid Fish Rearing and Salmonid Fish Spawning are not a listed beneficial use in Tables 1 - 19 with the exception of Table 19 (Klamath Basin) in which the cool water dissolved oxygen criteria will be applied (see Klamath TMDL supporting documentation, (Hammon 1998)). Specifically, the warm water criteria would be applied to:

Table 15: Malheur River (Namorf to Mouth), Willow Creek (Brogan to Mouth), Bully Creek (Reservoir to Mouth);
Table 16: Owyhee River (RM 0-18);
Table 17: Malheur Lake Basin - Natural Lakes;
Table 18: Goose and Summer Lakes Basin - High Alkaline & Saline Lakes.

Application of the cool-water Dissolved Oxygen Criteria (OAR 340-41- basin (2)(a)(E))**:** The language in the rule reads: *"For waterbodies identified by the Department as providing cool-water aquatic life, the dissolved oxygen shall not be less than 6.5 mg/l as an absolute minimum..."*

Cool-water aquatic life is a sub-category of cold-water aquatic life and is defined under OAR 340-41-006 (52) as *"the aquatic communities that are physiologically restricted to cool waters, composed of one or more species having dissolved oxygen requirements believed similar to the cold-water communities. Including but not limited to Cottidae, Osmeridae, Acipenseridae, and sensitive Centrachidae such as the small-mouth bass."* This criteria will be applied on an ecoregional basis[1] (see attached map) as follows:

West Side:

Cold Water: Coast Range Ecoregion - all, Sierra Nevada Ecoregion -all, Cascade-all, Willamette Valley - generally typical including Willamette River above Corvallis, Santiam (including the North and South), Clackamas, McKenzie, Mid Fork and Coast Fork mainstems.

[1] The original Ecoregions described in "Ecorgions of the Pacific Northwest" (James Omernik and A. Gallant, 1986, EPA/600/3-86/033) were used. This work is currently being updated but is not complete for Oregon. The terms most typical and generally typical are defined as follows: "The most typical portions of ecoregions are generally those areas that share all of the characteristics that are predominant in each ecoregion. The remaining portions, generally typical of each ecoregion, share most, but not all, of these same characteristics. These areas are defined on maps included in the publication referenced above and have been sent separately to EPA.

Cool Water: Willamette Valley Ecoregion - most typical.

East Side (with the exception of waters listed under warm water criteria in Tables 15-19)**:**
Cold Water: Eastern Cascades Slopes and Foothills - most typical, Blue Mountain - most typical.
Cool Water: Remainder of Eastern Oregon Ecoregions.

NUMERIC CRITERIA ISSUES:

Temperature criteria for waters without a specific numeric criterion: The temperature criteria of 64ºF will be applied to all water bodies that support salmonid fish rearing as identified in Tables 1 - 19. This would include all waters except those listed as warm water above. Currently, there is no numeric criteria for those waters listed as warm water. This was an inadvertent oversight for the rivers described under 2 and 3 below which will be corrected by setting site specific criteria during the next triennial review. In the mean time, these waters will be protected as follows:

1. There is a criteria that covers natural lakes and would cover lakes in the Malheur Lake Basin (Table 17) and Goose and Summer Lakes Basin (Table 18). This criteria (OAR 340-41-922 (2)(b)(A)) reads: *"…no measurable surface water temperature increase resulting from anthropogenic activities is allowed: … (vii) In natural lakes"*.

2. The waters shown in the Klamath Basin (Table 19) are currently listed in Oregon's 1994/96 303(d) list for temperature based on exceedence of the criterion that is linked to dissolved oxygen. This criterion (OAR 340-41-965 (2)(b)(A)) reads: *"…no measurable surface water temperature increase resulting form anthropogenic activities is allowed: … (vi) In Oregon waters when the dissolved oxygen (DO) levels are within 0.5 mg/l or 10 percent saturation of the water column or intergravel DO criterion for a given stream reach or subbasin."* An additional narrative criterion would apply to these waters as they contain a federally listed Threatened and Endangered species - Lost River Sucker and Shortnose Sucker, both of which are listed as endangered (USFWS, 7/88, 53FR27130). This criterion (OAR 340-41-965 (2)(b)(A)) states: *"no measurable surface water temperature increase resulting form anthropogenic activities is allowed: … (v) In stream segments containing federally listed Threatened and Endangered species if the increase would impair the biological integrity of the Threatened and Endangered population."* A Site Specific Criteria is currently being developed as part of a TMDL for these waters and a new criteria for temperature will be established. This criterion will be adopted by the EQC and submitted to EPA for approval prior the completion of a TMDL. This work should be accomplished during our next triennial standards review (1998 - 2000). The TMDL schedule is currently being negotiated with EPA.

3. Warm water streams in the lower Malheur and Owyhee (Table 15 and 16) would be addressed in a similar manner using temperature criterion that relates to dissolved oxygen. These waters were not listed on the current 303(d) list as the waters were not within 0.5 mg/l or 10 percent saturation of the water column DO criterion. These waters are included in beneficial use survey work that the Department is undertaking in the Snake River Basin/High Desert Ecoregion. This work, which will include the

development of numeric temperature criteria for these waters, will be accomplished during our next triennial standards review (1998-2000).

Willamette and Columbia River Temperature Criteria: The language in the rule (OAR 340-41-445 (2)(b)(A)) reads: *"…no measurable surface water temperature increase resulting from anthropogenic activities is allowed: … (ii) In the Columbia River or its associated sloughs and channels from the mouth to river mile 309 when surface water temperatures exceed 68.0ºF (20.0ºC); (iii) In the Willamette River or its associated sloughs and channels from the mouth to river mile 50 when surface water temperatures exceed 68.0ºF (20.0ºC);"*

For the Columbia River, this is not a change to the previous standard (OAR 340-41-445 (2) (b) (D). The Columbia River forms the boundary between the states of Oregon and Washington and this criterion is consistent with the current temperature standard for the State of Washington.

For the Willamette River, this value represents a decrease from the previous temperature criteria of 70ºF and makes it consistent with the Columbia River numeric criteria. The technical committee had recommended the 68ºF criteria for these large, lower river segments recognizing that temperatures were expected to be higher in these segments as factors such as the naturally wide channels would minimize the ability to shade these rivers and reduce the thermal loading.

Both of these rivers are water quality limited for temperature and the temperature criteria can be revisited as part of the effort to develop Total Maximum Daily Loads. The Department is currently working with EPA to develop a temperature assessment for the Columbia River and is participating in a Willamette Basin Reservoir Study with the Corp of Engineers and other state agencies. The timing of specific TMDLs is currently being negotiated with EPA.

64º F Temperature Criteria: EPA has expressed concern that the 64ºF criterion may not be fully protective. The Final Issue Paper on Temperature indicates that "the incidence of disease from *Chondrococcus columnaris* increases above 60-62º F and cites various sources for this statement (page 2-4 and Appendix D of the Final Issue Paper on Temperature). This is based both on observations from laboratory studies and field studies.

A review of this literature indicates that it is difficult to establish a temperature criteria for waters that experience diurnal temperature changes that would assure no affects due to *C. columnaris*. For example, J. Fryer and K. Pilcher ("Effects of Temperature on Diseases of Salmonid Fishes, EPA-660/3-73-020, 1974) conducted in the laboratory studies using constant temperatures and concluded:

> "When coho and spring chinook salmon, and rainbow trout are infected with *C. columnaris* by water contact, the percentage of fatal infections is high at temperatures of 64ºF and above, moderate at 59ºF and approaches zero at 49ºF and below. A temperature of 54ºF is close to the threshold for development of fatal infection of salmonids by *C. columnaris."*

There is literature that suggests that fish pathogens which affect Oregon's cold-water fishes become more infective and virulent at temperatures ranging from the lower mid-sixties to low seventies (Becker and Fujihara, 1978). Ordal and Pacha (1963) found that mortalities due to *C. columnaris* outbreaks are lessened or cease when temperatures are reduced below 65ºF. Bell (1986) suggested that outbreaks of high virulence strains of *C. columnaris* occur when average water temperatures reach 15.5ºC and the low virulence strains become apparent with average water temperatures over 20ºC.

A good discussion of field studies is given in the report "Columbia River Thermal Effects Study" (EPA, 1971).

> "Natural outbreaks of columnaris disease in adult salmon have been linked to high water temperatures in the Fraser River, British Columbia. …The pathological effects of the disease became evident when water temperatures along the migration route, and in spawning areas, exceeded 60ºF. Prespawning mortality reached 90 percent in some tributaries. Columnaris is the infected sockeye spawners was controlled when temperatures fell below 57-58ºF and mortalities were reduced. "

> "Data collected on antibody levels in the Columbia River fish "…suggest peak yearly effective infection of at least 70 percent to 80 percent of most adult river fish species" (Fujihara and Hungate, 1970). Occurrence of the disease was generally associated with temperatures above 55ºF; the authors further suggest that the incidence of columnaris may be increased by extended periods of warm temperatures than by peak summer temperatures."

> "Other factors including the general condition of the fish, nutritional state, size, presence of toxicants, level of antibody protection, exposure to nitrogen supersaturation, level of dissolved oxygen, and perhaps other factors interrelate in the infection of fish by diseases. However, the diseases discussed here are of less importance at temperatures below 60ºF; that is, in most instances mortalities due to columaris are minimized or eliminated below that level."

As indicated in the section on "Standard Alternatives and Technical Evaluation" in the Temperature Issue Paper, the technical committee had recommended a temperature range (58 - 64ºF) as being protective for salmonid rearing. While 64ºF is at the upper end of the range, the key to this recommendation is the temperature unit (page 3-2) that is used in the standard - the seven-day moving average of the daily maximum temperatures. Exceedence of the criteria is based on the average of the daily maximum temperatures that a waterbody experiences over the course of seven consecutive days exceeding 64ºF.

Streams experience a natural fluctuation of daily temperatures so streams that were just meeting the temperature standard would be experiencing temperatures over 60ºF for only short periods of time during the day and have lower average temperatures. For example, the Department has summarized temperature data collected at 6 sites around the state which are near the 7-day average of the daily maximum of 64ºF (see table below). As shown, the daily average temperatures typically range between 55-60ºF. Risks should be minimized at these average temperatures.

In conclusion, the criteria does not represent an assured no-effect level. However, because the criteria represent a "maximum" condition, given diurnal variability, conditions will be better than criteria nearly all of the time at most sites.

	7-Day Statistic	Average Daily Temperatures						
		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Grande Ronde Basin								
East Fork Grande Ronde River	64.7	57.8	58.1	57.4	57.1	57.3	58.0	58.1
Beaver Creek (upstream La Grande Res.)	65.2	55.1	56.5	58	58.2	59.7	60.1	59.9
Umpqua Basin								
Jim Creek (mouth)	62.5	58.2	59.5	59.9	60.1	58.6	55.7	56.8
Pass Creek (upper)	64.4	59.0	58.7	58.1	58.5	59.1	59.3	57.7
Tillamook Basin								
Myrtle Creek (mouth)	65.0	57.7	59.1	58.6	57.9	58.0	57.6	56.8
Sam Downs Creek (mouth)	63.9	55.8	55.9	55.5	55.5	55.7	55.6	56.1

Minimum Dissolved Oxygen Criteria for Cool Water and Warm Water Species:

Warm Water: The Oregon warm water criteria for dissolved oxygen is 5.5 mg/l as a 30 day mean and 4.0 mg/l as a minimum. These values meet or exceed the recommended national criteria for warm water criteria for other life stages (5.5 mg/l as a 30 day mean and 3.0 as a 1 day minimum as shown in Table 1 of the dissolved oxygen criteria in *Quality Criteria for Water, 1986* (EPA 440/5-86-001)). These values are slightly below national criteria suggested for protection of early life stages (6.0 mg/l as a 7 day mean and 5.0 as a 1 day minimum as shown in Table 1 of the dissolved oxygen criteria in *Quality Criteria for Water, 1986)*. As shown on Table 2 of the dissolved oxygen criteria in *Quality Criteria for Water, 1986*, this would represent a slight impairment for early life stages.

This criteria would be applied to both native and non-native warm water species. Table 2-3 in the Temperature Issue Paper (page 2-14) contains a list of non-salmonid fish species present in Oregon. Warm water species include: Borax Chub; Cyprinids (goldfish, carp, fathead minnows); Centrarchids (Bluegill, Crappie, Large-mouth Bass); and Catfish. The only known warm-water species that is native to Oregon is the Borax Chub, which is found near a hot springs. The others have been introduced and now perpetuate themselves in some basins. These species are typically Spring spawners (April - June) during which times dissolved oxygen values are not at the seasonal lows (July - August) and typically have not been found to be a problem. In addition, salmonid spawning criteria, which are more protective, typically apply during these time period.

It should be noted that most of the introduced warm water species now compete with the native cold and cool water species for habitat and food. There are numerous recovery plans being developed for these native species. A level of protection that may have a slight production impairment for non-native warm water species is not necessarily undesirable.

Cool Water: A cool water classification was created to protect cool water species where cold-water biota may be present during part or all of the year but would not form the dominate community structure. The cool water criteria match the national coldwater criteria - other life stages criteria.

Table 2-3 in the Temperature Issue Paper (page 2-14) contains a list of non-salmonid fish species present in Oregon. Cool water species include: Chub; Suckers; Sandroller; Sturgeon; Centrarchids (Small-mouth Bass); Striped Bass; and Walleye. Small mouth bass, striped bass and walleye are introduced species. This category was set up to provide more protection than that afforded by the other life stage criteria for warm water fish and, as discussed in the Gold Book, we provided these cool water species with the cold water species protection suggested in the national criteria (Table 1 of the dissolved oxygen criteria in *Quality Criteria for Water*, 1986). These species are typically Spring spawners (April - June) during which times dissolved oxygen values are not at the seasonal lows (July- August) and typically have not been found to be a problem.

Table 2-2 of the Dissolved Oxygen Issue Paper indicates that salmonids and other cold-water biota may be present during part or all of the year but may not dominate community structure. Any salmonid spawning would still be covered by the salmonid spawning standard. The Oregon standards provide higher protection for salmonid spawning and cold water rearing than that recommended under the national criteria by choosing the "no production impairment" levels suggested in Table 2 of the dissolved oxygen criteria in *Quality Criteria for Water*, 1986.

When adequate information/data exists: The dissolved oxygen standard provides multiple criteria for cold, cool and warm water aquatic life. For example, OAR 340-41-445 (2) (a) (D) reads: *"For waterbodies identified by the Department as providing cold-water aquatic life, the dissolved oxygen shall not be less than 8.0 mg/l as an absolute minimum. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/l, dissolved oxygen shall not be less than 90 percent of saturation. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen shall not fall below 8.0 mg/l as a 30-day mean minimum, 6.5 mg/l as a seven-day minimum mean, and shall not fall below 6.0mg/l as an absolute minimum (Table 21)."*

In this example, the Department would routinely compare dissolved oxygen values against 8.0 mg/l criteria (the higher dissolved oxygen criteria). Most dissolved oxygen data is collected by a grab sample during the day time and would not reflect minimum conditions, that is why we would use a more restrictive criteria. Adequate information to use the other criteria would involve the collection of diurnal data over long enough periods of time (e.g. multiple days or multiple weeks) during critical time periods (e.g. low flow periods, hottest water temperature periods, period of maximum waste discharge). Such data would be collected through continuous monitoring with proper quality assurance. Based on this data collection, sufficient data would be available to calculate means, minimum means and minimum values and to compare to the appropriate criteria. Models that would provide these statistics could also be compared to the appropriate criteria.

In addition, for actions such as permitting and developing TMDLs, additional information on the beneficial uses of the waterbody will be considered such as: species present; listing status of those species; locations, time periods and presence of sensitive early life stages,

etc. Based on presence of early life stages or T&E species, the more conservative criteria would be used.

IMPLEMENTATION ISSUES:

Air temperature exemption to the water temperature criteria: OAR 340-41-basin (2)(b)(B) specifies that *"an exceedence of the numeric criteria identified subparagraph (A) … of this subsection will not be deemed a temperature standard violation if it occurs when the air temperature during the warmest seven-day period of the year exceeds the 90th percentile of the seven-day average daily maximum air temperature calculated in a yearly series over the historic record. However, during such periods, the anthropogenic sources must still continue to comply with their surface water temperature management plans developed under OAR 340-41-026(3)(a)(D)."*

This policy identifies criteria to be used in certain limited circumstances to determine whether a violation of the temperature water quality standard has occurred. This interpretation would be applied for the purposes of enforcement of standards and the 303(d) listing determinations. Our interpretation of how this air temperature exemption would be applied has been sent to you separately. In the 1994/96 303(d) list, no water bodies were excluded from the list for this reason.

Exceptions to the policy that prohibits new or increased discharged load to receiving streams classified as being water quality limited:

OAR 340-41-026 (3) (C) states "the new or increased discharged load shall not be granted if the receiving stream is classified as being water quality limited under OAR 340-41-006(30)(a), unless…"

OAR 340-41-026 (3) (a) C (iii) added new language under this policy which defines a condition under which a new or increased discharged load could be allowed to a water quality limited waterbody for dissolved oxygen. The language states: "*(iii) Effective July 1, 1996, in waterbodies designated water-quality limited for dissolved oxygen, when establishing WLAs under a TMDL for waterbodies meeting the conditions defined in this rule, the Department may at its discretion provide an allowance for WLAs calculated to result in no measurable reduction of dissolved oxygen. For this purpose, "no measurable reduction" is defined as no more than 0.10 mg/l for a single source and no more than 0.20 mg/l for all anthropogenic activities that influence the water quality limited segment. The allowance applies for surface water DO criteria and for Intergravel DO if a determination is made that the conditions are natural. The allowance for WLAs would apply only to surface water 30-day and seven-day means, and the IGDO action level."*

This is an implementation policy for OAR 340-41-026 (3) (C) and clarifies that we could allow for an increase in load in a waterbody that is water quality limited for dissolved oxygen as long as it did not result in a measurable reduction of dissolved oxygen as defined above and it was determined that the low DO values were due to a natural condition. A site specific criteria for the waterbody would need to be developed and submitted to EPA for review and approval.

All feasible steps: OAR 340-41-026 (3) (D) indicates that: *"Sources shall continue to maintain and improve, if necessary, the surface water temperature management plan in order to maintain the cooling trend until the numeric criterion is achieved or until the Department, in consultation with the Designated Management Agencies (DMAs), has determined that all feasible steps have been taken to meet the criterion and that the designated beneficial uses are not being adversely impacted. In this latter situation, the temperature achieved after all feasible steps have been taken will be the temperature criterion for the surface waters covered by the applicable management plan. The determination that all feasible steps have been taken will be based on, but not limited to, a site-specific balance of the following criteria: protection of beneficial uses; appropriateness to local conditions; use of best treatment technologies or management practices or measures; and cost of compliance."*

As indicated, if the waters do not come into compliance with the standard after all feasible steps have been taken, the Department would develop a site-specific criteria which would be submitted to EPA for approval pursuant to EPA policy.

1.0º F increase for new or increased discharge loads from point sources or hydro-power projects in temperature water quality limited basins: OAR 340-41-026 (3) (F), (G), (H) state: *"(F) In basins determined by the Department to be exceeding the numeric temperature criteria, and which are required to develop surface water temperature management plans, new or increased discharge loads from point source sources which require an NPDES permit under Section 402 of the Clean Water Act or hydro-power projects which require certification under Section 401 of the Clean Water Act are allowed a 1.0ºF total cumulative increase in surface water temperatures as the surface water temperature management plan is being developed and implemented for the water quality limited basin if:*

- *(i) in the best professional judgment of the Department, the new or increased discharge load, even with the resulting 1.0ºF cumulative increase, will not conflict with or impair the ability of the surface water temperature management plan to achieve the numeric temperature criteria; and*
- *(ii) A new or expanding source must demonstrate that it fits within the 1.0ºF increase and that its activities will not result in a measurable impact on beneficial uses. This latter showing must be made by demonstrating to the Department that the temperature change due to its activities will be less than or equal to 0.25ºF under a conservative approach or by demonstrating the same to the EQC with appropriate modeling.*

(G) Any source may petition the Department for an exception to paragraph (F) of this subsection, provided:

- *(i) The discharge will result in less than 1.0ºF increase at the edge of the mixing zone, and subparagraph (ii) or (iii) of this paragraph applies;*
- *(ii) The source provides the necessary scientific information to describe how the designated beneficial uses would not be adversely impacted; or*
- *(iii) The source demonstrates that:*
  - *(I) It is implementing all reasonable management practices;*
  - *(II) Its activity will not significantly affect the beneficial uses; and*

(III) The environmental cost of treating the parameter to the level necessary to assure full protection would outweigh the risk to the resource.

OAR 340-41-026 (3) (F) and (G) reflect an implementation policy for OAR 340-41-026 (3) (C). They clarify under what conditions the Department could allow for an increase in load to a waterbody that is water quality limited for temperature as long as the load did not result in a measurable increase in temperature (less than or equal to 0.25ºF) or a cumulative increase of 1.0ºF under (F) but a source could petition for up to the cumulative increase of 1.0ºF under (G). The cumulative increase typically addresses the situation where there may be multiple new or increased discharges. A TMDL would still be developed to bring the waterbody back into compliance with the temperature criteria. The WLA and the permit for the new or increased source would target the appropriate temperature criteria using a conservative approach as shown below (e.g. calculations would be made using 63ºF so that the cumulative increase would not be above the standard of 64ºF).[2]

OAR 340-41-026 (3) (H) states: "*Any source or DMA may petition the Commission for an exception to paragraph (F) of this subsection, provided:*

(i) The source or DMA provides the necessary scientific information to describe how the designated beneficial uses would not be adversely impacted; or

(ii) The source or DMA demonstrates that:

(I) It is implementing all reasonable management practices;

(II) Its activity will not significantly affect the beneficial uses; and

(III) The environmental cost of treating the parameter to the level necessary to assure full protection would outweigh the risk to the resource. "

This exemption is a variance policy in which a source can petition the Commission to allow the temperature to increase by a specified amount for a limited period of time in order to allow for new or increased point source discharges to water quality limited waters until a TMDL is prepared. The variance would be submitted to EPA for review and approval. These variances would be reviewed again during the development of a TMDL or at permit renewal.

[2] Examples of various of discharge scenarios using a conservative mass balance analysis. The odd numbered examples show a scenario when the stream meets standards. The subsequent even numbered example shows the scenario when the stream is above standard. Examples 1 - 4 would be addressed under OAR 340-41-026 (3) (F); examples 5 - 8 would be addressed under OAR 340-41-026 (3) (G); and examples 9 - 10 would be addressed under OAR 340-41-026 (3) (H).

Example	Upstream		Effluent		Downstream		Change in
	Flow	Temp	Flow	Temp	Flow	Temp	Temp
1	10	63	0.4	69.5	10.4	63.25	0.25
2	10	73	0.4	69.5	10.4	72.87	-0.13
3	10	63	0.1	88	10.1	63.25	0.25
4	10	73	0.1	88	10.1	73.15	0.15
5	10	63	0.4	79.5	10.4	63.63	0.63
6	10	73	0.4	79.5	10.4	73.25	0.25
7	10	63	0.4	89	10.4	64.00	1.00
8	10	73	0.4	89	10.4	73.62	0.62
9	10	61.5	1	89	11	64.00	2.50
10	10	73	1	89	11	74.45	1.45

Source Petition for an exception to temperature criteria: OAR 340-41-basin (2)(b)(C) specifies that *"Any source may petition the Commission for an exception to subparagraph (A)…of this subsection for discharge above the identified criteria if: (i) The source provides the necessary scientific information to describe how the designated beneficial uses would not be adversely impacted; or (ii) a source is implementing all reasonable management practices or measures; its activity will not significantly affect the beneficial uses; and the environmental cost of treating the parameter to the level necessary to assure full protection would outweigh the risk to the resource."*

This will be, for most cases, a variance policy which allows the temperature to increase by a specified amount for a limited period of time in order to allow for an existing point source to discharge to water quality limited waters until a TMDL is prepared. In the case where that source would be the major cause for the temperature criteria to be exceeded and a TMDL would not be developed for that waterbody to bring it back into compliance, a site specific criteria would be developed and submitted to EPA for approval.

pH Standard exception: OAR 340-41-basin (2) (d) states *"The following exception applies: Waters impounded by dams existing on January 1, 1996, which have pHs that exceed the criteria shall not be considered in violation of the standard if the Department determines that the exceedence would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria."*

This language was intended to address the situation where a hydroproject would be applying for a 401 re-certification and it was found that the action of impounding the waters caused algal growth which caused the reservoir to subsequently exceed the pH standard. This might set up the situation where the only way to re-certify the project would be to destroy the dam which may not be the preferred option. In the cases where this exception would be applied, the Department would develop either a TMDL for nutrients in the upstream watershed, develop a site specific criteria for the waterbody or develop a use attainability analysis to modify the uses for portions of the reservoir.

Final Note: ODFW has a great deal of knowledge regarding location and timing for presence, spawning, etc of fish in Oregon streams. Much of this information is either in the files contained in local field offices or is gained from the judgment of the local biologist. Until recently, it has not been mapped. A mapping effort is underway and is furthest along for Bull Trout and Anadromous fish species. There is a coordinated effort underway entitled "StreamNet" (www.streamnet.org). This work is focused on a species by species mapping which would need to be generalized to match cold, cool, warm-water classification and spawning vs rearing groupings indicated in the standards. Issues such as mapping scales and coverage would still need to be worked out. This effort, to better categorize aquatic life uses, could be addressed in subsequent triennial standards reviews but will need additional funding to complete.

There are quite a number of standards related issues that are candidates for consideration during the next triennial review. ODEQ and EPA should get together once ODEQ has hired a new standards coordinator to discuss priorities and approaches for conducting the next triennial review process.

Please feel to contact Andy Schaedel (503-229-6121) or Lynne Kennedy (503-229-5371) if you have further questions.

Sincerely,

Michael T. Llewelyn
Administrator, Water Quality Division

cc: Water Quality Managers

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Oregon
Theodore Kulongoski, Governor

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Appendix 3

February 4, 2004

Mr. Randy Smith, Director
Office of Water
U.S. EPA Region 10
1200 Sixth Avenue
Seattle, WA 98101

Re: Oregon Responses to EPA Questions re the State's water quality temperature standards

Dear Mr. Smith:

This letter is a follow up to our similar correspondence of December 19, 2003, which described Oregon's newly adopted antidegradation and temperature rules. There are three purposes for this letter. First, we are offering similar clarifications regarding the State's intended methodology for identifying natural conditions for parameters other than temperature. Second, we are commenting on several proposed conservation measures EPA is developing pursuant to consultation under the Endangered Species Act. Finally, we are providing your Agency with information on the application of the dissolved oxygen criteria to resident fish spawning.

Natural Conditions

As we indicated in our earlier letter, our revised rules make it clear that where ODEQ identifies a natural condition which is less stringent than the numeric criteria set out in the State's water quality standards, the natural condition supercedes the numeric criteria. Very similar language appeared in our previous rules, which were previously approved by EPA.

By definition, "natural conditions" are those pollutants that are present in the State's waters that are not attributable to anthropogenic activities. Rather, these conditions are caused by local geophysical, hydrological and meteorological processes and wildlife. ODEQ anticipates that site-specific natural conditions might be identified for the following parameters:

- Bacteria (attributed to wildlife)
- Metals (attributed to naturally eroding ore deposits)
- Nutrients (attributed to background soil, vegetation and/or wildlife conditions)
- Sediments and Turbidity (attributed to soil erosion and/or organic matter not accelerated by human activities)

- Other parameters attributed to similar natural processes.

Prior to a natural condition superceding otherwise applicable numeric criteria, ODEQ will make a finding as to the level at which the pollutant is present with no influence from anthropogenic activities. Similarly, ODEQ will document the natural process contributing to the presence of the pollutant. The specific methodology used to support a natural condition finding may vary in each local situation. However, in general the methodologies used will be similar to that described in our December 19, 2003 letter:

- Reference streams,
- Pollutant transport models,
- DNA testing,
- Historical data (where available) and/or
- Other sampling methods and studies.

The public will have specific notice of these natural conditions whenever they are relevant to one of the Clean Water Act regulatory programs. The public notices and documentation accompanying the biannual 303(d) listing process, draft TMDLs, draft NPDES permits and 401 water quality certifications will indicate that the otherwise applicable numeric criteria have been superceded by a natural conditions finding. Moreover, since 303(d) listings and TMDLs are transmitted to EPA for approval, the Agency will have an opportunity to review ODEQ 's natural conditions conclusions. ODEQ is committed to work with EPA as natural condition methodologies are refined in the TMDL, NPDES and 303(d) listing contexts.

ODEQ expects that natural conditions will most commonly be identified through the TMDL process. In that circumstance, EPA will have an opportunity to review and evaluate any natural condition determination as part of its TMDL approval action. ODEQ will list the water bodies where "natural conditions" findings have been made on our standards web page to ensure that the public is aware and notified of natural conditions,

It should be noted that it is possible, at some locations in the State, that the natural condition will not support, and never has supported a designated beneficial use. In such circumstances, ODEQ will modify the designated use to properly adjust the beneficial use to better reflect the existing use of the water segment.

Proposed Conservation Measures

ODEQ is aware that EPA is considering several conservation measures associated with its approval of the State water quality standards revisions. EPA has inquired whether ODEQ would participate in these conservation measures if they are pursued. To begin with, ODEQ notes that most of these conservation measures pursue information on the future *implementation* of the State's standards. They are best categorized as efforts

intended to identify additional information supporting the use of our standards once they are in place.

Since Oregon has a strong interest in these federal initiatives, ODEQ will, resources allowing, participate in the proposed conservation measures as described in EPA's Biological Evaluation: Temperature Monitoring and Use Designations (2.5.1) and the Two Year Review (2.5.2).

Dissolved Oxygen and Spawning

The revised Oregon rules clarified spawning locations and timing for anadromous fish and Lahontan Cutthroat Trout. Due to a lack of site specific data for species other than these, and since temperature criteria for spawning were not established for other species, no similar clarification was made for resident trout (i.e., rainbow, redband, Westslope cutthroat and coastal cutthroat) or char (bull trout) spawning. However, the dissolved oxygen criteria contain provisions that continue to apply to resident trout and char spawning areas. ODEQ will use the following dates to apply the dissolved oxygen spawning criteria (throughout the range where the Oregon maps indicate trout rearing, redband trout and core cold water habitat uses are identified).

Resident Trout Spawning (Redband, Rainbow, Westslope and Coastal Cutthroat)

- *For waters designated as trout rearing, or redband trout use, spawning is deemed to occur from January 1 – May 15 each year;*
- *For waters designated as core cold water habitat, or bull trout spawning and rearing use, resident trout spawning is deemed to occur from January 1 – June 15 each year; and*
- *For trout rearing waters upstream from core cold water habitat, spawning is also deemed to occur from January 1 – June 15 each year.*

Char (Bull Trout) Spawning

The following dates apply to all reaches designated as having "bull trout spawning and rearing use" within the specified basin or subbasin:

Basin	Subbasin	Spawning Period	Source of Information
South Willamette		Aug 15 – May 30	ODFW
John Day		Sept 1 – April 30	ODFW

Umatilla		Sept 1 – April 30	ODFW
Walla Walla		Sept 1 – April 30	ODFW
Grand Ronde	Upper G. R.	Sept 1 – April 15	ODFW
	Wallowa	Sept 1 – May 15	ODFW
	Wenaha	Aug 15 – March 31	ODFW
Imnaha		Aug 15 – May 31	ODFW
Hood		Aug 15 – May 15	USFWS
Deschutes		Aug 15 – May 15	USFWS
Powder		Aug 15 – May 15	USFWS
Malheur		Aug 15 – May 30	USFWS
Klamath		Aug 15 - May 30	USFWS

This timing information will be circulated to ODEQ field staff responsible for implementing the dissolved oxygen criteria. ODEQ will continue to refine all of these designations as more information is developed on resident trout and char spawning activities.

Oregon looks forward to EPA's review and approval of our water quality standards. If you require any additional information or clarification of these rules, please contact me or have your staff call Mark Charles, water quality standards manager at (503) 229-5589.

Sincerely,

Michael T. Llewelyn, Administrator
Water Quality Program

Cc: Stephanie Hallock - ODEQ
Mark Charles - ODEQ
Paula van Haagen - EPA
Mary Lou Soscia - EPA

Appendix 4

Water bodies not used for resident trout spawning

1. Lower Tualatin River mainstem from river mile 0 to 62.6.(river miles from 2004/2006 assessment database.

   Supporting documentation: ODFW
   Reference: TMDL

Note: River mile 62.6 on the LLID 100k layer corresponds with the confluence of the Tualatin River and Wapato Canal. This point is also the downstream end of a designated Salmon / Steelhead spawning reach.

From Response to Comments on Oregon's Draft 2004/2006 Integrated Report
Page 24.

4. Tualatin River
Commenter suggests the listing for dissolved oxygen for spawning from January 1 to May 15 is in error.
The Assessment Methodology discusses the policy to apply the dissolved oxygen criteria for spawning for resident trout which is set out inset out in a 2/2/2004 letter from DEQ to EPA Region 10. The draft data assessment applied an assumed resident trout spawning time period based on a designated use in the Tualatin River for salmon and trout rearing and migration. However, upon further discussion with Oregon Department of Fish and Wildlife and review of the Tualatin TMDL Appendix F: Tualatin River Subbasin Fish Habitat and Fish Community Information
http://www.deq.state.or.us/WQ/TMDLs/WillametteBasin/Tualatin/TualatinAppxF.pdf , this assumption is being modified. Available stream information shows that native cutthroat trout are the resident trout species, and that the likely spawning areas for this species do not include the segment of the Tualatin River designated for salmon and trout rearing and migration. The data from sites and time periods previously evaluated against the dissolved oxygen spawning criterion are combined with other data and evaluated against the cool water criteria (6.5 mg/L). This segment is found to be attaining that criterion.

Appendix 5 - 2012 Oregon Integrated Report QA Review Summary

2012 Oregon Integrated Report Data submission QA Review Summary					
Data source	**Site info**	**Analytical**	**Grab/field**	**Continuous**	**Comments**
Gresham	Good n=10	QA good n=2168	NA	NA	Passed QA check
CCSWCD	Good n=10, needed some Site_ID edits	QA good, 2009/2010 data not in correct format	QA bad, n=100	NA	Fail QA - Lab data needs work to get into our format
Salem DW	No site info?	QA good n=182	QA good	NA	Fail QA - Lake Depth profile data, Site info incomplete
Salem Stream	Good, n=11, Sites in	NA	NA	Good, n=11 site with gen parameters	Is this in LASAR already?
Tualatin JWC	No site data	QA? No data screening form, data not in correct format	QA? No data screening form, data not in correct format	NA	Fail QA – Lab review status?
Wilsonville	Site data incomplete (Lat&Long)	QA? No data screening form, data not in correct format	QA? No data screening form, data not in correct format		Fail QA – Lab review status?
Canby	Not in Raw folder	Not in Raw folder	Not in Raw folder		Fail QA – Lab review status?