Summary of Materials and Request for Stakeholder and Community Input

Capitol Lake Long-Term Management Planning

Phase I Implementation – May Meeting Series

NEW PROVISO ELEMENT: METHODOLOGY FOR BEST AVAILABLE SCIENCE

Meetings to discuss potential methods for identification of Best Available Science will occur in May 2016. These discussions will encourage stakeholders to select an existing state-, federal-, or internationally-recognized method that will subsequently be used to identify Best Available Science on water quality and habitat related to the Capitol Lake basin. A list of technical studies, agency reports, evaluations, and other relevant topics will be reviewed to ensure data are compiled before the identification of best available science beings.

PREVIOUS PROVISO ELEMENT: GOALS AND OBJECTIVES

The materials prepared in support of Goals and Objectives for long-term management of Capitol Lake have been revised based on feedback from the Technical Committee, Executive Work Group and the Community. These materials are now available for a "second touch" review.

MATERIALS FOR REVIEW

- Example checklists and screening criteria from the state, federal and international levels that could serve as the methodology for reviewing best available science for Capitol Lake
- Summary of technical studies, agency reports and evaluations related to water quality and habitat for the Capitol Lake basin
- Revised Figure 3 that reflects comments from the April meeting series on goals and objectives and informs the development of a draft Purpose and Need statement

QUESTIONS FOR MATERIAL REVIEW AND INPUT

1. Of the three methodologies presented, which do you think should be used for reviewing best available science for Capitol Lake?
2. Are there any additional technical studies, agency reports or other relevant information related to water quality and habitat that should be evaluated in this process?

DATES FOR COMMUNITY INPUT ON METHODOLOGY FOR BEST AVAILABLE SCIENCE

Input can be provided at the Community meeting scheduled from 5:30 to 7:30 PM on June 1, 2016 at 1500 Jefferson St SE, Olympia, WA. Input on these materials and the questions above can also be submitted online from May 19, 2016 to June 2, 2106, at www.des.wa.gov.

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Federal Definition for Best Available Science

Per the Federal Water Pollution Control Act, Oil and hazardous substance liability section (33 U.S.C. 1321)

"...the term 'best available science' means that—

(A) maximizes the quality, objectivity, and integrity of information, inducing statistical information;

(B) uses peer-reviewed and publically available data; and

(C) clearly documents and communicates risks and uncertainties in the scientific basis for such projects."

Review of Available Methodologies for the Evaluation of Best Available Science

Three methodologies are being presented as potential options to assist in the identification of best available science related to water quality and habitat for the Capitol Lake basin.

The process to select these methodologies to identify best available science included:

o Reviewing a number of state, federal and international methods that were widely accepted and used

o Focusing on methods that would be suitable for review of environmental data such as water quality or habitat

o Confirming that the methods were commonly used and reflected current best practice

o Confirming that the methods were provided in formal guidance or codified in law

Sources:

Washington State Legislature. 2003. Washington Administrative Code 365-195-905, Criteria for determining which information is the "best available science." http://apps.leg.wa.gov/wac/default.aspx?cite=365-195-905. Accessed May 9, 2016.

U.S. Environmental Protection Agency (USEPA). 2012. *Guidance for Evaluating and Documenting the Quality of Existing Scientific and Technical Information: Addendum to "A Summary of General Assessment Factors for Evaluating the Quality of Scientific and Technical Information."* Prepared for the USEPA by members of the Peer Review Advisory Group of the Science and Technology Policy Council. December.

Klimisch, H.-J., M. Andreae, and U. Tillman. 1997. "A Systematic Approach for Evaluating the Quality of Experimental Toxicological and Ecotoxicological Data." *Regulatory Toxicology and Pharmacology* 25(1): 1–5. February.

Summary of the Methodologies Identified for Discussion

Washington State Criteria (Chapter 365-195 WAC Growth Management Act)

o Provides criteria to assist in determining whether information constitutes as best available science

o Provides a general indication of the characteristics of a valid scientific process in a table format

o Guides Washington cities and counties through inclusion of best available science in newly adopted policies and regulations to protect the functions and values of critical areas

o Used by Ecology and WDFW for the synthesis and summary of literature relevant to the science and management of wetlands and environmentally critical areas in the state of Washington

U.S. Environmental Protection Agency Guidelines

o Provides guidance for collecting and assessing existing scientific and technical information using five general assessment factors

o Establishes minimum review and documentation requirements for assessing and accepting data from other organizations

o Ensures that scientific and technical information comply with the agency's formal Information Quality Guidelines

o Relevant to any existing scientific and technical information used to support Agency decision making

Internationally-Recognized Scoring System

o Provides a scoring system with different reliability categories, including standardized criteria for characterizing and differentiating the quality of data

o Suggests that a brief written justification should be provided after the scientific data is evaluated and assigned a code or category of reliability

o Intended to harmonize similar processes in data evaluation internationally

o Used in risk assessments to evaluate whether data is complete and valid, and confirm that the data was derived using current standards

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Methodologies to Review
Best Available Science

Characteristics →	Peer Review	Methods	Logical Conclusions & Reasonable Inferences	Quantitative Analysis	State Methodology — Context	References
(descriptions)	*The information has been critically reviewed by other persons who are qualified scientific experts in that scientific discipline. The criticism of the peer reviewers has been addressed by the proponents of the information. Publication in a refereed scientific journal usually indicates that the information has been appropriately peer-reviewed.*	*The methods that were used to obtain the information are clearly stated and able to be replicated. The methods are standardized in the pertinent scientific discipline or, if not, the methods have been appropriately peer-reviewed to assure their reliability and validity.*	*The conclusions presented are based on reasonable assumptions supported by other studies and consistent with the general theory underlying the assumptions. The conclusions are logically and reasonably derived from the assumptions and supported by the data presented. Any gaps in information and inconsistencies with other pertinent scientific information are adequately explained.*	*The data have been analyzed using appropriate statistical or quantitative methods.*	*The information is placed in proper context. The assumptions, analytical techniques, data, and conclusions are appropriately framed with respect to the prevailing body of pertinent scientific knowledge.*	*The assumptions, analytical techniques, and conclusions are well referenced with citations to relevant, credible literature and other pertinent existing information.*

Sources of Scientific Information Evaluated

Source	Peer Review	Methods	Logical Conclusions & Reasonable Inferences	Quantitative Analysis	Context	References
A. Research: Research data collected and analyzed as part of a controlled experiment (or other appropriate methodology) to test a specific hypothesis.	✔	✔	✔	✔	✔	✔
B. Monitoring: Monitoring data collected periodically over time to determine a resource trend or evaluate a management program.		✔	✔	✚	✔	✔
C. Inventory: Inventory data collected from an entire population or population segment (e.g., individuals in a plant or animal species) or an entire ecosystem or ecosystem segment (e.g., the species in a particular wetland).		✔	✔	✚	✔	✔
D. Survey: Survey data collected from a statistical sample from a population or ecosystem.		✔	✔	✚	✔	✔
E. Modeling: Mathematical or symbolic simulation or representation of a natural system. Models generally are used to understand and explain occurrences that cannot be directly observed.	✔	✔	✔	✔	✔	✔
F. Assessment: Inspection and evaluation of site-specific information by a qualified scientific expert. An assessment may or may not involve collection of new data.		✔	✔		✔	✔
G. Synthesis: A comprehensive review and explanation of pertinent literature and other relevant existing knowledge by a qualified scientific expert.	✔	✔	✔		✔	✔
H. Expert Opinion: Statement of a qualified scientific expert based on his or her best professional judgment and experience in the pertinent scientific discipline. The opinion may or may not be based on site-specific information.			✔		✔	✔

Legend
✔ Characteristic must be present for information derived to be considered scientifically valid and reliable
✚ Presence of characteristic strengthens scientific validity and reliability of information derived, but is not essential to ensure scientific validity and reliability

Source: Washington State Legislature. 2003. Washington Administrative Code 365-195-905, Criteria for determining which information is the "best available science." http://apps.leg.wa.gov/wac/default.aspx?cite=365-195-905. Accessed May 9, 2016.

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Washington State Criteria
for Ensuring Best Available Science
is Used in Policy

When evaluating the quality and relevance of scientific and technical information, the considerations that the Agency typically takes into account can be characterized by five general assessment factors:

Soundness
The extent to which the scientific and technical procedures, measures, methods or models employed to generate the information are reasonable for, and consistent with, the intended application.

a. Is the purpose of the study reasonable and consistent with its design?

b. To what extent are the procedures, measures, methods, or models employed to develop the information reasonable and consistent with sound scientific theory or accepted approaches?

c. How do the study's design and results compare with existing scientific or economic theory and practice? Are the assumptions, governing equations and mathematical descriptions employed scientifically and technically justified? Is the study based on sound scientific or econometric principles?

d. In the case of a survey, have the questionnaires and other survey instruments been validated (e.g., compared with direct measurement data)? Were checks for potential errors made during the interview process?

e. How internally consistent are the study's conclusions with the data and results presented?

Applicability and Utility
The extent to which the information is relevant for the Agency's intended use.

a. How useful or applicable is the scientific or economic theory applied in the study to the Agency's intended use of the analysis?

b. How relevant are the study's purpose, design, outcome measures and results to the Agency's intended use of the analysis (e.g., for a chemical hazard characterization)?

c. Are the domains (e.g., duration, species, exposure) where the model or results are valid useful to the Agency's application?

d. How relevant is the study to current conditions of interest? For example, in the case of a survey, are conditions likely to have changed since the survey was completed (i.e., is the information still relevant)? Is the sampled population relevant to the Agency's current application? How well does the sample take into account sensitive subpopulations?

Clarity and Completeness
The degree of clarity and completeness with which the data, assumptions, methods, quality assurance, sponsoring organizations and analyses employed to generate the information are documented.

a. To what extent does the documentation clearly and completely describe the underlying scientific or economic theory and the analytic methods used?

b. To what extent have key assumptions, parameter values, measures, domains and limitations been described and characterized?

c. To what extent are the results clearly and completely documented as a basis for comparing them to results from other similar tests?

d. If novel or alternative theories or approaches are used, how clearly are they explained and the differences with accepted theories or approaches highlighted?

e. Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions (e.g., codes for missing values, data quality flags and questionnaire responses)? Are there confidentiality issues that may limit accessibility to the complete data set?

f. In the case of a modeling exercise, have the definitions and units of model parameters been provided? To what extent have the procedures for applying the model been clearly and completely documented? How available and adequate is the information necessary to run the model computer code?

g. To what extent are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

h. Have the sponsoring organization(s) for the study/information product and the author(s) affiliation(s) been documented?

i. To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

Uncertainty and Variability
The extent to which the variability and uncertainty (quantitative and qualitative) in the information or in the procedures, measures, methods or models are evaluated and characterized.

a. To what extent have appropriate statistical techniques been employed to evaluate variability and uncertainty? To what extent have the sensitive parameters of models been identified and characterized?

b. To what extent do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the study? What are the potential sources and effects of error and bias in the study design?

c. Did the study identify potential uncertainties such as those due to inherent variability in environmental and exposure-related parameters or possible measurement errors?

Evaluation and Review
The extent of independent verification, validation and peer review of the information or of the procedures, measures, methods or models.

a. To what extent has there been independent verification or validation of the study method and results? What were the conclusions of these independent efforts, and are they consistent?

b. To what extent has independent peer review been conducted of the study method and results, and how were the conclusions of this review taken into account?

c. Has the procedure, method or model been used in similar, peer reviewed studies? Are the results consistent with other relevant studies?

d. In the case of model-based information, to what extent has independent evaluation and testing of the model code been performed and documented?

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USEPA Guidance
for Evaluating the Quality
of Scientific Information

Klimisch Critera for Reliability Categories

Code	Justification

1
- **Guideline study**
- **Comparable to guideline study**
- **Test procedure according to national standards**

2
- **Acceptable, well-documented publication/study report which meets scientific principles**
- **Basic data given; comparable to guidelines/standards**
- **Comparable to guideline study with acceptable restrictions**

3
- **Method not validated**
- **Documentation insufficient for assessment**
- **Does not meet important criteria of today standard methods**
- **Relevant methodological deficiencies**
- **Unsuitable test system**

4
- **Only short abstract available**
- **Only secondary literature (review, tables, books, etc.)**

ECETOC Expansion of Justification Code

ECETOC: European Centre for Ecotoxicology and Toxicology of Chemicals

1 Reliable without restriction
- 1a 'Good laboratory practice' guideline study
- 1b Comparable to guideline study
- 1c Test procedure in accordance with national standard methods
- 1d Test procedure in accordance with generally accepted scientific standards and described in sufficient detail

2 Reliable without restriction
- 2a Guideline study without detailed documentation
- 2b Guideline study with acceptable restrictions
- 2c Comparable to guideline study with acceptable restrictions
- 2d Test procedure in accordance with national standard methods with acceptable restrictions
- 2e Study well documented, meets generally accepted scientific principles, acceptable for assessment
- 2f Accepted calculation method
- 2g Data from handbook or collection of data

3 Not reliable
- 3a Documentation insufficient for assessment
- 3b Significant methodological deficiencies
- 3c Unsuitable test system

4 Not assignable
- 4a Abstract
- 4b Secondary literature
- 4c Original reference not yet available
- 4d Original reference not translated
- 4e Documentation insufficient for assessment

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Internationally Recognized Scoring System
for Evaluating Data Quality

5/19/2016

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Document Review for Best Available Science in the Capitol Lake Basin concerning Water Quality and Habitat

*These documents provide science related to **water quality** and **habitat** and would be relevant to the evaluation of long-term management options and the impacts of retaining or removing the dam.*

*Technical studies regarding **Water Quality** include those from the entire watershed to capture waterbodies affecting or affected by Capitol Lake.*
***Habitat** is inclusive of habitat for fish, wildlife, and other aquatic organisms, and includes other information relevant to habitat, such as invasive species.*

Document	Brief Summary
Deschutes River, Percival Creek, and Budd Inlet Tributaries Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load: Water Quality Improvement Report and Implementation Plan - Final Washington State Department of Ecology, December 2015 Publication No. 15-10-012	Builds upon the 2012 study involving data collection that characterized the sources and processes relevant to the existing impairments, and developed analytical tools to simulate the potential benefits of various management strategies. Provides an approach to controlling pollution in the Deschutes River, Percival Creek, and Budd Inlet, and includes detailed steps to meet those goals.
Deschutes River, Capitol Lake, and Budd Inlet Total Maximum Daily Load Study: Supplemental Modeling Scenarios Washington State Department of Ecology, September 2015 Publication No. 15-03-002	Summarizes supplemental modeling analyses for Capitol Lake and Budd Inlet. States that the Capitol Lake dam causes the largest negative impact on dissolved oxygen of any activity evaluated due to the dam's combined effects of changing circulation as well as nitrogen and carbon loads. Concludes that adding advanced nitrogen removal treatment to three small wastewater treatment plants discharging to Budd Inlet, shifting the LOTT outfall north, and reducing recreational or marina boat discharges would not improve oxygen conditions significantly. Concludes that reducing Deschutes River temperature, conducting alum treatments in the lake, eliminating stormwater sources, and dredging the lake to a nominal 13 feet average depth would not improve water quality in Capitol Lake significantly.
2015 Survey for *Potamopyrgus Antipodarum* (New Zealand Mudsnail) within a Five-Mile Radius of Capitol Lake, Thurston County, Washington Edward J. Johannes, Deixis Consultants, June 2015	Updates previously reported findings and concludes that the mudsnail is still present throughout the north and middle basin. The mudsnail has also been found at one site along the Deschutes River; however, no significant spread within a 5-mile radius of Capitol Lake was reported.
Anthropogenic Dissolved Oxygen Impacts in Budd Inlet: Comparing Influences from a Lake or Estuary Washington State Department of Ecology (prepared by A. Ahmed, et al.), 2014 Publication No. 14-03-021	Provides initial findings from the Budd Inlet, Capitol Lake, and Deschutes River Total Maximum Daily Load Study, particularly focusing on the differences between influences to Budd Inlet from a Lake or Estuary management option.
2013 Survey for *Potamopyrgus Antipodarum* (New Zealand Mudsnail) within a Five-Mile Radius of Capitol Lake, Thurston County, Washington Edward J. Johannes, Deixis Consultants, June 2013	Confirms that the mudsnail is spreading throughout the Capitol Lake basin.
Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Technical Report: Water Quality Study Findings Washington State Department of Ecology, June 2012 Publication No. 12-03-008	This Ecology report summarizes the technical basis for a water cleanup plan (Total Maximum Daily Load study), which was conducted to determine the targets that enable water bodies to meet standards. However, water quality improvement targets are not quantified for Capitol Lake and Budd Inlet; the report defers to later work that will be performed by Ecology.
Distribution Survey for *Potamopyrgus Antipodarum* (New Zealand Mudsnail) in the North and Middle Basins of Capitol Lake, Thurston County, Washington Edward J. Johannes, Deixis Consultants, July 2011	Establishes through a series of samples collected from Capitol Lake that the New Zealand Mudsnail is present throughout the north basin, and within a majority of the middle basin.
Effect of Stocking in the East Mitigation Pond (Capitol Lake), Olympia, Washington Michelle Marko, et al., Concordia College, March 2011	The study demonstrates the ability of the milfoil weevil (*Euhrychiopsis lecontei*) to survive stocking, and to overwinter successfully. It is expected that the milfoil weevil could grow to populations that would control Eurasian watermilfoil in small water bodies.
Capitol Lake Alternatives Analysis – Final Report Herrera Environmental Consultants, July 2009	Provides a summary of potential effects to fish and wildlife habitat based on the findings of the WDFW report, "Implications of Capitol Lake Management for Fish and Wildlife." Summarizes findings from Ecology's "Water Quality Study Findings," and other similar reports to describe potential impacts to water quality.

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Document Review for Best Available Science in the Capitol Lake Basin concerning Water Quality and Habitat

Document	Brief Summary
Implications of Capitol Lake Management for Fish and Wildlife The Washington Department of Fish and Wildlife, September 2008	Reports that estuarine restoration (Estuary and Dual Basin Options) are anticipated to favor more special designation species than the lake options and support fewer exotic species than the lake options.
Generalized Surficial Geologic Units and Approximate Extent of Vashon Puget Lobe Ice, Plate 1 Washington State Department of Ecology (prepared by K.A. Sinclair and D.B. Bilhimer), 2007 Publication No. 07-03-002	Geologic map providing generalized surficial geological units to support the hydrogeologic investigation.
Study Well Locations, In-Stream Piezometer Thermographs, and Stream Seepage Results for the Deschutes River and Percival Creek Watersheds, Plate 2 Washington State Department of Ecology (prepared by K.A. Sinclair and D.B. Bilhimer), 2007 Publication No. 07-03-002	Graphical data from the hydrogeologic investigation.
Assessments of Surface Water/Groundwater Interactions and Associated Nutrient Fluxes in the Deschutes River and Percival Creek Watersheds, Thurston County Washington State Department of Ecology, January 2007	This report describes the results of a hydrogeologic investigation that was undertaken to support a TMDL evaluation of the Deschutes River and Percival Creek watersheds. Field techniques were employed to evaluate the direction, volume, and timing of surface water and groundwater interactions, and to estimate the potential loading of phosphorus- and nitrogen-based nutrients in groundwater that contributes to reaches of the Deschutes River and Percival Creek.
Interim Results from the Budd Inlet, Capitol Lake, and Deschutes River Dissolved Oxygen and Nutrient Study Washington State Department of Ecology (prepared by Mindy Roberts and Greg Pelletier), 2007	Provides interim results from samples collected along the length of the Deschutes River and Capitol Lake as well as tributaries that were analyzed for nutrient content, and for oxygen, pH, temperature, and conductivity.
Addendum to the Deschutes River Estuary Restoration Study: Analysis and Summary of Benthic Invertebrates from Selected Benthic Cores Ralph J. Garono et al., Earth Design Consultants, January 2007	An addendum to the existing Biological Conditions Report to provide additional detail regarding the type of organisms that may inhabit mud and sand flats of a restored Deschutes Estuary, and what the ecological roles of those organisms may be. Concludes that if the estuarine habitat develops as predicted, then the restored Deschutes Estuary should support a diverse and productive benthic community.
Deschutes River Estuary Restoration Study Biological Conditions Report Ralph J. Garono et al., Earth Design Consultants, September 2006	Combines field data with results of the USGS hydrodynamic and sediment transport model to describe the biological communities that would likely develop in a restored estuary. The USGS model results and literature review indicate that a restored Deschutes Estuary will harbor organisms mainly associated with mud and sand flats, and that areas dominated by vegetated salt marsh communities will be rare.
Capitol Lake Vertebrate and Invertebrate Inventory Herrera Environmental Consultants, September 2004	Agency report providing an inventory of fish, wildlife, and invertebrates that live in Capitol Lake and its shorelines.
Salmon Habitat Protection and Restoration Plan for Water Resource Inventory Area 13, Deschutes Thurston Conservation District Lead Entity, July 2004	Thurston County plan to present a multi-species approach for developing habitat project lists that lead to restoring and protecting salmon habitat through voluntary projects.
Heritage Park Water and Sediment Quality Assessment Thurston County Environmental Division, January 2003	A report describing the results of the Heritage Park water and sediment quality assessment. Also included in this report is additional sampling data obtained by the City of Olympia during the lake drawdown in July and August 2002.
Capitol Lake Adaptive Management Plan Results for Budd Inlet-Capitol Lake Simulations Final Report Brown and Caldwell, October 2000	The study concludes that eliminating the Capitol Lake drawdown would improve water quality in the West Bay of Budd Inlet, and that substantial water quality improvements to Budd Inlet could be realized through a restored Deschutes Estuary. The study relies on the *Budd Inlet Scientific Study, Final Report, Brown and Caldwell et al., August 1998 and the LOTT NPDES Permit Modifications Modeling, Revised Interim Report, Brown and Caldwell et al., November 1999.*
Deschutes River Off-Channel Habitat Inventory (Maps 1 thru 18) Thurston Regional Council for Squaxin Island Tribe Natural Resources, 1999	Series of maps (18 total) showing habitat within WRIA 13.

Document	Brief Summary
1997 Capitol Lake Drawdown Monitoring Results Entrance, November 1997	A memorandum describing results of the monitoring program for the 1997 Capitol Lake drawdown, including monitoring results related to shoreline habitat and water quality.
A Study of Rates and Factors Influencing Channel Erosion along the Deschutes River, Washington, with Application to Watershed Management Planning Brian Collins, April 1994	Study regarding erosion along the Deschutes River, between its inflow to Capitol Lake at RM 2 and Deschutes Falls at RM 41. The report is intended to support planning objectives including: reducing flooding, reducing loss of land to bank erosion, improving aquatic habitat, and slowing the delivery of sediment to Capitol Lake.
Budd Inlet/Deschutes River Watershed Characterization, Part II, Water Quality Study Thurston County/Washington State Department of Ecology, April 1993	Report prepared by Thurston County, in collaboration with Ecology, and providing results from water quality monitoring along the Deschutes River and tributaries, as well as Budd Inlet and Capitol Lake.
Budd Inlet/Deschutes River Watershed Characterization, Part I, Watershed Description Thurston County/Washington State Department of Ecology, March 1993	Predecessor to the Part II report, describing existing conditions of the natural environment, human environment, and activities throughout the watershed.
Capitol Lake Wetland Development Feasibility Analysis Entranco Engineers, November 1990	A feasibility study of three alternative wetland development concepts for the south and middle basins that would improve water quality in the north basin, defer maintenance dredging, and enhance fish and wildlife habitat.
Capitol Lake North Basin Shoreline Erosion Control Study Entranco Engineering, November 1990	Summarizes the present shoreline erosion conditions of the north basin of Capitol Lake and recommends conceptual repair actions and preliminary costs for planning purposes. The project included a condition survey of the entire north basin shoreline.
Deschutes River/Budd Inlet Watersheds Puget Sound Cooperative River Basin Team, June 1990	A USDA report that discusses forest, rural, and agricultural portions of the watersheds and their impacts on water quality. The report also includes a summary of findings with conclusions and recommendations for the improvement of water quality.
Budd Inlet Action Plan: Initial Data Summaries and Problem Identification U.S. Environmental Protection Agency (TetraTech), April 1988	The report provides information describing the geographic extent and severity of environmental degradation in Budd Inlet. Summaries of existing data are provided for the following indicators of environmental degradation: contaminant sources, eutrophication, microbial contamination, and chemical contamination of sediment and biota. Data that were collected from 1982 to 1987 are presented.
A Plan to Make Capitol Lake Swimming Beach Useable The ORB Organization, 1987	A report describing results from ambient water quality monitoring; intensive stream sampling; marina sampling; sediment sampling; and other special studies to provide a better understanding of water quality throughout the watershed.
Relationships Between Water Quality and Phosphorus Concentrations for Puget Sound Region Lakes Robert J. Gilliom, June 1984	The purpose of the study is to formulate predictive relationships between mean summer total phosphorus concentration and mean summer chlorophyll concentration and Secchi disc transparency for use in the management of Puget Sound region lakes. The predictive relationships developed in the study complement previously developed methods for estimating background and nonpoint source pollution loading for lakes in the region.
Capitol Lake Restoration Analysis Washington State Department of General Administration (prepared by Entranco Engineers), January 1984	A study addressing the prevention of fish kill, the current rate of sediment deposition, the current extent of water quality problems, and the performance of the swim beach restoration.
Deschutes River/Capitol Lake Water Quality Assessment Lynn R. Singleton/Washington State Department of Ecology, September 1982	A literature review that focuses on water quality issues in the watershed.
Water Quality in Capitol Lake Olympia, Washington Ecology (prepared by CH2M HILL), June 1978 Publication No. 78-e07	Concludes that Capitol Lake has experienced chronic algal, turbidity, coliform, and sedimentation problems since it was constructed in 1951. Studies show that the water quality in Capitol Lake is affected by natural and manmade causes. The major detriments to water quality in the watershed are predominantly nonpoint sources of pollution along the Deschutes River, but some point sources exist within the lake.
Hydraulic and Water Quality Research Studies of Capitol Lake Sediment and Restoration Problems College of Engineering, Washington State University, September 1975	A database and recommendation related to sedimentation, water quantity, and water quality, prepared to inform planning, design, and management decisions for dredging, maintenance, and improved utilization of Capitol Lake. Includes a sediment study and water quality study.