2001 Washington State Water Quality Assessment

Section 305(b) Report Update

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Water Quality Program

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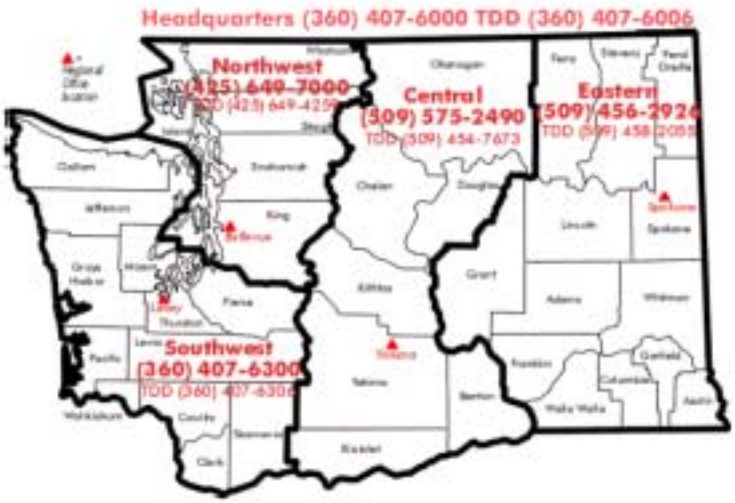

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Executive Summary

The state of Washington is blessed with an abundance of rivers, streams, lakes, wetlands, marine waters and aquifers. These waters provide a resource for irrigation, industry, electricity, drinking, and habitat for birds, shellfish and other aquatic life. State waters also support recreational activities such as fishing, swimming and boating. The quality of the state's waters can impact the economy in a number of ways.

Washington's economy depends on a healthy environment. Fishing, forestry, agriculture, and mining are examples of resource-based industries that depend upon the availability of natural resources to survive. These industries can also be a threat to water quality. With the population of the state growing, more demands are being placed on industry, and municipalities as well as on the environment. These demands can lead to an increased threat to water quality. It is important to monitor the surface and groundwaters of the state in order to guide activities to maintain pristine conditions where possible, minimize the impacts of unavoidable contamination and protect resources dependent on clean water.

Groundwater supplies are being challenged due to population growth and the accompanying demand for water use and wastewater disposal. Pesticides and nitrates found in wells, as well as lower than average rainfall over the years, are challenging the state's ability to sustain high quality water supplies.

In compliance with the federal Clean Water Act (CWA), section 305(b), the Washington State Department of Ecology (Ecology) gathers information on water quality in the state and reports this information to the U. S. Environmental Protection Agency (EPA) every year. The EPA then compiles the information with data received from other states to report the conditions of our nation's waters to Congress. Ecology's goal is to improve the quality of the state waters where existing quality is less than desired or required, as well as to maintain pristine conditions where they are found. By working together with state and local governments, tribes, community interest groups, industries and others, Ecology will be able to accomplish this task.

This report serves as a data update to the 2000 305(b) report submitted to EPA. The two assessment methods used in the 2000 305(b) report were also used in this report for the purpose of maintaining consistency. Both assessments offer valuable information for understanding the quality of the state waters.

The first assessment method provides water quality information based on data collected on specific waterbodies and on the use attainment assigned to those waters. This approach is known as the census approach. The assessment combines data and assesses only a small portion of the state. Use of only the census approach can result in a biased representation of the state's water quality.

The second assessment method uses the sample approach. This method makes assumptions about waterbodies at the regional level based on a small data set. Sample

surveys are intended to assess the condition of the entire resource when a complete census cannot be accomplished. This approach presents the conditions of the state's water quality by estimating the total use support from a monitored subset of waterbodies.

The results from both assessment methods indicate that water quality has improved for a number of uses compared to the results reported in the year 2000 305(b) report. Though these results indicate improvement in some areas, the method used for this analysis is not a statistical analysis and is not intended to be used as a trend analysis. The method of analysis used for this report, as set forth by the EPA guidelines, combines a number of parameters for each use assessed resulting in an overview of the states water quality, not trends. For a detailed description of state water quality conditions, please refer to Ecology's 1999 Water Year Report, publication number 01-03-013. Additional information may be obtained through Ecology's ambient monitoring program web site located at www.ecy.wa.gov/programs/eap/.

Current data results indicate that 49 percent (census survey) and 48 percent (sample survey) of all river and stream lengths monitored are impaired for one or more of their beneficial uses as established by state water quality standards. The primary causes of water quality problems continue to be high temperature, pH, and fecal coliform bacteria. The greatest pollution sources for impairment to Washington State rivers and streams are agricultural activities, modification of stream habitat, and stormwater runoff.

Data results for all estuary areas assessed indicate that 78 percent (census survey) and 77 percent (sample survey) of all estuaries monitored are impaired for one or more of their beneficial uses as established by state water quality standards. The primary causes of use impairment to estuaries continue to be temperature and low dissolved oxygen. Although the greatest pollution sources of impairments to Washington State estuaries are due to natural causes, these results must be reported as impairments according to the 1997 EPA guidelines for preparation of the 305(b) report.

Washington State lake data results indicate that 38 percent (census survey) and 37 percent (sample survey) of all lakes are impaired for one or more of their beneficial uses. The primary cause of use impairment in lakes continues to be excessive nutrients. Nonpoint source pollution originating from agricultural activities, urbanization, forestry operations, and natural conditions are the greatest source of water quality impairment to lakes in Washington State.

In the state of Washington, groundwater is the source of drinking water for the majority of citizens. In large areas east of the Cascade Mountain Range, 80 to 90 percent of the available drinking water is obtained from groundwater sources. Generally, groundwater quality in Washington State is good. However, there are several areas of degraded groundwater where beneficial uses have been negatively impacted. Degradation of Washington State's groundwater is primarily due to nitrates, pesticides, metals and other nonpoint source pollution.

Washington State's water resources are a valuable asset to the state. It is important that the state continue to protect these resources. Watershed planning, adequate funding, partnerships, and community involvement are important contributors to accomplishing this. As the state works toward the goal, of protecting water resources, citizens will be able to continue to enjoy them.

Introduction

The purpose of the 305(b) report update is to present to the U.S. Congress and the public the current conditions of the state's waters. Section 305(b) of the federal CWA requires each state to prepare an update to the water quality assessment report every year. The EPA compiles the information from the state reports and prepares a summary for Congress on the status of the nation's waters. The 2001 Washington State 305(b) report update has been prepared in accordance with the 1997 EPA guidelines for preparation of 305(b) reports.

The monitoring design and data used in this year's 305(b) report were selected because they best suited the requirements of the state's 305(b) report and for consistency purposes. All available data was not used to prepare the 305(b) report assessments because of the biases that some monitoring designs create.

Two different water quality assessments are being presented in this report. Both assessments offer valuable information for understanding the quality of the state waters. The first method provides water quality information based on a census approach. The census approach presents results based on data collected on specific waterbodies and on the use attainment assigned to those waters. This approach combines data and assesses only a small portion of the state. Monitoring all waters is not possible due to the lack of monetary resources. Therefore, the traditional census approach will likely never result in a complete statewide picture. However, efforts are currently being made by Ecology to improve its statewide monitoring program with the resources available.

The second assessment method uses the sample approach. The sample approach is intended to produce an assessment of the condition of the entire resource when that resource cannot be subject to a complete census. This approach presents the conditions of the state's water quality by estimating the total use support from a monitored subset of waterbodies. In this method, assumptions are made about waterbodies at the regional level based on a small data set.

I. Clean Water Act, Section 305(b) Reporting Specifics

I.A. Statewide Water Quality Assessment

Ecology is required by the federal CWA, section 305(b) to assess the quality of the states surface waters. The 305(b) report assesses beneficial uses according to the state Water Quality Standards, the causes and sources of impairment, and the pollutants present.

I.B. Assessment of Specific Uses

State water quality standards are used to determine whether waterbodies as fully, partially, or not supporting specific designated uses based on exceedence of the applicable criterion. These determinations consider criteria for chemical, physical, biological, toxicological or habitat parameters that have been established to provide a level of water quality that supports designated uses. These criteria are either shown numerically or in the form of a narrative statement.

Designated use support status is determined for entire waterbodies or portions of waterbodies based on the amount of area represented by monitoring data or other evaluation criteria. Area representation of sampling stations is determined by Ecology guidelines or best professional judgment. In many cases, different portions of a waterbody support different uses. In certain cases where information is not available to determine the limits of impaired areas, the entire waterbody is considered impaired.

The EPA guidance for the 305(b) report defines use support according to the percentage of data exceeding the criterion. The EPA defines uses as fully supporting if 10 percent or less of the data exceed the criterion, partially supporting if exceedances equal 11-25 percent of the data and not supporting if there is an exceedance rate greater than 25 percent.

Aquatic Life and Contact Recreation Uses

The EPA guidelines outline aquatic life use as the result of physical, chemical, biological, toxicological and habitat information. Aquatic life use support assessments are a compilation of the assessments of related individual designated uses classified in the state water quality standards. Contact recreational uses are based on state criteria for bacteriological indicators.

Shellfish Harvesting Use

The Washington Department of Health (WDOH) commercial and recreational shellfish classification inventory was used to assess shellfish harvesting. Classified areas were assessed from the WDOH 2000 shellfish inventory report. Some areas are classified based on assumed risk and not sanitary surveys. Assessments were not made for unclassified areas.

Approved commercial shellfish areas and open recreational shellfish beaches were assessed as good for the support of the shellfish harvest use. Restricted and conditionally approved commercial shellfish areas and conditional recreational shellfish beaches were assessed as fair for the support of the shellfish harvest use. Prohibited commercial shellfish areas and closed recreational shellfish beaches were assessed as poor for the support of the shellfish harvesting use. Harvesting restrictions due to biotoxins were not included in the assessment since these are not likely human caused impairments.

Aesthetic Enjoyment Use

The characteristic use most directly related to trophic status of lakes is aesthetic enjoyment. This use is highly value-laden and therefore difficult to assess. To derive an assessment, the assumption is made that at least some of a lake's users would find a eutrophic lake aesthetically impaired and that most users would find a hyper-eutrophic lake impaired.

Mesotrophic and Oligiotrophic lakes were assessed as having good support of aesthetic enjoyment. Eutrophic lakes were assessed as having fair support of aesthetic enjoyment. Lakes with trophic state index values between eutrophic and Mesotrophic status were assessed at the higher trophic level and considered fully supporting aesthetic enjoyment use. Hypereutrophic lakes were assessed as not supporting aesthetic enjoyment use.

Wildlife Habitat Use

Information from the Regional Environmental and Assessment Program (REMAP) report (Merritt, 1999) was used to assess the designated use of wildlife habitat. Wildlife habitat is defined in the standards to include terrestrial habitat and aquatic habitat. In the REMAP report, a habitat quality score was assigned by combining five metrics. The habitat quality score represents the relative comparison to reference sites. Habitat quality scores were assessed for small streams in only one ecoregion. The REMAP project is a fairly new project and the assessments needed for the Section 305(b) report have not been fully developed yet.

Fish Consumption Use

The criterion from the National Toxics Rule (40 CFR 131) were used with metals data collected by the Ecology Ambient Monitoring Program to assess the safety of fish consumption. The criteria specified for a one-per-million carcinogenic risk to human health for the consumption of organisms was used.

I.C. Causes and Sources of Designated Use Impairment

Causes are described in one of twenty-seven categories used by the EPA for the national report, depending on the parameter exceeding the criteria. Sources of pollution are described in one of ten categories now used by the EPA for the national report. A description of the EPA pollution source categories appears in the following table.

Possible pollution sources were identified by the best professional judgement of staff from Ecology's regional offices. Regional office staff have the best local knowledge within the agency of impacts to water quality. Stations for which no judgement was made were identified as unknown sources for the statewide extrapolation of sample data.

Causes and pollution sources for assessed waterbodies that did not fully support their designated uses were categorized according to the EPA definitions. Both the causes and the sources are identified for each station assessed with use impairment. No causes or sources were identified for waters fully supporting their uses.

Table 1: Description of the EPA Pollution Source Categories

Source Category	Description of Sources
Industrial Point Sources	NPDES permitted discharge of industrial wastewater
Municipal Point Sources	NPDES permitted discharge of domestic wastewater
Combined Sewer Overflows	Sanitary sewer overflows due to excessive stormwater infiltrating the system
Stormwater Runoff	Runoff from urbanized areas
Septic Tanks	On-site sanitary wastewater treatment systems
Agriculture	Crop production; pasture land, feedlots, aquaculture, animal holding and management areas, manure lagoons, etc.
Silviculture (Forest Practices)	Harvesting, restoration, residue management, forests management, road construction and maintenance, etc.
Construction	Highway, road, or bridge building land development, etc.
Resource Extraction	Surface mining, mine tailings, etc.
Land Disposal	Wastewater land application, landfills, hazardous waste, etc.
Hydromodification	Channelization, dredging, dam construction, flow regulation or modification, removal of riparian vegetation, streambank modification or destabilization, draining or filling of wetlands, etc.
Other Sources	Storage tank leaks, spills, in place contaminants, recreational activities, upstream impoundment, etc.
Natural Sources	Use impairment is not human caused. For example, surface heating in estuaries resulting from solar radiation can cause exceedance of temperature criteria.
Unknown Sources	A pollution source could not be identified

Table 2: Possible Pollution Source of Impairment of Assessed Waters (%)

Source Category	Streams	Estuaries	Lakes
Industrial Point Sources	2	8	0
Municipal Point Sources	6	14	1
Combined Sewer Overflows	1	4	0
Stormwater Runoff	6	4	4
Septic Tanks	9	3	1
Agriculture	30	13	6
Silviculture (Forest Practices)	4	0	0
Construction	4	0	0
Resource Extraction	3	0	0
Land Disposal	1	3	0
Hydromodification	18	0	1
Other Sources	2	2	3
Natural Sources	10	36	7
Unknown Sources	4	4	77

Table 3: Causes of Use Impairment to Rivers and Streams (%)

	Temperature	Dissolved Oxygen	pH	Fecal Coliform	Metals
Total Percentage	42	9	22	18	9

Table 4: Causes of Use Impairment to Estuaries (%)

	Temperature	Dissolved Oxygen	pH	Fecal Coliform
Total Percentage	35	39	23	3

Table 5: Causes of Use Impairment to Lakes (%)

	Nutrients
Total Percentage	100

I.D. Ecoregion Stratification as Defined by the EPA

Stratification

Ecoregion 1	Coast Range
Ecoregion 2	Puget Lowlands
Ecoregion 3	Willamette Valley (Clark County Area)
Ecoregion 4	Cascades (includes the Olympic Mountains)
Ecoregion 6	East Cascades and Foothills
Ecoregion 7	Columbia Basin
Ecoregion 8	Northern Rockies (Pend Oreille County Area)
Ecoregion 9	Blue Mountains (Asotin County Area)

Within each ecoregion, streams were further stratified into the following subpopulations using the Washington Rivers Information System (WARIS) GIS coverage:

- Small streams were defined as those reaches that are in the coverage as a single line.
- Large streams were defined as those reaches that are shown with double-banked cartographic features.

Within each ecoregion, lakes were further stratified into the following subpopulations:

- Small lakes are defined as lakes less than 20 acres in size measured from the WARIS GIS coverage.
- Medium lakes are defined as lakes between 20 and 100 acres in size.
- Large lakes are defined as lakes over 100 acres in size.

Within each ecoregion, estuary areas were stratified into the following subpopulations:

- Deep, well-mixed open water areas.
- Somewhat protected channels and passages.
- Bays, inlets and harbors.

Estuary strata were defined using the existing waterbody identification boundaries and the judgement of Ecology's marine ambient monitoring staff. No separate strata was made for shallower shoreline areas adjacent to deep water with monitored stations. Shallower areas were included in the stratum of water contiguous to it.

I.E. Monitoring Design and Data Selection

Monitoring Design

Differences in assessment results can be due to differences in monitoring design and not environmental conditions. The best monitoring design for use in this report is the random monitoring design. The data selected for this report was from a widely dispersed set of

data. This data, while not truly random, was the best data available and best suited the monitoring design requirements of the state's 305(b) report.

All available data was not used to prepare the 305(b) report assessments because of the biases that some monitoring designs created. Targeted monitoring designs are an example of this. The bias introduced by a targeted monitoring design can have a great effect on the statewide determination of use impairments for the 305(b) report. This bias occurs when data specifically sampled to characterize and identify known problems are used for the assessment. For example, data submitted as part of the Section 303(d) listing process primarily includes data with violations of standards. The complete data set from the same survey showing no other violations of standards, may not have been submitted. This results in reporting on impaired waters only and not on all sampled waters.

Another type of bias introduced by a monitoring design comes from sampling season and frequency. Some monitoring designs characterize only critical seasons. Other monitoring designs evaluate seasonal difference or long-term trends. By addressing the monitoring design with assessment methods, a much more accurate and less-biased estimate of statewide conditions is possible.

Data Selection

There are a total of eight data sources used in the assessment. These sources are listed below:

- Ecology Report: Water Quality Assessments of Selected Lakes within Washington State (March 2000)
- WDOH's Annual Inventory of Commercial & Recreational Shellfish Areas (2000)
- Ecology's Lake Water Quality Assessment Program updates from 1995 – 2000
- Ecology's Ambient Monitoring Program freshwater data from 1991-2000
- Ecology's Ambient Monitoring Program marine water data from 1991-2000
- REMAP Report: Biological Assessment of Small Streams in the Coast Range Ecoregion and the Yakima River Basin (Merritt, 1999)
- EPA Report: Western Lakes Survey Phase 1 - Characteristics of Lakes in the Western United States (January 1987)
- USGS Reports: Trophic Classification of Washington Lakes using Reconnaissance Data (Water Supply Bulletin 57, 1985 and Water Supply Bulletin 43, 1976)

Of the eight data sources, four primary sources were relied on for the assessments, as described below.

1. Stations from Ecology's Ambient Monitoring Program were selected for use in the assessment of streams and estuaries. Ecology's ambient monitoring data were used because the stations are generally selected to characterize an area, instead of being selected to further characterize a known problem. These stations are also sampled monthly year round, so that seasonal bias is not introduced. Only stations with at least

nine months of a year of data sampled at the same frequency were used to reduce possible seasonal biases.

2. The lakes data used for the assessments were selected since they were not designed to specifically identify problems, but to monitor a range of lake trophic states across the state. Very few widespread lake surveys have been conducted in the state. In order to obtain a larger sample size for extrapolation, data from some historical reports were used.

3. The WDOH 2000 shellfish commercial classification inventory was used to assess shellfish harvesting. Sampling conducted for this inventory does not focus on problem areas, but assesses all areas where shellfish harvesting is important. Therefore, the inventory represents a balance of areas that are impaired with areas that are fully supporting the use. No assessment on shellfish use was made to areas not classified.

4. Water quality data collected as part of the REMAP project was assessed for the wildlife habitat use. Only those eight stations that were sampled more than four times were used for the assessment. Samples were collected in the seasonal period from May through October. These stations only represent small streams in the Coast Range Ecoregion.

II. State Water Quality Assessment and Results

II.A. Assessment Design

The following state water quality assessment is being presented in two parts. Two different assessment methods were used for the purpose of maintaining consistency. The first method provides water quality information based on a census approach. The census approach gives results based on data collected on specific waterbodies and on the designated use assigned to those waters. This assessment combines data and assesses only a small portion of the state's waters.

The second method uses the sample survey approach. The sample approach is intended to assess the condition of the entire resource when a complete survey cannot be accomplished. This approach presents the conditions of the state's water quality by estimating the total use support from a monitored subset. The EPA guidance for the section 305(b) assessment allows for the use of the sample approach to estimate statewide numbers for the 305(b) report.

The sample approach applies to two types of monitoring designs. Both types of monitoring designs use a stratified sampling method so that inferences can be made about waters where data does not exist. The first type of monitoring design is the random sampling design. Stations are selected from a statistically random method within each stratum. Randomization in the site selection process is the only way to assure that sites are selected without bias. This method is known as a probability-based design.

The random sampling design has three elements:

1. Every possible station (population) has a known probability of being selected for monitoring (sample).
2. The set of stations monitored (sample) is drawn by some method of random selection, or a systematic selection with a random start.
3. Estimates are made about the population from the sample.

The second monitoring design is the judgmental design. Judgmental selection of a site is based on the best professional judgement of the monitoring agency. Each site is selected based on the judgement that it is representative of the target resource (subpopulation of waters). This method assumes that the stations selected represent all waters in a similar subpopulation (stratum). Stations from an existing sampling network are reviewed individually to determine the reasons why the locations were selected. Stations that are located based on the identification of specific problems, like downstream of a specific discharge, are not used in the assessment to represent other waters with similar characteristics.

The sample approach can be used to infer statewide estimates. Statewide water quality conditions were estimated by use of the proportion of stations assessed for each stratum.

These proportions were then applied to the total size of the stratum derived from GIS analysis. Assessments were then extrapolated for individual use support.

Below is a stepwise example of how an assessment was used to infer a statewide estimate using the example stratum of large streams (those indicated by double lines on the maps) in the Puget Lowlands ecoregion.

Step 1. Measure total population size of stratum - Using GIS, intersect the ecoregion boundary and double-banked stream polygons with coverage hydro layer. Sum the linear miles. Assume 397 miles for example.

Step 2. Assess data from stations in stratum using the EPA guidelines. Assume nine stations out of 19 sampled are fully supporting uses.

Step 3. Extrapolate assessment to stratum population using the proportion represented by the assessed stations. The example data would estimate 47 percent or 188 miles are fully supporting uses.

Step 4. Estimate statewide assessments for streams, lakes, and estuaries by summing estimates for all strata.

II.B. Census Survey Results

Table 6: Summary of Fully Supporting and Impaired Rivers and Streams Census Survey (miles)

Degree of Use Support	Total Assessed Size
Size Fully Supporting All Assessed Uses	1,731.5
Size Partly Supporting All Assessed Uses	676.5
Size Not Supporting All Assessed Uses	982.3
Total Size of Waters Assessed	3,390.2

Note: Total size of streams obtained from data submittals.

Table 7: Individual Rivers and Streams Use Support Summary Census Survey (miles)

Use	Size Assessed	Size Fully Supporting	Size Partially Supporting	Size Not Supporting
Aquatic Life	3,353.3	1,980.6	902.7	470.0
Salmon Spawning	3,022.5	1,928.2	751.7	342.5
Fish Spawning	3,353.3	1,980.6	902.7	470.0
Fish Migration	3,343.8	2,690.4	606.2	47.2
Fishable Goal	3,353.3	1,980.6	902.7	470.0
Fish Consumption	446.6	166.5	57.3	222.8
Swimming	3,390.2	2,343.6	273.4	773.2
Primary Contact	3,390.2	2,343.6	273.4	773.2
Secondary Contact	3,390.2	3,108.2	92.9	189.2

Note: Total size of streams obtained from data submittals.

Table 8: Summary of Fully Supporting and Impaired Lakes Census Survey (acres)

Degree of Use Support	Total Assessed Size
Size Fully Supporting All Assessed Uses	172,037.6
Size Partly Supporting All Assessed Uses	103,204.0
Size Not Supporting All Assessed Uses	3,855.0
Total Size of Waters Assessed	279,096.6

Note: Total size of lakes obtained from data submittals.

Table 9: Lakes Aesthetic Use Support
Census Survey (acres)

Degree of Use Support	Number of Lakes Monitored	Acreage of Lakes Monitored
Size Fully Supporting Aesthetic Use	523	172,037.6
Size Partly Supporting Aesthetic Use	271	103,204.0
Size Not Supporting Aesthetic Use	46	3,855.0

Note: Total size of lakes obtained from data submittals.

Table 10: Summary of Fully Supporting and Impaired Estuaries
Census Survey (sq. mi.)

Degree of Use Support	Total Assessed Size
Size Fully Supporting All Assessed Uses	508.6
Size Partly Supporting All Assessed Uses	498.6
Size Not Supporting All Assessed Uses	1,400.2
Total Size of Waters Assessed	2,405.4

Note: Total size of estuaries obtained from data submittals.

Table 11: Individual Estuary Use Support Summary
Census Survey (sq. mi.)

Use	Size Assessed	Size Fully Supporting	Size Partially Supporting	Size Not Supporting
Aquatic Life	2,405.4	939.1	624.3	842.0
Fish Spawning	2,405.4	1,788.9	435.3	181.2
Fish Migration	2,405.4	1,628.3	605.2	171.9
Fishable Goal	2,405.4	939.1	624.3	842.0
Shellfish Spawning	2,405.4	1,278.4	565.5	561.5
Swimming	2,405.4	2,405.4	0.0	0.0
Primary Contact	2,405.4	2,405.4	0.0	0.0
Secondary Contact	2,405.4	2,405.4	0.0	0.0

Note: Total size of estuaries obtained from data submittals.

II.C. Sample Survey Results

Table 12: Summary of Fully Supporting and Impaired Rivers and Streams Sample Survey (miles)

Degree of Use Support	Total Assessed Size
Size Fully Supporting All Assessed Uses	35,977.1
Size Partly Supporting All Assessed Uses	14,769.6
Size Not Supporting All Assessed Uses	19,692.7
Total Size of Waters Assessed	70,439.4

Note: Total size of streams obtained from Department of Ecology GIS Coverages.

Table 13: Individual Rivers and Streams Use Support Summary Sample Survey (miles)

Use	Size Assessed	Size Fully Supporting	Size Partially Supporting	Size Not Supporting
Aquatic Life	70,439.4	42,263.7	16,905.4	11,270.3
Salmon Spawning	70,439.4	46,071.2	15,230.1	9,138.1
Fish Spawning	70,439.4	46,071.2	15,610.9	8,757.3
Fish Migration	70,439.4	46,071.2	15,610.9	8,757.3
Fishable Goal	70,439.4	42,263.7	16,905.4	11,270.3
Fish Consumption	58,989.6	14,238.9	6,102.4	38,648.3
Swimming	70,439.4	46,202.2	4,923.2	19,314.0
Primary Contact	70,439.4	46,202.2	4,923.2	19,314.0
Secondary Contact	70,439.4	62,107.9	1,893.5	6,438.0

Note: Total size of streams obtained from Department of Ecology GIS Coverages.

Table 14: Summary of Fully Supporting and Impaired Lakes Sample Survey (acres)

Degree of Use Support	Total Assessed Size
Size Fully Supporting All Assessed Uses	154,834.4
Size Partly Supporting All Assessed Uses	80,229.7
Size Not Supporting All Assessed Uses	13,618.3
Total Size of Waters Assessed	248,682.4

Note: Total size of lakes obtained from Department of Ecology GIS Coverages.

Table 15: Lakes Aesthetic Use Support Sample Survey (acres)

Degree of Use Support	Number of Lakes Monitored	Acreage of Lakes Monitored
Size Fully Supporting Aesthetic Use	523	154,834.4
Size Partly Supporting Aesthetic Use	271	80,229.7
Size Not Supporting Aesthetic Use	46	13,618.3

Note: Total size of lakes obtained from Department of Ecology GIS Coverages.

Table 16: Summary of Fully Supporting and Impaired Estuaries Sample Survey (sq. mi.)

Degree of Use Support	Total Assessed Size
Size Fully Supporting All Assessed Uses	662.3
Size Partly Supporting All Assessed Uses	509.5
Size Not Supporting All Assessed Uses	1,732.1
Total Size of Waters Assessed	2,903.9

Note: Total size of estuaries obtained from Department of Ecology GIS Coverages.

Table 17: Individual Estuary Use Support Summary Sample Survey (sq. mi.)

Use	Size Assessed	Size Fully Supporting	Size Partially Supporting	Size Not Supporting
Aquatic Life	2,903.9	1,222.7	713.2	968.0
Fish Spawning	2,903.9	2,037.8	407.6	458.5
Fish Migration	2,903.9	2,139.7	356.6	407.6
Fishable Goal	2,903.9	1,222.7	713.2	968.0
Shellfish Spawning	2,903.9	1,732.1	458.6	713.2
Swimming	2,903.9	2,903.9	0.0	0.0
Primary Contact	2,903.9	2,903.9	0.0	0.0
Secondary Contact	2,903.9	2,903.9	0.0	0.0

Note: Total size of estuaries obtained from Department of Ecology GIS Coverages.

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Appendix A: Clean Water Act, Glossary of Parameters

Glossary of Parameters

The following glossary of parameters, is not comprehensive, but was designed to provide an overview of causes of use impairment.

Ammonia-N
Ammonia-N is a reduced form of Nitrogen that is toxic to aquatic life at higher concentrations. It is typically found in waters that are contaminated with human or animal waste. It can also contribute to depletion of dissolved oxygen in surface waters.

Bis(2-ethylhexyl)Phthalate
See Phthalates

Dioxin
Dioxin is a waste product of the pulp and paper industry that is known to be toxic to living organisms.

Dissolved Oxygen (DO)
DO is oxygen that is freely available in water. Adequate DO is necessary for the life of fish and other aquatic organisms.

Fecal Coliform
Organisms common to the intestinal tract of man and of animals. Pathogen indicators, including such bacteria as fecal coliform, and e coli, can affect drinking water use, curtail shellfish harvesting, and restrict recreational use.

Fine Sediment
Sediment is typically fine particles of soil carried in suspension by flowing water that ultimately settles to the bottom. Sediment is usually caused by erosion and can impair fish spawning areas.

4-methylphenol or Cresol
Cresol is a compound that was used to preserve wood and wood treatment facilities and is highly toxic to living organisms.

Instream Flow
Instream Flow is the amount of water in a stream required to support or protect existing uses of fish and fish habitat.

Metals
Metals can cause human health concerns when contaminated water and/or contaminated aquatic organisms are ingested. They can accumulate in the environment, can be highly toxic if breathed or swallowed, and can damage living organisms at low concentrations.

Organics
Organics is a collective term for any number of carbon-based substances that are toxic to aquatic life or can accumulate in fish tissue to levels that are unsafe for human consumption.

PAHs
Polynuclear Aromatic Hydrocarbons (also known as PAHs) are a class of complex organic compounds, having more that one benzene ring, some of which are persistent and cancer-causing. These compounds are formed from the combustion of organic material and are everywhere in the environment. PAHs are commonly formed by the combustion of gasoline and by forest fires. They often reach the environment through atmospheric fallout and highway runoff.

PCBs
Polychlorinated Biphenyls (or PCBs) are organic toxicants that include about 70 different but closely related man-made compounds made of carbon, hydrogen, and chlorine. They persist in the environment and can accumulate in food chains because they are not water-soluble. PCBs are suspected of causing cancer in humans and were previously found in electrical transformers.

Pentachlorophenol
Pentachlorophenol is a compound that was previously used to preserve wood and wood treatment facilities. Its use was banned due to its highly toxic effects on living organisms.

Pesticides
Pesticides are agents (usually chemicals) that are used to destroy pests (insects). Pesticides can be present in surface waters as a result of direct application, runoff, or manufacturing discharge, and can have adverse effects on water quality. Careless use of pesticides may result in fish kills. DDT was the first of the modern chlorinated hydrocarbons used as an insecticide. It has a half-life of 15 years and its residues can become concentrated in the fatty tissues of certain organisms, including man and animals. It was found to be cancer-causing and banned for use in the U.S. in 1972.

Petroleum Hydrocarbons
Petroleum Hydrocarbons is a collective term for motor vehicle fuels, lubricating oils and greases, tars, and asphalt's (defined in the State Water Quality Standards as oil and grease). The sources of petroleum hydrocarbons in urban runoff include partially-burned fuels in motor vehicle exhausts, leakage from motor vehicle engines and drive lines, improper disposal of waste crankcase oil in gutters and storms drains, and accidental spillage.

pH
pH is a measure of the intensity of the acidic or basic character of water. pH is an important factor in the chemical and biological system of water. If these systems are unbalanced and the resulting pH is high or low, it can kill fish and other organisms.

Phthalates
Phthalates are a waste product of the plastics industry. They can accumulate in fish tissue to levels that are unsafe for human consumption.

Sediment Bioassay
A sediment bioassay is a test procedure that measures the effects of sediment on living plants or animals.

Temperature
Elevated water body temperatures can destroy fish resources by reducing dissolved oxygen in the water.

Total Dissolved Gas
Total Dissolved Gas is formed when water spills over a dam and plunges deep into a pool on the other side, taking excess air with it. This air dissolves into the water and forms high concentrations of total dissolved gas. Fish in waters with high concentrations then ingest gas bubbles in their tissue and blood vessels. This has the same effect on fish as when a diver gets the bends. The result can cause illness or death in fish.

Total Nitrogen
Total Nitrogen is the amount of nitrogen in the water that is available for plant growth or exceeds the necessary amount.

Total Phosphorus
Total Phosphorus (in the form of phosphate) is a major source of nutrients for plant life. Too much phosphorus in the water increases algae growth. Increased plant growth can then use up available oxygen in the water. A plentiful oxygen supply is necessary for the survival of fish and other inhabitants of fresh and marine waters. Phosphates can come from human and animal wastes, detergent, industrial processing, some vegetation, and even from atmospheric fallout.

Turbidity
Turbidity is suspended sediment that clouds the water. Too much turbidity blocks sunlight needed for aquatic life and clogs industrial filters which can be disastrous for sensitive processes. Turbidity is also aesthetically unattractive in drinking water.

Water Column Bioassay
The water column bioassay is a test procedure that measures the effects of ambient water on living plants or animals.