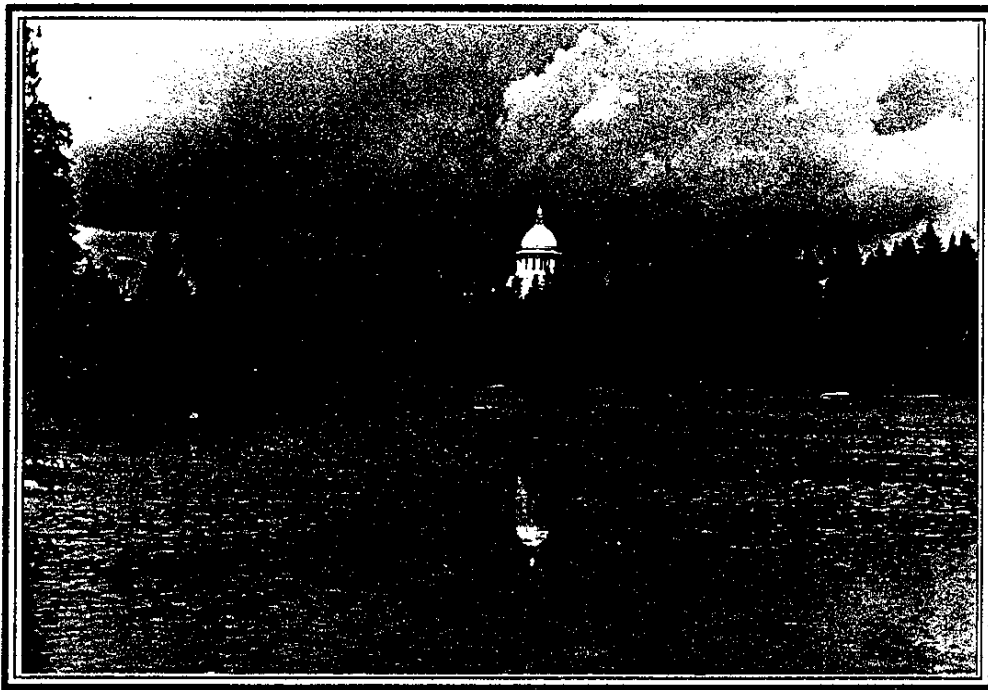




Washington State
Department of General Administration

**EROSION/NONPOINT SOURCE POLLUTION CONTROL PLAN
DESCHUTES RIVER/CAPITOL LAKE SYSTEM**



C A P I T O L L A K E

NOVEMBER 1990



ENTRANCO ENGINEERS, INC.



This report printed on recycled paper.

CAPITOL LAKE

EROSION/NONPOINT SOURCE POLLUTION CONTROL PLAN DESCHUTES RIVER/CAPITOL LAKE SYSTEM

Prepared for

Department of General Administration
State of Washington

Prepared by

ENTRANCO ENGINEERS, INC.

November 1990

EXECUTIVE SUMMARY

The 1989 Washington State Legislature authorized the Department of General Administration to develop this plan for the control of erosion and nonpoint sources of pollution in the Deschutes River Watershed. The Erosion/Nonpoint Source Pollution Control Plan identifies the various kinds and sources of erosion and nonpoint pollution in the watershed and also identifies best management practices (BMPs) for their control. The Plan focuses on the control of sediment (erosion), fecal coliform bacteria, and phosphorus as the dominant nonpoint pollution parameters in the watershed, but also addresses toxic substances, such as pesticides and household hazardous wastes, as well as other pollutants of concern. The Plan evaluates the following land use categories and their associated nonpoint pollution loading sources:

- Forest Lands
- Rural Residential/Agricultural Lands
- Urban Lands

The scope of this report was limited to rely exclusively on recent and historical documentation and personal communication, and precluded the development of new inventories or the collection of new monitoring data. A significant portion of the information contained in this Plan was extracted from the report prepared by the Puget Sound Cooperative River Basin Team (PSCRBT) titled "Deschutes River/Budd Inlet Watersheds" including many of the recommendations contained in that report for best management practices. The Watershed Action Plans for the Henderson and Eld Inlet watersheds and other historical documents were also used as reference documents.

Caution should be used when considering implementation of any of the BMPs listed in this report since there is limited information regarding the degree of water quality benefit that will be realized as a result of implementing a given BMP. Priority should be given to those land use activities with obvious, measurable, and direct adverse impacts to receiving waters. It may be appropriate to conduct site specific water quality monitoring to verify adverse impact prior to BMP implementation. This approach should maximize BMP cost-effectiveness.

It should also be recognized that Thurston County has initiated an 18-month water quality monitoring program in the Deschutes River basin. Data collected by the County will be utilized to locate and prioritize nonpoint source pollution problems in the watershed and provide a better information base on which to build a watershed management plan. Upon completion of the monitoring program the County will be preparing a watershed management plan for the basin under the provisions of WAC 400-12, "Local Planning and Management of Nonpoint Source Pollution". Therefore, information contained in this report should be used on an interim basis only, until the County plan is completed.

PREFACE

A preliminary draft of the Erosion/Nonpoint Source Pollution Control Plan was issued in April 1990. Review comments were subsequently received from the Washington State Departments of Natural Resources, Fisheries, and Ecology as well as the City of Olympia and the Squaxin Island Tribe (included in Appendix A). This version of the document includes a number of revisions based on the comments that were provided. Where revisions were not made, an explanation has been provided in the response to comments, also included in Appendix A.

ACKNOWLEDGEMENTS

This Erosion/Nonpoint Source Pollution Control Plan was funded by a special appropriation as authorized by the 1989 Washington State Legislature. The Plan was completed at the direction of the State of Washington Department of General Administration under the supervision of Nick Cockrell and Bob Arndt, Division of Capitol Management.

The development of the scope of work and reviews of draft reports was greatly enhanced by the cooperative efforts of the members of the Wetland Technical Advisory Committee:

Nick Cockrell	- Washington Department of General Administration
Bob Arndt	- Washington Department of General Administration
Randy Acker	- House of Representatives
Bill Robinson	- House of Representatives
Allen Moore	- Washington Department of Ecology
Brian Benson	- Washington Department of Fisheries
Jeff Skriletz	- Washington Department of Wildlife
Jeff Dickison	- Squaxin Island Tribe
Gregg Grunenfelder	- Thurston County
Rick Nelson	- Thurston County Conservation District
Leonard Smith	- City of Tumwater
Joanne Richter	- City of Olympia

The consultant team for the report included Dale Anderson, David Morency, Gretchen Johnson, and Stacie Martella of Entranco Engineers, Inc.

Special recognition is also extended to Mr. Arden Olsen and Mr. Dan Bigger of the State of Washington Department of National Resources for their review comments on the forest practices section of the report.

CONTENTS **Page**

EXECUTIVE SUMMARY i

PREFACE iii

ACKNOWLEDGEMENTS v

EROSION/NONPOINT SOURCE POLLUTION PROBLEMS 1

RELEVANT NONPOINT SOURCE POLLUTION PLANNING
STUDIES / ACTIVITIES 3

NONPOINT SOURCE POLLUTION AND FORESTRY ACTIVITIES 6

NONPOINT SOURCE POLLUTION AND RURAL /
AGRICULTURAL ACTIVITIES 12

NONPOINT SOURCE POLLUTION AND URBAN LAND USES 17

REFERENCES 22

APPENDICES

- A - Comment Letters and Responses
- B - Preferred Temperature Ranges for Select Species of Fish
- C - Compliance Memorandum of Agreement

EROSION / NONPOINT SOURCE POLLUTION PROBLEMS

Nonpoint sources of pollution, including sediment, bacteria, and phosphorus, represent significant water quality problems affecting the Deschutes River, Capitol Lake, and Budd Inlet. (The Deschutes River/Percival Creek Watershed is shown in figure 1.)

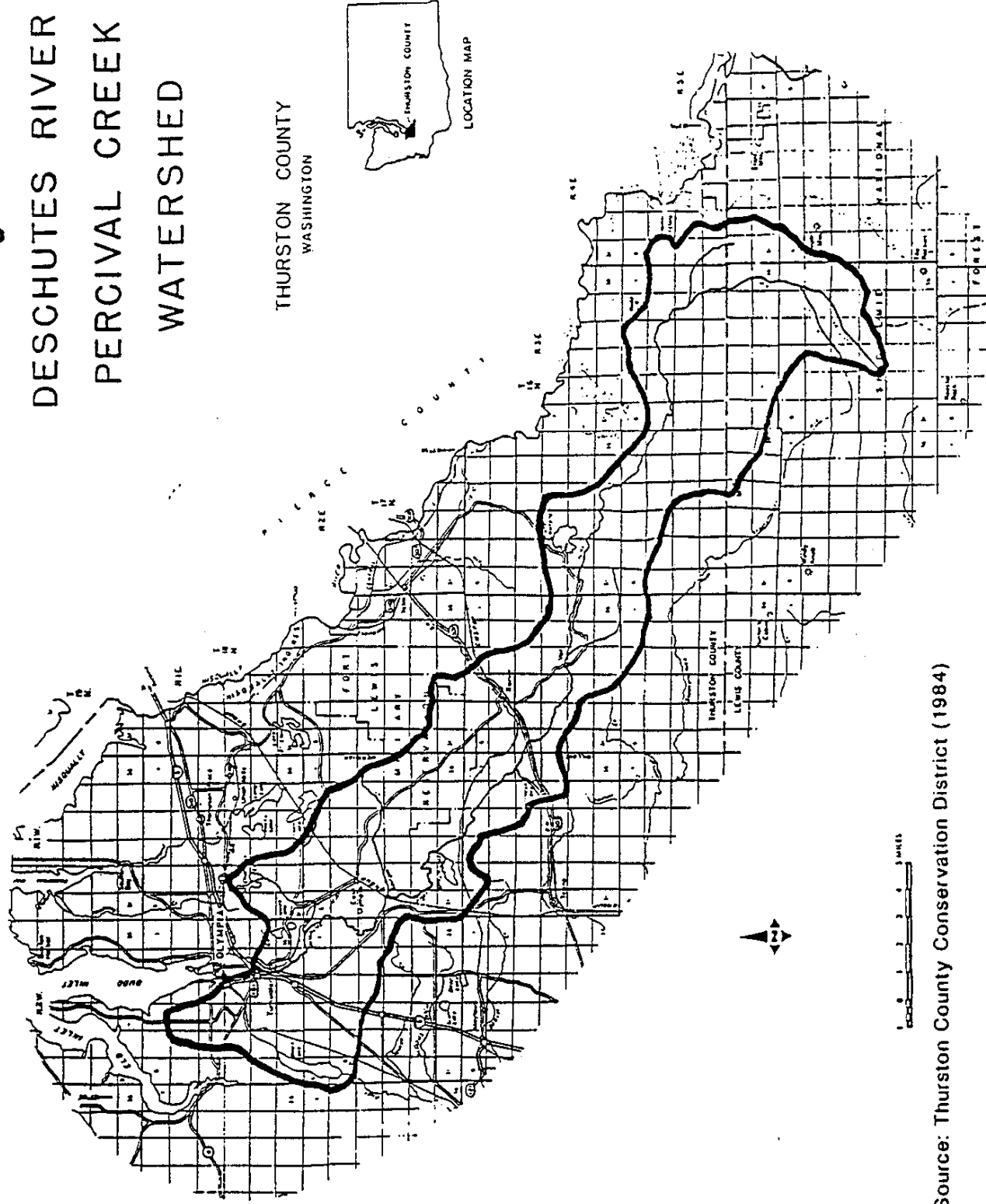
- *Sediment* - Excessive sediment loading to Capitol Lake has led to construction of sediment traps in the middle and south basins, construction of sediment handling facilities in the middle basin, and ongoing costs of an expensive maintenance dredging program (\$1 million per year).
- *Bacteria* - Bacterial loadings from the Deschutes River and Percival Creek watersheds and from the immediate Capitol Lake watershed, have resulted in periodic violations of state water quality standards. Potential sources of bacteria include livestock, failing septic tanks, stormwater runoff, brewery discharges, and waterfowl. High bacterial concentrations led the City of Olympia to close its swimming facilities on the north end of the lake in 1985. Since that time the City has been exploring alternatives for providing swimming to the citizens of Olympia.
- *Phosphorus* - Excessive phosphorus loading to Capitol Lake has led to the development of undesirable algal blooms during most summers, a condition that interferes with safe swimming (excessive turbidity interferes with the ability to spot and rescue drowning swimmers) and overall aesthetic enjoyment and appreciation of the lake. In addition, excessive algae growth can result in oxygen depletion and adverse impacts to fisheries.

Beneficial uses that have been adversely impacted or could be impacted by future nonpoint pollution include:

- Fish rearing/passage spawning
- Flood control
- Shellfish
- Swimming and contact recreation
- Boating and navigation
- Wetlands and wildlife habitat
- Aesthetic enjoyment
- Archaeological and cultural resources

A number of past studies have been conducted to determine the causes of the three main sources of pollution in the Deschutes Capitol Lake system, and to find and implement corrective measures [refer to the summary discussion in Koenings (1989)]. Despite the considerable number of past studies that have been conducted on Capitol Lake and its tributaries, these have seemingly not given sufficient attention to the control of nonpoint pollution in the watershed. Given the potential to control pollution problems at their source, and the potential to minimize the pollution impacts and their associated costs, there is a need to provide a more thorough examination of nonpoint source pollution problems and their control in the Deschutes River and Percival Creek watersheds.

Figure 1
DESCHUTES RIVER /
PERCIVAL CREEK
WATERSHED



Source: Thurston County Conservation District (1984)

Although the State of Washington Department of General Administration has an interest in increasing the understanding of nonpoint source pollution and control, for the reasons stated above, the Department does not presently have the resources to support a detailed watershed management planning effort given the other needs and priorities of this study. Therefore, the Department has determined that it would be useful to review other nonpoint planning studies that have recently been completed in adjoining watersheds, as well as other ongoing and planned activities in the Deschutes River watershed, and to use the understanding gained from such an exercise to develop a set of nonpoint source control recommendations. These recommendations will provide some direction for nonpoint planning and control on an interim basis, until more thorough planning activities can be completed.

RELEVANT NONPOINT SOURCE POLLUTION PLANNING STUDIES / ACTIVITIES

The earliest effort to evaluate nonpoint source pollution in the watershed was made by the Thurston County Conservation District with the completion of the Stream Corridor Management Plan for the Deschutes River, Washington (1984). The Conservation District work focused on river hydrology, erosion, sediment transport and erosion control alternatives. Based on a combination of field work and interpretation of historic aerial photos, the District determined that 140 river bank erosion sites were contributing an estimated 35,000 to 40,000 cubic yards of sediment erosion annually. An estimated 78 percent of this material comprised of fine sands, silts, and clays reaches Capitol Lake. The remaining 22 percent comprised of coarse gravels, cobbles, and boulders is retained in the river channel. (Refer to table 3, page 20 of the District report). In addition, the District identified 49 sites where debris jams (log jams and associated material) were problematic, and 128 sites where leaning trees (caused by channel undercutting and erosion) were creating problems. The District evaluated 21 alternative stream bank protection and erosion control measures.

The District gave greatest attention to a comparison of riprap techniques versus stream corridor conservation techniques. Riprap had several disadvantages including high cost, limited site access for heavy equipment (only 14 out of 140 sites could be treated), potentially high maintenance costs, and questionable effectiveness. The conservation approach could be implemented by the Washington Conservation Corps using manual labor at much lower cost and would involve such measures as pruning and felling of leaning trees, removing organic debris directly responsible for streambank erosion, revegetating raw banks, and fertilization.

The District ultimately recommended the stream corridor conservation approach in combination with a five-year monitoring program. Because the conservation approach was relatively new at the time, the District recommended implementation with ongoing evaluation. Based on observations made during the course of the work, the District was prepared to modify conservation practices or to consider other erosion control measures such as riprap.¹ The recommended program would not eliminate the need for maintenance dredging in Capitol Lake, but might reduce the amount of sediment

¹ Note: There has been some question over the years about the potential effectiveness of using rip-rap for river bank stabilization. Dr. John Orsborn, P.E. (personal communication), a specialist in river hydrology and engineering, says that improperly placed rip-rap can direct river energies in such a way as to create additional downstream erosion. However, he clarifies that rip-rap, log placement, rock placement, bank revegetation and other measures can be used very effectively to enhance bank stability and reduce bank erosion. Each erosion site must be specifically evaluated and engineered for best results.

transport by as much as 3,200 cubic yards per year at an equivalent dredging removal cost of \$38,500 per year.

More emphasis was placed on a more comprehensive approach to nonpoint source control planning in subsequent years. With the adoption of the Puget Sound Water Quality Management Plan in 1987 (Puget Sound Water Quality Authority 1987) a mandate was given to state and local governments to identify nonpoint source pollution problems and to develop action plans for the control of nonpoint source pollution. Watershed action plans have been completed recently for adjacent Henderson Inlet (Thurston County Planning Department 1989) and Eld Inlet (Eld Inlet Watershed Management Committee 1989)—watersheds which lie to the east and west, respectively, of the Deschutes River Watershed.

There is a need for a similar level of nonpoint pollution control planning in the Deschutes River watershed, and Thurston County has identified this watershed as their next nonpoint source planning project. In order to develop a firm technical basis for future planning, the County has obtained a grant from the Washington State Department of Ecology (WDOE) to perform 18 months of baseline sampling in the river. This monitoring began in the summer of 1990. Once the monitoring program is completed, the County intends to begin a watershed planning process, similar to the efforts that have already been completed on Henderson and Eld Inlets, and in accordance with WAC 400-12, "Local Planning and Management of Nonpoint Source Pollution". The watershed planning process for the Budd/Deschutes system should be completed sometime in 1994.

In addition to these County efforts, the Puget Sound Cooperative River Basin Team (PSCRBT), a consortium of experts from various state and federal agencies, has recently completed a draft report (December 1989) which addresses nonpoint sources of pollution in the Budd/Deschutes basin including forestry, agriculture and rural residential activities. The report does not address nonpoint source pollution in the urban area. The PSCRBT report identifies the causes of nonpoint source pollution, provides some quantification of nonpoint problems, and also includes recommendations regarding nonpoint pollution control for each land use category. The report does not attempt to allocate pollutant loading to the river by land use category nor to estimate the amount of pollutant load reductions that might be achieved by implementation of various nonpoint source control techniques. The PSCRBT report is based upon review of a number of recent and past studies to obtain information and reach conclusions; the PSCRBT team also conducted interviews with a number of individuals from various public and private organizations to obtain first hand information regarding existing management practices and problems. Using this approach, the team has provided an assessment of existing conditions and needed nonpoint source control measures. The report is expected to be finalized sometime this year (1990).

The Cities of Olympia and Tumwater and Thurston County are engaged in a drainage basin planning study for the Percival Creek Watershed. This effort is expected to address water quality issues having to do with urban runoff.

Under the direction of the Puget Sound Water Quality Management Plan, the WDOE is working together with the State of Washington Department of Transportation (WSDOT) to develop the Puget Sound Highway Runoff Program (WDOE 1989). This program will require WSDOT to prepare a highway runoff manual that includes various best management practices (BMPs) for highway runoff. Under the draft rules (WAC 173-270), WSDOT would be required to identify and prioritize BMP needs on all existing state highways and to prepare a biennial capital improvement plan for implementation.

Initially, work would be directed to highway facilities with average daily traffic in excess of 50,000. (This number may be revised downward based on public testimony.) These rules are expected to be finalized in 1990 and a highway runoff manual prepared in 1991. Once in place, this program could very likely change the treatment and quality of stormwater runoff that discharges to Capitol Lake from State Highway 101 and Interstate Highway 5 (I-5).

A similar rule, the Puget Sound Stormwater Management Program (WAC 173-275), is being developed by the WDOE. It will require improved water quality management of urban runoff generated by local government. The draft rule is expected to be released as a draft to the public sometime during the fall of 1990. Final rule adoption is expected by June 1991.

Additional information about the nonpoint pollution impacts of forestry activities is being developed under the new Timber:Fish:Wildlife (T/F/W) agreement (see page 9). Although most of these studies are being conducted in other watersheds, the intention is that new understanding about a given nonpoint source problem can be applied to other watershed areas including the Deschutes River watershed. The Cooperative Monitoring Evaluation and Research (CMER) Committee has initiated studies on a number of subjects including (1) the impacts of runoff from the transient snow zone, (2) the impacts of forestry practices on water temperatures and fish rearing potential in small stream reaches, (3) the impacts of road construction and other forestry activities on mass wasting and soil erosion, (4) the cumulative effects of various nonpoint pollution problems, and (5) many other related issues of resource management concern. As with most research, conclusive evidence of cause and effect relationships may take some time to establish. However, these research efforts are expected to contribute significantly to our understanding of nonpoint problems and appropriate management solutions. Modifications to nonpoint source control efforts in the forest zone should be made as new information becomes available.

The studies and ongoing planning activities identified above provide the basis for the following discussion of nonpoint source pollution. Much of the information contained in this section is summarized or taken directly from sources cited, especially the PSCRBT report (1989) and the Henderson Inlet Watershed Action Plan (Thurston County Planning Department 1989). An issue paper and handbook on nonpoint source pollution by the Puget Sound Water Quality Authority were also used in preparing this report (1986, 1989).

Finally, the relationship between nonpoint source planning activities and the Deschutes Corridor Recreation Plan (Thurston Regional Planning Council 1986a) should be addressed. Although there is presently no government sponsored contact recreation in the river or Capitol Lake, the Deschutes Corridor Recreation Plan has identified both swimming and rafting as desirable activities to provide in the lower Deschutes River. It is envisioned that several river access sites might be acquired and improved by local government to support the swimming and rafting activity that is presently occurring at unauthorized locations. With this emphasis on contact recreation, the control of nonpoint pollution, especially those activities that contribute to bacterial contamination (e.g. livestock waste), take on added significance. Swimmers and rafters themselves contribute to nonpoint source bacterial contamination at sites where no sanitary facilities are provided (Johnstone and Bailey 1981). The Recreation Plan indicates that there are several locations along the lower Deschutes River where as many as 100 swimmers/rafters may congregate on a given weekend in the summer. Provision of public sanitary facilities at these locations would be a worthwhile nonpoint source control activity. In addition, stream bank protection measures, as discussed in this nonpoint

source analysis, may be needed to protect any public parkland/facility investments. Thus nonpoint source control activities would appear to be consistent with the Recreation Plan and would not have any adverse impacts on the plan.

NONPOINT SOURCE POLLUTION AND FORESTRY ACTIVITIES

Land Use/Resource Description

Forestry is recognized as an important element of the economy of the State of Washington and Thurston County. This important economic activity must be supported and, at the same time, managed in a manner that minimizes water resource impacts.

The PSCRBT report (1989) provides the following information about forestry activities in the watershed. Forested lands cover over 59 percent (74,654 acres) of the entire Deschutes River/Budd Inlet watershed (126,609 acres), with 46 percent of the total watershed (57,984 acres) being managed for industrial timber production by both public and private organizations. Approximately 21 percent of the industrial forest lands are occupied by trees less than 10 years old; 42 percent are occupied by trees between age 10 and 50 years; and 37 percent are occupied by trees greater than 50 years old. Since trees are not harvested until they reach a minimum age of 50 years, the age distribution of trees gives an indication of the number of acres harvested during the past 50 years, and the potential harvest opportunity in future years. There are also 483 miles of forest roads on these lands.

The largest single owner of forested lands in the watershed is the Weyerhaeuser Timber Company, with 49,480 acres (85 percent) of the industrial timber lands in the watershed. According to the PSCRBT report (1989) tree harvests on Weyerhaeuser lands in the Deschutes watershed are expected to decline during the next 10 years as the company shifts operations to other harvest areas.

The Nonpoint Source Pollution Problem

There are several kinds of potential water pollution that may be associated with forest practices in the Deschutes River watershed. These include:

- Erosion and sedimentation
- Nutrients
- Pesticides
- Organics
- Temperature and dissolved oxygen

Each pollution category is discussed briefly in this section.

The degree of pollution occurring in the watershed at any given point in time is a function of the number of acres of forest land under harvest management, the kind of forest management being practiced, the location of harvest activities. (Impacts are generally greater in locations with steep slopes, higher rainfall, closer proximity to receiving waters, and unstable soil conditions.)

Erosion/Sedimentation

In the Deschutes River watershed, erosion and sedimentation represent the greatest impact from forest practices. Forest roads are a major source of the problem, because of poor construction, improper maintenance, poor drainage design, poor location, or a combination of the above. Since logging roads are unpaved, some erosion and sedimentation of fine sediment particles occurs with every rain storm. A more significant and serious problem is associated with "mass wasting", a condition that involves the movement of large masses of soil. The PSCRBT report (1989) indicated the presence of seven earth slides in the Deschutes River watershed. Five of these are apparently associated with logging roads, and two are related to other forestry management activities, such as loading areas. More recent inventories by the Squaxin Island Tribe have resulted in the identification of 13 new mass wasting sites that resulted from heavy storms in the watershed during the fall-winter of 1989-1990. The Tribe confirms that mass wasting is a problem largely associated with logging roads. The Tribe also indicates that erosion/mass wasting tends to be episodic (occurring at a single point in time) and not necessarily a continual source of sediment (refer to comment letter, Appendix A).

According to the PSCRBT, the earth slide activity associated with roads is due to the fact that:

Roads appear to be designed with insufficient waterhandling capabilities, i.e., not enough culverts, lack of ditch cleaning, waterbarring, out-sloping of roads, insufficient means of removing the water from fill slopes, or the lack of road closures.

The report also indicated that these slides were typically occurring in the upper watershed in areas of steep slope, high rainfall, and unstable soils types.

Other logging activities can contribute to erosion and sedimentation, such as exposed soils at log landing areas, harvesting too close to receiving streams, and similar activities.

The impacts associated with erosion/sedimentation can be very significant. Impacts to fisheries are well-known, including loss of rearing and spawning habitat, loss of fish food habitat, and direct impacts to respiration caused by clogging of the gills. According to the PSCRBT report, sedimentation in Capitol Lake has also reduced its juvenile salmon rearing capacity.

Accumulated sediments can also contribute to flooding in locations where channel and culvert capacities have been restricted. The PSCRBT report (1989) indicates that significant sediment accumulation (aggradation) has occurred in the Deschutes River downstream from Road 1000. This is evidenced by the river's transformation from a meandering to a braided channel configuration. This implies that the original channel has become too shallow to carry peak flows and that additional channels have formed to carry the total flow. This also means that additional erosion is taking place as new channels are formed, and that the river is out of equilibrium and may continue to be so for a considerable number of years until accumulated sediments are eventually carried downstream.

Ultimately, these sediments reach Capitol Lake and Budd Inlet, where they are interfering with such beneficial uses as flood control and navigation, and where expensive dredging programs are required to maintain the status quo. The PSCRBT report

summarizes previous sediment loading rate estimates from eight different studies and reports a range of 20,100 to 85,600 cubic yards per year. The PSCRBT report estimated dredging costs at \$12 to \$22 per cubic yard; this would represent a potential annual cost of \$241,200 to \$1,883,200. (Note: Both the estimated sediment accumulation rates and estimated unit costs for dredging, as specified in the PSCRBT report, have a greater upper range than values presented by Entranco (1984).)

Nutrients and Organics

Excessive nutrients (nitrogen and phosphorus) and organic compounds in surface waters can be caused by the same forestry practices that contribute to erosion and sedimentation. The upper soil layer is typically comprised of decomposing plant materials that include a high percentage of organic compounds and nutrients. In addition, nitrogen compounds can also increase in receiving waters as a result of forest fertilization. According to the PSCRBT report (1989), Weyerhaeuser fertilizes with urea nitrogen on a five-year frequency, at a rate of 200 pounds per acre on stands between 18 and 35 years of age. Although forest fertilization has been practiced in the Deschutes River watershed, there is no indication from historical data that nitrogen levels in the Deschutes River, Capitol Lake, or Budd Inlet are being adversely affected. A recent study on Capitol Lake (Entranco Engineers 1984) indicated that the lake is typically phosphorus limited, so that increased nitrogen levels would not be expected to result in increased algal growth. Although Budd Inlet is nitrogen limited, recent studies of the inlet (URS 1986) indicate that the LOTT sewage treatment plant is the dominant source of nitrogen loading to the inlet and that Capitol Lake and the Deschutes River contribute no more than about 10 to 30 percent of the total. Whether there are more localized impacts to receiving streams near the point of application in the watershed is not known and could be a subject for further investigation.

Increased phosphorus loading can contribute to increased eutrophication (increased algal growth and reduced water clarity) in Capitol Lake. However, there is no existing data that would indicate what percentage of total river phosphorus loading is attributed to forestry practices in the watershed in comparison to other sources such as livestock. This too could be a subject for further investigation.

Organic compounds, introduced at undesirable relatively high concentrations, can contribute to biochemical oxygen demand (BOD) and undesirable low dissolved oxygen concentrations. Again, however, there is no historical data that would indicate that forestry practices are contributing to high BOD levels in the Deschutes River, Capitol Lake or Budd Inlet. Most of the documented dissolved oxygen problems in Capitol Lake have been attributed to the trapping of marine water in so-called tide gate craters (Entranco Engineers 1984), and routine monitoring data indicates that dissolved oxygen levels typically range from 7.0 to 17.5 mg/l, within acceptable levels. And although the Deschutes River BOD loading represents about 60 to 80 percent of the total surface BOD loading to Budd Inlet, this load represents only 10 percent of the total BOD load in the inlet (URS 1986). The remaining 90 percent is the result of algal decomposition at the sediment water interface. This algal growth is stimulated primarily by nutrients that are discharged to Budd Inlet by the LOTT sewage plant (URS 1986).

Dissolved oxygen problems that have been observed in Percival Cove (J. Dickison, pers. comm.) could be the result of a number of factors, including increased algal production and BOD loading from Black Lake, increased BOD loading from increased urban runoff in the Percival Creek watershed, and/or the result of accumulating fish

feed and fish waste in the Cove in connection with fish rearing operations. It is unlikely that any dissolved oxygen problems in the Cove would be attributed to forest practices.

Pesticides

If improperly applied, herbicides used in the forest industry can result in toxicity to fish and wildlife and can destroy vegetation in undesirable locations (e.g. along stream-banks). Pesticide practices are covered by WAC 222-38 "Forest Chemicals". Present practice is not known to be the cause of any significant water quality problems in the watershed. However, pesticide practices have been the subject of discussion at many T/F/W meetings and attempts are still being made to improve procedures to keep pesticides out of waterways. Obviously, whenever toxic chemicals are used there is the risk of accidental spillage and or misapplication resulting from human error. The intent of existing forest practices and regulations is to minimize this risk.

Temperature and Dissolved Oxygen

Clearcutting also has the potential to adversely impact stream temperatures and dissolved oxygen levels in a manner that can be detrimental to fish life. This can occur when streamside vegetation and its shading effects are removed. Loss of shading results in increased water temperatures, primarily during summer months. Since dissolved oxygen levels decrease in water as temperature increases, loss of shading can produce synergistic stress effects on fish (high temperatures and low dissolved oxygen). Although the Washington Forest Practices Rules and Regulations (Washington Forest Practices Board 1988) include provisions for protecting streams from loss of shading, protective measures are greatest for larger Type 1, 2, and 3 streams, and less stringent for Type 4 and 5 watercourses. Unpublished research conducted by the Cooperative Monitoring, Evaluation and Research Committee has apparently revealed that the smaller streams are more susceptible to temperature effects (J. Dickison, pers. comm.) and that the real impact of present forest practices may be greater than previously recognized. It should also be noted that Type 1 streams are also protected under the Shoreline Management Act.

Stream temperature monitoring in the Deer Creek watershed (a tributary of the Stillaguamish River in Snohomish County) by the Tulalip Indian Tribe revealed water temperatures exceeding 20 degrees centigrade at a number of locations during the months of July and August (Snohomish County Public Works 1989). Although the Tulalip Tribe was unable to distinguish whether these temperatures were increased above normal levels by forestry practices, they did conclude that there were potential impacts to desirable fish species when compared to preferred species temperature ranges (see Appendix B of this report). This kind of data from other Puget Sound watersheds indicates the need for continued concern and surveillance in the Deschutes River Watershed.

Effects of Clearcutting on Hydrology and Erosion

In addition to these water quality problems, the PSCRBT report (1989) also gives considerable attention to the notion that clear cut areas can contribute to increased rates of runoff as compared to forested areas. This is apparently most significant in the so-called "transient snow zone" where accumulated snow in clear cut areas melts more rapidly with rain on snow events than in areas covered by trees. This becomes potentially significant in watersheds where large acres of land have been clear cut in a relatively short period of time. Increased runoff increases the potential for both stream-

bank erosion in the mainstem of the Deschutes River and downstream sedimentation and flooding. The Thurston County Soil Conservation District (1974) also indicated that clearcutting practices in the Deschutes River Watershed could be contributing to increased river flows and subsequent increases in in-stream bank erosion and sedimentation. Additional watershed-specific studies may be needed to confirm or disprove this conclusion. Dennis Harr of the University of Washington is conducting additional research on this topic at various locations in the Puget Sound and should be contacted for additional information.

The Regulatory Setting

Forest practices on state and private lands in Washington are regulated primarily by the State of Washington Department of Natural Resources under the provisions of the Forest Practices Act of 1974 (RCW 76.09 and WAC 222). The Forest Practices Act specifies approved forest practices for harvesting, road construction and maintenance, reforestation, site preparation, and use of chemicals. Under the act, review, inspection and approval of forest practices is to be carried out with input from the Departments of Ecology, Fisheries, and Wildlife.

Although this basic regulatory framework brought substantial improvement to forest practices, some controversy continued to exist between environmental organizations, Indian Tribes, Department of Fisheries, Department of Natural Resources and the forestry industry. A unique agreement, known as the Timber/Fish/Wildlife (T/F/W) Agreement, was reached between these parties in January 1987. The agreement established a new cooperative approach to resource management. As described by the Puget Sound Water Quality Authority (1989), the T/F/W agreement has four major components:

- Revised rules and regulations for forest practices;
- Voluntary opportunities for habitat enhancement;
- Programs of cooperative monitoring/evaluation/research; and
- A process for site specific problem solving.

Activities under the jurisdiction of the new agreement include forest roads, riparian management zones (RMZs), upland management areas (UMAs), unstable slopes, timber harvesting, silviculture, archaeological/cultural sites, old growth, cumulative effects, corrective action, and incentives and compensation. [Refer to Department of Natural Resources (1987) for a complete description of the agreement.]

The new T/F/W agreement has become such an important aspect of forestry management, that the Puget Sound Water Quality Authority has directed the various non-point source watershed planning committees to coordinate all forestry-related planning activities through the appropriate T/F/W coordinators and committees. There is a special Central Puget Sound Region T/F/W Coordinator with the Department of Natural Resources in Chehalis, with jurisdiction over the Deschutes River Watershed (telephone: 753-3410).

Recommended Best Management Practices

It is not the intent of this section of the report to reiterate the significant body of management practices that have already been documented in the Forest Practices Act and the T/F/W agreement, but rather to identify those aspects of forest management in

the Deschutes River system that seem to need specific attention. The following recommendations have been adapted from the PSCRBT report (1989):

- Increase the size and number of culverts and provide downspouts to the toe of the slope (with riprap outfall) on forest roads to move water from the roads more efficiently and to help reduce the potential for slides.
- Use water bars to remove water from the surface of low-traffic or abandoned roads. Consider improved roadbed construction, improved drainage facilities and/or limited wet weather hauling on roads in active use.
- Provide more intensive road and drainage facility maintenance in landslide prone areas, including the use of storm patrols during periods of heavy rainfall and runoff.
- Close "orphaned" (abandoned) roads using an approved closure procedure (WAC 222-24-050). Provide adequate road maintenance for other roads in use.
- Consider the use of skyline logging, slack line, or other yarding systems to provide full or partial suspension of logs in areas of steep and unstable slopes where the risk of landslides is great.
- Develop limitations for the size of clear cuts, buffer, and space cuts so as to minimize cumulative runoff impacts in the transient snow zone. Base recommendations on the results of studies by Dennis Harr, University of Washington (in progress) and in cooperation with the Sustainable Forestry Roundtable Coalition.
- Continue to follow Forest Practices Rules for streamside buffers. Adequate buffering is apparently being provided on type 1, 2, and 3 streams, but more attention may be needed on type 4 and 5 streams.
- Retain adequate buffers around all wetlands.
- Develop a water quality monitoring program to measure the benefits of BMP implementation and coordinate the program with T/F/W, Thurston County and others with interests in monitoring results.
- Continue to support the forest cumulative effects studies under T/F/W.
- Continue to support the T/F/W Steering Committee on sedimentation, hydrology and mass wasting, and revise forestry practices in the Deschutes River watershed in accordance with any new findings.
- Provide public education regarding forestry and nonpoint pollution. Maximize use of existing information available through the TFW Training/Information/Education Committee.
- Attend the annual Weyerhaeuser forest management review and provide input to management decisions. Contact the DNR Central Region office and Weyerhaeuser to coordinate involvement.

In addition to the recommendations made in the PSCRBT report, the following actions are also recommended:

- Provide additional evaluation of the measures to reduce river bank erosion, including the selective use of riprap, bioengineering approaches, and/or channel deepening. Sites identified by the Thurston County Conservation District (1984) should be revisited by a qualified engineer and a representative of the Washington Conservation Corps, and representatives from Thurston County, The Conservation District, the Departments of Fisheries and Wildlife, and the Squaxin Island Tribe to develop site specific recommendations and cost estimates, develop a capitol improvement plan and implementation schedule.*
- Consider need for improved staffing and monitoring by local government of the conversion of forest lands to rural and urban uses.
- In areas where erosion and sediment problems begin to develop, (e.g. in the vicinity of log yarding and landing sites) provide conventional erosion control measures such as straw bales, filter fences, or check dams to reduce downstream impacts.
- Encourage alternatives to the use of pesticides such as hand slashing. Consider integrated pest management practices that provide best control with least environmental and economic impact.
- Encourage active involvement of the Budd/Deschutes Watershed Management Committee in the T/F/W coordination process, including an annual watershed inspection to evaluate areas of high erosion potential, and better site access for local government officials in connection with the permit review process.
- In cases where landslides are contributing significantly to erosion problems, consider means by which the landowner can stabilize the slide and mitigate further adverse impact.*
- Encourage continued development of GIS (geographic information system) mapping of sensitive soil geologic units by DNR as a means of focusing non-point source control activities (e.g. road maintenance).

* Indicates need for additional scientific and/or engineering studies.

NONPOINT SOURCE POLLUTION AND RURAL / AGRICULTURAL ACTIVITIES

Land Use/Resource Description

The PSCRBT report (1989) included a variety of land use activities under the rural/agricultural category: rural residential uses (up to 20 acres without livestock), small farms (with one to 50 livestock), commercial farms (with more than 50 livestock), and woodlots. This land use category generally lies in between the urban area to the north and the commercial forest zone to the south. All together, rural/agricultural uses comprise about 44,000 acres, or 35 percent of the total watershed area.

The PSCRBT report (1989) indicates that rural residential land use covers 15,807 acres (35 percent of the rural agricultural category), with 8,203 housing units (91 percent) and 27,950 residents (87 percent). Small farms comprise 8,052 acres (18 per-

cent of the rural agricultural land category) with lot sizes ranging from 1.5 to more than 20 acres. Population is estimated at 619 residents or seven percent of the category total. Total livestock numbers for small farms are estimated at 3,500 animals, with densities ranging from 0.5 to 2.2 animals per acre. Commercial farms cover 2,296 acres or five percent of the total category. Population is only 61 (less than one percent of total). The total livestock count is estimated at 2,213 animals. The commercial farms include four dairies and 15 beef operations. One of the dairies includes 97,000 chickens and a sheep operation. Finally, woodlots cover an estimated 16,899 acres or 35 percent of this land use category and include mature forest lands in small ownerships, Christmas tree farms, and firewood lots. The population is 503 residents or five percent of the total category.

The Nonpoint Source Pollution Problem

The kinds of nonpoint pollution differ among the land uses within this category and so this discussion is organized accordingly. Again, the majority of this section is derived from the PSCRBT report (1989).

Rural Residential

On-site wastewater disposal is one of greatest potential sources of nonpoint pollution associated with this land use. There are a number of variables affecting the pollutant loading potential of each individual on-site system including such factors as age, design and construction technique, maintenance frequency, soil type and slope, proximity to ground and surface waters, wasteload rate (number of users) and others. In general, on-site wastewater disposal is a relatively good method of wastewater treatment and disposal for such rural areas and the majority of systems are normally functioning without significant pollution impact. A typical failure rate study might find as many as 15 percent of systems with detectable problems that need correction.

According to a survey conducted by the PSCRBT, 34 percent of the households in the rural residential area of the Deschutes River watershed had their septic tanks pumped during the past five years (the recommended pumpout interval). Interestingly, 44 percent of the systems over five years old had never been pumped out. Also of interest is the fact that 97 percent of all units are located on soils that have been identified as having severe limitations for septic tank drainfield use, the majority of soils being limited by excessive drainage (poor filtration) or poor drainage (effluent tends to surface because of hardpan or otherwise poor-draining soils). The average age of systems in the rural area is 13.5 years.

In areas with excessive drainage the greatest potential impact is to groundwater and drinking water supplies. Groundwater supplies can be contaminated by nitrate nitrogen (a cause of methemoglobinemia in infants), bacteria (indicators of pathogens), or other pollutants where soils are comprised of coarse sands, gravels and cobbles. Poorly draining soils are more likely to be associated with impacts to surface waters such as rivers and streams. Surfacing effluent can result in excessive concentrations of bacteria and nutrients. These problems are more likely to be apparent during the winter months when soils become saturated as a result of high precipitation and surface runoff.

Septic tank systems that are located in areas of high ground water table and or flood prone areas are most likely to fail and produce pollution problems. There are ap-

parently some homes located in the flood plain of the Deschutes River in the vicinity of Henderson Boulevard that fall within this category.

Household chemicals such as fertilizers, pesticides, paints, automotive fluids and similar materials are another source of nonpoint pollution associated with this land use category. If not properly disposed, these chemicals can result in contamination of ground and surface waters.

Stormwater runoff from impervious surfaces is also of some concern in rural areas. Usually, the greatest concern is related to the method of private and county maintenance of roadside drainage ditches, which may involve the use of mechanical equipment or herbicides to totally remove vegetation. Both methods can reduce the water quality treatment benefits of the vegetation. Use of mechanical methods can expose disturbed soils which can then contribute to erosion/sedimentation problems.

Another potentially significant source of nonpoint pollution associated with rural residential land uses which was not mentioned in the PSCRBT report, is erosion and sedimentation associated with site development and construction. In rural areas such impacts are generally spread out over time. Nevertheless, impacts can be significant, especially when building sites and construction activities occur during the rainy season and/or in close proximity to surface waters. Potential impacts are the same as those already discussed in connection with forest practices, but clearly would be more localized and smaller in overall scale.

Small Farms

Small farms have the same potential residential impacts as those described under the rural residential category above, although they are less likely to be problematic in view of the smaller population and lower density. The two greatest potential impacts associated with small farms are livestock waste (a source of bacteria, nutrients and organics), and erosion/sedimentation caused by overgrazed pasture or direct livestock access to receiving streams. The potential impact of each small farm unit is related to such factors as the livestock density, manure management practices, and proximity to receiving waters. In general, livestock density is inversely proportional to parcel size with the greatest densities occurring on the smallest lots.

According to the PSCRBT report (1989), small farms in the watershed account for a total of 3,500 livestock. In general, there are a number of small farms in the watershed where the number of livestock exceed recommended guidelines for the size of available pasture. Manure management practices are either absent or inadequate in most cases. A common waste management practice in the watershed is to spread manure on pasture or other lands during winter months when rainfall and runoff are more likely to result in significant pollutant washoff. A significant percentage of small farm units provide animals with direct access to streams, where impacts are greater than farm units that are more remote from receiving waters.

Commercial Farms

Potential residential impacts are insignificant with this use category and impacts are almost entirely associated with livestock. Pollutants and their potential impacts are the same as those described above for small farms. With an estimated 2,213 animals, the total number of livestock is actually less than the total number for small farm units.

The human population equivalent is 22,000 to 33,200. As previously indicated, there are both dairy and beef cattle operations in the watershed as well as two horse stables, some sheep, and 97,000 chickens. As with the small farm units, commercial operations generally apply manure wastes year around and there are also some cases where livestock have direct access to the river and tributary streams. The combination of small and commercial farms is considered to be an important contributor to high bacterial and phosphorus levels in the Deschutes River (Entranco Engineers 1984, Thurston County Health Department 1986, and PSCRBT 1989).

Agricultural pesticides and fertilizers can also contribute to nonpoint pollution. It should be noted that use of commercial fertilizers is relatively limited in areas where livestock raising is the primary agricultural activity since livestock wastes are used as the main source of fertilizer and thus fertilizer management/impacts are identical to manure management. Agricultural pesticides are used to control undesirable plant species and have been the source of nonpoint pollution elsewhere in Thurston County. In addition, many commercial farms have large farm machinery, and may have fuel and oil handling problems or storage facilities that could contribute to nonpoint pollution.

Woodlots

Although woodlots represent a relatively significant land area in the rural / agricultural land use category, these lands are managed in such a manner as to pose a relatively minor threat of nonpoint pollution.

The Regulatory Setting

The Thurston County Health Department is largely responsible for permitting on-site wastewater facilities in the watershed and for developing maintenance regulations. County regulations may be affected by new state regulations developed by the Washington Department of Social and Health Services, as required by the Puget Sound Water Quality Management Plan. In addition, the Nonpoint Rule (WAC 400-12) requires watershed management committees to incorporate specific on-site sewage disposal strategies.

Agricultural activities are largely managed on a voluntary basis by the individual landowners, with technical assistance provided by various local, state, and federal agencies. The Thurston County Conservation District is the local agency that works directly with the farmers and acts as a clearinghouse and directory for other programs. Conservation Districts are required by the Nonpoint Rule to assist farmers in the development and evaluation of farm plans which specify BMPs for individual farm operations. Additional assistance is available through the U.S. Soil Conservation Service and state Cooperative Extension Service. Again, the Nonpoint Rule (WAC 400-12) requires watershed management committees to develop control strategies for agricultural activities. The WDOE can also be involved in agricultural activities where water quality violations have occurred. Agricultural nonpoint source pollution control activities in Thurston County are also subject to the Compliance Memorandum Agreement between the WDOE, the Washington State Conservation Commission, and the Thurston County Conservation District (see Appendix C).

Recommended Best Management Practices

Except as noted, the following recommendations have been derived directly or adapted from the PSCRBT report (1989).

- The Thurston County Conservation District and Thurston County Health Departments should conduct detailed farm and stream walk inventories to confirm the work of the PSCRBT (1989) and to prioritize problem farms and stream corridor reaches for BMP implementation. (This recommendation was not part of the PSCRBT report.)*
- The Thurston County Conservation District should be requested to prioritize their work with both small and commercial farm operators in the watershed to develop site specific farm plans. Each farm plan should include one or more BMPs necessary to control nonpoint pollution. Areas needing the greatest attention include: (1) livestock waste management with six months waste storage and proper timing of land application (April-September); (2) use of fencing, vegetation buffers and alternative water supply measures to keep livestock out of the river and its tributaries; (3) guidelines on proper livestock densities necessary to maintain favorable pasture conditions; and (4) educational materials on proper application of fertilizers and pesticides and proper handling of other toxic substances such as machinery fuel and oil. During the interim period, prior to the development of the County watershed management plan, compliance should be strictly voluntary, unless water quality violations can be demonstrated. The County plan, when it is developed, should consider means of enforcement in instances where voluntary compliance is ineffective. The farm plans should also consider the potential economic impacts and should include a time table and financing program consistent with the farmers' ability to pay. Farm plans should be developed on a priority basis, with first consideration given to those farms having the greatest impact.
- The Conservation District and Health Department should meet annually to review the status of BMP implementation on farm lands, to conduct additional field investigations as needed, and to make adjustments in the implementation plan as needed. (This recommendation was not part of the PSCRBT report).
- Establish stream corridor zones within the Rural/Agricultural area to retain the productive capacities of these habitats for fisheries and wildlife, to reduce streambank erosion, and to retain their filtering and assimilative capacities to rid streams of sediment and other pollutants. This work should use the existing Thurston Regional Planning documents: Wetlands and Stream Corridor Program Phase II (1987). Any work in the Percival Creek area should build upon the Percival Creek Corridor Plans (1985 and 1986).
- Develop a program in the Rural/Agricultural area which encourages the retention or the reestablishment of vegetation, especially native vegetation, within all stream corridors.
- Develop a watershed-wide program that requires preventative maintenance for septic systems.
- Provide sanitation facilities and garbage cans at swimming/rafting locations along the lower Deschutes River in accordance with the Deschutes Corridor Recreation Plan. (This recommendation was not part of the PSCRBT report.)

- Conduct an on-site system failure survey for all homes in the watershed (this should be performed by qualified individuals from the Thurston County Environmental Health Department) and recommend corrective actions for failing systems and more detailed evaluation of any suspect systems. Consider the design and construction of community drainfields and other innovative approaches where appropriate. Prioritize problem sites and develop an implementation plan. (This recommendation was not part of the PSCRBT report).*
- Develop educational materials specifically for the Deschutes River watershed describing the nonpoint sources of pollution and the corresponding best management practices. A BMP handbook should address proper septic system maintenance, disposal of household waste, erosion control during site clearing and construction, and proper livestock and waste management. Considerable information is being generated through the Public Information and Education (PIE) program that can be adapted for use in this watershed. In addition, workshops, field trips, videos, and demonstration projects can be employed to enhance knowledge of nonpoint pollution and BMPs. Educational efforts should be coordinated through the Grange, Farm Bureau, Agriculture Advisory Committee, Dairymen's Federation and other groups interested in agriculture.*
- Develop and implement a water quality monitoring plan to better evaluate levels and sources of nonpoint pollution, to monitor the success of corrective actions, and to determine the need for additional action. The monitoring program being initiated by Thurston County should be the starting point for a long term monitoring program in the watershed.
- The County, Conservation District, and WDOE should develop a compliance agreement for the Deschutes River watershed similar to the one described in the Eld Inlet Watershed Action Plan (1989). (This recommendation was not included in the PSCRBT report.)

** Indicates need for additional scientific and/or engineering studies.*

NONPOINT SOURCE POLLUTION AND URBAN LAND USES

Land Use/Resource Description

The lower portion of the Deschutes River watershed is comprised of urban land uses including portions of the Cities of Olympia, Lacey, and Tumwater. According to the PSCRBT report (1989), urban land use covers 13,862 acres or 11 percent of the total watershed area. The urban area includes an estimated 24,447 housing units (73 percent of total watershed) and a residential population of 52,150 (63 percent of total watershed). The majority of this area is served by conventional sewage collection and treatment although there are some homes served by on-site wastewater systems. Large portions of the urban area are also impervious and thus require storm sewers to collect and discharge runoff to Percival Creek and Capitol Lake.

The Nonpoint Source Pollution Problem

The major source of nonpoint pollution in urbanizing areas is stormwater runoff from streets, highways, rooftops, and other impervious surfaces. Stormwater typically

contains relatively high concentrations of nutrients, bacteria, sediments, various metals (lead, copper, and zinc), organic compounds, and oil and grease. A broad range of other kinds of toxic compounds can also be introduced to stormwater facilities as a result of accidental or unregulated discharges from gas stations and other commercial or light industrial users. Nutrients, bacteria, organics, and sediments can have the kinds of adverse impacts already discussed in previous sections of this report. Oil and grease can be toxic at higher concentrations (usually only occurring with large spills) and otherwise unsightly if concentrations are high enough to produce visible sheens. Metals can also be toxic at high concentrations, especially in the sediments near outfall pipes where they tend to accumulate. Stormwater discharges to Capitol Lake were monitored for nutrients and bacteria by Entranco Engineers (1984). High concentrations of phosphorus and bacteria were found. Despite the high concentrations, however, the relative significance of the loading to Capitol Lake was quite small, since the amount of flow is relatively small compared to river and stream flow contributions. For example, runoff represented less than 3 percent of the total phosphorus loading to Capitol Lake, according to the Entranco study.

Although there are relatively few dwelling units using on-site systems in the urban area, they can have the same problems discussed above under the Rural/Agricultural category.

Site clearing and grading and temporary erosion/sedimentation is another source of nonpoint pollution in the watershed. Nutrient and sediment loading impacts can be significant especially if relatively steep and erodible soils are exposed during the high runoff period and in close proximity to receiving waters.

Household wastes represent a special kind of nonpoint source problem in urban areas given that they are sometimes improperly disposed in storm sewer systems. Again, such materials as automotive fluids, paints, pesticides, fertilizers, and cleaning solvents may be involved. Most of these materials are toxic to aquatic life if they occur at sufficiently high concentrations in the environment.

Another potential source of pollution originating from the urban area may be associated with sanitary sewers. Although sanitary sewers are typically considered as a point source problem, there may be situations under which they contribute pollutant loading in a more nonpoint fashion. One concern involves potential sanitary sewer overflows during periods of high rainfall and runoff. This can occur if the combination of wastewater and infiltration and inflow exceeds pipe capacity at any point along the pipe transmission route. If this does occur, then wastewater can surcharge through manholes and flow into storm sewer systems to receiving waters. Failing lift stations can lead to similar problems. In addition, there may be old sewer pipes serving portions of the sewer service area that either have poor joint connections or that may have been damaged by tree roots or some other means. This kind of damaged pipe system could allow wastewater to leach into the ground and ultimately to receiving waters. In any case, relatively high concentrations of nutrients, bacteria, and organic compounds could be discharged.

Finally, fish rearing activities should be considered as a nonpoint source of nutrient pollution in the urban area, since Capitol Lake and Percival Cove are the areas where fish rearing takes place. The Department of Fisheries rears and feeds 7.1 million fall chinook salmon (150-250 fish per pound) in Capitol Lake from April to June each year and 100,000 fall chinook (5-25 fish per pound) in Percival Cove between October and May each year. In addition, there are adult returns of chinook, coho, steelhead, and searun cutthroat trout which spend at least some time in Capitol Lake. The fish ex-

creta and unconsumed fish food are sources of nutrients to Capitol Lake. Although the benefits of these fisheries undoubtedly outweigh the nutrient loading impact, the contribution should be considered as part of the total load to the system, and management practices should be evaluated to determine if there are any potential modifications that would minimize impacts.

The Regulatory Setting

Stormwater is managed by Thurston County and the Cities of Lacey, Olympia, and Tumwater Public Works Engineering Departments. Each has a stormwater utility, and the four jurisdictions are working cooperatively on a drainage design manual. These organizations are responsible for the review and approval of site clearing, grading, and drainage plans for new developments and are also responsible for the operation and maintenance of all public facilities except those under the jurisdiction of the state. State and federal highways come under the jurisdiction of the WSDOT. As indicated in the beginning of this report, the WDOE is developing new regulations that will affect stormwater management practices by each of these organizations.

On-site wastewater facilities and household chemical practices come under the jurisdiction of the Thurston County Health Department as previously described.

Sanitary wastewater facilities are owned and operated jointly by LOTT, in a cooperative arrangement involving the County and the three municipalities. LOTT facilities are also regulated by the WDOE and the U.S. EPA.

Fisheries activities are the joint responsibility of the Department of Fisheries, Department of Wildlife, and the Squaxin Island Tribe.

Recommended Best Management Practices

Recommendations relating to stormwater in this section were largely derived from the Henderson and Eld Inlet Watershed Action Plans (1989). Other recommendations were provided by Entranco Engineers.

- Complete the Percival Creek Drainage Basin Plan and implement recommendations. Consider the need for drainage basin planning in other urban or urbanizing areas draining to Capitol Lake such as the area east of Capitol Lake, portions of the city of Tumwater and the Chambers Creek watershed.*
- Review and implement the provisions of the Wetlands and Stream Corridors Phase II report (Thurston Regional Planning Council 1987) and the Percival Creek Corridor Plan (ibid 1985 and 1986), including the provision of proper stream and wetland buffers.
- Inventory existing stormwater outfalls and consider measures to retrofit drainage facilities to improve water quality treatment, such as providing detention ponds, manmade wetlands, and using grass-lined swales. Stormwater outfalls should not be allowed to discharge at the tops of steep slopes in such a manner as to promote erosion. Prioritize and develop a capitol improvement plan and schedule.*

- Inventory existing stormwater detention facilities and consider measures to retrofit these facilities that would improve water quantity control and quality treatment efficiencies: for example: multiple orifice outlets, energy dissipation at the inlet, permanent ponding, and use of wetland vegetation. Prioritize these measures and develop a capital improvement plan and schedule. Also identify any facilities that are not presently maintained or properly maintained and develop and implement new maintenance regulations.*
- Review existing drainage ordinances to ensure that water quality treatment language is included. Promote the use of innovative control measures.
- Support the implementation of the water quality treatment provisions of the new Drainage Design Manual.
- Develop policies for roadside ditch maintenance which encourage retention of vegetation that will enhance water quality treatment.
- Provide educational materials and collection programs that will remind and encourage homeowners of the need to properly dispose of toxic chemicals.
- Provide educational materials to building contractors regarding erosion control methods for single lot construction.
- Require daily erosion control inspection for development sites that are under construction during the rainy season (October to March).
- Require stormwater treatment for new construction prior to discharge to streams, lakes, ponds, or wetlands.
- Conduct a monitoring program of selected sanitary sewer manholes during winter runoff events and assess the degree of surcharge, water quality impact and need for mitigation.*
- Conduct dye and or leachate studies to assess the extent of leakage from old sewer lines. This work should be initiated in the vicinity of the east shore of the north basin of Capitol Lake and extended to other suspect locations depending upon results.*
- Coordinate with WSDOT regarding the provision of stormwater BMPs for runoff from state highways.
- Consider the use of manmade wetlands, soil infiltration, grass-lined swales and grasscrete for new construction.
- Identify corrective measures needed to stabilize erosion sites in the Percival Creek Canyon. Develop a capital improvement plan and implementation schedule.*
- Follow the recommendations in the Rural Agricultural category regarding on-site wastewater disposal systems.
- Coordinate with the Washington Departments of Fisheries and Wildlife to obtain estimates of fish excreta and quantities of fish food used in Capitol Lake and

Percival Cove. Estimate nutrient loading impacts and consider management alternatives for reducing this impact, if significant.*

- Develop educational and monitoring programs for stormwater runoff in the urban area.*

* *Indicates need for additional scientific and/or engineering studies.*

REFERENCES

- Eld Inlet Watershed Management Committee
1989 Eld Inlet Watershed Action Plan.
- Entranco Engineers, Inc.
1984 Capitol Lake Restoration Analysis.
1987 Pattison and Long Lakes Restoration Project. Final Report. Prepared for Thurston County. June 1987.
- Jonstone, D.L. and G.C. Bailey
1981 Comparative Water Quality in Snake and Columbia River Swim Embayments and Main Channel Waters 1972, 1973, 1975, and 1978. Department of Civil and Environmental Engineering, Washington State University, Pullman, Washington.
- Koenings, J.L.
1989 Capitol Lake Restoration: Committee Report and Proposed Action Plan.
- Puget Sound Cooperative River Basin Team
1989 *Draft Report*. Nonpoint Sources in the Deschutes River Budd Inlet Watersheds. December 1989.
1990 Deschutes River Budd Inlet Watersheds, Thurston County, Washington. June 1990.
- Puget Sound Water Quality Authority
1986 Issue Paper: Nonpoint Source Pollution.
1987 1987 Puget Sound Water Quality Management Plan.
1989 Managing Nonpoint Pollution: An Action Plan Handbook for Puget Sound Watersheds.
- Snohomish County Public Works
1989 Stillaguamish Watershed Action Plan. Technical Supplement.
- Sullivan, K., et al.
1987 A Summary Report of the Deschutes River Basin Sediment, Flow, Temperature, and Fish Habitat. Weyerhaeuser Company Technology Center, Tacoma, Washington.
- Thurston County Conservation District
1984 Stream Corridor Management Plan for the Deschutes River, Washington. Prepared for the State of Washington Department of General Administration. January 1984.
- Thurston County Health Department
1986 Upper Deschutes River Land Use Activity Study.
- Thurston County Planning Department
1989 Henderson Inlet Watershed Action Plan.

Thurston Regional Planning Council

1985 Percival Creek Corridor Plan. Volume 1: Canyon and Middle Reaches.

1986a Deschutes Corridor Recreation Plan.

1986b Percival Creek Corridor Plan. Volume 2: Upper Reach.

1987 Wetlands and Stream Corridors Phase II. Volume 1: Final Report and Volume 2: Appendices.

URS Company

1986 Southern Puget Sound Water Quality Assessment Study. Comprehensive Circulation and Water Quality Study at Budd Inlet. Washington State Department of Ecology.

Washington, State of, Department of Ecology (WDOE)

1989 Draft Rule: Puget Sound Highway Runoff Program, WAC 173-270.

Washington, State of, Department of Natural Resources

1987 Timber/Fish/Wildlife Agreement: A Better Future in Our Woods and Streams: Final Report.

Washington State Forest Practices Board

1988 Washington Forest Practices Rules and Regulations.

Personal Communications

Dickison, Jeff. Squaxin Island Tribe.

Orsborn, Dr. John, P.E., Washington State University.

Appendix A

COMMENT LETTERS AND RESPONSES



SQUAXIN ISLAND TRIBE

MEMORANDUM

TO: Dale Anderson, Entranco Engineers
FROM: Jeff Dickison *JD*
DATE: June 12, 1990
RE: Capitol Lake Non-Point Draft

RECEIVED
JUN 21 1990

ENTRANCO ENGINEERS

Here are some comments that I have to contribute to the revision of the draft. Sorry for stretching the deadline. I actually wish I had more time to put into this, but that is not to be.

If you have any questions please give me a call. Thanks.

Comments on Erosion/Non-point Source Pollution Control Plan for
the Deschutes River/Capitol Lake System - April 6, 1990 Draft

Introduction, page 1:

- * In handling the introduction of non-point pollution problems, it is inappropriate to combine general references with specific references. For example, "Bacterial loadings from the Deschutes River. . . . including resident and migratory waterfowl," may bias the reader's perception of the problem. The waterfowl are the only specific source mentioned. Are we to conclude that they are the worst part of the problem, or even significant? No data is offered, nor are any other specific sources such as septic systems or agricultural waste mentioned here. 1
- * In the section headlined phosphorus, swimming and aesthetics are not the only impacts associated with algae blooms. This condition can result in depressed dissolved oxygen which can have a severely debilitating effect on fish. 2
- * The beneficial uses listing should include archaeological and cultural resources. 3

Relevant Non-Point source Pollution Planning Studies/Activities
page 2:

- * "an estimated 78 percent of this material reaches Capitol Lake." Is this statement taken directly from the report mentioned? Please provide a reference. 4
- * Page 3: referring to the DOT capital improvement plan: it has not been agreed that this will be focused only in areas with an ADT in excess of 50,000. In the following sentence, Capitol Lake receives discharge from I-5 as well as 101. 5

The Non-Point Source Pollution Problem, page 5:

- * Problems associated with forest practices also include effects on dissolved oxygen and temperature. 6
- * Referring to mass wasting, the Squaxin Island Tribe has identified at least 13 new mass wasting events as the result of heavy storms in the watershed this past winter. We would concur with the evidence that the majority of these conditions are associated with forest roads. It should be noted that these events appear to be episodic. That is, they appear to be triggered by a specific set of climatic events acting upon conditions that are existing within the watershed. This is in contrast to being a regular and continual source of sediment input. 7

- * A better discussion is needed regarding additional erosion and sedimentation problems. Increased stream flow as it relates to the "transient snow zone" is mentioned in a paragraph on page 7, however, the description is neither accurate nor does it reflect the full dynamics of the transient snow zone. Rain on snow events can contribute a substantial pulse of water from deforested areas into stream channels. These events contribute to stream channel erosion on an accelerated basis compared to a forested watershed. 8

- * Another area that needs better discussion concerns the effects of an increased bedload in the stream channel on stream bank erosion. Increased bedload from inputs higher up in a system aggregate within the channel as they move through the system. Aggregations of material can cause localized diversion of flow and direction within the channel resulting in bank erosion and compounding the problem further downstream. This mechanism received some attention in the Conservation District report but is essentially absent from your review. 9

- * Nutrients and Organics, page 6: More information should be supplied regarding fertilization practices, the potential inputs from application procedures, the impacts of urea fertilizer upon direct water contact, and the biological effects of fertilization within the watershed. 10

- * The statement, "However, there is no evidence that the present rate of organic loading to Capitol Lake, the Deschutes River, or its tributaries, is a problem" is clearly in error. There are numerous examples of low dissolved oxygen in Capitol Lake. It is likely that some forms of BOD contribute to these. 11

- * Pesticide practices have been the subject of discussion of many TFW meetings and attempts are still being made to develop procedures to keep pesticides out of waterways. However, no assurance currently exists to protect all waters from pesticide application or drift. 12

The Regulatory Setting

- * The Deschutes Watershed is in the Central Region of DNR 13

Recommended Best Management Practices

- * Attempts are being made and should be supported for better documentation of poor soil stability and geologically unstable conditions. These will help to better target activities such as intensive road maintenance. 14

- * 250 acres as a limitation on clear cut size is arbitrary and not supported by documentation. Many areas may require a smaller clear cut size. 15
- * On what basis is the judgement made that 'adequate' streamside buffering is being provided? The monitoring program to assess this is far from reaching any conclusions. 16
- * Some wetlands may require greater than 100 foot buffers. 17
- * Which cumulative effects study are you suggesting we continue to support? We need to establish an explicit framework for cumulative effects. We know they exist, the question which remains is when have they had a large enough increment attached to the impact that we think they are worthy of doing anything about. 18
- * Regarding the implementation of measures to combat stream bank erosion, this subject should be considered by all the interested parties before any decisions are made to move ahead with an implementation schedule. 19

Agricultural Activities

- * Animal density range from .5 to 2.2 doesn't jibe with an animal population of 3,500 animals on 8,052 acres which gives an average density of less than .5 animals per acre. 20
- * Is the statement to the effect that 97% of all septic tank units are located on severely limited soils true? If so, what criteria and documentation is used for this assessment? 21

Small Farms/Commercial Farms

- * Comparisons of waste loading from agricultural animals and humans are not appropriate. These sources of waste are not equivalent in their health effects or their pollution impacts. 22
- * Little mention is made of pesticides, fertilizers, and farm machinery as contributing to non-point pollution. In addition, farm animal access to waterways and the resulting erosion and bacterial loading is not adequately discussed. 23

In addition to these other comments, stormwater quantity needs to be adequately addressed in the urbanized area. Both quality and quantity are major issues relative to the pollution load in Capitol Lake and should receive attention. 24

Response to Comments From Squaxin Island Tribe

1. The introductory paragraph in question was re-written with the intent to remove bias. Additional sources of bacteria were listed. Since this is part of the introduction we did not think it would be appropriate to provide data and references here, but rather in the body of the report.
2. Although severe algae problems can result in dissolved oxygen depletion and fish kills, this mechanism has not been documented in Capitol Lake to our knowledge. We did not want to mislead the reader into thinking that this was an existing or historically significant problem at Capitol Lake. It is our understanding that fisheries biologists typically prefer relatively productive lakes, like Capitol Lake, because of the food chain benefits to the fishery. If other dissolved problems are occurring in the lake these need to be verified with monitoring data and appropriate solutions evaluated. These issues and the problems with dissolved oxygen in Percival Cove have been addressed in the modified report (see section on Nutrients and Organics in the Forestry section).
3. Archaeological and cultural resources have been added to the list of beneficial uses.
4. The specific table and page reference has been added, and the text has been modified to provide further clarification.
5. The paragraph (third sentence) makes it clear that these are draft rules and thus it would be possible for the ADT number to change based on revisions to the draft rules. An additional parenthetical statement has been added to provide further clarification. I-5 has been added to the text.
6. Temperature and dissolved oxygen problems have been added to the list of forestry-related problems on page 6 and new text has been added to summarize this issue within this section of the report.
7. The text has expanded to include new information provided by the Tribe. Although mass wasting erosion tends to be episodic in terms of washoff from the watershed, its impact in the river and lake may occur on a longer term, on-going basis since the sediment deposited in the river bed will tend to be resuspended and carried downstream as a function of river flow and energy over time.
8. The text has been modified to improve accuracy and expand on the cause and effect relationships.
9. This issue was addressed in the preliminary draft report. Refer to the first paragraph of page 6 of the preliminary draft. We have made only minor modifications to the language in this revised draft.
10. Additional discussion has been included based on our understanding from documents in our possession. Additional discussion could be incorporated in the final report if it is deemed appropriate.

11. To our knowledge, the only dissolved oxygen problems that have historically occurred in Capitol Lake are those associated with the tide gate crater problem. BOD loading from the watershed was not a contributing factor. Additional discussion is provided in the text regarding the significance of BOD loading from the Deschutes River/Capitol Lake system to Budd Inlet based on the URS (1986) report. The reported DO problems in Percival Cove are also addressed; as indicated, we see no evidence that DO problems in the cove are associated with forestry activities.
12. The text has been expanded to enhance the discussion.
13. The text has been modified.
14. The suggested BMP has been added.
15. Comments by DNR suggest that results of studies by Dennis Harr should be used as the basis for limiting clear cuts. It may not be possible to resolve this issue within the time frame and budget constraints of the present study.
16. As indicated, the stated BMP is taken from the PSCRBT report and reflects their opinion. If there are on-going monitoring programs to assess this issue it may not be possible to resolve this issue in the framework of the present study. Your opinion is acknowledged.
17. The language has been changed to "provide adequate buffers around all wetlands." The DNR commented that 100 feet may be excessive for some wetlands, depending on their size and value. We agree. The Thurston Regional Planning Council report on Wetlands and Stream Corridors, Phase II (1987) recommends wetland buffers of 0 to 100 feet depending on the size and value of the wetland and the adjacent land use. Whether or not some wetlands require buffers in excess of 100 feet in the forest environment should be determined outside the context of this study as the watershed planning process for the Deschutes River progresses under County leadership.
18. Your comment is a good one. As you indicated in our phone conversation, these are issues which may not be determined in the near future, but as the results of various CMER Committee research projects become available.
19. The text has been modified to show wider agency participation.
20. Table 16 of the PSCRBT shows a total of 5,057 acres for small farms and an average livestock density of 0.7 animals per acre. This suggests that there are 2,995 acres of non-pasture lands included in the total small farm acreage figure.
21. The statement is accurately related from the PSCRBT report which is based on soil limitation criteria cited in the USDA Soil Conservation Service Soil Survey of Thurston County Area, Washington (unpublished). The 97 percent total is broken down further in the PSCRBT report as follows:

cemented pan -	16 percent
flooding -	7 percent
slope -	4 percent

percs slow -	19 percent
poor filter -	50 percent
bedrock -	1 percent

The majority of systems are located on soil units with excessive drainage (50 percent with poor filtration). This implies potential impacts to groundwater. Further discussion of this issue could be pursued with the County to determine if they have any data indicating groundwater problems. Based on groundwater monitoring results in the Pattison/Long Lake area (Entranco Engineers 1987), it appears that on-site wastewater disposal in such areas is not causing any serious drinking water problems. Groundwater problems identified in the Pattison Lake area were attributed to excessive agricultural fertilization and pesticide use. Recent studies by the City of Olympia and Thurston County in the McCallister Springs area may shed additional light on this subject. Our experience also indicates that most on-site systems function effectively if properly maintained. A typical failure rate survey may uncover anywhere from 0-15 percent failing systems. This issue could be better clarified by review of groundwater data (or collection of data if none exists) and by the septic tank failure survey recommended as a BMP.

22. The comparison has been eliminated from the text.
23. Additional discussion has been added to the text and additional BMP measures recommended.
24. The latest water quality study of Capitol Lake (Entranco Engineers 1984) indicated (based on actual monitoring results) that direct urban runoff to Capitol Lake represented less than 1 percent of the total flow and only 2 percent of the annual phosphorus loading. Stormwater could have some localized nearshore impacts to Capitol Lake during summer months when river flow rates are low and nearshore water exchange is inefficient. Stormwater impacts to Percival Creek are likely to be of greater significance, however, and should probably be given priority consideration from both the flow and quality control perspective. BMPs recommended in the draft report seem adequate to address these concerns.



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

June 13, 1990

RECEIVED
JUN 14 1990

ENTRANCO ENGINEERS

David Morency
Entranco Engineers
5808 Lake Washington Boulevard NE
Kirkland, WA 98033

Dave
Dear ~~Mr.~~ Morency:

Listed below are my comments on two of the Capitol Lake Wetland Feasibility Study reports.

"Erosion/Nonpoint Source Pollution Control Plan" draft, April 10, 1990.

Page 3. Paragraph 1. The Deschutes River baseline monitoring will start with the lake drawdown (mid-July).

Page 6. Paragraph 3. The what is the nutrient components of the 200 pounds of fertilizer applied to forest lands?

Page 7. Paragraph 1. After a period of time, the increased runoff rates caused from clearcutting decreases. What is this timetable? What is the rate of recovery to pre-clearcut times?

Page 9. Paragraph 9 and 10. PSRBT should be PSCRBT.

Page 10. Paragraph 7. Soil is also disturbed, or removed and or left bare and becomes a sediment source.

Page 11. Paragraph 3. Receiving is misspelled twice.

Page 12. Paragraph 3, 5, and 6. Thurston County Soil Conservation District should be Thurston County Conservation District.

Page 12. Paragraph 3. Soil Conservation District should be Soil Conservation Service. The Cooperative Extension Service is an arm of Washington State University so I believe that it should be "State" not "Federal".

Page 12. Paragraph 6. I thought that the Conservation District was already working with farm operators to develop farm plans. Perhaps we should urge the District to "work more closely" with the farmers.

Page 14. Paragraph 3. Is stormsewer one word?

David Morency
June 13, 1990
Page 3

Page 15. Paragraph 5. Stormwater is managed by Thurston County and City (should be Cities) of...

The following comments address the report "Capitol Lake Wetland Development Feasibility Memorandum", May 16, 1990.

Page 10. Paragraph 3. The exotic, purple loosestrife, Lythrum salicaria, is becoming one of the dominant wetland plants in the middle and south basins.

Page 14. Paragraph 5. ...ski launch area... is what?

Page 15. Paragraph 1. Should something be said about the importance of benthic organisms that are part of the biology and food chain?

Page 15. Paragraph 5. Is it true about chum salmon? I have never heard of anyone catching chum salmon out of Capitol Lake.

Page 18. Paragraph 3. "The soils near the bottom..." ??

Page 10. Paragraph 4. "Near the mudline..." ??

Page 26. Paragraph 2. "Because Capitol Lake Serves..."

Page 30. Paragraph 2. You should check to see if the brewery name has been changed back to Olympia Brewery.

Page 31. Paragraph 1. What year did the NPDES permit expire?

Page 32. Paragraph 1. For the past two summers, I have been observing large mats of algae floating in the south basin and the south end of the middle basin.

Pages 33, 34 and 35. I believe that Jeff Dickison already said that it is the Squaxin Island Tribe.

Page 40. Paragraphs 5 and 6. Perhaps something should be said about the duck and goose droppings that hamper recreation and aesthetics and may be a health risk.

Page 41. Paragraph 1. Same as above.

Page 44. Paragraph 6. Purple loosestrife will be a pioneer colonizer.

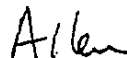
Page 67. Paragraph 4. Memo to Joan Thomas, Department of Ecology, Water Quality Program, Division Supervisor.

Page B.1. Update the plant list to include purple loosestrife.

David Morency
June 13, 1990
Page 3

This concludes my comments. If you have any questions, please call me at 459-6063.

Sincerely,



Allen W. Moore
Project Manager
Water Quality Financial Assistance Program

AWM:dm

cc: Bob Arndt, Dept. of GA
grant files

**Response to Comments From
State of Washington
Department of Ecology**

1. Appropriate text revisions were made for each comment pertaining to the April 10, 1990 draft of this report.



WASHINGTON STATE DEPARTMENT OF
Natural Resources

RECEIVED
APR 24 1990

BRIAN BOYLE
DIVISION OF CAPITAL ~~MANAGEMENT~~ of Public Lands

DATE: April 23, 1990

OLYMPIA, WA 98504

MEMORANDUM

TO: Robert F. Arndt, Facilities Planning Manager
Division of Capital Management (AX-22)
Department of General Administration
Olympia, WA 98504

FROM: Arden Olson, Manager *Arden Olson*
Division of Forest Regulation and Assistance (EL-03)
Department of Natural Resources
Olympia, WA 98504

SUBJECT: Review of Draft Report by Entranco Engineers, Inc. on
"EROSION/NON-POINT SOURCE POLLUTION CONTROL PLAN,
Deschutes River/Capital Lake Watershed"

General
Comment:

Early history and sedimentation of Capitol Lake, originally a tidal estuary, is ignored. The "Lake" was created in a natural sediment trap and will always require maintenance dredging. Periodic transects or measurements of the lake bed are needed to determine actual sedimentation rate.

1

Page 2 References the disputed Conservation District, 1984 study and report and the more recent PSWQA Watershed Plans for Henderson and Eld Inlets. Budd/Deschutes watershed planning is to be completed 1994.

Comment: Both completed and proposed plans lack adequate factual data. The data is to be supplied by proposed monitoring. Existing plans ignore the lack of factual data and recommend additional measures to further protect the environment. Because assumptions, generalities and perceptions are used in lieu of facts, great care is needed in drafting recommendations.

2

Page 4 Middle of 3rd paragraph states, "It is a well known fact...".

Comment: No references or data are provided to support, "well known fact".

3

Page 4 Last sentence.

Comment: Assumption of a 50 year minimum harvest age is based on the most intensive forestry practices current. A 50 year harvest age is atypical of early and recent commercial timber harvest. Most of the harvest is in ages from 70 - 100 + years.

4

Arndt
April 23, 1990
Memo Page 2

Pages 5, 6, 7

Comment: Content appears reasonably factual and balanced in addressing forest practices related impacts of erosion and sedimentation.

The use of phrasing, such as, "(forest practice) can cause (impact)" may be true in general, but may not be true for the specific case. The Report notes lack of evidence that forest practices caused impacts in Nutrients and Organics and Pesticides.

Writing about possibilities rather than facts CAN be misleading.

Recommendations based on generalities rather than specific site data can increase costs and reduce effectiveness of protection.

Page 8,9 Recommendations incorporated from the PSCRBT report.

Responses In Sequence of Draft Report

Increase size, number and downspouts of culverts.

Comment: Increases in culvert sizes and numbers and additional downspouts or energy dissipators may reduce erosion and sedimentation.

Water bar roads.

Comment: Water bars can be effective on low traffic or abandoned roads. Other measures are needed for roads in active use.

More maintenance and storm patrols.

Comment: More maintenance and storm patrols may reduce erosion. Road maintenance may not reduce mass wasting and landslides within harvest units.

Close roads not to be used for 5 years.

Comment: Closing (abandon) roads not intended for use in the next 5 years may be an impractical and very costly method to reduce erosion because of the additional disturbance from removing and installing culverts, shaping grades, cuts and fills.

Road maintenance and abandonment is regulated by current Forest Practices Rules.

Use "skyline logging" on unstable slopes.

Comment: Several yarding systems can provide partial to full suspension yarding of logs. The system should be designed for specific conditions whether skyline or some other system or combinations.

Arndt
April 23, 1990
Memo Page 3

Continue with comments on Recommendations, Page 8

Limit clear cuts to 250 acres separated from adjacent cuts by forest buffers and adequate time between cuts in the transient snow zone.

11

Comment: The acreage number is arbitrary, the buffer is not described physically or by time interval. Dennis Harr's work with U of W and USFS is not completed, but some guidelines are expected soon.

Better attention to Type 4 and 5 Waters.

Comment: Forest practices buffers (RMZs) on Type 1-3 Waters are regulated. TFW Group suggested the regulatory measures adopted by the Forest Practices Board.

12

Studies on Type 4 and 5 Waters show that small streams vary greatly in sediment budgets and delivery. If needed, additional measures can be required to protect slope and channel stability using forest practices rules and application conditions.

100' buffers around all wetlands.

Comment: Need to describe wetlands and minimum size to be protected. Some description of buffers needed. 100' buffers may be excessive for some wetland locations and sizes.

13

Develop and coordinate water quality monitoring program with Thurston County, TFW participants and others.

Comment: TFW participants have sponsored and guided a number of research projects in other locations. It would help if some others would come forward with plans and assistance.

14

Support cumulative effects study.

Comment: Cumulative effects studies are difficult, time consuming and expensive. Addressing current impacts has highest priority, but the Forest Practices Board agenda includes review of long term and cumulative effects. Preventing immediate impacts can mitigate some cumulative effects.

15

Support studies on sedimentation, hydrology and mass wasting and revise rules as indicated by findings.

Comment: TFW, CMER studies on sedimentation, hydrology and mass wasting are intended to provide the Forest Practices Board with factual data that will support forest practices rule revision for better protection of public resources and the environment.

16

Arndt
April 23, 1990
Memo Page 4

Continue Draft Report on Recommendations, Page 8

Provide public information and education on forestry and non-point pollution.

Comment: TFW has a TIE Committee (Training, Information, Education) that has produced informational material about TFW and forestry. The DNR, other agencies and participants have conducted training sessions for operators, landowners and participants. The U of W, Center for Streamside Studies has conducted seminars and symposia of forests and other resources.

17

Attend Weyerhaeuser annual harvest and management plan reviews and provide input.

Comment: Contact DNR Central Region office and local Weyerhaeuser branch office about attendance and purpose of the annual harvest and management plan reviews.

18

Other recommendations not part of the PSCRBT report, Page 8:

Conduct further studies, cost estimates, budget and capital improvement plans to control river bank erosion.

19

Comment: More factual data is needed on source and cause of sedimentation.

Other recommendations, Page 9

Provide a means for local government to monitor conversion of forest lands to other uses.

Comment: Local government receives copies of forest practices applications for conversions and practices subject to SEPA review. Local governments are entitled to receive all forest practices applications within their jurisdiction, but are usually selective in what they want to review.

20

Provide conventional methods of erosion and sediment control at landings, log sort yards etc.

Comment: Forest practices regulations do not limit the methods to protect public resources and the Department of Natural Resources has ordered the use of conventional and other methods of erosion and sediment control.

21

Encourage alternatives to the use of pesticides such as hand slashing.

Comment: Hand slashing may not be effective or practical and has risks for workers. The least damaging, effective method of pest/weed control is encouraged.

22

Arndt
April 23, 1990
Memo Page 5

Continue other recommendations, Page 9

Encourage Watershed Management Committee involvement in the TFW coordination process, annual inspection/evaluation of watershed areas with high erosion potential. Provide access for local government officials to review practices.

Comment: There are practical and legal problems with implementing all of the recommendation. Coordination and communications can be improved. Local TFW participants and the DNR are willing to meet with local government representatives about forest practices.

23

Consider methods landowner can implement to mitigate sediment impacts of mass wasting.

Comment: Current technology may mitigate impacts of some slides and may be appropriate for high value lands and resources. Small mass wasting areas on forest lands can be mitigated; there may not be suitable technology or funds to mitigate large scale mass wasting areas in forests or elsewhere.

24

Report Page 9, last paragraph

Comment: Categories and numbers are difficult to understand and need to be presented more clearly or simplified.

25

Remainder of Draft Report addresses non-forest issues of non-point pollution.

General Comment on erosion and sedimentation:

It would be useful to measure sediment and bedload transport at several points along the main stem and selected tributaries to identify or indicate probable source and quantity of sediment from land management activities and natural events.

26

Further regulating current forest practices may not be the most cost effective method for addressing current high sediment loads. It may take a decade or longer for large, earlier deposits to work through the system and into Capitol Lake.

The Department of Natural Resources, Division of Forest Regulation and Assistance is willing to work with the Department of General Administration to address forest practices impacts on the Deschutes River and Capitol Lake.

xc w/Report: Don Dowdell, RP&S-Asst. Regional Manager
Department of Natural Resources
Central Region (MS-S-3) (tel. 3-3410)
Chehalis, WA 98532

**Response to Comments From
Washington State
Department of Natural Resources**

1. It is true that the reservoir will continue to trap sediments and we agree that periodic aerial photographic comparisons should be made to obtain improved information on rates of sedimentation. The question of continued maintenance dredging is one that is presently under study in the companion study by Entranco, "Wetland Development Feasibility Analysis", in which we are evaluating the feasibility of allowing the middle basin of the lake to fill in.
2. This comment seems to address the question of the proper philosophy behind nonpoint source planning. Entranco recognizes two basic approaches:
 - One is to identify the kinds of land use management practices in the watershed that have the potential to contribute to nonpoint source (NPS) pollution and to develop best management practices targeted at each suspected source. This is the approach that has been used in most watershed planning studies to date. The problem with such approaches is the assumption that all potential nonpoint sources of pollution are significant sources of nonpoint pollution. Thus considerable effort can be spent controlling practices that are not substantially affecting receiving water quality. In the long run this approach can create considerable frustration on the part of all participants because great effort can be spent with little, if any, measurable results.
 - The other approach is to spend considerable effort in monitoring programs with the intent to quantify pollutant loading associated with suspect NPS land use activities and to prioritize control efforts to target activities associated with the highest loading. The Entranco team sees this approach as the preferred approach because there is a much greater likelihood that control efforts will be targeted in such a manner as to produce the greatest water quality benefit for the least expenditure of effort. The disadvantages of this approach are that (1) considerable dollars and time must be spent before action plans can be developed and (2) public interest and momentum can be difficult to maintain over the long time frame.

These philosophies have been discussed by the Wetland Technical Advisory Committee and they have concluded that, although the present approach is not based on quantification of the contribution from each suspected source, NPS planning must begin with the best information available. Additional monitoring efforts initiated by Thurston County and the Squaxin Island Tribe will make it possible to improve on the quantification of pollutant loading sources before the County watershed planning process is completed. Also, refer to the statement of caution included in the Executive Summary of this report.

3. The wording of this sentence has been revised and a reference added.
4. The DNR comment is noted; however, the comment does not change the intent of the message which is to inform the reader that as much as 63 percent of the watershed has been logged off during the past 50 years.

5. Comments noted. An attempt was made to distinguish between potential problems and "measured" or "observed" problems in this specific watershed. As indicated in response 2 above, the need for additional monitoring and quantification is acknowledged and will serve to improve cost-effectiveness as watershed planning efforts evolve in the future.
6. DNR comment is supportive of recommended BMPs.
7. This BMP statement has been modified to provide clarification.
8. Drainage facility maintenance has been added to the BMP statement. It is recognized that improved maintenance may not correct or prevent every mass wasting episode; however, such measures may correct or prevent some sites from failing. Poor roadway or drainage facility design may be responsible for some mass wasting problems; obviously, improved maintenance would not improve conditions in these instances.
9. BMP language has been modified to eliminate the time frame element. The question of when to close orphaned roads should be considered in future discussions of forestry BMPs in the watershed.
10. BMP language has been modified to include other possible yarding systems that would provide full or partial suspension. It is understood that the yarding system should be selected based on site specific circumstances.
11. BMP language has been modified.
12. Comment noted.
13. The language has been changed in such a manner as to preclude specific buffer requirements. It is our understanding that DNR and WDOE will be working cooperatively to develop specific wetland management guidelines for forestry practices under the direction of the Governor's executive order.
14. Comment noted.
15. Comment noted.
16. Comment noted.
17. BMP language has been modified.
18. BMP language has been modified.
19. The authors agree that more monitoring data is needed regarding the location and source (suspended, side bank or bedload) of sediment.
20. Comment noted.
21. Comment noted.
22. BMP language has been modified.

23. Comment noted.
24. Comment noted.
25. Comment noted.
26. It is likely, but probably cannot be proven conclusively, that clear cutting of more than 60 percent of the watershed during the past 50 years has contributed significantly to the sediment accumulations that are presently working their way down the Deschutes River. While implementing additional forest practices may not mitigate the impact of sediment that has already accumulated in the river, it is likely that good forest practices will assist in reducing the delivery of additional sediment to the river in the future. Additional work is needed to establish those forestry BMPs that produce the greatest benefit for every dollar expended, and to balance resource protection efforts with the economic realities of the forestry industry.

Appendix B

**PREFERRED TEMPERATURE RANGES FOR
SELECT SPECIES OF FISH**

Source: Snohomish County
Public Works (1989, page 2-20)

STILLAGUAMISH WATERSHED ACTION PLAN
 TECHNICAL SUPPLEMENT
 CHAPTER 2 - WATER QUALITY ASSESSMENT

TABLE 2-3. Preferred Ranges of Water Temperatures For Steelhead Trout and Salmon (Embery, 1987; Lucchetti, 1988)

<u>LIFE STAGE</u>	<u>SPECIES</u>	<u>PREFERRED RANGE IN C*</u>	<u>PRESENCE IN DEER CREEK WATERSHED DURING SUMMER MONTHS</u>
Migration	Steelhead	10.0-12.8	Yes
	Chinook	9.4-14.2	Yes (Lower 2 Mi.)
	Coho	7.2-15.6	Yes
	Pink	7.2-15.6	Yes (Lower 2 Mi.)
	Chum	8.3-18.3	Yes
Spawning	Steelhead	3.9-9.4	Yes
	Chinook	5.6-13.9	Yes
	Coho	4.4-9.4	Yes
	Pink	7.2-12.8	Yes
	Chum	7.2-12.8	Yes
Incubation	Steelhead	10.0	Yes
	Chinook	4.4-13.3	Yes
	Coho	4.4-13.3	Yes
	Pink	4.4-13.3	Yes
	Chum	4.4-13.3	Yes
Rearing	Steelhead	12.0-14.0	Yes
	Chinook	12.0-14.0	No
	Coho	12.0-14.0	Yes
	Pink	12.0-14.0	No
	Chum	12.0-14.0	No

*Preferred range is an estimate based on observation and is variable according to specific locations and stock of fish.

Appendix C

COMPLIANCE MEMORANDUM OF AGREEMENT

COMPLIANCE MEMORANDUM OF AGREEMENT

among
The Department of Ecology,
The Thurston County Conservation District
and
The Washington State Conservation Commission
relative to

Agricultural Water Quality Management

The Conservation Commission is an agency of state government organized under Chapter 89.08 RCW and is responsible for administering the legal and program activities of conservation districts. Conservation districts are entities of state government, under Chapter 89.08 RCW, and are responsible for the conservation and development of natural, renewable resources within district boundaries.

The Department of Ecology is an agency of state government organized under Chapter 43.21A RCW. Ecology is responsible for protecting and managing the state's air, land, and water resources.

The purpose of this Memorandum of Agreement is to recognize the working relationship between conservation districts (district), the Conservation Commission (Commission) and the Department of Ecology (Ecology) in protecting water quality of the state, and to coordinate the functions of the Commission, Ecology, and the Thurston County Conservation District to carry out a program of agricultural water quality protection and management. Therefore, this agreement outlines a process by which complaints on water quality violations will be handled at the district level.

- I. The Department of Ecology will, in exchange for these covenants:
 - A. Identify existing or potential water quality problems resulting from agricultural practices.
 - B. Receive, process, and verify complaints concerning discharge of pollutants from all farms regardless of size.
 - C. Determine if an agricultural water quality problem requires immediate corrective action under the Washington State Water Pollution Control Laws (Chapter 90.48 RCW), the Washington State Water Quality Standards (Chapter 173-201 WAC), or other authorities. Ecology shall maintain the lead enforcement responsibility.

If such determination is made, notify the operator and appropriate conservation district.

If immediate action is not necessary by Ecology, the handling of complaints will differ depending on the amount of information available and the compliance option selected by the conservation district involved.

1. When the name and address of the party against whom the complaint was registered are known:
 - a. Districts operating at levels 1 and 2 will receive a copy of complaint information, and compliance letter if one was sent out.
 - b. Districts operating at levels 3 and 4 will receive a copy of complaint information and the letter sent by Ecology to the operator informing the operator of the complaint and providing the operator with the opportunity to work with the conservation district on a voluntary basis.
 2. Ecology and the conservation district will work together at the local level to resolve complaints when the name and address of the party against whom the complaint was registered are unknown.
- D. Administer and enforce NPDES discharge permits for operators of concentrated animal feeding operations where required, and administer state codes.
 - E. Appoint representatives to participate in the Compliance Review Committee which will annually review and update policy and disseminate information as needed.
 - F. Encourage communication between local Ecology personnel and the appropriate conservation district personnel.
 - G. Encourage the use of Soil Conservation Service standards and specifications in designing Best Management Practices for agricultural water quality management plans.
 - H. Provide to the Conservation Commission an annual report of agricultural pollution enforcement activities.

Ecology cannot delegate its responsibilities in enforcement and reserves the right to take appropriate enforcement action. Ecology will initiate an investigation within 30 days with noncooperative operators.

Ecology's capability is dependent upon the level of funding provided to Ecology for agricultural water quality problem source control.

II. The Conservation District will, in exchange for these covenants:

- A. Adopt and annually update the water quality section in the conservation district annual plan.
- B. As part of the district annual report, include a water quality progress report on activities conducted that are related to this compliance agreement.
- C. Encourage communication between the conservation district personnel and local Ecology personnel.
- D. Adopt and carry out a compliance option from Level 1, Level 2, Level 3, or Level 4.

The conservation district's capability to carry out its responsibilities in the four levels of compliance is contingent upon the availability of funding and resources to implement a water quality program.

Compliance Levels:

Level 1 - Information/Education/Technical Assistance

The conservation district will serve as a local source of information on statewide applicable water quality implementation programs (e.g. Puget Sound Water Quality Management Plan; State Dairy Waste Management Plan; State Dryland and Irrigated Agriculture Water Quality Management plans; or other plans that may be developed). The conservation district will promote plans and efforts to improve water quality and explain the benefits of participating in available implementation plans through news releases and other media for the general public; programs for schools; presentations to groups and civic organizations; workshops; training sessions; or other appropriate means. The conservation district will provide technical assistance upon request.

Ecology will respond to complaints which involve water quality problems caused by agricultural activities or facilities. Ecology will work with the operator to bring the operation into compliance with all environmental statutes and regulations. If immediate action is deemed necessary, Ecology will pursue the appropriate actions which may include enforcement against the responsible parties. Ecology will advise the operator of the information/technical assistance available through the conservation district. Ecology will notify the conservation district of the operator's need for information/technical assistance.

Level 2 - Information/Education, Problem Assessment, and Handling Complaints

The conservation district will carry out programs described in Level 1. In addition, the conservation district will inventory water quality problems defined in the water quality section of its annual plan. The conservation district will prioritize problems and work to apply voluntary solutions to the highest priority problems within available resources utilizing information/education, technical assistance, and incentives. Response to Complaint - The conservation district will make an appointment for an on-site contact with the alleged violator within ten (10) working days and determine if the operator desires to work with the conservation district. If the operator wishes conservation district assistance, within six months the conservation district will develop a plan with the individual operator which includes a schedule for application of Best Management Practices (BMP). The operator will have 18 months, or by agreement, an approved schedule with alternative time period to implement the plan. If hardships occur, the operator may request an extension of the implementation schedule subject to concurrence of Ecology.

The conservation district in responding to complaints will report progress, or the need for further Ecology technical expertise, to the individual involved and Ecology. A copy of the plan will be made available to Ecology. If the district offers assistance and the individual involved refuses to cooperate or ceases to work with the conservation district, the district will notify Ecology.

The conservation district will refer all alleged water quality violations, or individuals who wish to make a complaint to Ecology.

Ecology will investigate and seek resolution of all complaints that appear to need immediate action and refer all other complaints concerning agricultural activities or facilities to the appropriate conservation district. Ecology will keep a record of those complaints. When a referral is made by a conservation district, due to a continuing unresolved water quality problem, Ecology will take appropriate action and advise the conservation district of the action taken.

Level 3 - Information/Education, Problem Assessment, Handling Complaints, and Assisting in Compliance

(This level is the original 208 process.)

The conservation district will carry out programs described in Level 1 and Level 2. In addition, the conservation district will actively follow-up those problems and complaints deemed highest priority by the conservation district within 60 days after the initial contact. The complaint referral follow-up will include:

1. Meet with the owner/operator.
2. Make an on-site assessment of the nature and extent of the problem, if so desired by the owner/operator.
3. Notify Ecology that the owner/operator has (has not) requested assistance from the conservation district.
4. Assist the owner/operator in the development of a water quality management plan within six months. Implementation is to be completed within 18 months, or by agreement and approved schedule, with alternative time period to implement the plan. If hardships occur, the operator may request an extension of the planning and/or implementation schedule with concurrence of Ecology.
5. Provide such technical assistance as is necessary and available during plan implementation.
6. Monitor plan implementation.

7. Notify Ecology in the event that the owner/operator either refuses to cooperate in the development of a water quality plan that will correct the problems identified during the on-site assessment, or fails to implement the plan within the designated time period.
8. By June 30 of each year, submit a formal summary of progress on alleged water quality violations referred to the conservation district by Ecology.

Ecology will investigate and seek resolution of all complaints that appear to need immediate action.

Ecology will pursue all activities addressed under level 2. Except that on those sites where the conservation district is making progress on water quality problems caused by agricultural practices and is reporting the same to Ecology, Ecology will hold any related enforcement actions in abeyance until the problem is solved, or the operator refuses to cooperate further. Ecology shall continue to pursue any immediate action where required. (See Section I-C.)

Level 4 - Compliance

(This level is the original 208 process plus additional involvement by the conservation district.)

The conservation district will carry out programs described in Levels 1-3. In addition, the conservation district will provide information and direct support for resolving water quality actions which may be filed by Ecology pursuant to its statutory authority.

Information and support include the following:

1. A field site tour to provide information and attempt to resolve the issues.
2. Provision for access to public information in conservation district's files, and if appropriate, in-house documents such as field notes, photographs, and in-house memoranda. Access is subject to applicable laws and regulations.
3. Ecology interviews with appropriate conservation district personnel regarding a site under enforcement.

4. Assistance and attendance, if appropriate, at negotiation sessions with responsible parties.
5. Affidavits or testimony necessary to document the case.

Ecology will pursue all activities as addressed in Level 3, except where the conservation district has been involved, Ecology will utilize the information and support offered by the conservation district to resolve the matter.

III. The Conservation Commission will, in exchange for these covenants:

- A. Forward to Ecology the annual water quality progress reports.
- B. Provide such assistance as may be appropriate to the conservation districts in the discharge of their responsibilities as management agencies in agricultural implementation.
- C. Provide coordination for conservation district water quality programs at the state level through special arrangements with appropriate federal and state agencies.
- D. Coordinate the programs of the respective conservation districts as related to plan implementation and resolve any conflicts in such programs.
- E. Inform conservation districts of activities and experiences of other conservation districts relative to agricultural water quality protection, and facilitate an interchange of advice, experience, and cooperation between such districts.
- F. Encourage communication between the conservation district personnel and local Ecology personnel.
- G. Appoint conservation district representatives to serve on the Compliance Review Committee with advice of the Washington Association of Conservation Districts.
- H. Appoint a Commission representative to participate on the Compliance Review Committee which will annually review and update policy and disseminate information as needed.

- I. Work with Ecology to provide communication outreach to representatives of agricultural and environmental organizations to receive feedback on implementation of the Compliance Memorandum of Agreement.

The Commission's capability to carry out its responsibilities within this agreement is contingent upon the availability of funding and resources to implement a water quality program.

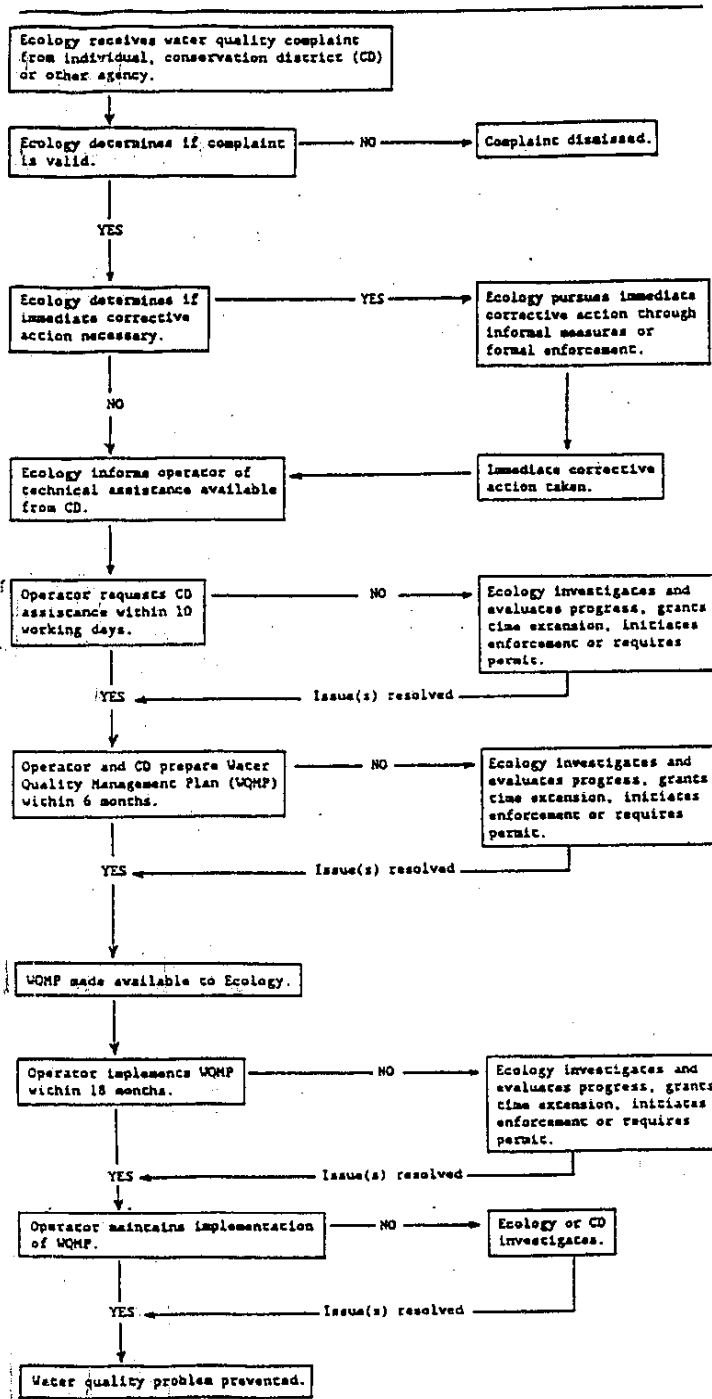
This agreement does not imply an offer of funds for the purposes of this agreement. None of the parties of this agreement are liable for each other's actions.

This agreement may be terminated by any party hereto upon providing 30 days' written notice to the other two parties. Such notice shall be mailed to the principal executive officer of the other two parties by certified mail, postage fully prepaid, and shall be deemed served the day after depositing such notice in a United States Post Office. Termination of this agreement by one conservation district will not affect the other conservation districts.

This agreement may be amended only upon the written agreement of all parties hereto. The Compliance Review Committee will consider proposed amendments annually.

This agreement contains all the terms and conditions agreed upon by the parties. No other understanding, oral or otherwise, regarding the subject matter of this agreement shall be deemed to exist or to bind any of the parties. All parties have read and understand the above contract and now state that no representations, promises, or agreements not expressed in this agreement have been made to induce the other to execute the same.

SIMPLIFIED FLOWCHART FOR
 AGRICULTURAL COMPLIANCE MEMORANDUM OF AGREEMENT
 COMPLAINT PROCESS
 BETWEEN
 WASHINGTON DEPARTMENT OF ECOLOGY,
 WASHINGTON CONSERVATION COMMISSION,
 AND CONSERVATION DISTRICTS



- NOTES: 1) The operator may choose to prepare and implement a WQMP without assistance from the conservation district, subject to the same steps, timeframes and plan approval by Ecology.
 2) This flowchart only identifies general procedural steps contained in the Agreement. Additional detailed information may be obtained from the Conservation Commission, Ecology or local conservation district.

(Washington Department of Ecology, Water Quality Program, July 1989)

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be executed on this 14th day of February, 19 89.

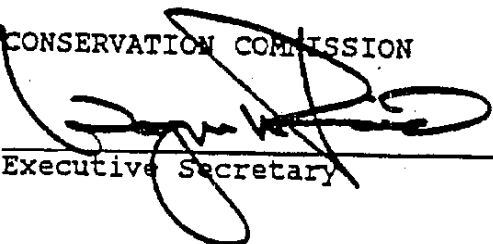
APPROVED AS TO FORM:


Assistant Attorney General

DEPARTMENT OF ECOLOGY


Director

CONSERVATION COMMISSION


Executive Secretary

The Thurston County Conservation District will participate in this agreement at:

Compliance Level 1 _____
Level 2 _____
Level 3 _____
Level 4 _____

Thurston County
CONSERVATION DISTRICT


Chairman