Corps of Engineers Northwestern Division
North Pacific Region
Portland, Oregon

2000

Water Quality Annual Report

Prepared with input from:
Portland District
Seattle District
Walla Walla District
North Pacific Region

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1. Summary

This report on the 2000 Water Quality Program was prepared in conformance with ER 1110-2-8154 and NPDR 1110-2-101. Dredging was also included for reference purposes. The report only covers programs and activities within the North Pacific Region of the Northwestern Division (Portland, Seattle and Walla Walla Districts).

NWD-NP division-wide Water Quality Management Program in 2000 represented an estimated 33 staff-year effort and a combined contracts total of $1.84 million. (see Table 1).

A summary of Division and District activities is given in Table 3, including the three most important issues/concerns and accomplishments in each organization.

The water quality and water quality-related highlights of the year included the following events/activities:

- ✓ Flow augmentation and spill for-fish-passage measures needed to improve fish survival in the Columbia/Snake waterway continued to affect water quantity and quality.
- ✓ NMFS continued to request interim standards waivers from the states and the Nez Perce Tribe to make it possible for the spill for-fish-passage and other flow augmentation measures to occur to NMFS Biological Opinion levels. Waivers were granted covering part or all of the April 1-August 31 period, temporarily raising the dissolved gas standards from 110 percent to 120 percent in the tailwater of the spilling dam, and from 110 percent to 115 percent in the forebay of the next downstream dam. Waivers from the State of Idaho were not requested.
- ✓ The Districts continued to be responsible for all TDG field monitoring functions. Portland and Seattle Districts contracted out the field calibration and maintenance. Walla Walla district contracted out the routine calibration of the instruments and chose to perform the routine and emergency maintenance with internal staff. The current TDG network included 27 Corps fully automated data collection and transmission facilities installed in forebays and tailwater areas of all Columbia and Snake River mainstem dams and some riverine sites. No unusual data collection and transmission problems were encountered.
- ✓ The Dissolved Gas Abatement Study report is expected to be completed by June of 2001.
- ✓ The US-Canada Transboundary Gas Group (TGG) continued to meet in 2000. This international technical group is designed to cooperatively undertake TDG abatement studies on a systemwide basis. Representatives of NMFS, EPA and the Northwest Power Planning Council are currently the US leads on this effort.
- ✓ Design and/or operational actions associated with the salmon and steelhead recovery effort continued to drive many of the water quality programs in the North Pacific Region.
- ✓ Water quality conditions at most reservoirs and lakes in the Northwestern Division, North Pacific Region remained practically unchanged from the previous years (see Table 4).

More specific water quality highlights for 2000 are listed below for the Division and the three Districts.

1.1. North Pacific Regional Office

- ✓ Day-to-day coordination of the basinwide TDG monitoring program in the Columbia River Basin
- ✓ Participation in the activities of the Technical Management Team (TMT), a regional inter-agency group to advise on the weekly reservoir operation for the salmon recovery in the Columbia River Basin.
- ✓ Winter monitoring of TDG continued for the third year at selected lower Columbia/lower Snake River projects.
- ✓ Water quality staff operated and maintained an Internet homepage that provides the real-time project information needed for basin-wide water management.
- ✓ Active contribution to the preparation of the following annual planning documents: (1) 2000 Water Management Plan for the Columbia and Snake River system, for use by the TMT, (2) 2000 TDG Management Plan (for attachment to the TMT's Water Management Plan) and (3) Plan of Action for the 2000 TDG monitoring.
- ✓ Refinement and application of statistical procedures for predicting dissolved gas saturation levels, including (1) evaluation of the increase in TDG mass caused by spill up to the 120% TDG target, (2) review of a one-dimensional water temperature model developed for DGAS by Battelle, and (3) review and use of a system TDG spreadsheet based model developed as an extension of the Chief Joseph-Grand Coulee TDG Abatement Study.

Continued active participation in other regional forums dealing with water quality, including coordination of TDG-related regional research plan in NMFS's Dissolved Gas Team, the Clean Water Action Plan group, and coordination with EPA, the states and tribes in the development of mainstem TMDLs.

1.2. Portland District

- ✓ Completion of the fifth year of successful assumption of direct responsibility for dissolved gas monitoring at 8 stations on the lower Columbia River starting from John Day forebay, using the services of the USGS. Data loss for WY 2000 was less than 1 percent.

- ✓ Completion of a summary water quality report for the Willamette Projects Detroit, Big Cliff, Green Peter, Foster, Blue River and Cougar that encompassed water quality since the projects became operational.

- ✓ Participation in a cooperative effort with the U. S. Forest Service/ City of Salem concerning turbidity studies in the upper Santiam River watershed.

- ✓ Continuous findings of no contamination in dredged material samples collected from selected NWP's project sites.

- ✓ Water continued to be released from Lost Creek and Applegate to improve Spring Chinook and Fall Chinook salmon spawning conditions. Flow and water temperature targets were again met. Routine water quality monitoring for nutrients and limnological parameters continued at both projects.

- ✓ In the Willamette River Basin turbidity was measured at Detroit Lake outflows in cooperation with a watershed monitoring program involving the USFWS, COE, USGS and the City of Salem. Water temperatures were monitored at 9 locations – 3 in the mainstem Willamette and 6 below Willamette projects – to observe effects of flow volume on mainstem temperatures. Ten temperature monitoring sites were set up in the South fork of the Santiam River to assist the State in developing a temperature TMDL.

- ✓ The selective withdrawal structure at Willow Creek Lake was used to help improve downstream water temperatures in Willow Creek. The device was lowered to a depth of approximately 17 feet where cooler waters were available. Outflows were monitored for temperature, DO and pH immediately below the project. About 1 mile downstream, at Morgan Street temperature was again measured to determine extent of temperature improvement. The point of the study was to aid locals in improving conditions in the creek so that, in the future, the stretch immediately below the dam could be removed from the 303d list.

- ✓ The District is coordinating with resource agencies water quality monitoring during construction of the temperature tower at Cougar. This year the USFS profiled the lake at three sites delimiting the area of the 106 acre residual pool that will result during construction. The USGS added temperature and turbidity to the upstream and downstream gaging stations and DO to the downstream station to monitor construction impacts on water quality.

1.3. Seattle District

- ✓ The District continues to be an active participant in the Instream Flow Commission, a multi-agency commission to establish flows for the Cedar River, a tributary to Lake Washington.

- ✓ The District continued to monitor water temperature at Wynoochee Dam, owned by the City of Aberdeen and operated by Tacoma Public Works Department.

- ✓ The District continued to study the effect of increased conservation storage at Howard A. Hanson Dam. The instillation of the environmental mitigation has been completed.

- ✓ This spring had "normal runoff" in the Columbia River basin including the Kootenai River. This allowed for only one sturgeon pulse at full powerhouse discharge, which provided 25 kcfs at Bonners Ferry for 17 days. The strategy this year was to obtain flows that would benefit sturgeon larvae releases from Kootenai Indian Tribe's Fish hatchery.

- ✓ TDG was monitored at the two permanent water quality sites (forebay and tailwater) at Chief Joseph Dam.

- ✓ The District continued to pursue a dissolved gas abatement study at Chief Joseph Dam in consultation with Washington State and the NMFS regional forum. As called for in the 1998 NMFS Biological Opinion for salmon, the merits of operating Chief Joseph and Grand Coulee Dams jointly for dissolved gas abatement were examined in a system wide study.

- ✓ In July and August the District performed a study to determine how the operations of Hiram Chittenden Locks can effect DO, salinity and temperature upstream of the locks. This study will help to determine if lock operations can create/enhance an estuarine environment around the locks for migrating salmon species. The water quality data will also be joined with hydroaucoastic monitoring of salmon to determine if salmon follow a specific water quality parameter.

- ✓ The District continued to monitor water quality throughout the ship canal (5 permanent water quality stations), Lake Koocanusa and the Kootenai River via a contract with USGS (6 permanent water quality stations) and at Howard Hanson dam (8 sampling sites).

- ✓ A two-dimensional water quality model was used to simulate saltwater intrusion into the Lake Washington Ship Canal.

- ✓ A 2 dimensional model of the Sammamish River was updated to the CE-QUAL-W2 (version 3) and recalibrated using 1999 data.

- ✓ The District continues to participate in the numerous fish studies through out the Green and Cedar River basins to improve the water quality and habitat of salmonids.

1.4. Walla Walla District

Fiscal year 00 was a very challenging year for water quality problems in the Walla Walla District. The U.S. EPA issued a letter of Violation for the Lower Granite Public Owned Wastewater Treatment (POTW) discharging in excess of its National Pollution Elimination Discharge System (NPDES) permit. The Washington Department of Health issued a Notice of Violation (NOV) to the Lower Granite Illia housing unit water supply system for violation of fecal coliform and public notification in the water supply tank at the point of issue.

Dworshak Dam and the Dworshak National Fish Hatchery water systems are operating under voluntary consent orders with the State of Idaho. Corrective actions to bring these systems up to Safe Drinking Water Standards are scheduled for December 2003 and 2002 respectively. The new system update for Big Eddy Marina at Dworshak was just completed and approved after a 2-year struggle with equipment and supply water problems.

At the Ice Harbor Dam a NOV was received from the Washington Department of Health for exceeding the nitrate standards in the drinking water system monitoring and reporting violations. Ice Harbor has also been notified that well #3 at the dam is not a permitted well, and is not to be operated as a public water supply until approved.

The McNary Project, at Hood Park; Washington Department of Health notified the Corps that Well #1 is not a permitted well and shall not be operated as a public water supply until approval. Problems continue to plague this water supply system with both source water and distribution systems.

Walla Walla District personnel conducted a sediment sampling in the Snake River and Clearwater Confluence. Sediments were analyzed for a variety of organic and inorganic

constituents. The planned FY2000 dredging was cancelled because it failed to meet NEPA and the Endangered Species Act coordination. Efforts to meet these objectives are under study in the Dredge Material Management Program study.

Previous juvenile salmon mortality at collection facilities was attributed by some agencies representatives to be a direct cause of thermal stress in the collection system, and in the reservoir itself. This controversial topic was further evaluated. The District placed more temperature monitoring devices into the ladder and collection systems. A report is scheduled for release in FY2001.

The nine district swim beaches are monitored for fecal coliform bacteria. Last year approximately 600 individual samples were collected. In previous years Swallows Park swim beach experienced closures. This last year due to the dredging and good water year there were no public beach closures due to water quality problems.

Temperature measurements were made in the Dworshak Reservoir and monitoring is continuing. At eight different locations there are point thermisters and chains to collect yearly temperature cycling data. This data is to be used by the water quality staff to advise operations when operating for temperature and to select additional locations for temperature monitoring as needed.

The water quality objectives proposed for 2000 were different. Water quality monitoring will continue in sensitive project areas. Most efforts will be related to on-going operational concerns.

Table 1. 2000 Water Quality Staff Levels
(includes staff in water quality-related disciplines)

Offices	**GS-7/8**	**GS-9**	**GS-11**	**GS-12**	**GS-13**	**Total**
Division Water Mgt			1	1	1	3
Portland PE						
Seattle Water Mgt	1		2	6	1	10
Seattle ERS	1	1	1	2	1	6
Seattle DMO					1	1
Seattle RGS					1	1
Seattle NS				1		1
Walla Walla PL			0.2			0.2
Walla Walla IM						
Walla Walla EN			2			2
Walla Walla OP				0.2		0.2
Full and part-time staff	2	1	6.2	10.2	5	24.4

Table 2. 2000 Water Quality Contracts Summary (in $1,000s)

Offices	Universities and AE's	Other Corps	Other Federal	Water Quality	Sediment Quality	Total Sediments +WQ
NWD-NP						
NWP	300.6	0.4	306.6	162.4	138.2	607.6
NWS	427	10	62	331	168	499
NWW	115	0	0	27	70	212
TOTAL	**842.6**	**10.4**	**368.6**	**520.4**	**376.2**	

Table 3. 2000 Annual Water Quality Activity Summary

Items	NWD-NP	NWP	NWS	NWW
A. **No. of WQ Monitoring Stations**				
A1. Reservoir	-	12	15	25
A2. Riverine.	-	49	35	10
A3. Dredging	-	79	8	-
A4. Others . .	-	-	6	-
B. **No. of WQ Studies related to**:				
B1. Planning	1	8	10	1
B2. Operations	1	11	3	2
B3. R&D	1	1	1	-
B4. Others	-		-	-
C. **No. of WQ reports**				
C1. In-progress	0	2	10	2
C2. Completed	3	12	5	-
D. **WQ Staff and Contract Amount**				
D1. FTE's ..	3	9	19	2
D2. Full-time staff.	2	9	6	2
D3. Part-time staff.	2	0	13	2
D4. Contract Amount ($1,000)	0	607.5	394	212
E. **Support Rec'd** (+) **or Given** (-)				
E1. HEC/WES	+1	+1	+1-1	0
E2. Other districts.	-2	0	+3-3	0
E3. Others (AE,U)	+0	0	+3-2	+1 (PUD)

Three Most Important Issues/Concerns	Three Most Important Accomplishments
NWD-NP 1.Dissolved gas supersaturation 2.Water Temperature 3.Regional coordination for the NMFS forum and TMDLs.	**NWD-NP**. 1. TDG: Coordination & Applic ations 2. Activities within TMT and DGT Teams 3. Coordination of NWD-NP-WQ programs
NWP 1. TDG in Lower Columbia River Projects 2. TMDLs in Willamette & L. Columbia River 3. State 303(d) listings below projects	**NWP** 1.Successful TDG fixed monitoring program 2. Selective withdrawal at Willow Creek to lower downstream temperatures 3. Installment I of Willamette Valley Project water quality report
NWS 1.Disposal of dredged material 2. Saltwater intrusion Lake Union 3.Water Temperature	**NWS** 1.Chief Joseph Gas Abatement 2.Improvements to dredged analysis info system 3.Improved real-time regulation for WQ
NWW 1. Public Health 2. Impacts of proposed dam breaching 3. High temperatures in Lower Snake River and McNary	**NWW** 1. Increased support to water and wastewater problems 2. Installation of fish facility temperature monitors 3. Dworshak temperature study

Table 4. Summary of 2000 Water Quality Conditions

Districts/Projects	Ratings	Historical Problems	1998 Problems	Future Problems
Portland				
1. Lost Creek	Good	Outflow temperature	Outflow temperature	Temperature.
2. Applegate	Good	Outflow temperature, mercury	Outflow temperature	Outflow temperature., mercury, anoxia
3. Fall Creek	Good	H_2S, algae, anoxia	Temp.	Algae Temp.
4. Hills Creek	Fair	Turbidity, algae	Temp.	Turbidity, algae
5. Lookout Pt.	Good	None	TDG	TDG, temp
6. Dexter	Fair	Algae, macrophytes	TDG	TDG, temp
7. Dorena	Fair	Mercury	Mercury, anoxia	Mercury, anoxia
8. Cottage Gr.	Fair	Mercury	Mercury, anoxia, temp	Mercury, anoxia, temp
9. Fern Ridge	Poor	Eutrophication, nuisance aquatic plants	Nutrients	Eutrophication, Aquatic plants
10.Willow Cr.	Poor	Enrichment	Anoxia, H_2S, nutrients, methane, algae, fecals	Anoxia, H_2S, nutrients, methane, algae, fecals
11.Cougar	Good	Temperature	None	Temp.,algae
12.Blue River	Good	Temperature	None	Temp., algae
13.Detroit	Good	Temperature,	Turbidity,	Turbidity

		turbidity	temperature	
14.Big Cliff	Good	Temperature, turbidity	Turbidity	Turbidity
15.Green Peter	Good	Turbidity, temperature	None, temperature	Turbidity, temp
16.Foster	Good	Turbidity, temperature	None	Turbidity
17.Bonneville	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature
18.The Dalles	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature
19.John Day	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature
Seattle				
1. Libby Dam	Good	Nutrient, metals, temp.	None	None
2. Albeni Falls	Good	No temp controls, metals	Outfall Temp	Temp
3. Chief Joseph	Good	No temp controls	None	Temp, TDG
4. Mud Mountain	Fair	Turbidity, sediments	Turbidity	Turbidity
5. Howard Hanson	Exc	No temp controls, turbidity	None	Turbidity
6. Nav Locks &	Fair	Saltwater intrusion,	Saltwater intrusion	Benthic O_2 Demand
Lake Union		toxic + metals waste, sediment O_2 demand	SOD	Toxic organics
7. Wynoochee	Exc	Outflow temperature	Outfall Temp	Outfall Temp
Walla Walla				
1. Dworshak	Good	Trash/Debris, TDG, Turbidity, potable water	Potable water operating under MOU with State of Idaho. Separate MOU for Dworshak National Fish hatchery. Currently looking at participation in local water district.	Increase withdrawl and drawdown, Decreased fish productivity
2. Lower Granite	Fair	High levels of Total Dissolved Gas during high flow periods. In the summer high water temperatures, increase nutrient loading, and slower water velocities contribute to blue-green algae blooms.	Currently have water and wastewater problems related to lack of money to fix problems, and lack of certified personnel to operate waste water system. Have difficulty meeting NPDES permit requirements. No	Contaminated Sediments impacting dredging operations and contributing to eutrophication conditions during low flow periods. Increased pesticides and herbicides in the runoff. Many of the newer pesticides and

			NPDES permits for Fish facility outflow.	herbicides have not been tested for their deleterious effects
3. Little Goose	Fair	High levels of Total Dissolved Gas during high flow periods.	Currently waste water problems related to lack of certified personnel to operate waste water system. No NPDES permits for fish facility outflow. Having trouble getting all required testing done.	Contaminated Sediments impacting dredging operations and contributing to eutrophication conditions during low flow periods. Increased pesticides and herbicides in the runoff. Many of the newer pesticides and herbicides have not been tested for their deleterious effects
4. Lower Monumental	Fair	High levels of Total Dissolved Gas during high flow periods.	Having trouble getting all the required testing done.	Contaminated Sediments impacting dredging operations and contributing to eutrophication conditions during low flow periods
5. Ice Harbor	Fair	The potable water has been a problem at Ice Harbor for several years. Fecal coliform at swims beaches and in water supplies have been historical problems. High levels of Total Dissolved Gas during high flow periods.	Problems with potable water exceeding nitrates. Problems with potable water exceeding coliform level. Problem getting all required testing done. Problems posting of water system. Well #3 not approved by Washington Dept of Health for potable water.	High Temperatures. Increase in water disposal, algae, delayed fish passage, bacteria, shoaling problems with well #1 in Hood Park. Not approved for potable water by Washington Dept of Health. Non-point source nutrient loading. Increased pesticides and herbicides in the runoff. Many of the newer pesticides and herbicides have not been tested for their deleterious effects
6. McNary	Fair	Dissolved Gas, temperature	Problems with well #1 in Hood Park. Not approved for potable water by Washington Dept of Health. High dissolved gas and water temperatures	Temperature. Non-point source nutrient loading. Increased use of pesticides and herbicides. Unknown concentrations in the runoff

			were a problem	Present a challenge to making factual determinations
7. Lucky Peak	Good	None	Swimmer's itch	Increase demand, non-point source nutrient loading
8. Mill Creek	Fair	Stratification, anoxia, turbidity, swimmer's itch	Sedimentation due to flooding	High Turbidity, Conditions caused by reservoir refill

Table 5. Water Quality Staff Expertise (2000)

Staff	**Technical Expertise**	**Years in WQ**	**GS-Grade**
Regional Office			
CENWD-CM-WR-N			
Richard Cassidy	Reservoir regulation, limnology, hydrology	32(32)	13
Nancy Yun	Database, modeling, data analysis	17(11)	12
Ruth Abney	Environmental chemistry, computer specialist	12(0.5)	11
Portland District			
Roger Ross		35(1)	13
Jim Britton	Sediment quality, water quality, biology	32(13)	11
Mark Siipola	Civil engineer, oceanography	24(15)	12
Mike Posovich	Environmental engineer, water quality modeling	7	11
Tim Sherman	Biology, chemistry	22(11)	11
Laura Hamilton	Environmental engineer, data management	18(5)	11
Kathryn Harris	Environmental engineer	4	11
Seattle District			
EC-TB-HH-WM			
David van Rijn	reservoir regulation, water quality, field work	4	11
Marian Valentine	hydrologic engineering, WQ studies, chemistry, limnology	5	13
Louie Read	instrumentation, field work	11	8
Ray Strode	instrumentation, field work, data collection platform installation	18	11
EC-TB-ER			
Fred Goetz	in-stream flows, limnology, aquatic biology, habitat modeling	11	12
Kathy Kunz	wetlands, aquatic biology	24	13
Dean Parren	salmonid fisheries, filed work	8	11
Jeff Laufle	fisheries/aquatic biology, in-stream flows	18	12
Jeff Dillon	aquatic biology, sampling strategy, field	6	11

	work		
Patrick Cagney	habitat restoration, ecology	14	12
Charles Ebel	Fish passage, field work	7	7
Steve Martin	shellfish biology, marine science	26	12
Mike Scuderi	planning	15	12
Aimee Kinney	estuarine biology/dredging	3	9
George Hart	Wildlife, fisheries, aquatic habitat	12	12
OP-TS-DM			
David Kendall	environmental biogeochemistry, marine ecology, benthic habitat assessment	27	13
Stephanie Stirling	marine ecology, sediment chemistry, environmental regulation	10	12
Lauran Warner	dredge materials technical support	11	12
Hiram Arden	project management, maintenance dredging, seasonal monitoring of WQ	31	12
Walla Walla District			
CENWW-ED-H			
Dave Reese			
Russ Heaton	limnology, water quality, aquatic ecology, water chemistry, invertebrate and microbiology, dissolved gas sampling and analysis, sediment chemistry, hazardous materials, parisitology, toxicology, dredge material testing, and lab management	13	11
Phillip Fishella	limnology, sediment and water sampling, aquatic plants, water and wastewater treatment, fisheries management, fish culture, wildlife management, wetlands ecology.	21 (20)	11
CENWW-PD-ER			
Sandy Simmons	Environmental compliance, permits, section 404(b)1, in-water work coordination, agency coordination.	20 (14)	11
CENWW-OD-RM			
Jimmie Brown	Environmental compliance, potable and swim beach water quality monitoring, ERGO	24 (8)	12

2. Water Quality Management Program

2.1. Introduction

This portion of the report summarizes the Northwestern Division (North Pacific Region) Water Quality Management Program for program objectives, major activities, accomplishments in 2000, and proposed objectives for 2001. The report conforms to ER 1110-2-8154, Water Quality and Environmental Management for Corps Civil Works Projects dated 31 January 1995, and with NPDR 1110-2-101, Water Control Management - Quality, dated 19 December 1986.

2.2. Organization And Coordination

Most NWD-NP Reservoir Control Center water quality programs are surveillance and monitoring in nature. These programs are to ensure that Corps activities meet all applicable federal, state and local standards to the full extent possible. In some cases, water quality programs can be project-specific and lead to changes in project operations and/or design features. An example is dissolved gas monitoring and its use in adjusting real-time spill on the mainstem Columbia and Snake Rivers or longer term efforts of changing spill patterns and modifying spillway and stilling basin configurations. Data from the dissolved gas monitoring program is also being used to help refine existing regression-based and deterministic dissolved gas models.

In many districts, compliance with the Clean Water Act (e.g. NPDES — National Pollutant Discharge Elimination System, and Section 404(b)(1) evaluations) is managed under the water quality program. Although most division and district water quality elements have no direct regulatory responsibility, their annual reporting requirements are more extensive than those of other functional elements.

2.2.1. Assigned Responsibilities

2.2.1.1.Regional Office

At the regional level, the Water Quality Team (WQT) in the Reservoir Control Center (Water Management Division, Engineering and Technical Services Directorate) provides technical and policy guidance on CENWD-NP's water quality programs. The WQT staff directly coordinate the Dissolved Gas Monitoring Program for the Columbia/Snake River System, and schedule short- and long-term reservoir operations for water quality that impact fish passage and fishery research. Coordination also extends to other water quality programs and activities by the Corps, other agencies and regional organizations. The WQT provides direct input to the Technical Management Team, which makes recommendations on the operation of the Federal Columbia River Power System for multi-purpose use. The WQT represents the Corps as active participants in the NMFS BiOp Water Quality Team which is expanding to address regional TMDL issues. The NP-WQT also coordinates with the Clean Water Action Plan development group. The group includes representatives from the US Army Corps of Engineers, the Bonneville Power Administration, the Bureau of Reclamation, the National Marine Fisheries Service and the Environmental Protection Agency.

It is primarily through the WQT that operational measures needed to enhance or remediate water quality problems and concerns are implemented at Corps projects on the mainstem Columbia and Snake Rivers. The WQT is responsible for preparing this report, after review and synthesis of materials submitted by the districts. The WQT is responsible for preparing the TDG Annual Report for distribution to the region.

The Engineering Team of the Planning/Engineering Division oversees water quality studies on groundwater for possible contamination. The Environmental Resources Branch (also in the Planning/Engineering Division), and the Natural Resources Team and the Navigation Team in Operations & Construction Division, oversee another important field of water quality — dredging.

2.2.1.2.Districts

At the district level, all three NWD-NP districts are assigned broad responsibilities in developing and implementing water quality management programs. Districts are responsible for identifying and monitoring the sources of water quality problems affecting (or caused by) their projects. They inform State and Federal agencies of water quality changes that could present a public health hazard. They report emergency events to the Division's Readiness Management (Operations, Construction & Readiness Directorate). Some of their water quality activities overlap with other programs, such as the Defense Environmental Restoration Program and EPA Superfund Program. Water quality problems that can be resolved through reservoir operations are reported to the Reservoir Control Center for appropriate actions.

Primary responsibility for reservoir water quality programs usually rests with the planning and engineering elements. This is true for the Portland and Seattle Districts. In CENWW (Walla Walla District), the Engineering H&H Branch and Operations Division's Natural Resources Management manages water quality. The H&H Branch also handles hazardous, toxic, and radioactive waste (HTRW) issues including ground water and sediment contamination with emphasis on contaminant identification It provides water quality expertise and coordination for planning studies such as the Dissolved Gas Monitoring, Lower Granite Dredging Compliance Monitoring, Lower Snake River Project Water and Wastewater operation, and Public Health activities. The District Water Quality steering committee coordinates work with other districts and division as needed.

All NWD-NP districts have direct access to the Waterways Experiment Station in Vicksburg, MS and the Hydrologic Engineering Center in Davis, CA for physical and mathematical modeling support. Each district reports its water quality activities annually to the Regional Office for review, synthesis, reporting and posting on the Internet.

2.2.2. Cooperation with Other Agencies

District and Division staffs routinely coordinate with Federal, State, and local agency environmental quality counterparts and state Department of Health for Public Services. The listing of twelve Pacific salmon species under the Endangered Species Act (ESA) has made this

coordination critical since the Corps is responsible for the operation of it's project for multiple purposes. All water users have a vested interest in what operation is being planned by the Corps, where, when, and how.

CENWD-NP's Reservoir Control Center (RCC), in the Water Management Division, plays an active role in implementing the flows measures contained in the NMFS's 1995 Biological Opinion and its 1998 Supplement. There is continual dialogue between RCC and the Pacific Salmon Coordination Office, the Bonneville Power Administration (BPA), utilities, state and federal fishery agencies and Indian Tribes. The RCC makes all final reservoir regulation decisions, frequently based on recommendations from the Technical Management Team, a mid-management level group set up by NMFS in 1995 and chaired by the Corps representative.

NWW cooperates with the U.S. Department of Energy in analysis of existing data, development of GIS, and plans for future activities in water quality and fishery programs. Studies of sediment pollution for dredging activities are performed in cooperation with EPA and the Washington Department of Ecology. State of Washington Department of Ecology, State of Idaho Division of Environmental Quality (IDEQ), NMFS, and ODEQ in performing NPDES permitting activities. Contacts with IDEQ, State of Washington Department of Ecology, EPA, and U.S. Department of Energy are also needed to help address sediment transport and contaminant concerns

Coordination with NMFS, USFWS Cooperative Research Unit at University of Idaho, and the State of Washington Water Research Center at Washington State University is maintained on the Comprehensive Limnological Study of the Lower Snake River.

2.2.3. National Corps Committees

CENWD-NP is represented on national Corps committees. These include the Corps' Committee on Water Quality (by CENWD-CM-WR-N), Committee on Tidal Hydraulics (by CENWS's Engineering), Corps Research and Development Field Review Group (by CENWD-CM-WR-N and CENWP-NP-ET-HR), and Committee on Hydrology (by CENWD-NP-ET-WH).

2.3. Major Goals And Objectives

Executive Order 12088, dated 8 November 1978 made it a national policy for the Federal Government to provide leadership in a nation-wide effort to protect and enhance the quality of air, water, and land resources. ER 1110-2-8154 (Water Quality and Environmental Management for Corps Civil Works Projects) dated 31 May 1995 establishes a policy for the water quality management program at Corps civil works projects. In accordance with this policy and additional guidance provided in NPDR 1110-2-101 ("Water Control Management, Water Quality") dated 19 December 1986, the established long-term goal of the Division's Water Quality program is to ensure that waters at each project are of suitable quality for the project's established project use(s). To meet this goal, there is a need to:

✓ Develop a good understanding of the physical processes affecting water quality, including relationship between project operations and ambient water quality conditions; and

✓ Monitor water quality trends and current conditions so that future conditions can be reliably predicted and efficient corrective actions taken.

In order to achieve these objectives, there is a need to:

✓ Maintain staff capability in state-of-the-art water quality techniques and procedures, and correct application thereof;

✓ Implement reliable and adequate monitoring programs to support water management functions in an efficient and expeditious manner;

✓ Provide a comprehensive, up-to-date, and easily accessible data base; and

✓ Foster close cooperation with other Federal, State, and local agencies involved in water quality programs.

Objectives set by each district reflect the district's own priorities and requirements. These objectives and a summary of their status for FY00 are listed in the following sections.

2.3.1. Regional Office

2.3.1.1.Objectives

1. Continue to coordinate and monitor the Corps annual total dissolved gas monitoring program in the Columbia River Basin;

2. Continue to monitor and adjust spill levels at Corps projects in the Columbia River Basin during the spill season to maintain TDG levels below the state standards of 115% in the forebays and 120% in the tailraces;

3. Continue to develop, maintain and operate an active homepage for real-time use in water management of the Columbia River reservoir system,

4. Continue to improve numerical modeling capability;

5. Continue to improve Division-District coordination on water quality and related issues

6. Continue to provide the required level of oversight to the Dissolved Gas Abatement Study team; and to represent the Division at regional forums dealing with compliance issues involving total dissolved gas and other water quality parameters, and

7. Provide water quality and general environmental modeling support to others as needed.

2.3.1.2.New Objectives

8. Work with HQ to resolve state water quality variance issues.

9. Develop an inter-agency Water Quality Plan for the Columbia/Snake system.

10. Participate in TMDL development for TDG and water temperature on the Columbia/Snake mainstems.

11. Participate in the development of a CENWD – North Pacific Water Quality Team to provide regional program management guidance.

12. Develop and implement 1-year and 5-year Water Quality Plans as specified in the 2000 NMFS BiOp.

13. Participate with BPA and BOR in water temperature and TDG modeling as specified in the 2000 NMFS BiOp.

14. Create a North Pacific Water Quality Team to provide program management approach to water quality issues affecting the planning, design, construction and operation of the Corps projects in the Columbia River Basin.

2.3.1.3.Status

Objective 1 (dissolved gas monitoring) represents a continuing effort started in 1984. The Corps total dissolved gas and water temperature monitoring now includes deployment of 27 fully automated instruments at both forebay and tailwater areas of all Corps mainstem dams and other river locations. Division staff continues to coordinate the monitoring program on a system-wide basis, prepare real-time data reports, disseminate relevant information, and store the information in a permanent database.

Objective 2 (monitor and adjust spill levels), information collected through the dissolved gas monitoring program was used by the Inter-agency Technical Management Team on a real-time

basis for adjusting project spill in an attempt to control total dissolved gas levels to the State standards. A spill and dissolved gas management policy was formulated and implemented annually division-wide. As was the case in the previous five years, NMFS required that spill be implemented at lower Columbia and lower Snake Rivers mainstem dams to improve juvenile passage conditions.

Objective 3 (develop, maintain and operate an active homepage), project operational information including fixed monitoring station data (TDG and temperature) are published real-time from CROHMS on the TMT web page to aid regional decision makers. Monthly historical summaries of the FMS data are also published to the TMT web page.

Objective 4 (maintain modeling capability) continued to be pursued. This included:

- following up with ongoing TDG model development under the DGAS Study by Battelle Northwest and WES,
- developing a spreadsheet model using empirical spill versus TDG equations for internal use,
- assisting EPA in calibrating their one-dimensional water temperature model, and
- attending a 5-day workshop on the application of the two-dimensional CE-QUAL-W2 model.

Objective 5 (coordination with Districts) is institutionally a continuing activity. Division staff closely coordinated with all three Districts in many areas, including TDG monitoring, scheduling special reservoir operations for TDG-related research and flip-lip construction, developing the 7-day 10-year flows, coordinating joint studies with other Federal agencies, sponsoring District attendance to regional forum meetings, etc.

Objective 6 (Dissolved Gas Abatement) was fully met. Division staff assisted this District-led study by reviewing 1- and 2-dimensional modeling work performed under contract by Battelle, , generally serving as Division technical adviser and monitor, and coordinating preparation of TDG-related Research.

Objective 7 (modeling support to others) is also a continuing requirement already addressed above under Objectives 3 to 6.

2.3.2. Portland District

2.3.2.1.Water Quality Objectives

1. Continue limnological and routine water quality monitoring at Lost Creek and Applegate Lakes, Rogue River Basin, Oregon; and at Willow Creek Lake, Heppner, Oregon.

2. Continue to operate and maintain stream-gaging programs in the Willamette and Rogue River Basins, Oregon, Willow Creek Basin, and in Toutle River Basin, Washington, and in the Lower Columbia River main stem.

3. Work with Oregon resource agencies to develop instream-flow rules for the Willamette River requiring the Corps of Engineers to provide specific flows year-round for fisheries and water quality enhancement.

4. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal projects.

5. Continue studies of mercury in Cottage Grove Reservoir by measuring loading during storm events.

6. Continue routine monitoring of Willamette System reservoirs as needed.

7. Obtain historical data collected by USGS and contractors for entry into District water quality database.

8. Continue to implement the District Fixed Monitoring Program (FMP) for monitoring TDG below Corps Projects in the lower Columbia River. Evaluate the need for dropping and/or moving FMP sites to improve the program.

9. Continue to monitor TDG below Corps Projects in the Willamette and Rogue Basin on an as-needed basis.

10. Continue to participate with the U.S.F.S. and the city of Salem as a team member to monitor water quality in the North Santiam Watershed.

11. Finish analysis of impacts John Day Dam drawdown alternatives on water quality.

12. Develop plans and specifications for water quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir.

2.3.2.2.New Goals for 2000

2.3.2.3.Water Quality Status

Objective 1 (water quality monitoring at Rogue and Willow Creek Projects), Objective 2 (stream gaging program), Objective 4 (coordinate compliance with standards with agencies), Objective 7 (obtain historical USGS data), Objective 11 (Detroit turbidity monitoring), and Objective 12 (John Day Drawdown water quality impacts) were fully met.

Objective 3 (Willamette instream flow rules). The State of Oregon requested higher flows in the Willamette to protect steelhead fish. An interim agreement was reached between Oregon Department of Fish and Wildlife, National Marine fisheries Service and the Portland District to provide the needed flows.

Objective 5 (mercury studies in Cottage Grove Reservoir) was put off to next year because of low runoff from infrequent storm events this year.

Objective 6 (Monitoring Willamette Reservoirs) Profiling for basic water quality parameters was carried out by the USFS at Cougar Reservoir to characterize the lake prior to construction of the temperature tower.

Objective 8 (TDG monitoring in lower Columbia River) The fourth year of district monitoring was completed with less than 1 % data loss. Problems arose at the John Day tailwater because of calibration problems associated with instrument sensors and membranes. The District will install a second backup monitor at this site because of the importance to resource agencies of this data. Calibration procedures will be improved to insure accurate data.

Objective 9 (monitor TDG as needed at Willamette and Rogue Projects) No TDG measurements were taken this year.

Objective 13 (water quality during Cougar SWS construction) Input from resource agencies was used to develop a water quality monitoring program during construction of the selective withdrawal structure at Cougar Reservoir. The Portland District will monitor water quality above and below the project while the USFS will monitor water quality in the residual pool behind the dam. USFS started monitoring in April of 2000.

2.3.2.4.Sediment Quality Objectives

1. Continue the District-wide sediment quality evaluation program at Operations and Maintenance dredging projects. During 2001, sediment quality evaluations are scheduled in the Columbia River, Lower Willamette River, Chetco River, Umpqua River and Winchester Bay, Siuslaw River, Skipanon Channel and Hammond Boat Basin.

2. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal navigation projects. Additionally, advise the Regulatory and Environmental Resource Branch (CENPP-OP-R) on testing procedures and interpretation of results for Section 404/103 permit actions.

3. Continue updating management/monitoring plans and implement the management/monitoring programs for ODMDSs.

4. Continue to participate in development of regional dredging teams as defined in the December 1994 MARAD report.

5. Continue to participate in expansion of the Columbia River Regional Testing Manual for sediment quality evaluation.

6. Complete evaluation studies leading to new ODMDSs at Yaquina Bay.

2.3.2.5.New Goals for 2000

2.3.2.6.Sediment Quality Status

Objectives 1 (sediment quality evaluations), 2 (standard compliance), and 3 (ODMDS studies) were fully achieved in 2000. More work will be done still in 2001.

Under Objective 3 (management and monitoring of ODMDS programs), annual bathymetric surveys were completed at the ODMDSs. Mathematical models of dredged material placement and subsequent sediment transport were conducted at MCR and ODMDSs E.

Reaching Objectives 4 (participation in regional dredging teams) is an on-going activity. A team consisting of Corps, EPA, NMFS and USFW representatives is charged with developing guidelines for regional dredging activities.

Objective 6 (Yaquina Bay ODMDS evaluation) is on-going as a sub-set of Objective 3. Sediment quality, area sidescan sonar studies, and benthic infauna studies were completed.

2.3.3. Seattle District

2.3.3.1.Water Quality Objectives

1. Continue performing project and related data evaluation and reduction.

2. Continue development and application of an operational water temperature model for Libby Dam to aid in determining the effects of Kootenai River white sturgeon flows (as required by the Endangered Species Act).

3. Continue to develop and implement a total dissolved gas-monitoring program for Libby Dam and the Kootenai River in the event of spill.

4. Continue automating data collection capabilities with emphasis on the Lake Washington Ship Canal.

5. Continue maintenance and updates to the Dredged Analysis Information System (DAIS).

6. Continue coordination with other federal, state, and local agencies involved in water quality programs, on all project planning, construction and operating efforts.

7. Insure that water quality assessment and water quality goals are included in watershed evaluations conducted by the District.

8. Continue development and application of a predictive model of salinity intrusion for the Lake Washington Ship Canal (LWSC).

9. Continue to develop a sediment-monitoring program at Howard Hanson Dam (HDD) as part of the drawdown of the turbidity pool.

10. Continue interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam.

11. Continue to evaluate the possibility of installing at least one new generating unit at Libby Dam to allow high flows with reduced risk of spill and high TDG levels.

2.3.3.2.New Goals for 2000

2.3.3.3.Water Quality Status

All objectives were adequately met during 2000.

Objective 1 (data evaluation). Efforts were made to continually re-evaluate and enhance the District's water control data collection system. A cooperative data collection program was continued with the U.S. Geological Survey. Summaries of fish ladder operations and gate settings at the LWSC were provided to the state for water quality comparisons.

Objective 2 (Libby water temperature monitoring) was completed in 2000 and will continue in 2001. The District successfully used a numerical model to assist a multi-agency recovery team in planning Libby Dam releases that would benefit sturgeon larval releases from the Kootenai Indian Tribe's fish hatchery.

Objective 3 (TDG monitoring below Libby). The District maintained readiness to operate a total dissolved gas sensor at the gage house downstream of Libby Dam in the event of spill. In the rare event of spill for flood control, District personnel plan to monitor dissolved gas between Libby Dam and the Kootenai Falls. This has not been necessary for over a decade.

Objective 4 (Data collection on Lake Washington). The District continued operation of five water quality stations in the Lake Washington Ship Canal (LWSC). All stations transmit real-time data to the District's Reservoir Control Center. The LWSC data are used to make operational decisions for control of saltwater intrusion.

Objective 5 (Dredge Analysis). The Dredged Analysis Information System (DAIS) continued to be used successfully to manage data used in the assessment of sediment quality for regulated and federal operations and maintenance projects.

Objective 6 (Coordination with others). The District conducted meetings with the Department of Interior, Colville Confederated Tribes and local net pen operators to address effects of high dissolved gas levels in Lake Rufus Woods. District conducted inter-agency meetings on Chief Joseph dissolved gas abatement problem, the installation of additional generating units at Libby Dam, and organized several multi-agency wetland delineation courses throughout the Northwest and Alaska. ERS coordinated with State and Federal agencies and Tribes for water quality certification, hydraulic permits and environmental studies related to water quality.

ERS also worked on projects as part of Planning Assistance to the States programs to:

(1) Investigate use of pulsed light (strobes) to guide juvenile salmon away from the filling culvert intakes in the large lock at the Lake Washington Ship Canal with King County.
(2) Investigate juvenile salmon use of nearshore mainstem and side-channel habitats of the Green River during the refill period for Howard Hanson Dam (City of Tacoma sponsor).

Also under Objective 6, ERS worked with USFWS, Idaho Fish and Game, EPA, Idaho Department of Environmental Quality, and Idaho Department of Natural Resources on water quality issues surrounding the use of herbicides for treatment of Eurasian watermilfoil. ERS conducted meetings with manufacturers and state and federal agencies to determine the best treatment method.

Objective 7 (Incorporation of water quality goals). Environmental Resources Section incorporated water quality goals into the study design of three continuing general investigation studies on the Stillaguamish, Duwamish/Green Basins and at Howard Hanson Dam on the Green River. The focus of these projects is on fish and wildlife restoration. ERS incorporated sediment and water quality goals and sampling into the design and/or construction of 6 Section 1135 habitat restoration projects:

1. Lake Washington Ship Canal;
2. Bear Creek;
3. Sammamish Weir; and
4. Turning Basin.
5. Wynoochee Dam
6. Howard Hanson

Objective 8 (Salinity Model). The Hydrology and Hydraulics Section continued refinement of a predictive model of saltwater intrusion for the Lake Washington Ship Canal. The model is currently being used to predict the movements of the saltwater wedge as a result of changing operations at the Locks.

Objective 9 (Sediment monitoring at HHD). The Hydrology and Hydraulics Section monitored total suspended solids on the Green River above Howard Hanson Dam to determine if there is a correlation between turbidity and total suspended solids. This effort will continue in WY 2001.

Objective 10 (TDG issues at Chief Joseph Dam). The District continues to participate in interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam.

Objective 11 (New Turbine Unit at Libby). The District provided information to outside agencies that are exploring power unit installation as a means of reducing the risk of spill and high TDG levels at Libby Dam.

2.3.4. Walla Walla District

2.3.4.1.Water Quality Objectives

1. Begin in-put of the limnological data into CROHMS. Start with current water year data and work backwards with the period of record data set.

2. Install multiple level thermister data collection sets in the forebay of McNary and the four Lower Snake River Projects.

3. Continue evaluation of the fish facility and ladder temperatures and process an annual district report.

4. Continue work on the water quality manual and coordinate the WQ program within Walla Walla District to encompass all of the operational requirements into a single comprehensive plan.

5. Draft a Lower Snake River Regional Sediment Evaluation Framework Document. This document will be used to complement Jack Sand's Dredge Material Management Study and facilitate the overall district dredge evaluations. The framework will also enhance NEPA documentation.

6. Improve the in-house water quality modeling capability. Begin using existing models such as BASINS 2.0, BATHTUB, or CE QUAL RIV2.

2.3.4.2.New Goals for 2000

2.3.4.3.Water Quality Status

Objective 1 (Begin in-put of the limnological data into CROMES). This work was suspended due to NWD's change in priorities. NWD is currently looking for a new database program that will be mandated and implemented in all of it's subordinate districts. See NWD's portion of the report for specific details.

Objective 2 (Install multiple level thermister data collection sets in the forebay of McNary and the four Lower Snake River Projects) Equipment and floats have bee purchased. Inadequate funding prevented the installation last year. The plans are to have the thermister strings installed by spring of 2001 if funding can be obtained.

Objective 3 (Continue evaluation of the fish facility and ladder temperatures and process an annual district report) Work has progressed steadily. All of the projects are outfitted with these devices. This winter (2001) the instruments will be re-powered with new lithium cells. The report for the FY2000 season should be out by late spring or early summer (FY2001).

Objective 4 (Continue work on the water quality manual and coordinate the WQ

program within Walla Walla District) New restructuring in the district requires the manual to be re-written again. Work on this product is suspended until restructuring is complete as far as how the water quality program functions. As of FY2001 Program and Planning Management Division

Objective 5 (Draft a Lower Snake River Regional Sediment Evaluation Framework Document) The Snake and Mid-Columbia testing framework will be completed in FY2001.

Objective 6 (Improve the in-house water quality modeling capability) The H&H Branch is currently studying many of the various models capable of temperature predictions. The Walla Walla District has some of the most complete temperature records available.

2.4. Laboratory and Field Equipment

2.4.1. Regional Office

No laboratory facilities or activities.

2.4.2. Portland District

1. No laboratory facilities.

2. Portland District continued to use the U.S. Forest Service Forestry Sciences laboratory Corvallis, Oregon, to perform chemical analyses on interstitial seep waters from the concrete matrix of Willow Creek Dam, as well as nutrient analyses on samples from the lake.

3. The USGS laboratory at the Water Resources Division was used for calibration, maintenance and repair of TDG saturometers and DCPs for the Fixed Monitoring Stations (FMSs). The District purchased 5 Hydrolab mini-sondes for measuring TDG at the FMS sites.

4. Portland District has 3 Hydrolab H20s and 3 TDG saturometers that are used for routine water quality monitoring.

5. Sediment samples were analyzed by various contract analytical companies.

2.4.3. Seattle District

1. The Seattle District continued to use a variety of environmental contractors to obtain field samples for biological, physical and chemical testing. A partial list of these contractors include SAIC, North Creek Analytical, AM Test, David Evans and Associates, Striplin Environmental Associates, R2 Resource Consultants, Parametrix, Biomarine Enterprises, Northwest Hydraulics, BioSonics, HTI, and WES.

2. Water Management Section maintains its own on-site laboratory for calibration and maintenance of water quality sensors.

3. Twenty-three Hydrolab sensors are maintained for the Lake Washington Ship Canal to monitor temperature, conductivity, and salinity. One multi-parameter probe is maintained to monitor dissolved oxygen at East Bay Marina in Olympia, Washington. Several other multi-parameter sensors and data loggers are maintained for remote monitoring and field-testing. Water Management Section (WMS) has three dissolved gas sensors deployed seasonally upstream and downstream of Chief Joseph Dam and one downstream of Libby Dam. Three additional dissolved gas sensors are used for field studies. WMS maintains several data-logging thermistors for use in special studies.

2.4.4. Walla Walla District

1. Walla Walla District maintains the capacity to collect water and sediment samples throughout the Division. The water quality program laboratory is capable of performing a broad array of particle size, qualitative, and quantitative sediment analyses. Equipment

available includes a two man canoe, a 16' river jet boat, and two 23' GPS equipped aluminum work vessels, a Ford F350 super duty service body truck, an RDI acoustic Doppler profiler, and 50+ water quality multi-probe profilers. There are comprehensive groundwater sampling apparatus, submersible pumps, and biological sample &analysis equipment. The Walla Walla District maintains sediment Ponar and core samplers, winches and other related instruments and equipment. Walla Walla District has the capacity to handle sampling volumes in excess of 100 samples per day. The LSRFS put this capability to the test, when no less than 12 each 55-quart ice chests were packed and shipped per day during the month of August. On one particular day the district processed 167 sediment samples for shipment to contractor laboratories.

2. Walla Walla District enhanced the capability of its modest water quality laboratory facility. The laboratory is equipped to handle titration for the calibration of field instruments and QA/QC of total dissolved gas instrumentation. A NIST certified barometer and certified pressure sources insure that the TDG instrumentation is kept at optimal performance. The Laboratory has a comprehensive suite of equipment to maintain and repair Hydrolab, YSI, and Sweeny, total dissolved gas data collection equipment. The new feature of the water quality laboratory is the ability to analyze nutrient samples for the district reservoirs. Parameters include phosphorus, nitrate, ammonia, sulfate, and total nitrogen. The district laboratory can also quantify chlorophyll a and evaluate anions and cations. The laboratory will be increasing its ability to support a variety of turbidity monitoring equipment in support of dredging and construction operations. The laboratory also monitors and maintains contracts for the analysis of metals and organic contaminants in support of district missions. The laboratory has detailed apparatus for the evaluation of most waste water parameters. Several microscopes aid in the evaluation and determination of biological samples.

2.5. Data Collection and Analysis

2.5.1. Regional Office

In January of 1996 the water quality collection activities in the Columbia River Basin were turned over to the district offices. The Regional Office serves as the data collection site for the real-time FMS data. The Division Office, through the Water Quality Team (WQT), Reservoir Control Center, Water Management Division continues to coordinate District data collection activities. Tasks performed included the following:

- ✓ Develop an annual plan of action in coordination with the Districts, including number and location of monitoring stations, quality assurance and quality control (QA/QC) protocols for data measurement, data coding and transmission, and instrument calibration and maintenance;
- ✓ Coordinate the start and end dates for the monitoring season;
- ✓ Monitor FMS data received, coordinate with responsible party when an FMS malfunctions, fill data data gaps and correct data in the water quality copy of the CHROMS data set which is used for water quality reporting;
- ✓ Prepare daily reports on dissolved gas saturation, water temperature, project spill, pool elevations and total flow;
- ✓ Perform statistical analyses and computer modeling to refine site-specific or system-wide spill versus TDG relationships;
- ✓ Hold a post-season review of Corps monitoring activities with regional participation to discuss details of monitoring activities, receive comments and recommendations and plan for future changes and improvements; and
- ✓ Prepare an annual report on the FMS performance with a discussion of the current year's operations, and recommendations for next year's activities.

The WQT staff also posted information to the regional Technical Management Team (TMT) homepage for dissemination to regional users and researchers, as well as coordinating reservoir regulation details for data collection below Corps projects. The Plan of Action for TDG monitoring in 2000 was included in various documents, including the Corps' Fish Passage Plan and NMFS's application package for state standard water quality waivers.

The annual TDG monitoring report prepared by the Division was based on information received from the district and division water quality staffs and the US Geological Survey. Refer to the Annual TDG Report for a summary of the FMS Program.

2.5.2. Portland District

2.5.2.1.Applegate and Lost Creek Lakes.

In situ water quality data were collected monthly between April and November 2000. Inflow, in-lake and outflow stations were sampled. In situ measurements for dissolved oxygen, pH, specific conductance, and temperature were taken in the water column with a Hydrolab H20 instrument. Lake water transparency was determined with a Secchi disk. A transmissometer and

a nephelometer were deployed monthly through the water column to obtain vertical profiles for light transmission and turbidity, respectively at Applegate Lake. A photometer (unfiltered light) was deployed once a month to determine the extent of down welling irradiance at Applegate Lake.

Water grab samples were collected at inflow and outflow sites and at various depths in the water column at Applegate Lake. Samples were analyzed for dissolved oxygen, chlorophyll a, nutrients, ammonia, fecal coliforms, TSS, TDS, organic carbon, silica, manganese, iron, sulfide and sulfate. The same analyses were performed on incoming tributary and release water samples. This pattern of grab sample analyses alternates between Applegate and Lost Creek Lakes according to year – odd years, Applegate, even years Lost Creek. Water quality data from the two lakes will be used to monitor watershed and lake conditions and in future modeling efforts.

Lost Creek lake samples were measured for geosmin to determine if the lake was producing taste & odor compounds at the depth of withdrawal. This was done because a local water district was experiencing taste & odor problems downstream from the project. Geosmin results were negative.

2.5.2.2. Willow Creek Lake.

In situ water quality data were collected monthly between April and November 2000. Inflow, in-lake and outflow sites were sampled. In situ measurements for dissolved oxygen, pH, specific conductance, and temperature were taken in the water column with a Hydrolab H20 instrument. Lake water transparency was determined with a Secchi disk. A photometer (unfiltered light) was deployed once a month from June to September to determine the extent of downward irradiance.

Water grab samples were collected at inflow and outflow sites and various depths in the water column at Willow Creek Lake. Samples were analyzed for dissolved oxygen, chlorophyll a, nutrients, ammonia, fecal coliforms, TSS, TDS, organic carbon, silica, manganese, iron, sulfide and sulfate. The same analyses were performed on incoming and release water samples. The results will be useful for water quality modeling.

Six times, between May and December, water samples collected from throughout the water column were analyzed for methane, methane oxidation, hydrogen sulfide, DO, CO2 and nutrients. Methane analyses were done by portable gas chromatograph.

Interstitial seep waters in the concrete matrix of Willow Creek Dam were sampled monthly in 1999 and analyzed to determine chemical composition. These samples are collected for the Dam Safety Section in support of studies regarding the integrity of the roller-compacted concrete dam.

Locals requested the Corps help them improve temperatures and pH in Willow Creek below the dam. This part of the creek is 303 (d) listed for these parameters. The selective withrawal device was lowered in the lake and temperature, pH, and DO levels were monitored. The results will be descibed in an upcoming report. The effort appeared to be a success.

2.5.2.3.Elk Creek.

Water temperatures and turbidity were recorded hourly by the USGS at four monitoring sites (Trail, Cascade Gorge, West Branch, and Alco Creek) on Elk Creek in the Rogue River Basin, Oregon. This work continues a database useful for assessing water quality impacts resulting from the partially completed Elk Creek Dam.

2.5.2.4. Fern Ridge Lake.

The local project office is supporting the Long Tom Watershed Group in collecting basic water quality from incoming streams. The lake water quality volunteers program was discontinued in order to support the watershed group.

2.5.2.5. Detroit Lake.

The District, City of Salem and USFS began routine monitoring of turbidity in the fall of 1998. The District entered into an agreement with its partners to cooperate in this effort. Monitoring according to the agreement continued this year.

2.5.2.6.TDG Fixed Monitoring Program (FMP).

TDG was measured from mid-March through mid-September for most stations at District projects on the lower Columbia River. A total of 8 instruments were assigned to forebay, tailwater, and downstream stations for John Day, The Dalles and Bonneville Projects. Data was transmitted real time to the Division CHROMS database. This year less than 1 % of the data was lost. The data is important for monitoring compliance with state TDG standards and impacts to fish.

2.5.2.7.Dredged Material Projects.

Sediment samples were obtained during 2000 at the following federal navigation projects in the Columbia River, and along the Oregon coast: Tillamook Bay, Willamette River Yaquina Bay and South Beach Marina and Columbia River RM 29-34. Bulk physical and chemical analyses were performed on samples to determine compliance with water quality standards and, in some cases, suitability for ocean disposal. Physical and chemical tests were conducted in accordance with Corps of Engineers and Environmental Protection Agency water/sediment analytical guidelines (Dredge Material Evaluation Framework for the Lower Columbia Management Area). Sediments were collected with several types of sampling equipment, including box core surface sampler, gravity and vibra corers. Physical tests included particle-size distribution, percent volatile solids, void ratio, specific gravity, and re-suspended density. Sediments were also tested for priority-pollutant heavy metals, pesticides, dioxin/furans, dioxin/furan, PCBs (polychlorobiphenyls), PAHs (polynuclear aromatic hydrocarbons), organotin (TBT), TOC (total organic carbon), phenols, phthalates and miscellaneous extractables.

2.5.3. Seattle District

1) Water quality monitoring continued at all District projects. Real-time water temperature, salinity, dissolved oxygen, and total dissolved gas data were transmitted to the District and Division offices. These data were supplemented by field turbidity measurements at Howard A. Hanson and Mud Mountain projects. The automated salinity sensors installed in the Lake Washington Ship Canal were ground-truthed periodically to ensure accuracy.

2) As of FY2000 the management of the water quality database was transferred to the Portland Division Office. The Seattle District Office will continue to perform the data collection and maintenance of the sensors.

3) During the summer conservation season, additional water quality data were collected at Howard A. Hanson reservoir and the Lake Washington Ship Canal. In-situ measurements of temperature, dissolved oxygen, pH, and specific conductivity were collected at various depths in the water column. The City of Aberdeen collected similar data for Wynoochee reservoir and furnished copies of the data to the District. The data were used to monitor reservoir thermal stratification at Wynoochee and Howard A. Hanson reservoirs and saltwater intrusion and dissolved oxygen concentration in the Lake Washington Ship Canal.

4) Water quality data collection at Libby Dam was performed by contract with the U.S. Geological Survey. This sampling program consisted of analyses for total phosphorus, orthophosphate, nitrate, total Kjeldahl nitrogen, silica, metals, salts, heavy metals, and nitrogen saturation. Vertical profile measurements of temperature, specific conductance, pH, alkalinity, and dissolved oxygen were also performed.

5) Water quality and wastewater evaluations were included in the Environmental Compliance Assessment of Chief Joseph Dam.

6) District staff continued monitoring and data collection of the restoration projects for the Coastal America sites.

7) Seasonal water quality monitoring data is collected at one station in the East Bay Marina, Olympia Harbor, in South Puget Sound. Data is reviewed to determine when the Port of Olympia must operate its mechanical aeration system to increase dissolved oxygen levels to levels that are not harmful to fish.

8) District staff continued to collect water and crab data at Grays Harbor Channel and near-shore disposal sites.

9) ERS and King County used ultrasonic tags, video cameras and hydroaucoastics to track adult Chinook salmon (tagged by Washington Department of Fish and Wildlife) at the Hiram Chittenden Locks.

10) R2 Resource Consultants and ERS collected water quality data and sampled juvenile fish abundance in side channel habitats of the Green River and Sammamish River.

11) The District staff collected water quality data around the locks to determine how the lock operations effect water quality upstream of the locks.

12) The H&H section in conjunction with King County collected water temperature data from the mainstem of the Sammamish River and in the tributaries.

13) ERS and King County performed two Forward Looking Inferred Radiometer (FLIR) flights of the Sammamish River to identify any warm or cold groundwater inputs into the system.

14) ERS and King County started a juvenile salmonid habitat use survey in the Sammamish River.

2.5.4. Walla Walla District

1. There is a comprehensive swim beach monitoring program, NPDES monitoring program, and drinking water program. The District collects samples and provides for analysis of a wide variety of Public Health concerns. With additional discharge permits requirements this area will become the water quality programs primary focus of concern.

2. During the summer and fall temperature loggers were used to collect water temperatures at in the adult fish ladders and in the juvenile system at the Walla Walla District Projects. The loggers were attached to a rope and lowered in the water approximately one foot from the bottom. The data loggers were set to record water temperature once per hour. The project biologists download the data to a shuttle. The district plans to publish a report detailing the temperature monitoring at the ladders and the fish facilities throughout the year for each year.

3. Routine Reservoir Water Quality Monitoring covering a wide array of physico-chemical parameters including photic zone depth, dissolved oxygen, temperature, conductivity, pH, and total dissolved solid depth profiles, zooplankton and phytoplankton biomass and species composition, and metals, major cations and anions, and nutrients at surface, mid-depth, and bottom. No samples were collected in FY00 because there was a lack of personnel and finical resources available.

4. Multiple level temperature sensor devices were placed in the Dworshak Reservoir.

5. Total Dissolved Gas was monitored at 16 stations located in the fore bay and tail water of District projects to determine gas levels resulting from various project spill events. Data was transmitted to the CROHMS database.

6. Sediment samples were taken on the Lower Snake and Clearwater River confluence for the FY00 dredging project. The sampling will be used to determine the most likely areas for sediment quality problems and analysis plans in future investigations.

2.6. Water Quality Reports

2.6.1. Division Office

Annually the Division Office publishes this comprehensive report and a separate report for Total Dissolved Gas Monitoring in the Columbia Basin.

2.6.2. Portland District

1. Larson, Douglas W. September 2000 Willamette Reservoirs Oregon: Detroit, Big Cliff, Green Peter, Foster, Blue River, Cougar Limnological and Water Quality Studies 1950-2000 Final Report.

2. Sherman T. J, U. S. Army Corps of Engineers, Portland District. 2000. Tier II Columbia River RM 29-34, Sediment Quality Evaluation.

3. Sherman T. J, U. S. Army Corps of Engineers, Portland District. 2000. Tier II Willamette River RM 2 & 8.5-10, Sediment Quality Evaluation.

4. Sherman T.J., U. S. Army Corps of Engineers, Portland District. 2000. Tier II Yaquina Bay and South Beach Marina, Sediment Quality Evaluation.

5. Sherman T.J., U. S. Army Corps of Engineers, Portland District. 2000. Tillamook Bay, Tier II Sediment Quality Evaluation.

6. Sherman T.J., U. S. Army Corps of Engineers, Portland District. 2000. Springfield Millrace, Tier II Sediment Quality Evaluation.

7. Sherman T.J., U. S. Army Corps of Engineers, Portland District. 2000. Eugene Delta Ponds, Tier II Sediment Quality Evaluation.

8. Sherman T.J., U. S. Army Corps of Engineers, Portland District. 2000. Columbia Slough GI Study, Tier II Sediment Quality Evaluation.

9. Sherman T.J., U. S. Army Corps of Engineers, Portland District. 2000. Columbia River Fishing Treaty, Tier I Sediment Quality Evaluation.

9. Sherman, T.J., U. S. Army Corps of Engineers, Portland District. 2000. John Day Drawdown Study Tier I Sediment Quality Evaluation.

10. Sherman, T.J., U. S. Army Corps of Engineers, Portland District. 2000. John Day Dam – Cable Crossing Tier I Sediment Quality Evaluation.

12. Harris, K.L. U.S. Army Corps of Engineers, Portland District. Draft 2000. Water Quality Report for Delta Ponds Section 206 Project.

13. Britton, J.L. and Harris, K.L. U.S. Army Corps of Engineers, Portland District. Draft 2000. Water Quality Project Management Plan in Response to Columbia River Biological Opinion.

14. Tanner, Dwight. USGS. December 2000. Data-Collection methods, Quality-Assurance Data, and Site Cosiderations for Total Dissolved Gas Monitoring, Lower Columbia River, Oregon and Washington, 2000. Water-Resources Investigations Report 01-4005.

2.6.3. Seattle District

1) The US Army Corps of Engineers, 2000 dissolved Gas Abatement Study of Chief Joseph Dam. The Final General Reevaluation Report and Final Environmental Assessment were completed.

2) Prepared by Edinger Associates, Inc. for the US Army Corps of Engineers, "Sammamish River Temperature Study: 1998 and 1999 CE-QUAL-W2 Calibration and Management Scenarios", September 15, 2000.

3) Seattle Districts, Annual Water Quality Report, December 1999. This report in incorporated in the Division Annual Water Quality Report.

4) ERS and Waterways Experiment Station submitted two manuscripts on research studies conducted at the Hiram M. Chittenden Locks, which were accepted by the American Fisheries Society for publication in a fish passage book on behavioral guidance technology. The manuscripts were entitled: "Evaluation Of Strobe Lights For Vertically Displacing Juvenile Salmon Near A Filling Culvert Intake At The Hiram M. Chittenden Locks", Seattle, WA, and "Evaluation of Low-Frequency Sound Emitters for Guiding Salmon Smolts Away From A Navigation Lock".

5) ERS completed a draft report on adult fish passage at the Hiram M. Chittenden Locks during 1999 entitled: "Lake Washington Ship Canal Adult Fish Passage Monitoring".

2.6.4. Walla Walla District

No Reports were produced or published this Year

2.7. Data Management System

2.7.1. Division Office

All water control and water quality data are stored in a HEC-DSS database. Data are available in both DSS and 132 column formats. DSS utility programs are routinely used to store, list, display, and manage the data. Hourly total dissolved gas, water temperature, project flow and project spill data are posted on the Technical Management Team's homepage (http://www.nwd-wc.usace.army.mil/TMT/index.htm)

2.7.2. Portland District

1. Water quality data collected at District projects in 2000 were entered into the District's Water Quality database, a Microsoft Access relational database. Historical data collected by contract at Lost Creek and Applegate lakes during 1991 to 1995 was checked for accuracy and entered into the database. Kathryn Harris checked the accuracy of the data in the database and ensured the database contains only quality data. Kathryn Harris continues to enter additional historical data into the database.

2. Kathryn Harris worked with Ruth Abney in the development of a Division wide database to store water quality data. A variety of software packages are currently being presented to the Districts within the Northwestern Division.

3. Water quality data are available via the District WEB site under the Water Management page. Ralph Almeria with the Northwest Division office is responsible for maintenance of the data access.

4. The Ocean Disposal Data (ODD), initiated by WES for the preparation and submission of annual reports on the ocean disposal of dredged material from the United States pursuant to obligations under the London Dumping Convention (LDC), was updated. Data from 1999 was added to the ODD database by the Portland District for projects under its authority.

5. Sediment quality data generated in FY 2000 were entered into SEDQUAL, an ArcView related database, being populated to replace the FoxPro database. This data is being used to analyze relationships between physical sediment characteristics, river basin location, and contaminant levels. Raw sediment quality data was compiled in the raw data file, which consists of a series of three ring binders located in the Reservoir Regulation and Water Quality Section.

6. George Kalli continued maintenance of the Microsoft Access relational database of all DGAS and DGAS related information and is responsible for data validity as well as data availability. Currently the database is 882 Megabytes in size and is in its final form. The DGAS database is available on CD and currently is located at the office of Joe Carroll at The Dalles Dam.

7. TDG data from the Fixed Monitoring Program were stored in the CROHMS database at Division. The USGS, as part of their scope of work, made recommendations for adjusting the data set in CROHMS based on interpretations of anomalies in field data that could traced to instrument response.

8. Water quality data from two gaging stations, one above, the other below Cougar Reservoir, are stored in the USGS ADAPS database. Soon this data will be available on the Division WEB site for resource managers and the public to view. The purpose of collecting and making the data available real-time is to allow managers the ability to respond quickly to water quality problems, if they arise, during construction of the new selective withdrawal device at Cougar Reservoir.

2.7.3. Seattle District

Hydraulics and Hydrology Section's primary data management is a microcomputer database using HECDSS with a user-friendly Visual Basic front-end. This database system has facilitated access and communication with the District's water control and water quality data collection system and has improved accessibility for data analysis and presentation. As of FY 2000 Portland Division Office maintains a homepage that makes much of this data available to the public via the Internet. Data collection will still be performed by Seattle District Office.

The Dredged Analysis Information System (DAIS) stores chemical and biological testing data submitted for proposed dredging projects. These data are used by the Dredged Material Management Office and other participating Dredged Material Management Program (DMMP) agencies to make suitability determinations for disposal of dredged sediments at eight open-water disposal sites in Puget Sound and three open-water disposal sites each in Grays Harbor and Willapa Bay. Automated reporting features are also available in DAIS, including reports summarizing sampling, testing, and administrative data. ArcView software is used for geographic information system (GIS) queries.

BioStat (a bioassay statistics program) was created by Seattle District to automate the interpretation of biological testing data in sediment assessments. The use of the software provides consistency in data interpretation for dredged material testing evaluations.

Regulatory Branch uses the Regulatory Analysis and Management system (RAMS) to track fills in wetlands and required mitigation.

2.7.4. Walla Walla District

1. Total Dissolved Gas data collected by the Total Dissolved Gas Monitoring System (TDGMS) at projects and fed into the NWD Headquarters Office via the GOES system. The TDGMS data transmitted to NWD was calculated at 99.6% complete. In FY00, the Hydrology Branch conducted extensive test and data quality evaluation and determined the maximum potential for accuracy of the instruments.

2.8. Research and Development

2.8.1. Division Office

The Division office was involved in efforts with the Walla Walla and Seattle Districts, reviewing the current numerical modeling capabilities with a focus on how each model available serves the needs of the region. Different models have been developed, with data from specific years and weather conditions, for long range planning and prediction as well as for use as operational decision making tools. These models are being reviewed and tentative plans are being drafted to implement these tools into a cohesive management plan. Numerical models under review are CE-QUAL-W2, MASS1 and MASS2.

2.8.2. Portland District

Portland District contributed funding to the Oregon DEQ to conduct a study of temperature in the South Santiam river in order to develop a TMDL. The study involved using Forward Looking Infrared Radiometry (FLIR) deployed from a helicopter to measure surface temperatures. Portland District deployed temperature loggers in the river to help ground truth the FLIR data and to insure data quality.

Temperature loggers were deployed below select Willamette Projects and in the mainstem to determine if project flows could influence mainstem temperatures.

Temperature loggers were also deployed in Willow Creek and Balm Fork to provide data for future lake water quality modeling and to provide data for future TMDL and listing concerns.

2.8.3. Seattle District

1. Hiram M. Chittenden Locks Refuge Study – From July 25 through August 25, 2000, the District performed a study on the effects of lock operation on water quality upstream of the locks.

2. The Dredged Analysis Information System (DAIS) has been rewritten in Visual Basic 6.0, making it Y2K-compliant and Windows-compatible. This upgrade has increased the speed at which the DIAS system operates save time and energy. Minor modifications are being made to the display properties of BioStat

3. ERS conducted crab population surveys in outer Grays Harbor. These surveys will help identify crab use of different water and sediment habitat types.

4. In 1999 a report, which was prepared by the District, recommend strobe lights as a restoration feature under the Lake Washington Ship Canal Section 1135 Feasibility Report. The operation of the strobe lights was scheduled for 2000 but due to mechanical malfunctions in the lights, the strobe lights could not be operated. The operation of the strobe lights is planned for the 2001 season.

5. ERS, in cooperation with the WA Department of Fish & Wildlife, Muckleshoot Indian Tribe and King County, continued studies on the use of modified locking procedures at the Locks to improve survival of salmon smolts migrating through the Locks. Analysis of study results was used to recommend a preferred slow locking procedure for implementation under the Lake Washington Ship Canal Section 1135 Feasibility Report.

6. In cooperation with BioSonics, Inc., District personnel are conducting a study on the horizontal and vertical distribution of salmon smolts in the lower Lake Washington Ship Canal. Contour plots of fish abundance were completed in 1999 and 2000.

7. In cooperation with HTI., the District personnel performed 3 dimensional monitoring of salmon around the locks using a hydroacoustic monitoring.

8. In cooperation with Biosonics, the District personnel used a video camera to monitor fish entrapment in the saltwater drain during various lock operations.

9. The Corps of Engineers performed velocity studies around on the locks and 1,000 feet upstream. This study was to determine the flow patterns and velocities into the Lock's intake culverts and the saltwater drain.

10. ERS continued to collect surf smelt population and breading area surveys at LaPush, WA, to identify surf smelt use of areas that have been rebuilt with dredged material from the Quillayute harbor project.

11. Seattle District sponsored the Skagit System cooperative to analyze riprap impacts on the Skagit River.

12. The District contracted with WES to conduct physical model studies of flow deflectors at Chief Joseph Dam. Initial studies were completed in FY 2000.

13. The District contracted with Edinger Associates, Inc. to update and recalibrate the Sammamish River Temperature model to CE-QUAL_W2 (version 3).

14. ERS performed surveys to determine salmonid use of various habitats and restoration sites in the Sammamish River.

2.8.4. Walla Walla District

None.

2.9. Water Quality Problems

2.9.1. North Pacific Region

1. Since it's 1998 Supplemental Biological Opinion, NMFS calls for water to be voluntarily spilled up to the full 120% TDG level at the Corps' mainstem Columbia and Snake River dams during the spill season. NMFS pursued and obtained waivers with the states and tribes to spill to the higher TDG levels.

2. Compliance with the State TDG standards is a recurring issue with no easy solution in sight. In some cases, water entering Corps and other federal reservoirs is already supersaturated. Any further increase in spill, either to provide a safer passage route to fish or to accommodate limited plant capacities, can only further exacerbate TDG conditions. Given the sensitivity of the spill and the related TDG issue, TDG data continued to be closely scrutinized by various agencies and interest groups. As a result, the demands on the monitoring program increased significantly. Because of limited plant capacity spill is required at most Lower Snake River dams as soon as flows exceeded 100 kcfs. Decreasing spill through upstream storage or passing more water through the powerhouse is not always feasible. The need to operate all turbine units at flows within 1 percent of their peak efficiency flow to avoid more extensive damages to fish contributed to a *de facto* decrease in powerhouse capacities.

As was done in the past few years, NMFS obtained waivers from the states to allow for the spill for-fish-passage to occur. The Oregon and Washington waivers applied to the March 23 - August 31 period; and the Idaho waivers, to April 15 – June 1, June 18 – July 15 and August 16 – August 31 periods. The Oregon Environmental Council did not, however, grant TDG waivers for the for the Spring Creek Hatchery release, March 13-23.

3. The NMFS's Water Quality Team (WQT) continued to provide a forum for peer review and technical exchange of information on TDG. Although advisory in nature, the NMFS WQT also played an active advocacy role. The NMFS WQT reviewed and commented on the 2001 Plan of Action and TMT Spill Management Plan, as well as participating in the TDG post-season review meeting.

4. The Transboundary Gas Group met in March and October. Discussion subjects included treaty obligations and limitations, TDG monitoring and abatement measures on the Canadian side of the border and monitoring issues on the US side of the border.

5. EPA, the states and the tribes coordinated on a combined approach to TMDL issues in the Columbia and Snake River mainstems. The Corps attempted to keep abreast of these issues and provide support where feasible. The initial TMDL effort is focused on TDG and water temperature.

6. Many of the water quality programs in the North Pacific Region continued to be driven by design and/or operational actions associated with the salmon and steelhead recovery effort.

2.9.2. Portland District

1. **Willow Creek Lake**, Oregon is eutrophic and well stratified thermally during summer. By August, the reservoir's hypolimnion is anoxic and contains high concentrations of hydrogen sulfide, methane, ammonia and other chemically reduced substances. Phytoplankton blooms, principally of blue-green algae aggravate water quality problems in the impoundment. A recent report analyzing trends in the limnology of the lake suggests that conditions are improving (Willow Creek Lake, Oregon Limnological and Water Quality Studies 1984-1996 Final Report, April 1997). However, this year methane levels increased over previous years suggesting that a declining trend may be questionable. The fluctuations in methane production need to be further examined to provide direct links to lake limnology. Cracks and voids in the dam concrete matrix provide avenues for leakage of hypolimnetic waters. Seepage entering the dam's tunnels and gallery is enriched with hydrogen sulfide and dissolved lime. There were concerns that oxidation of hydrogen sulfide and ammonia by chemosynthetic bacteria is producing sulfuric and nitric acid, respectively, that could be corroding the concrete in the dam. Deposition of calcium carbonate on the gallery walls and floors could be potential signs of corrosion. Studies in the late 1980s were completed on the geochemistry, microbiology, and hydrodynamics of seepage waters to determine whether the structural integrity of the dam is at risk. These studies, combined with other engineering analyses, including petrographic studies, indicate that the dam is safe. Yearly monitoring of seepage continues along with limnological surveys of Willow Creek Lake.

High nutrient input to the lake from the watershed continues to be a problem. Monitoring data shows inputs of phosphorus and nitrogen from Balm Creek and Willow Creek.

The State has put Willow Creek below the lake has on the State 303(d) list for temperature and pH. This year temperature improvements below the dam were achieved by lowering the selective withdrawal device in the lake.

2. The U.S. Fish and Wildlife Service and Oregon Department of Fish and Wildlife reported in 1988 substantial reductions in the number of anadromous fish using the McKenzie River in the Willamette River Basin. The agencies attribute much of this reduction to Corps of Engineers impoundments, claiming that water released from these projects tends to be thermally sub-optimal for fish migration and reproduction. Thus, the agencies have urged the Corps to provide more favorable release-flow temperatures at projects on the McKenzie River (Cougar and Blue River) for the purpose of improving habitat and thereby sustaining larger fish populations downstream. The greatest threat to the chinook occurs in the fall when water 10 degrees F warmer than the river temperature is released from an outlet near the surface of the reservoirs. Other reservoirs in the Willamette System (Hills Creek, Fall Creek, Lookout Point, Green Peter and Detroit) may affect downstream water temperatures in ways that impact anadromous fish as well.

Construction of the Selective Withdrawal Structure at Cougar has been approved and construction is slated to begin in spring of 2001. The structure is designed to improve downstream temperatures for fish.

3. **State 303(d) Listings.** In 1998 the Oregon Department of Environmental Quality (DEQ) released a new 303(d) list of "water quality limited waters". Some District reservoirs and stretches of river below reservoirs were on the 303(d) list. Interpretation of the reservoir listings is straightforward. However, listings of rivers below the reservoirs are subject to interpretation. The impact of a reservoir on downstream conditions must be evaluated on a case-by-case basis. For instance, the Coast Fork Willamette is listed for high summer temperatures from the mouth to Cottage Grove Reservoir, but the reservoir releases water in mid August that is below the 64° F Standard. In this case, the reservoir may actually be helping to make the problem less severe in a specified reach of river below. District projects with associated in-lake and downstream water quality problems described in the DEQ 303(d) list are given in Table 7 below.

Table 6. NWP Water Quality Problems on DEQ 303(d) List

Reservoir	**Res. Parameter(s)**	**Below Res. Paramater(s)**
Applegate		Flow, Temp. (summer)
Cottage Grove	Toxics – tissue, water	Temp. (summer)
Dorena	Toxics – tissue, water	Temp. (summer)
Fall Creek		Temp. (summer)
Dexter		Temp. (summer)
Fern Ridge	Turbidity, Bacteria	Temp. (summer), Bacteria
Blue River		Temp. (summer)
Cougar		Temp. (summer)
Willow Creek		Temp., PH (summer)
Bonneville		Toxics, pH, Temp.,TDG
The Dalles		Temp., TDG
John Day		Temp., TDG
Elk Creek		Temp. (summer)

6. Water, sediment and fish from **Cottage Grove Reservoir** contain elevated levels of mercury. The mine tailings from Black Butte Mine about 8 miles above the reservoir are the probable source of mercury. Some fish in the reservoir exceed the FDA action limit for mercury in muscle. Since 1993, studies have been conducted to determine the loading and distribution of mercury in the water, sediment, and food chain. . In 1999, the Oregon DEQ collected water and fish samples before and during the anoxic period to correlate methyl-mercury production with fish tissue concentrations. Cooperative studies will continue in 2000 at both Cottage Grove and Dorena Reservoirs. The State of Oregon has issued a Health Advisory concerning consuming fish from Cottage Grove Reservoir

7. **Fish in Dorena Reservoir** contain high concentrations of mercury but for a less obvious reason than fish at Cottage Grove. Although some fish exceed the FDA action limit, concentrations are not as high as in fish from Cottage Grove Reservoir. High mercury levels may be related to the historic use of mercury in the process of refining gold in the Dorena watershed. However there is no direct evidence to support this view. The State of Oregon has issued a Health Advisory concerning consuming fish from Dorena Reservoir

8. **Total Dissolved Gas (TDG**) supersaturation in the Lower Columbia River continues to exceed the 110% water quality standard below projects (John Day, The Dalles and Bonneville). Increased spill to promote fish passage has contributed to this problem. In the past, spill was minimized to try to keep TDG within the standards. TDG levels were substantially lower in 1999 because of addition of flip lips to John Day dam.

9. Willamette River Projects are believed to exceed TDG standards under limited discharge scenarios. .Data from Green Peter and Foster Reservoir collected during high flows TDG concentrations greater then 110% immediately below the dams. Water at Harrisburg and Salem during this period hovered around 100 % TDG well below the standard.

Most of the Willamette Projects experience **algae blooms** of blue-greens in July and August. So far , these have not reached the nuisance stage that would lead to strong taste and odors or organic loading in water below the projects.

According to the NMFS Willamette River Biological Opinion on threatened Salmon and Bull Trout, Willamette Projects operations affect habitat and water quality below dams because of changes in stream hydrology. Changes in riparian habitat and aquatic ecology may be impacting fish.

10. **Columbia River Projects,** according to a NMFS Biological Opinion on threatened Salmon and Bull Trout, affect habitat and water quality in and below dams because of project operations. Total dissolved gas and temperature are the main culprits, but other water quality variables may also impact threatened and endangered species.

2.9.3. Seattle District

1. Water quality problems in 2000 included high turbidity at Howard Hanson and Mud Mountain Dams.

2. A combination of divers and suction dredging was used to remove Eurasian watermilfoil in the Pend Oreille River above Lake Pend Oreille. Only a few acres were removed due to the labor intensity and cost. ERS in conjunction with other federal and local agencies are developing a long-term treatment and monitoring plan for the Eurasian milfoil. The use of the aquatic herbicide (renovate) is being considered in the removal plan. Renovate has been used in prior years under an EPA granted experimental use permit. These treatments were considered a "stop-gap" effort to kill off the tops of the plants and reduce the spread of plant fragments, the source of new or expanded infestations. This was considered the first step in an effort to control the spread of milfoil in the reservoir upstream of Albeni Falls Dam. If the milfoil becomes established in sloughs and wetland areas off the main river channel, it will be effectively impossible to control. The Corps interests will be focussed on the impacts at recreation areas and in wildlife management areas susceptible to milfoil growth.

3. Chief Joseph Dam downstream sensor experienced technical problems on two occasions. Both incidences didn't occur during a critical spill times and where quickly fixed.

2.9.4. Walla Walla District

The most pressing water quality problem in Walla Walla District is water and wastewater and its effect on public health. During the third and fourth quarters of FY00 water quality efforts revolved around identifying and investigating the extent of the problems we had to deal with. In the last days of fiscal year 2000 we began to develop some courses of action to solve these major problems.

1. Wastewater at Lower Granite and Little Goose Dams are complex. These are package plants designed to service a limited amount of daily load and process this load for primary treatment. At Little Goose overloading during peak use prevents adequate retention, settling, and disinfecting time. At Lower Granite under loading of solids but higher water flow rates coupled with excessive aeration causes problems with solids discharge and establishment of an active working sludge blanket.

2. Drinking Water at Illia Community. The primary problem with this system is the continued reoccurrence of fecal coliform and notices of violation. This water system was under a boil order for a majority of the summer in FY 2000. We are currently studying methods of upgrading and repairing this infrastructure.

3. High TDG levels remain the primary water quality problem in the Walla Walla District. Spill at run-of-the-river dams on the Lower Snake and Columbia Rivers causes total dissolved gas supersaturation which often exceeds the water quality State standard and Federal criteria of 110 percent. Water passed through spillways entrains air in the form of bubbles as it passes under the Tainter gate, over the spillway face, and plunges into the stilling basin water. The air (total gas) in the bubbles is forced into solution by hydrostatic pressure encountered deep in the stilling basin, increasing water TDG tensions. Major factors contributing to TDG increase caused by spill include depth of plunge, air bubble density, and turbulence. The amplitudes of these factors increase with increased spill discharge. TDG data collected in tailwaters of the four Lower Snake River and McNary dams show tailwater TDG levels are influenced most directly by the rate of spill discharge. Simple linear regression analyses of tailwater TDG versus spill discharge in very good r^2 values, indicating that the majority of variation in TDG measured just downstream of the spillway can be explained by variation in the quantity of spill. In general, as spill discharge increases, so does TDG supersaturation.

4. Water Temperature remains a problem since it has brought litigation forward from the EPA and other parties. Additional work will be coming in the future as it is a very complex problem. A comprehensive study and monitoring plan needs to be developed to take a scientific approach to dealing with the problem.

5. Nitrate contamination of two of the three potable water supplies to Ice Harbor Dam is forcing expensive purchases of bottled water and is an obstacle to the operation and planned improvements of the public recreation areas. This is a problem that requires immediate action because of the public health concerns and the welfare of our own employees.

2.10. Special Studies

2.10.1. Division Office

1. See section 8, Research and Development

2. The regional office is coordinating with WES and the NMFS forum to introduce the SYSTDG spreadsheet model to the region. This model was developed by WES through the Seattle District for the Gas Abatement study at Chief Joseph Dam and was seen to have regional benefits.

2.10.2. Portland District

1. **Cottage Grove Mercury Contamination**. During summer, when the lake bottom becomes anoxic, water and fish samples were taken to determine if there is a correlation between seasonal methyl-mercury in water and fish tissue.

2. Dredge Material Modeling. Mathematical modeling studies of dredge material disposal were performed at two Ocean Dredge Material Disposal Sites off the mouth of the Columbia River. MDFATE was used to simulate the disposal of dredged material for the two-year period 1996-1998. The resulting modeled bathymetry was then fed into RCPWAVE to determine if the simulated disposal mounds would have any adverse effects on the wave climate in the area of the disposal sites. As a result of this effort temporary site expansion is being pursued.

3. Willamette Valley Temperatures. Water temperatures were measured on an hourly basis immediately below Fall Creek and Dexter Reservoirs, 5 locations on the Willamette River, 1 location on the McKenzie River, and 11 locations in the Santiam basin. The sites were chosen to ascertain the effect of Corps reservoir projects on water temperatures in tributaries to and on the mainstem Willamette River.

4. Willow Creek Water Quality Improvement. Water temperature and pH in Willow Creek below the reservoir are elevated above Oregon Water Quality Standards during the summer months. The city of Heppner asked the Corps to operate the selective withdrawal device built as part of the reservoir project in order to improve water quality in Willow Creek. A multiparameter water quality probe (Quanta by Hydrolab), was deployed in the tailwaters of Willow Creek Reservoir to monitor temperature, dissolved oxygen (DO), and pH of the release waters. Water temperature probes were also deployed upstream of the reservoir in two creeks, Balm Fork and Willow Creek in their headwaters and immediately above the reservoir. A test of the selective withdrawal device indicated the depth should be kept at 14 ft to release high quality water. Hydrogen sulfide was tested in mid-summer and showed non-detectable levels of that parameter in the discharge waters. Hydrogen sulfide was detected by smell by the District water quality personnel and contractors visiting the project during the late summer. No complaints from the city regarding hydrogen sulfide were relayed to the Corps.

2.10.3. Seattle District

1. **Olympia East Bay Marina Water Quality Mitigation**. The East Bay Marina Dissolved Oxygen Monitoring and Aeration System has been operated and maintained by the

Port of Olympia since project construction in 1983. An automated water quality sensor was installed in 1991 at the project. The sensor is removed during winter months and reinstalled each summer. The data are transmitted by the District's water control data collection system and then furnished to the Portland District Office, the Corps' project manager and Port of Olympia. The District continues to review the water quality monitoring data, which is used by the Port of Olympia to determine when to operate their mechanical aeration system.

2. **Howard Hanson Dam Additional Water Storage Project Study**. The District Completed the Record of Decision for the final EIS in 1999, which included the evaluation of possible impacts to sedimentation and water quality resulting from a proposed increase in the summer conservation pool at the project. The additional water stored would be used for Tacoma's municipal water supply and higher instream flows for fisheries. The water quality studies were geared toward sediment transport, turbidity analyses, and outflow temperature. The recommended project should not adversely impact water quality and will probably improve downstream river temperatures. An additional benefit of low-flow augmentation would be to slow salinity intrusion upstream of the Duwamish Estuary. This project is currently in the Preliminary Engineering Design Phase.

3. **Libby Dam - Kootenai River Sturgeon.** Libby Dam was operated to meet the flow objectives of the 1998 Biological Opinion for Steelhead, the 1995 Biological Opinion for Snake River Salmon, and the 1998 US Fish and Wildlife Service Biological Opinion for Kootenai River White Sturgeon. The flow regimes were coordinated through the Columbia River Technical Management Team. This year's sturgeon operation focused on flows to maximize survival of sturgeon larvae releases from the Kootenai Indian Tribe's fish hatchery. On June 6th outflows where slowly increased to obtain 25 kcfs at Bonners Ferry by June 11th. This flow was maintained for 17 days then reduced to Bull Trout flows, which are specified by the Region 6 of the USFWS (for FY2000 it was 8Kcfs). There were no increases in flow for juvenile salmon in the lower Columbia.

Spilling at Libby Dam may result in very high levels of dissolved gas supersaturation and damage to downstream fish. This has not occurred in the past decade.

4. **Chief Joseph Dam - Dissolved Gas Supersaturation.** The District completed a dissolved gas abatement study at Chief Joseph Dam in consultation with Washington State and the NMFS regional forum. As called for in the Biological Opinion, the study also looked at the merits of combining Chief Joseph and Reclamation's Grand Coulee Dam in a system wide study context. Spill through the regulating outlets of Grand Coulee could cause high TDG levels in Rufus Woods Lake, Chief Joseph's reservoir. The study recommended installation of flow deflectors at Chief Joseph and then transfer of power generation from Chief Joseph to Grand Coulee and concurrently transfer of spill from Grand Coulee to Chief Joseph. This transfer would not be necessary every year. When it is necessary, it would be limited to the period of high flows in the spring.

5 **Mill Creek SAMP.** District staff continued to work on the draft wetland management and restoration plans for the Mill Creek Basin. The plan incorporates the King County Surface Water Management Plan and the Mill Creek Water Quality Management Plan and emphasizes

maintaining and improving the water quality functions of the Mill Creek Basin's wetlands. The restoration plan was completed in 2000 and is now waiting to be adopted.

6 **Multi-User Disposal Site (MUDS).** The District in cooperation with EPA, Washington State Department of Ecology, Washington State Department of Natural Resources, and Washington Public Ports Association are jointly evaluating the potential for developing a multi-user disposal site for contaminated sediments. During F Y1999 the Programmatic EIS was completed. The EIS concluded that: 1) there is a need for disposal of contaminated sediment from Puget Sound, 2) there are a number technically feasible ways to confine contaminated sediments, 3) treatment appears promising but needs to be demonstrated on a large scale, 4) there are a number of management barriers, like liability, that need to be overcome before developing a site, and 5) central Puget Sound has the greatest need.

7 **Bear Creek 1135 Project.** This project will modify a flume-like channel that was dredged as part of the original Sammamish River flood control project. Meanders and riparian habitat will be restored. Large woody debris will be added to reduce velocities and provide holding and rearing habitat for adult and juvenile salmon. Water temperature and velocity considerations are paramount in the design of this project.

8 **City Light North 1135 Project.** This project restored inter-tidal habitat in the Duwamish Estuary. This project was completed in 2000.

9 **Green Duwamish General Investigation.** This basin restoration reconnaissance study was completed in 1997. The project is still in its feasibility phase and an EIS is currently in progress.

10 **Stillaguamish General Investigation.** This project examined existing water quality, vegetation, fish, and wildlife data to determine the limiting factors to fish and wildlife population health. This study is in the feasibility phase.

11 **Wynoochee 1135.** Spring flow modifications as well as year-round power generation was investigated. Purpose of the project is to provide adequate fish passage and flow for juveniles; it will also allow additional flexibility in adult passage. The project is in the feasibility phase.

12 **Howard Hanson Dam Additional Water Storage Project**. R2 Resource Consultants completed a final report on the second year of monitoring juvenile salmon habitat use of side-channels in the Green River. The report was entitled: Juvenile Salmonid Use of Lateral Stream Habitats in the Middle Green River, Washington. R2 Resource Consultants and HDR Engineering also completed a Biological Assessment (BA) for the HHD project. The BA included an appendix for a conceptual management plan on sediment management. FY 2000 progress included implementing the mitigation.

13 **Bellingham Pilot Project.** Seattle District, in cooperation with the Environmental Protection Agency, the Puget Sound Water Quality Action Team and the State of Washington Departments of Wildlife and Fisheries, Ecology, Natural Resources and Transportation, have entered into a joint working relationship with the Port of Bellingham, City of Bellingham,

Whatcom County Department of Health, Lummi Tribe and the Nooksack Tribe to facilitate comprehensive contaminated sediment cleanup in Bellingham Bay. This process has been ongoing since September 1996, and has resulted in a comprehensive strategy for sediment cleanup, habitat restoration, source control and long-range aquatic use planning. The comprehensive strategy included several near-term cleanup alternatives that were evaluated in the June 1999 Draft State Environmental Policy Act (SEPA) Environmental Impact Statement. The Bellingham Pilot Interagency Team has decided that capping is the preferred alternative and construction will begin in 2001.

14 **Lower Columbia River Dredged Material Evaluation Framework.** This interagency team includes representatives from Seattle District, Portland District, Northwestern Division, Washington Departments of Ecology and Natural Resources, EPA Region 10 and the Oregon Department of Environmental Quality. The team has developed a regional manual for the evaluation of dredged material intended for disposal in the aquatic environment. A full public interest review was completed, and the agency heads signed the final document in November 1998. The committee continues to meet to address new issues and concerns.

15 **Cedar River Habitat Conservation Plan.** The District has been involved in negotiations with the City of Seattle concerning a new set of instream flows for a tributary of Lake Washington that supplies most of the inflow to the lake. Any change in instream flows will need to be examined closely for its effect on saltwater control and drafting of the lake. This flow agreement is part of a Habitat Conservation Plan (HCP) for the Cedar River. Parties to the agreement include the Corps, National Marine Fisheries Service, and US Fish and Wildlife Service as well as state agencies and an Indian tribe. The HCP was completed in 1999 and will assure the City of a reliable water yield and minimum flow requirements for the listed endangered species in the basin.

16 **Albeni Falls TDG monitoring.** H&H installed a temporary TDG data logger down stream of Albeni Falls in March. The sensor was stolen shortly after instillation. In FY 2001 this monitoring will be attempted again.

17 **Albeni Falls Eurasian Watermilfoil Treatment**. The use of Renovate was not permitted this year because there was no long-term comprehensive monitoring and maintenance plan. A combination of divers and a suction dredge was used to remove a couple acres of milfoil in Pend Oreille River. This 2000 effort was considered a "stop-gap" effort to reduce the likelihood of the weed spreading to non-infested areas. Other known areas of infestation in the river channel were left untreated due to limited funding. Inter-agency discussion and coordination continues to develop a comprehensive plan for dealing with the spread of the weed. This could included the application of renovate.

Renovate has been used in the past under an EPA granted experimental use permit (EUP). The areas treated were limited primarily by funding constraints. Location of additional weedbeds in flowing water and the non-availability of granular herbicides precluded additional treatment.

18 **East Waterway Navigation Improvements.** Section 356 of the Water Resources Development Act (WRDA) 96 directed the Corps of Engineers to a) expedite review of potential

deepening of the channel in the East Waterway (Duwamish River) from Elliott Bay to Terminal 25 to a depth of up to 51 feet, and b) if determined to be feasible, implement such deepening as part of the project maintenance. This is a significant action under NEPA and SEPA because of contaminated sediments, and requires an EIS. The District and the Port have each contracted several consultant firms to obtain ecological baseline information for the Federal/State EIS. The Biological evaluations have been completed. The largest contract was with SAIC to biologically and chemically evaluate the sediments.

19 **Green River Habitat Conservation Plan.** The District is participating in the City of Tacoma's drafting of a Habitat Conservation Plan (HCP) for all water supply-related activities on the Green River. This HCP is distinct and unlike the Cedar River HCP for two reasons. First, the City of Tacoma has already negotiated for and reached agreement on minimum instream flows on the Green River. Second, Tacoma is a sponsor of the Howard Hanson Dam (HHD) Additional water Storage Project and the HHD Section 1135 project. Both projects seek to improve current operation of HHD for protection and restoration of instream resources. Like the Cedar River HCP, Federal, State and Tribal staffs are parties to the Green River HCP. The Corps is providing input to the HCP in ensure consistency with the ongoing HHD reservoir operation and the new planing projects. The draft HCP and EIS was distributed for public review during winter FY 2000.

20 **Lake Washington Ship Canal, Section 1135.** The feasibility phase of this project was completed in the 4th quarter of FY 1999 and the final design and phased construction began in the 1st quarter of FY 2000. This project will improve juvenile salmon passage at the Hiram Chittenden Locks. The final design and construction of the strobe light array around the two large lock intake culverts was completed. The installation of 6 variable speed motors to slow the fill rate of the large lock is still in the design phase. Removal of the barnacles that line the filling conduits of the large lock was performed in FY2000.

21 **Lake Washington Ship Canal Strobe Light Guidance Study**. This study began in FY 1998 and evaluated strobe lights as a means to guide juvenile salmon and steelhead away from the large lock filling culverts. A draft report was completed in FY 1999 and distributed for review by the Lake Washington Ecological Studies Group and Waterways Experiment Station. Results showed a 90% reduction in fish density when strobe lights were on during filling of the lock chamber. Study results were incorporated in the LWSC Sec. 1135 project and were shared with other resource agencies at the Columbia River Anadromous Fisheries Evaluation Program review for potential application on the Columbia River. Due to technical problems with the bulbs the strobe lights where not functional in FY 2000 but will be fixed for the spring of FY2001.

22 Lummi Section 103 Rock Revetment Project. As mitigation for the revetment project, District staff worked with the Lummi Indian Tribe to construct a 600-ft channel for the purpose of providing juvenile salmonid passage into a shallow freshwater pond. Riparian plantings are planned to reduce erosion along the excavated banks. Construction was completed in 1999 and the project is currently being monitored.

23 **Sammamish River Temperature Study.** Seattle District's ERS and H&H sections completed at temperature study of the river. This including a 2-dimensional water quality model of the Sammamish River and two flights of the Sammamish River where performed using a forward looking inferred radiometer (FLIR). The FLIR photos where used to identify cold or warm groundwater inputs in the river.

24 **Union Slough 1135.** This project will restore tidal inundation to 40 acres on Smith Island in the Snohomish River Estuary, Snohomish County, Washington. This project is currently in the planning phase.

25 **Lake Washington General Investigation Study.** In July 25 to August 25, 2000 the H&H section and Hiram Chittenden Locks performed a study to determine if spilling, salt water barrier operation, saltwater drain operations, and large lockages can effect dissolved oxygen, salinity, conductivity, and temperature upstream of the locks.

26 **Program Management Plan for the Columbia River.** The Seattle District, Walla Walla District, Portland District and Portland division office have been working together to develop a Program Management Plan for the mainstem of the Columbia River. The primary water quality characteristics being evaluated are temperature and total dissolved gas.

2.10.4. Walla Walla District

1. The multiple level thermisters will be used to determine the temperature regime of the Dworshak reservoir. Future possibilities include fisheries investigations in the Dworshak reservoir and combining this research project with other data collection activities.

2. Studies were conducted at Lower Granite and Little Goose Public Water Systems. Recommendations for UV systems and structural modifications were made to the Managers in Operations.

3. A special study is ongoing to determine optimal operation procedures and potential construction modifications at the Lower Granite and Little Goose wastewater treatment facilities.

2.11. Personnel and Training

2.11.1. Personnel

2.11.1.1. Division Office

1. In 2000 CENWD-NP staff involved in all or parts of the water quality effort totaled 3 people. (See Table 1). Stay-in-school students and GSA support contractor employees also provided help. The estimated staff devoted to reservoir water quality is about 5 staff-years for the entire division. Sediment (dredging) and environmental quality represented an additional 1 staff-year effort, for a combined total of approximately 6 staff-years. Funding sources are about one third O&M and the remaining two-thirds, GI and others.

2. In CENWD-NP--ET-WR, Ruth Abney, hydrologic technician, and Ayuekanbe Atagabe, stay-in-school, continued to be deeply involved in TDG monitoring, including data screening, corrections, analysis, Internet homepage posting and dissemination, and reporting. Nancy Yun, hydraulic engineer, continued to refine the necessary procedures for quickly and easily extracting data from the HEC-DSS Data Storage System, coordinate preparation of various graphs needed for annual reports, and operate and maintain water quality models.

Other Corps staff involved in data collection, retrieval and dissemination included:

- ✓ Jim Versteeg, CENWD-NP-ET-WH
- ✓ Rick Delaney, CENWD-NP-ET-WH
- ✓ Debra Petersen, CENWP-IM

2.11.1.2. Portland District

In NWP, George Kalli was kept on as a Term employee to manage the District's water and sediment quality database, as well as to assist in water quality data collection and planning studies.

2.11.1.3. Seattle District

In NWS, Dave VanRijn is in his third year as the District's water quality coordinator, under the direct supervision of Marian Valentine, Water Management Section chief.

2.11.1.4. Walla Walla District

In NWW, two (GS-11) Limnologists conducted water and sediment quality sampling field and laboratory analyses. The Hydrology Branch Chief (GM-13) provided leadership/oversight. Project employees conducted project swim beach and drinking water quality monitoring. The Operations Division section staff consists of 1 GS-12 Ergo Compliance Coordinator providing part time coordination and programmatic planning. The two GS-11 Limnologists are the only personnel in the district assigned permanent water quality duties.

2.11.2. Training

2.11.2.1. Division Office

2.11.2.2. Portland District

1. Kathryn Harris attended a two-day boat operators training at Bonneville Dam in the June 28-29 2000.

3. Laura Hamilton attended Introduction and Advanced ArcView, October 25-29, 2000.

4. Tim Sherman attended Environmental Law and Regulations, June 12-16, 2000.

5. Mark Siipola attended Dredged Material Assessment and Management Seminar in San Diego, CA January 2000.

6. Mark Siipola successfully completed Federal Appropriations Law course, May 2000.

7. Mark Siipola successfully completed requirements of the training course Project 98 Introduction, April 2000.

8. Mark Siipola successfully completed requirements of the training course Project 98 Managing and Tracking, April 2000.

2.11.2.3. Seattle District

Jef Dillon from ERS attended a SSFATE (Suspended Sediments FATE) modeling workshop in September in Rhode Island.

Jeff Dillon from ERS attended a Dredging Effects Review in Jacksonville in April.

George Hart from ERS attended and set up the Case studies section of the Conference on Effectively Restoring Ecosystems in St. Louis, Missouri.

Fred Goetz attended a two-day course (extension class) at the University of Washington, Seattle, Washington on the Geology and Geomorphology of Stream Channels.

Fred Goetz attended the First International Conference on Large Wood in Rivers at Oregon State University, Corvallis, Oregon.

Fred Goetz attended two fisheries conferences of the American Fisheries Society, North Pacific International Chapter in Mt. Vernon, Washington and Western Division in Telluride, Colorado.

Fred Goetz attended a University of Washington (in Seattle, Washington) sponsored workshop on climate change in the Pacific Northwest.

Fred Goetz attended the annual meeting of the Salvelinus Confluentus (bull trout) Curiosity Society Meeting in the Olympic National Park, Washington.

Amie Kimmey from ERS attended a course on Process Based Channel Design, which include turbidity issues, in September 2000.

Ray Strode from the Hydraulics and Hydrology section attended the Geomation System 2300 Advanced Operations & Programming Training Course, April 2000.

Stephanie Stirling and Lauran Cole-Warner from the DMMO section attended the Dredge Material Assessment Seminar, January 2000.

2.11.2.4. Walla Walla District

Phillip Fishella is in training to be certified as a WWT operator level one.
Russ Heaton is in training to be a certified public water supply and treatment operator.

2.12. Contract Work

The Northwestern Division, North Pacific Region's 2000 total contract work was $1,843,582.00 The Regional office awarded no contracts in 2000. A detailed listing of the contract costs follows.

Table 7. Water Quality Contracts Awarded in 2000

12.1 Division Office (CENWD-NP-ET-WR)		Amount ($)
Region's Total		0
12.2 Portland District		
1. John Salinas, The Cascade Research Group, Murphy OR; water quality monitoring of Lost Creek and Applegate Lakes, Rogue River Basin, OR		40,073
2. Dave Canoy, Environmental Testing, Salem, OR; Temperature monitoring in the S. Santiam River		2,448
3. Oregon DEQ TMDL FLIR study		8,000
4. Jim Sweet, Aquatic Analysts, Portland, Oregon; water quality and limnological monitoring of Willow Creek lake and dam-seepage waters, Willow Creek Lake Project, Oregon.		63,412
5. USFS water quality monitoring at Cougar Lake		4,200
6. Equipment purchase – Hydrolabs FMS program		6,566
7. USGS: TDG monitoring in lower Columbia River.		145,193
8. Forest Science Laboratory, OSU – nutrient analyses – Willow Creek Reservoir.		22,600
9. FMP Real Estate Lease – The Fishery - Warrendale, OR		1,200
10. EWEB, water quality monitoring McKenzie River below Cougar/Blue River		2,000
11. Doug Larson – Willamette Valley Projects water quality report.		24,700
12. Temperature loggers		3,708
13. FMS equipment - Hydrolab Mini-sondes		8,203
14. STENNIS. FMS equipment rental DCP		10,602
NWP WATER QUALITY SUBTOTAL		**342,905**
USGS GAGING STATION CONTRACTS DETAILS		
NUMBER	**LOCATION**	**COST ($)**
14252580	Toutle River, Twr Road, Nr Silver Lake, Wa	35,000
14330000	Rogue River Blw Prospect, Or	3,780
14335075	Rogue River At Mcleod, Or	14,500
14337500	Big Butte Creek Nr Mcleod, Or	14,500
14337600	Rogue River Nr Mcleod, Or	3,780
14337830	Elk Creek Nr Cascade Gorge, Or	14,500
14337800	Elk Creek Blw Alco Creek, Or	22,500
14337870	West Branch Elk Cr Nr Trail, Or	3,780
14338000	Elk Creek Nr Trail, Or	14,500
14338100	Rogue River At Trail, Or	14,500

14339000	Rogue River At Dodg Br Nr Egl Pt, Or	14,500
14359000	Rogue River At Raygold, Or	3,780
14362000	Applegate River Nr Copper, Or	3,780
14366000	Applegate River Nr Applegate, Or	3,780
14369500	Applegate River Nr Wilderville, Or	3,780
	USGS GAGING STATIONS SUBTOTAL	**170,960**
SEDIMENT QUALITY		
18. Sound Analytical Services – Tillamook Bay, Sediment analyses		5,568
19. Sound Analytical Services –Willamette River, Sediment analyses.		34,672
20. Sound Analytical Services – Springfield Millrace, Sediment analyses		7,672
21. Sound Analytical Services – Yaquina Bay and South Beach Marina, Sediment analyses		6,275
22. Sound Analytical Services – Columbia Slough GI, Sediment analyses.		27,645
23. Sound Analytical Services – Columbia River RM 29-34		29,777
24. Sound Analytical Services – Eugene Delta Ponds		12,966
25. Sound Analytical Services – ODMDS Yaquina Bay		11,955
26. Sound Analytical Services – MCR Project/Deep Water Site		23,880
27. Doug's Diving - Boat & operator, Tillamook Bay, Yaquina Bay and South Beach Marina- Sediment sampling.		1,800
28. Bill Jaworski – Boat crew and sampling equip, Willamette River - Sediment sampling.		4,985
29. John Vlastelicia – Boat & Operator , Columbia River RM 29-34 - Sediment sampling.		1,600
SEDIMENT QUALITY SUBTOTAL		**168,795**
ODMDS EVALUATION		
30. Sediment Trend Analysis-MCR ODMDS study		259,845
31. Sidescan Sonar/Sediment Acoustic Characterization		31,432
32. Hydrosurvey Boat and Crew		29,125
33. Sidescan Sonar Yaquina Bay		35,231
34. Benthic Infauna Evaluation Yaquina Bay		49,600
		405,242
NWP'S TOTAL (WATER QUALITY, GAGING & SEDIMENTS)		**1,088,082**
12.3 Seattle District		
1. Sediment quality studies for Howard Hanson		$1,000
2. SAIC: Sediment Management Annual Review Meeting minutes		$5,000
3. Striplin Environmental: Physical monitoring at the Commencement Bay PSDDA Site utilizing sediment vertical profile imagery		$23,000
4. U.S. Geological Survey (Montana District): Field water quality data collection/analysis on Lake Koocanusa (3 reservoir stations, 1 Riverine station)		$62,000
5. Common Sensing, Inc. (Clark Fork, ID): Dissolved gas sensor operation and maintenance for Chief Joseph forebay		$5,000
6. Jones & Stokes: Scour chain monitoring Cedar River.		$26,000

7. R2 Resource Consulting. Sammamish River Habitat Survey	$43,000
8. HDR: Cedar Spawning Channel Spawner Survey and Fry Production	$35,000
9. SAIC: Data entry for PSDDA projects (DAIS)	$5,000
10. Striplin Environmental: Water quality monitoring in East Waterway	$54,000
11. WES: Water Quality Study of Hiram Chittenden Locks	$10,000
12. Striplin Environmental: Sample Analysis Plan for the Squaliam Creek Waterway, Bellingham,WA.	$7,000
13. Striplin Environmental: Sediment Characterization of the Squaliam Creek Waterway, Bellingham,WA.	$39,000
14. Striplin Environmental: Sediment Characterization of Grays Harbor, WA	$43,000
15. Science Application International: Water Quality Monitoring	$40,000
16. Jones and Stakes: Interstate 90 Upgrade – Work Plan for Aquatic Studies for NEPA and ESA Document, Seattle, WA.	$42,000
17. Lauks Environmental: Total Suspended Sediment Analysis, Howard Hanson Dam	$1,000
18. North West Hydraulics: Sammamish River Temperature Model	$51,000
20. Watershed Science Inc. – Sammamish River Temperature Study	$7,000
TOTAL NWS DISTRICT with sediment water quality	**$499,000**
Total without sediment quality:	**$331,000**
12.4 Walla Walla District	
1. HDR Engineering assisted on the sediment collection efforts for the planned FY00 dredging activities	$115,000
2. Vizcaya and Anatek Laboratories. Lab analysis for waste samples water samples, drinking water samples, and sediment samples for multiple projects throughout the district.	$98,000
3. Vehicles, Repairs, Purchases of Equipment and Boats	$34,000
4. Swim beach water samples with the county health departments	$9,500
TOTAL WALLA WALLA DISTRICT	**$256,500**

2.12.1. Meetings and Conferences

2.12.1.1. Regional Office

1. Water Quality Team staff (Richard Cassidy, Nancy Yun and Ruth Abney) attended numerous in-house, public, and inter-agency meetings in conjunction with the implementation of the spill for-fish-passage and fish flow augmentation measures requested by NMFS. Meetings were held with National Marine Fisheries Service, US Fish and Wildlife Service, Bureau of Reclamation, Bonneville Power Administration, Power Planning Council, State Environmental Departments, Indian tribes, and others. Most of the attendance has been at the weekly meetings of the regional Technical Management Team discussing weekly flow augmentation operations for fish during April-August 1998. Attendance at NMFS's Water Quality Team meetings was also quite frequent.

2. Water Quality Team staff attended numerous regional meetings concerning TMDL generation and implementation.

3. Nancy Yun represented the North Pacific Division at the Corps Water Quality Committee (CWQ) meeting held in St. Paul, MN, August 28 – September 1, 2000.

4. The WQT organized and participated in two trips to view the Corps fixed monitoring stations. The NMFS WQT members were invited to attend. The Portland District sites were visited in July with representatives from USGS, ODEQ, WDOE, NMFS and EPA. The Walla Walla District sites were visited in November with representatives from NMFS.

5. Mr. Richard Cassidy attended the US-Canada Transboundary Gas Group meeting in Vancouver, BC, Canada on October 12, 2000. He made a presentation on the 2000 spill season at the mainstem Columbia and Snake projects.

2.12.1.2. Portland District

1. Tim Sherman and Mark Siipola attended a contaminated sediments seminar sponsored by The Oregon Law Institute, October 29,1999.

2. Tim Sherman and Mark Siipola attended, Annual Ocean Coordinators Meeting, January, 2000, Sponsored by Corps & EPA.

3. Tim Sherman, Mark Siipola and Laura Hamilton attended SMARM Seminar May 10, 2000, Seattle District Corps.

5. Kathryn Harris and Jim Britton attended Riparian Ecology and Management in Multi-land Use Watersheds conference, August 28-31, 2000 sponsored by American Water Resources Association.

6. Kathryn Harris and Jim Britton attended a data summit hosted by Oregon Department of Environmental Quality (DEQ) to discuss and share data for Willamette River TMDL development May 28, 2000.

2.12.1.3. Seattle District

David van Rijn and Marian Valentine participate in various Program Management Plan meetings in Portland.

David van Rijn and Marian Valentine participate in various monthly Instream Flow Commission meetings for the Cedar River HCP.

David van Rijn, Fred Goetz, and Marian Valentine participate in a Climate Conference in Seattle.

Marian Valentine and Kathy Hacker represented the District in presentations to the NMFS's regional forum on several occasions, Portland, Oregon.

Stephanie Stirling participated in the Western Dredging Association Annual Meeting, September.

David Kendall, Lauran Cole-Warner, and Stephanie Stirling coordinated the Sediment Management Annual Review Meeting, May.

ERS presented three talks at the Lake Washington Chinook salmon Recovery Workshop in Seattle, Washington regarding fish passage and water quality monitoring at the Hiram M. Chittenden Locks. The presentations were entitled: Introduction to the Locks – History and Issues; Juvenile Passage Through Smolt Passage Flumes; and Juvenile Passage through the Large Locks.

ERS presented a paper on juvenile salmon use of side-channels in the Green River at the annual meeting of the American Fisheries Society North Pacific International Chapter in Mt. Vernon, Washington. The paper was entitled: Juvenile Salmonid Use of Lateral Stream Habitats in the Middle Green River, Washington.

ERS presented a paper on Corps ecosystem restoration work in the Green River at the Northwest Salmonid Recovery Workshop in Seattle, Washington.

Presented brown-bag talks to Seattle District employees on fish passage technology and ESA information on bull trout and Chinook salmon.

2.12.1.4. Walla Walla District

None

2.12.2. Future Water Quality Objectives/Reports

2.12.2.1. Regional Office

1. Continue to coordinate and monitor the Corps annual total dissolved gas monitoring program;

2. Continue to monitor and adjust spill levels at Corps projects during the spill season to maintain TDG levels below the state standards of 115% in the forebays and 120% in the tailraces;

3. Continue to develop, maintain and operate an active homepage for real-time use in water management of the Columbia River reservoir system,

4. Continue to improve modeling capability;

5. Continue to improve Division-District coordination on water quality and related issues

6. Continue to provide the required level of oversight to the Dissolved Gas Abatement Study team; and to represent the Division at regional forums dealing with compliance issues involving total dissolved gas and other water quality parameters, and

7. Provide water quality and general environmental modeling support to others as needed.

8. Work with HQ to resolve state water quality variance issues.

9. Develop an inter-agency Water Quality Plan for the Columbia/Snake system.

10. Participate in TMDL development for TDG and water temperature on the Columbia/Snake mainstems.

11. Participate in the development of a CENWD – North Pacific Water Quality Team to provide regional program management guidance.

12. Develop and implement 1-year and 5-year Water Quality Plans as specified in the 2000 NMFS BiOp.

13. Participate with BPA and BOR in water temperature and TDG modeling as specified in the 2000 NMFS BiOp.

2.12.2.2. Portland District

WATER QUALITY

1. Continue limnological and routine water quality monitoring at Lost Creek and Applegate Lakes, Rogue River Basin, Oregon; and at Willow Creek Lake, Heppner, Oregon.

2. Continue to operate and maintain stream-gaging programs in the Willamette and Rogue River Basins, Oregon, Willow Creek basin, and in Toutle River basin, Washington, and in the Lower Columbia River main stem.

3. Work with Oregon resource agencies to develop instream-flow rules for the Willamette River requiring the Corps of Engineers to provide specific flows year-round for fisheries and water quality enhancement.

4. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal projects.

5. Continue studies of mercury contamination in Cottage Grove and Dorena Reservoirs.

6. Continue selective withdrawal at Willow Creek Reservoir to aid locals in reducing temperatures in Willow Creek and so that the immediate downstream portion can be removed from the State's 303(d) list.

7. Review historic and current data to determine problem specific water quality studies to conduct at Corps projects.

8. Continue to implement the District Fixed Monitoring Program (FMP) for monitoring TDG below Corps Projects in the lower Columbia River. Evaluate the need for dropping and/or moving FMP sites to improve the program.

9. Continue to monitor TDG below Corps Projects in the Willamette and Rogue Basin on an as-needed basis.

10. Continue to participate with the U.S.F.S. and the city of Salem as a team member to monitor water quality in the North Santiam Watershed.

11. Implement plans and specifications for water quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir.

12 Continue to support efforts to set up water quality models of District Projects that have important water quality problems.

13. Support the State and EPA in developing TMDLs for the Willamette and Columbia River.

14. Participate in developing a water quality plan for District projects in the Lower Columbia River as required in the NMFS Biological Opinion on saving threatened fish species.

SEDIMENT QUALITY

1. Continue the District-wide sediment quality evaluation program at Operations and Maintenance dredging projects. During FY 2001, sediment quality evaluations will be conducted in the Columbia River, Lower Willamette River, Umpqua River, Coquille River, Siuslaw and Chetco River federal projects.

2. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal navigation projects.

3. Additionally, advise the Regulatory and Environmental Resource Branch (CENWP-EC-R) on testing procedures and interpretation of results for Section 404/103 permit actions.

4. Continue to develop management/monitoring plans and implement the management/monitoring programs for ODMDSs.

5. Continue to participate in development of regional dredging teams as defined in the December 1994 MARAD report.

6. Continue to implementation of the Columbia River Regional Testing Manual for sediment quality evaluation.

2.12.2.3. Seattle District

1. Continue maintenance and updates to the Dredged Analysis Information System (DAIS).

2. Continue development and application of an operational water temperature model for Libby Dam to aid in determining the effects of Kootenai River white sturgeon flows (as required by the Endangered Species Act).

3. Continue to develop and implement a total dissolved gas-monitoring program for Libby Dam and the Kootenai River in the event of spill.

4. Continue automating data collection capabilities with emphasis on the Lake Washington Ship Canal.

5. Continue coordination with other federal, state, and local agencies involved in water quality programs, on all project planning, construction and operating efforts.

6. Insure that water quality assessment and water quality goals are included in watershed evaluations conducted by the District.

7. Continue development and application of a predictive model of salinity intrusion for the Lake Washington Ship Canal.

8. Continue the sediment-monitoring program at HHD as part of the drawdown of the turbidity pool.

9. Continue interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam.

10. Continue to evaluate the possibility of installing at least one new generating unit or other means at Libby Dam to allow high flows with reduced risk of spill and high TDG levels.

2.12.2.4. Walla Walla District

1.) Develop district potable water program that encompasses procedures and contacts for all operation and emergency situations. The program will include training systems and test/evaluation programs. A final work product of this effort will be a document outlining this program. This is a joint effort with H&H Branch and Natural Resources Branch.

2.) Develop district wide sanitary system program in parallel and very similar to the program in goal number 1.

3.) Identify existing facilities that need coverage under the Clean Water Act and the Safe Drinking Water Act and compliance status. Plan corrective actions, develop the budgets, necessary to correct the problems. Also determine necessary permits and operations to comply with Phase II NPDES and WRDA 96.

4.) Identify personnel needs required to monitor and operate district water plants and wastewater plants.

5.) Hire and or train, required personnel to satisfy compliance with Safe Drinking Water Act and Clean Water Act.

6.) Bring all water and wastewater systems into compliance with Safe Drinking Water Act and the Clean Water Act by FY04.

7.) Complete a 5-year evaluation of the swim beach monitoring program, evaluate training, equipment, and evaluate trends. Produce a report outlining the current status.
Look at ways to reduce costs and increase effectiveness of the monitoring.

8.) Reinstate routine limnology sampling to identify CWA compliance and assess reservoir water quality problems associated with low flow. Investigate limnological connections that influence sediment quality and impacts to future dredging projects. Analyze existing water quality data to determine trends and requirements for further investigations.

9.) Support the Division's water quality database efforts and emphasize district operational requirements as the first priority for data entry and data extraction.

10.) Improve the quick reaction capabilities and emphasize readiness to support Operations, Construction and Program Management emergency sampling, monitoring and analyzing requirements if funding is available.

2.13. Appendix:

NWD ENGINEERING REGULATION ON WATER CONTROL MANAGEMENT, WATER QUALITY-- DRAFT

(This regulation will, upon formal approval by Management, supersede NPDR 1110-2-101 dated 6 November 1978)

*NWDR 1110-2-101

DEPARTMENT OF THE ARMY
NORTHWESTERN DIVISION, CORPS OF ENGINEERS
North Pacific Region P.O. Box 2870 Portland, Oregon 97208-2870
Missouri River Region 12565 W. Center Road Omaha, Nebraska

CENWD-NP-ET-W
CENWD-MR-ET-R
Regulation No. 1110-2-101
(DRAFT) 28 December 1998

Engineering and Design
WATER CONTROL MANAGEMENT, WATER QUALITY

Supplementation of this regulation and/or of other local forms of regulatory guidance is prohibited without prior approval from CENWD-NP-ET-W and/or CENWD-MR-ET-R.

1. PURPOSE. This regulation provides guidance to Corps of Engineers Districts within the Northwestern Division (NWD) for water quality data collection, reporting, storage, and analysis activities necessary for supporting water management functions, and to provide for the periodic reporting to higher authorities of these and other water quality related activities.

2. APPLICABILITY. This regulation is applicable to existing NWD civil works projects, exclusive of marine/estuarine, groundwater and dredging projects.

3. REFERENCES. Publications listed below may be found on the following Corps of Engineers webpages:
http://www.usace.army.mil/inet/usace-docs/eng-tech-ltrs/etl-all.html
http://www.usace.army.mil/inet/usace-docs/eng-regs/cecw.htm

a. Required Publications.

(1) ER 15-2-4 (Committee on Water Quality, 24 April 1992), cited in paragraph 11a.
(2) ER 1110-1-261 (Quality Assurance of Laboratory Testing Procedures, 31 March 1998), cited in paragraph 6.
(3) ER 1110-1-8100 (Laboratory Investigations and Testing, 31 December 1997), cited in paragraph 6.
(4) ER 1110-2-240 (Water Control Management, 8 October 1982), cited in paragraph 9.
(5) ER 1110-2-8154 (Water Quality and Environmental Management, 31 May 1995), cited in paragraphs 4c(1), 7a, and 7b.

(6) ETL 1110-2-252 (Quality Control of Water Quality Field Sampling, 30 June 1980), cited in paragraph 7a.

b. Related Publications.

(1) ER 1110-1-263 (Chemical Data Quality Management For Hazardous, Toxic, Radioactive Waste Remedial Activities, 1 April 1996).
(2) ER 1110-2-1403 (Coastal, Hydraulic and Hydrologic Studies, 1 January 1998).
(3) ER 1110-2-1941 (Drought Contingency Plans, 15 September 1981).
(4) ETL 1110-2-239 (Nitrogen Supersaturation, 15 September 1978).
(5) ETL 1110-2-244 (Water and Wastewater Laboratory Quality Control, 14 May 1979).
(6) ETL 1110-2-253 (Measurement of Dissolved Gas, 26 September 1980).
(7) ETL 1110-2-281 (Reservoir Contaminants, 17 June 1983).
(8) ER 1110-2-1462 (Water Quality and Water Control Considerations for Nonfederal Hydropower Development at Corps of Engineers Projects, 20 February 1991)

4. RESPONSIBILITIES.

a. Corps of Engineers' responsibilities for water quality at Corps civil works projects include the effects of the impoundments on the quality of water in storage and water released downstream, and their relationships to federal and state standards.

b. At the Division level, the North Pacific Region's Water Management Division (CENWD-NP-ET-W) and the Missouri River Region's Reservoir Control Center (CENWD-MR-ET-R) will serve as the coordination point for impoundment-related water quality activities of the Division.

c. Each District is responsible for:

(1) Establishing and implementing, for each civil works project that has a potential for significant negative environmental impacts, a comprehensive water quality management program including specific water quality management objectives and/or goals consistent with ER 1110-2-8154.

(2) Keeping the Division's water quality management staff informed of potential and actual water quality problems, and corrective actions to be undertaken.

(3) Reporting annually on and preparing a management analysis of the District water quality programs and activities.

(4) Performing any corrective actions necessitated by water quality emergencies.

d. In order to provide an effective, coordinated water quality program, the District Engineer will assign a functional element, preferably one that is connected with water management, the responsibility for the coordination of District water quality activities. This coordination includes internal coordination with project managers and environmental planners in the various District elements, and with the Division regional office. All water quality concerns during pre- and post-authorization planning, construction, and operating phases of civil works projects are to be considered.

5. COORDINATION WITH OTHER AGENCIES. Each District's water quality management programs at both existing and proposed projects should be coordinated with relevant programs of

Federal and State agencies, especially with regard to water quality and pollutant source monitoring. All practicable methods for sharing the work and cost should be explored. The District functional element tasked with water quality coordination responsibility mentioned above should coordinate this activity to ensure continuity and consistency.

6. PROCUREMENT OF WATER QUALITY LABORATORY SERVICES. ER 1110-1-8100 provides guidance on freshwater and saline water quality testing and related services. When circumstances preclude using in-house laboratory services, water quality testing services may be obtained by contract with other laboratories. Before contracting for such services, a quality assurance inspection should first be conducted as required by ER 1110-1-261.

7. WATER QUALITY SURVEYS AND STUDIES.

a. The scope of water quality management programs and sampling frequencies of specific projects should be in accordance with ER 1110-2-8154 and ETL 1110-2-252.

b. Pre-impoundment investigations should be made to collect physical, chemical and biological data to define existing baseline water quality conditions, and predict future environmental impacts. Use of mathematical modeling techniques is encouraged for the modeling of future conditions, including development of detailed design and operating criteria. Water quality objectives for these investigations must be established in accordance with ER 1110-2-8154.

c. Post-impoundment investigations and water quality surveys will be made to ensure that Corps civil works projects are meeting applicable state standards. If necessary, alternative solutions to the identified problem areas must be formulated, including a prediction of the expected water quality improvements that would result. Priorities for such investigations should be as follows:

(1) Problems that threaten or affect an authorized project use of storage or project function.
(2) Problems that violate stream standards.
(3) Situations in which water quality conditions may be enhanced.

d. Maintenance monitoring schedules will be established and maintained for all Corps impoundments to detect significant changes in water quality in the impoundments and in the downstream area influenced by project discharges. Parameters monitored will include, but not be limited to, those parameters found to be of concern during the initial water quality investigations and/or surveys, and needed for discharges regulation and future facilities design.

8. FUNDING.

a. Programming. In preparing budget requests, plans must consider systematic progress toward comprehensive and responsive water quality management programs. Close coordination should be maintained between Engineering, Planning, Construction/Operations, and Navigation functional elements for developing adequate funding for these programs.

b. Budgeting. Budgeting will be accomplished in accordance with the guidance furnished by HQUSACE for each annual budget submission. Water quality data collection, processing and analysis required for project operation will be considered among the highest priority water control management activities in the budgeting process.

c. Cost Data. Pre-authorization studies that include water quality activities will be funded by the appropriate survey authority. Water quality investigations for authorized projects and projects under construction will be charged to the applicable appropriation and feature account.

Water quality programs conducted at completed projects will normally be funded by the O & M, General Appropriation, and costs will be reflected in the Water Control management feature (609) on the PB-2a form.

9. WATER CONTROL MANAGEMENT. The quality of reservoir releases must be controlled in strict accordance with the reservoir regulation manual, applicable water quality standards, and ER 1110-2-240. District water quality elements will periodically review basinwide water quality data collected, with special attention to reservoir and downstream water quality during low flow periods or other adverse water conditions. Corrective actions for water quality problems will be considered concurrently with related quantitative hydrologic conditions.

10. DISTRICT ANNUAL WATER QUALITY REPORT.

a. Reporting Requirements. The districts will E-mail the District's Annual Water Quality Report to the applicable regional office, Attn: CENWD-NP-ET-WR or CENWD-MR-ET-R, by 15 December each year. Based on districts and other pertinent inputs, the regional offices will compile two separated Division Annual Water Quality Management Reports, one for each region, by 1 February. The regional offices will post these reports on the regional office Internet homepage and inform HQUSACE accordingly. The districts may post the same reports, in their entirety or just the portions related to their projects, on the district homepages. This new reporting method is as outlined in a CECW-EH-W guidance letter dated 3 November 1998.

b. General.

(1) The District's Annual Water Quality Report should include concise summaries of water quality activities conducted at all District water control projects during the past calendar year. All planned activities for the forthcoming year, and use of data management systems should be included. Sufficient detail should be furnished for significant items to permit their inclusion in the Division's Annual Water Quality Management Report. Minimum requirements for the Division report are summarized in Attachment 1.

(2) Tabulations of routine data should not be included in the annual report. Such data are to be maintained by the District and be readily available upon request.

(3) The District's Annual Water Quality Report should be prepared in two separate parts. The first portion should address the District's overall water quality management program and highlight significant water quality accomplishments. The second portion should present a project by project summary.

c. Part 1. Program Status and Projected Activities. The following areas should be addressed:

(1) Technical Staff Capabilities
(2) Relationship between Water Quality and Water Control Management Activities
(3) Contracted Workload
(4) Laboratory Facilities. including any Laboratory inspection
(5) Data Management Systems
(6) Training and Areas of Needs
(7) Coordination with Other Agencies
(8) Research and Development Needs
(9) Special Studies Completed or Required.

d. Part 2. Project Summary. This part should provide basic information on all pertinent factors affecting water quality for each reservoir project. This information should include, whenever applicable, the following items:

(1) Watershed Characteristics
(2) Project Description and Background Information
(3) Physical Project Elements Affecting Water Quality (including presence/absence of selective withdrawal facilities)
(4) Project Water Quality Management Activities
(5) Project Regulation/Operation Required to Meet Water Quality Objectives
(6) Description of Water Quality Data Collection Program
(7) Overall Water Quality Conditions and Trends
(8) Special Regulation Activities that Impact on Water Quality
(9) New or Modified Water Quality Data Collection Programs
(10) Problems Encountered at Each Project
(11) Plans to Address Identified Problems
(12) Progress on Solving Past Problems
(13) Progress on Solving Present Problems
(14) Discussion on How Well Each Project Met Its Water Quality Objectives and Re-evaluation of Each Project Objective
(15) Possible Corps-wide Application of Available Data
(16) General Recommendations

11. CONSULTING SERVICES.

a. ER 15-2-14 establishes procedures for requesting consulting services from the Corps' Committee on Water Quality. District offices are encouraged to use these services and should direct questions pertaining to or requests for this service to the applicable Division regional office (CENWD-NP-ET-WR or CENWD-MR-ET-R). Some of the services currently provided by the Committee on Water Quality are as follows:

(1) Review of Water Quality Reports
(2) Design of Data Collection Programs
(3) Predicting Water Quality Effects
(4) Methods of Data Evaluation and Interpretation
(5) Investigations Related to Legislative Requirements such as P.L. 92-500
(6) Coastal and Estuarine Water Quality Programs.

b. Districts are encouraged to seek the expertise available in the Division office, other NWD Districts and Corps offices to help solve their technical problems.

12. WATER QUALITY MEETING. A Division's Water Quality Meeting will be held once every two years to provide a forum for collective discussion on and review of activities, problems, coordination, etc. To the extent feasible, the meeting will be rotated from District to District within the Northwestern Division. When applicable and feasible, bi-annual meetings may also be held in conjunction with other national water quality meetings.

FOR THE COMMANDER:

CLIFTON P. JACKSON, JR.
Executive Assistant

ATTACHMENT 1. Minimum Division Report Contents to meet Headquarters Special Requirements and Needs (Reference CECW-EH-W letter dated 3 November 1998)

(a) Narrative summary of the water quality management program for the reporting FY including highlights of division and district activities.

(b) Description of the Goals and objectives of the division's overall water quality management program, progress made toward meeting those goals and plans for next FY. Include a copy of the most current division water quality regulation.

(c) Tabular summary of water quality staff indicating technical expertise (modeling, chemistry, limnology, aquatic biology, wetlands, hydrologic engineering, etc.), years involved in water quality work and grade. Indicate any staffing changes from last year's report.

(d) Brief description of each district's water quality sampling program, including strategy, QA/QC, data management (i.e. data storage, analysis and interpretation). Describe collaboration and coordination within the Corps, with other agencies and with other interested parties. Coordination between water quality and water control management activities.

(e) List research and development needs related to water quality activities

(f) Present brief project by project narrative summary of water quality conditions, including problems and achievements and how these were addressed. Indicate for each project if there is a water quality management plan with clearly stated goals and objectives. Indicate how ell those goals and objectives are being realized.

(g) Describe special regulation activities, new or modified data collection programs, plans to address the identified problems, innovative techniques, etc. that may be applicable to other locations.

3. Specific Project Information

3.1. Portland District

3.1.1. Rogue River Projects/Lost Creek Lake-Applegate Lake Water Quality

a. Summary. John Salinas, The Cascade Research Group, is collecting monthly secchi, nutrient, phyto/zooplankton and hydrolab profiles at Lost Creek and Applegate Lakes. This work will continue from April through November of each year until November of 2001 depending on funding. Temperature data collected downstream of the dam are used throughout the summer and fall drawdown period to estimate the week-to-week availability of "cool" water stored in the impoundments. Based on these estimates, "cool" water is apportioned in releases during this critical period, thereby maintaining release-flow temperatures required for fisheries protection and enhancement.

b. Proposed Activities. Work will continue in 2001. The water quality model CE-QUAL-W2 was set up for Lost Creek and will be further refined to assist the District in achieving target temperatures and in predicting water quality. Next year, water quality data will be collected during the spring filling of the lake to aid the modeling effort. To further aid the effort to meet target temperatures, plans were set in motion to replace defective temperature monitors near the withdrawal structure.

3.1.2. Rogue River Projects/Elk Creek Turbidity

a. Summary. A limited turbidity monitoring program was continued at the Elk Creek dam site. The objective was to assess the impact of dam construction on Rogue River water quality, and to obtain data for use in the verification of a numerical model. The model is used by Portland District to predict seasonal turbidity regimes for Elk Creek reservoir and release flows. Turbidity data are collected hourly at four stream gauging stations, which are operated and maintained by the USGS under contract with the Portland District.

The history and monitoring capabilities of each of these stations are as follows:

ID/STREAM/LOCATION/PARAMETERS/ INITIATION YEAR

14338000/Elk-Creek-NR-Trail/TEMP-TURB-TEMP/June 1973

14337800/Elk-Creek-NR-Cascade-George/TEMP-TURB-TEMP/Aug 1973

14337830/Elk-Creek-Below-Alco-Creek/TEMP-TURB/May 1986

14338100/Rogue-Riv-Below-Trail/TEMP-TURB/May 1988

Also selected as a turbidity monitoring site was a stream-gaging station located on West Branch Elk Creek (USGS Gage Number 14337870). Stream discharge and temperature data have been collected at this site since October 1973 and August 1977, respectively. As directed, the USGS installed a turbidimeter at this station, but was not able to supply the equipment with electrical power. Thus, the station was excluded from the turbidity-monitoring network in the Elk Creek drainage basin.

In 1988, the turbidimeter at Station 14338000 (Elk Creek near Trail, located 0.4 miles upstream of Elk Creek's confluence with the Rogue River) was transferred to a newly constructed USGS gage house located roughly one mile farther upstream near the Elk Creek dam site

b. Proposed Activities. Work will continue in 2001.

3.1.3. Willow Creek Lake Project

a. Summary. Aquatic Analysts, Portland, and Dr. Marvin Lilley, University of Washington, continued with water quality and limnological studies at Willow Creek Lake Project in 1998. A total of 8 field trips were made in 1998. They will continue on a 5-year contract ending in 2001. An added emphasis of the new contract will be to collect inflow, in-lake and outflow water quality data for future modeling efforts.

Water quality was monitored in the tailwaters of Willow Creek reservoir and downstream within the city limits. Water temperatures were collected hourly upstream of the reservoir in Willow Creek and Balm Fork, both in the headwaters and before the streams enter the reservoir.

b. Proposed Activities. Limnological and water quality studies, including research on methane production, will continue in 2001. More intensive water quality monitoring of nutrient loading during spring will occur in 2001 to aid in setting up a water Quality model of the lake (CE-QUAL-W2). Also, to assist locals and help improve downstream conditions, the selective withdrawal structure will release water from deeper in the pool. This should reduce temperatures and improve pH – both of which are too high in Willow Creek immediately below the dam.

3.1.4. Willamette Valley Projects

a. Summary. Most monitoring this year occurred at Cottage Grove, Dorena, Hills Creek, Lookout Point, Dexter, Detroit and Fern Ridge. TDG was measured below Green Peter, Foster, Hills Creek and Dexter and in the Willamette River at Harrisburg and Salem. The purpose was to 1) obtain additional gas data to supplement that collected in the late 1970s; 2) to address future ESA listing issues regarding gas levels below projects during spill; and, 3) at Dexter to determine the best gate settings to reduce gas levels during involuntary spill resulting from turbine repairs. Turbidity and lake profile data was collected at Detroit. Mercury concentrations in fish and water were measured at both Dorena and Cottage Grove. At Green Peter and Foster an X-Ray diffraction study of sediment samples was completed. The purpose of this study was to characterize watershed sediment sources in these lakes. At Fern Ridge lake water quality volunteers under the direction of Jim Beal completed a third year of lake monitoring for temperature, turbidity and nutrients. A District-wide study of nuisance aquatic plants in all lakes was completed by PSU botanists in the late summer. So far, nuisance plants are far and few between. Fern Ridge and Dexter lakes seem to have the most species of nuisance plants. The steep sides of many reservoirs combined with the way they are operated probably helps keep nuisance species from catching hold. A report of the survey results will be out in December of 1999.

Water temperatures were monitored below Dexter and Fall Creek reservoirs as well as in the mainstem Willamette, McKenzie River at Vida, in the South Santiam Basin. Data were collected to assess the impact Corps reservoirs have on mainstem Willamette River temperatures.

b. Proposed activities. Mercury studies at Cottage Grove and Dorena Reservoirs will continue weather permitting. TDG concentrations during spill below projects where fish concerns are paramount will continue to be measured on a spot basis. The cooperative agreement with PSU to identify nuisance aquatic plants may be

extended in 2001 to check for growth during a warm year. Lake resource personnel will be contacted to determine what direction the water quality monitoring effort should take in the projects.

3.1.5. Fern Ridge Reservoir

a. Summary. James Beal, the Project supervisor funded efforts by the local watershed council to collect water quality data in in-coming streams. The water quality lake volunteer program was discontinued.

b. Proposed Activities. Same as 2000, except a deep lake station may be added.

3.1.6. Cottage Grove Reservoir

a. Summary. No activity this year because of drier than normal conditions so that few storm events were available to sample for mercury loading to the reservoir.

b. Proposed Activities. Mercury sampling during storm events if the opportunity arises.

3.1.7. Cougar Reservoir

a. Summary. The USFS monitored the lake by collecting profiles at three sites once a month from April through November.

b. Proposed Activities. In 2001 contract specifications for water quality monitoring during construction of the Selective Withdrawal Tower will be developed and gaging stations outfitted for temperature, turbidity and DO monitoring well before construction begins.

3.1.8. Detroit Dam and Reservoir

a. Summary. The Corps, City of Salem, and USFS coordinated efforts to install turbidity monitoring equipment in the tributaries of the reservoir.

b. Proposed Activities. In 2000 the three agencies will continue to monitor turbidity.

3.1.9. Columbia River Projects - TDG Fixed Monitor Program (FMP)

a. Summary. Monitoring of TDG concentrations continued in the forebay and tailwater of John Day and The Dalles dams and in the downstream water below Bonneville to provide real-time data for operations, and time series data for research and modeling efforts through the Fixed Monitoring Program.

b. Proposed Activities. Continue TDG monitoring at the FMP sites under MIPR to the USGS. An evaluation of the Camas site will be conducted. Transects of forebays may be performed to measure TDG characteristics.

3.1.10. Dredged-Material Evaluations for Navigation Projects

a. Summary. Dredged-material evaluations were conducted for sediments at Tillamook Bay, Yaquina Bay and South Beach Marina and on going Columbia (RM 29-34) and Lower Willamette (Portland Harbor) Rivers.

3.2. Seattle District

3.2.1. Lake Koocanusa (Libby Dam)

a. Summary. There were no significant water quality problems at Libby Dam Project in WY 2000.

Under contract, the U.S. Geological Survey performed water quality monitoring below Libby Dam and at three sites within the reservoir. The monitoring program consists of analyses for nutrients, inorganic compounds, heavy metals, chlorophyll, pH, specific conductivity, dissolved oxygen, nitrogen saturation, and water temperature. These analyses help identify pollution from

upstream agricultural, mining, industrial, and municipal sources. They also establish a baseline for identifying similar types of pollution from sources downstream from the project. This data is shared with state and local water quality agencies to assist in that endeavor.

Real-time outflow water temperature data were also transmitted to the Division and District Office by the water control data collection system. Daily temperature records show that the Montana State water quality standard of 19.5°C (67°F) was not exceeded during this water year. The selective withdrawal facilities at the dam allowed the temperature rule curve to be closely followed throughout WY 2000. Monthly dissolved oxygen sampling showed that the Montana State minimum standard of 7.0 mg/l was not violated. The Montana State minimum standard of 110% nitrogen saturation was not violated in 2000.

A total dissolved gas sensor, which transmits real-time data to the District Office, was added in 1995. This sensor is deployed when spill for flood control is likely. This sensor has not been deployed since it was added.

Libby Dam was operated to meet the flow objectives of the 1998 Biological Opinion for Steelhead, the 1995 Biological Opinion for Snake River Salmon, and the 1998 US Fish and Wildlife Service Biological Opinion for Kootenai River White Sturgeon. The flow regimes were coordinated through the Columbia River Technical Management Team. This year's sturgeon operation focused on flow to maximize survival of larvae from Kootenai Tribe. On June 6th outflows where slowly increased to obtain 25 kcfs at Bonners Ferry by June 11th. This flow was maintained for 17 days then reduced to Bull Trout flows, which are specified by the Region 6 of the USFWS (for 2000 it was 8Kcfs). There were no increases in flow for juvenile salmon in the lower Columbia.

b. Proposed Activities. The Seattle District will work to improve water temperature monitoring in both Lake Koocanusa, and downstream in an effort to meet water temperature criteria set forth by the US Fish and Wildlife Service in their annual guidelines for white sturgeon recovery. The District will continue to work with other federal, state, local, and tribal agencies to coordinate appropriate water quality and flow regimes for the white sturgeon in the spring of 2001.

3.2.2. Pend Oreille Lake (Albeni Falls Dam)

a. Summary. H&H section placed a temporary total dissolved gas data logger below Albeni Falls in early spring. This logger was stolen before any data could be collected.

Daily temperature records show that the Idaho State water quality standard of 20°C (68°F) was not exceeded. The project did not experience any water quality problems during WY 2000.

A combination of divers and suction dredging was used to remove Eurasian watermilfoil in the Pend Oreille River above Lake Pend Oreille. Only a few acres were removed due to the labor intensity and cost. ERS in conjunction with other federal and local agencies are developing a long-term treatment and monitoring plan for the Eurasian milfoil. The use of the aquatic herbicide (renovate) is being considered in the removal plan. Renovate has been used in prior years under an EPA granted experimental use permit. These treatments were considered a "stop-gap" effort to kill

off the tops of the plants and reduce the spread of plant fragments, the source of new or expanded infestations. This was considered the first step in an effort to control the spread of milfoil in the reservoir upstream of Albeni Falls Dam. If the milfoil becomes established in sloughs and wetland areas off the main river channel, it will be effectively impossible to control. The Corps interests will be focussed on the impacts at recreation areas and in wildlife management areas susceptible to milfoil growth.

b. Proposed Activities. A multi-agency group is developing a long-term treatment and monitoring plan. Follow-up monitoring and treatments of milfoil are planned for next year. Spot checks of TDG during spill will also be performed.

3.2.3. Rufus Woods Lake (Chief Joseph Dam)

a. Summary. Dissolved gas and water temperature data was collected via a sensor in the forebay and a sensor in the tailwater. Common Sensing, Inc., based in Clark Fork, Idaho performed sensor maintenance and calibration.

Due to the relative lack of spill in the Upper Columbia in WY 2000, dissolved gas levels entering Rufus Woods Lake remained below 115%. Tailwater dissolved gas measurement was complicated by the location of the tailwater sensor on the spillway side of the river. Water from the spillway and powerhouse do not mix fully for several miles downstream of the project. As a result, the tailwater sensor can reported high levels of dissolved gas during periods of spill. A weighted average of spillway and powerhouse flow was used to predict an average value for the river cross-section, should be used to determine gas levels during spill events.

The District completed a dissolved gas abatement study at Chief Joseph Dam in consultation with Washington State and the NMFS regional forum. As called for in the Biological Opinion, the study also looked at the merits of combining Chief Joseph and Reclamation's Grand Coulee Dam in a systemwide study context. Spill through the regulating outlets of Grand Coulee could cause high TDG levels in Rufus Woods Lake, Chief Joseph's reservoir. The study recommended installation of flow deflectors at Chief Joseph and then transfer of power generation from Chief Joseph to Grand Coulee and concurrently transfer of spill from Grand Coulee to Chief Joseph. This transfer would not be necessary every year. When it is necessary, it would be limited to the period of high flows in the spring.

The Columbia River from the Washington-Oregon border to Grand Coulee Dam surface water classification is Class A (Excellent). Based on the downstream sensor temperature records, it appears that the discharge water temperature exceeded the Washington State standard for water temperature of 18^{o}C (64.4^{o}F) from 4 August through 1 October 2000. Chief Joseph Dam does not have selective withdrawal temperature control. No new permits were issued for net pens in Rufus Woods Lake by NWS, in 2000.

b. Proposed Activities. The District plans to continue dissolved gas abatement for WY 2001.

3.2.4. Lake Washington Ship Canal and Locks

a. Summary. Saltwater intrusion into Lake Washington through the ship canal was prevented in WY 2000. The District continued to collect salinity data from five

stations that automatically transmit hourly data to the Reservoir Control Center through the District's water control data collection system. This real-time data allowed a significant reduction in the field monitoring effort and closer monitoring of advances of the saltwater wedge and enabled more efficient operation of the Locks for conservation and control of saltwater intrusion. Periodic field measurements were made at sampling stations in the canal and Lake Union to ground-truth the automated sensor data.

The spring and summer of 2000 were normal. Spill from the smolt slides continued into July. Salinity intrusion was controlled by a combination of saltwater drain and spill. In the past, mini-flushing proved a valuable tool in removing saltwater from the lock chamber before it entered the ship canal. Evaluation of juvenile salmon migration through the large lock has shown that this technique injures and kills too many juveniles to be considered as a viable technique for salinity control. Installation of 4 new smolt slides and spill through one spillbay indicates surface spill may be a viable technique.

The Corps performed a study in July and August, to determine if the operations of the locks could effect the water quality around the locks and up into the ship canal. This study looked at how lockages, saltwater barrier operations and salt water drain operation-effected salinity, dissolved oxygen and temperature. This study will be combined with other fish tracking studies to determine if there is any correlation between water quality and fish behavior.

b. Proposed Activities. The District plans to continue monitoring the network of salinity sensors and to use this data in determining lock operations associated with control of saltwater intrusion. In 1996, District personnel constructed a predictive model of saltwater intrusion into the Lake Washington Ship in order to assess the effects of changes in lock operation. The District plans to continue refinement of this model and to use it to evaluate the efficacy of various water management and saltwater control scenarios. The District will also continue to look at operational effects on water quality upstream of the locks and in the ship canal.

3.2.5. Wynoochee Dam and Lake

a. Summary. The 2000 annual shutdown of the hydroelectric plant for fish outmigration (part of their FERC license) began on 15 April. Discharge was transferred to the multi-level fish passage conduits in the dam for the duration of the shutdown. Hydroelectric plant operations resumed on 1 July.

During the summer stratification period, the intake temperature panel system was used to regulate downstream temperatures during operation of the hydroelectric plant. A normal spring and a late spring storm provide Wynoochee with enough water to refill.

The downstream temperature control point for the Wynoochee Project is the USGS River Gauging Station known as the Wynoochee River at Grisdale Gauge. A sensor at that gauging station reports river temperature on a real-time basis. Manual readings are taken weekly to check calibration of the sensor. In addition to temperature monitoring done at the Grisdale Gauge, there is a sensor monitoring the temperature of the water in the hydroelectric plant tailrace.
Additional water quality monitoring was done as described below;

Data from the intake temperature string, which transmits real-time temperature data hourly, was plotted weekly as forebay temperature profiles.
From May through October, water quality data was collected from five locations in the river, including inflow to the lake.
In addition water quality profiles were taken in the reservoir forebay.

b. Proposed Activities. No new activities are currently planned.

3.2.6. Howard A. Hanson Dam and Lake

a. Summary. During WY 2000, water quality problems at Howard A. Hanson dam were limited to occasional high turbidity readings.

The Green River specific surface water classification is Class AA (Extraordinary). Throughout the year, daily water temperature and turbidity values are collected by Tacoma Water Department personnel at their plant intake located a short distance downstream of Howard A. Hanson Dam and by project personnel at the inflow and outflow sites of the reservoir. Continuous real-time water temperature data are also collected by the Seattle District water control data collection system from the project tailwater monitoring station ¾ mile downstream of the dam. Records show the outflow temperature did not exceeded the Washington State water quality standard of 16°C (60.8°F) during 2000. Turbidity readings in excess of the State standards (5 NTU) were generally of short duration and occurred during or immediately following storm events.

During the period of conservation storage (generally June through October), field measurements of the reservoir water quality profiles are taken approximately every three weeks. Depth versus dissolved oxygen, temperature, and specific conductivity measurements are made at seven reservoir stations. In addition, the above parameters are measured upstream of the reservoir and just below the dam. There was little change in the chemical quality of the impounded water throughout the year.

b. Proposed Activities. FY 2001 work includes continue water quality, sediment and total suspended solid monitoring in the reservoir and downstream.

3.2.7. Mud Mountain Dam

a. Summary. Water quality data collection efforts in WY 2000 were limited to daily measurements of temperature and turbidity above and below the reservoir as a guide in regulating release patterns and to comply with State and Federal regulations. Most water quality problems at Mud Mountain Project are related to a high suspended-solids load associated with upstream glacial melt and erosion of sediment accumulations upstream of the project and in the reservoir. During and immediately following high flows and in association with some project maintenance procedures, relatively short-term high turbidity levels will be experienced that will exceed State of Washington water quality standards.

The White River has a natural high sediment load during storm events. During significant storms, a large amount of debris from the upstream watershed may enter the reservoir. While much of the debris is usually collected in upstream areas, some of it may accumulate on the trash-rack. As debris is removed from the trash-rack, the river lowers and can cut channels through accumulated sediment upstream of the dam resulting in higher turbidity during these operations.

b. Proposed Activities. No new activities are currently planned.

3.3. Walla Walla District

3.3.1. Total Dissolved Gas Monitoring System (TDGMS)

a. Summary. The TDGMS system operated all 16 sites in the Walla Walla District. Ten of the sites were operated year round and 6 seasonally. GOES communications were on-line at the two new stations, PAQW and ANQW. Completed sensor performance evaluations using the primary standards calculated and quantified absolute accuracy capability and repeatability of the Hydrolab instruments. A comprehensive district QA/QC plan for TDGMS was utilized and will become the basis for a division-wide QA/QC program. The first annual QA/QC report of NWWs TDGMS was submitted to NWD Water Management Division. There was a substantial amount of instrument and facility repairs uncompleted or deferred. Some repairs have been deferred due to lack of funding for over 2 years. This situation could become critical next year.

Spill season TDG monitoring was performed at Dworshak (DWQI) on the North Fork of the Clearwater River, at Peck (PEKI) and Lewiston water intake (LEWI) on the mainstem Clearwater River, Anatone (ANQW), Lower Granite (LWG), Lower Granite tailwater (LGNW), Little Goose (LGS), Little Goose tailwater (LGSW), Lower Monumental (LMN), Lower Monumental tailwater (LMNW), Ice Harbor (IHR), Ice Harbor tailwater (IDSW)on the Snake River and at Pasco Washington (PAQW), McNary forebay Oregon (MCQO), McNary forebay Washington (MCQW) and McNary tailwater (MCPW) on the Columbia River. Year round TDG monitoring is being tested and performed at the sites listed above that are underlined.

b. Proposed Activities for 2000. Completely deferred repairs to instruments and effect repairs on damaged infrastructure prior to April of FY2001. Completed barometric and depth performance evaluations using the hyperbaric chamber. Issue a QA/QC plan for TDGMS and submit annual QA/QC reports to NWD and NWW Operations Division. Begin replacing units that are in service beyond the recommended service life.

3.3.2. McNary Project and Reservoir

a. Summary. Planned reservoir water quality samples from the forebay, near Wallula Gap, and on the Columbia above the confluence with the Snake on a monthly and quarterly cycle were not taken. The samples were to be analyzed for nutrients, algae and suspended solids by Vizcaya Chemical labs. The H&H limnologists took sediment samples from the McNary Forebay possible dredge sites for ERDC (WES) for radioactive analysis.

Water temperature data was collected in the fish ways and forebay as part of the fish way temperature monitoring, under a contract with the Washington Department of Fish and Wildlife. Water temperatures were recorded once daily in the turbine unit gate wells and in the forebay from 15 June through 30 August. Temperature data were collected from the B bulkhead slot of all 14 turbine units at orifice depth. Forebay water temperature measurements were taken at 7 locations across the face of the powerhouse, approximately in front of every other turbine unit. Juvenile collection channel temperatures were logged hourly at units 1, 7 and 14 and on the juvenile fish facility separator every 30 minutes.

Temperature measurements were also recorded at 0700h each day in the juvenile fish facility sample-trough

The planned chain thermisters were not installed in the forebay. NWD has requested these in FY98. The instrumentation is about 80% complete but no funding was provided to complete the stations and install them.

b. Proposed activities for 2001.

- ✓ Conduct water quality monitoring as required by the USACE regulations.
- ✓ Expand temperature monitoring to include a Washington and Oregon forebay thermister string as requested in FY98.
- ✓ Cooperate with NWD on data acquisition activities.
- ✓ Request funding to complete required tasks and catch up on maintenance of equipment.

3.3.3. Ice Harbor Project and Reservoir

a. Summary. Planned reservoir water quality samples from the forebay, near Charboneau, and the Lower Monumental tail water on a monthly and quarterly cycle were not taken. The samples were to be analyzed for nutrients, algae and suspended solids by Vizcaya Chemical labs. Requests for funding and resources were sent through supervisory channels but Program Management Division placed water quality funding as low priority. The H&H limnologists took part in the Ice Harbor drinking water evaluation. Assistance was given to operations personnel on test and evaluation procedures. District Natural Resources Management Branch personnel identified no swim beach water quality problems. Severe nitrate problems were identified for the third year at Ice Harbor. Funding was provided to monitor.

b. Proposed activities for 2001.

- ✓ Conduct water quality monitoring as required by the USACE regulations.
- ✓ Expand temperature monitoring to include a forebay thermister string as requested in FY98.
- ✓ Cooperate with NWD on data acquisition activities.
- ✓ Request funding to complete required tasks and catch up on maintenance of equipment. Obtain funding for Natural Resources and H&H to correct the Drinking Water Problems.
- ✓ Determine biological productivity. The purpose of this study would be to determine primary productivity in the Lower Snake reservoirs and use data from previous research and models to predict biomass production at higher trophic levels. This is extremely useful in assisting operation of the projects for water quality.

3.3.4. Lower Monumental Project and Reservoir

a. Summary. Planned reservoir water quality samples from Riparia, and the Little Goose tail water on a monthly and quarterly cycle were not taken. The samples were to be analyzed for nutrients, algae and suspended solids by Vizcaya Chemical labs. High levels of pesticide and herbicide loading from the Palouse River is suspected based on USGS data. No data was collected.

Proposed activities for 2001.

- ✓ Conduct water quality monitoring as required by the USACE regulations.

- ✓ Expand temperature monitoring to include a forebay thermister string as requested in FY98.

- ✓ Cooperate with NWD on data acquisition activities.

- ✓ Request funding to complete required tasks and catch up on maintenance of equipment.

- ✓ Determine biological productivity. The purpose of this study would be to determine primary productivity in the Lower Snake reservoirs and use data from previous research and models to predict biomass production at higher trophic levels. This is extremely useful in assisting operation of the projects for water quality.

3.3.5. Little Goose Project and Reservoir

a. Summary Planned reservoir water quality samples from Central Ferry, and the Lower Granite tail water on a monthly and quarterly cycle were not taken. The samples were to be analyzed for nutrients, algae and suspended solids by Vizcaya Chemical labs. District Natural Resources Management Branch personnel identified no swim beach or drinking water quality problems. The Wastewater treatment facility at Little Goose time was out of compliance with its NPDES permit a majority of the time in FY2000. This problem and persisted for a few years and remedial actions have not been funded. If this problem continues the Corps will face significant fines and penalties. The plant discharges into a river with listed endangered salmon species.

b. Proposed activities for 2001

- ✓ Conduct water quality monitoring as required by the USACE regulations.
- ✓ Expand temperature monitoring to include a forebay thermister string as requested in FY98.

- ✓ Cooperate with NWD on data acquisition activities.

- ✓ Request funding to complete required tasks and catch up on maintenance of equipment.

- ✓ Determine biological productivity. The purpose of this study would be to determine primary productivity in the Lower Snake reservoirs and use data from previous research and models to predict biomass production at higher trophic levels. This is extremely useful in assisting operation of the projects for water quality.

- ✓ Request funding to design and modify the waste water treatment plant to become compliant with the NPDES permit. Train plant operators and remote controls to the power house for monitoring and operation so there is 7 days per week coverage. This is a critical compliance issue

3.3.6. Lower Granite Project and Reservoir

a. Summary. Planned reservoir water quality samples from 3 pool locations and the Lower Clearwater on a monthly and quarterly cycle were not taken. The samples were to be analyzed for nutrients, algae and suspended solids by Vizcaya Chemical labs. District Natural Resources Management Branch personnel identified no swim beach. A drinking water quality problem has occurred at the Illia housing community. Several boil orders were issued for bacteria contamination primarily due to poor

maintenance and faulty equipment. No severe illnesses have been reported this year. The problem could be solved with maintenance and automatic disinfection equipment. The Wastewater treatment facility at Lower Granite was out of compliance with its NPDES permit a majority of the time in FY2000. This problem and persisted for a few years.

Temperature data was collected in the fish ways and forebay as part of the fish way temperature monitoring. This data will be related to temperature, volume, and timing of inflows to Lower Granite Reservoir and source of water for flow augmentation during the July through September period.

The proposed FY 2000 confluence dredging was cancelled due to incomplete environmental compliance documentation.

b. Proposed activities for 2001.

- ✓ Conduct water quality monitoring as required by the USACE regulations.
- ✓ Expand temperature monitoring to include a forebay thermister string as requested in FY98.
- ✓ Request funding to upgrade and repair the Illia community water supply system. This problem needs priority funding because it is a serious public health concern.
- ✓ Cooperate with NWD on data acquisition activities.
- ✓ Request funding to complete required tasks and catch up on maintenance of equipment.
- ✓ Determine biological productivity. The purpose of this study would be to determine primary productivity in the Lower Snake reservoirs and use data from previous research and models to predict biomass production at higher trophic levels. This is extremely important because of the potential for rapid eutrophication problems when conditions are right. If monitored and treated early the impact to endangered species would be minimized.
- ✓ Request funding to design and modify the waste water treatment plant to become compliant with the NPDES permit. Train plant operators and remote controls to the power house for monitoring and operation so there is 7 days per week coverage. This is a critical compliance issue

3.3.7. Dworshak Project and Reservoir

a. Summary. The Lewiston water intake TDGMS station pipe the Peck TDGMS station pipe left partially dry during the slate summer months due to low flows on the Clearwater River. This station has been out of repair for four years and needs a major overhaul. No resources were available to make repairs.

No Water quality data was collected from six in-reservoir stations, twelve inlet stream stations, and below the dam outlet for the third year in a row. Data that was to be collected included: Light penetration, vertical profiles, nutrients, ions, suspended solids, metals, and biological parameters measured.

Previous data showed that Dworshak has a dominant blue-green algae community. Sufficient flows from Dworshak could inoculate the Lower Granite Pool and provide favorable conditions for a blue-green algae bloom.

Temperature profiles were taken from Dworshak using temperature strings in the reservoir. The data was collected for the immediate 7 month period. No resources have been allocated to down load the strings in FY 2001 and that years data will be lost.

b. Proposed activities for 2001.

- ✓ Evaluate the long-term water quality transitions from natural river to reservoir through a thorough evaluation of all previous water quality work completed to date.

- ✓ Review and request continuation of the Thermograph Study research using the in-reservoir chain thermisters. Request resources to collect the data off the loggers and maintain the equipment that was placed in operation.

- ✓ Conduct water quality monitoring as required by the USACE regulations from six in-reservoir stations, twelve inlet stream stations, and below the dam outlet.

- ✓ Request funding for extending pipes and possible shifting of the TDGMS stations on the Clearwater River avoid data outages.

3.3.8. Mill Creek and Virgil B. Bennington Lake

a. Summary. No reservoir water quality samples were taken from the lake at two sites and at two depths. The water quality if fair by lake classification but leakage and low flows keep the lake relatively low most of the year. No plans have been made for any restoration of recreation enhancements. An oil spill was reported during the winter construction window. The contaminant found in the soil was diesel at about 100 ppm or less.

b. Proposed activities for 2001.

- ✓ Water samples should continue to be taken periodically during the spring, summer and fall months from the lake. The goal is to propose adequate funding to comply.

- ✓ Conduct water quality monitoring as required by the USACE regulations.

3.3.9. Lucky Peak Reservoir

Summary. Water samples and Hydrolab profiles were taken from the reservoir by a contractor (Ralston and Associates) three times during the summer of 1999. The samples were shipped to NWW and Vizcaya laboratories and analyzed for nutrients and chlorophyll. The project was not visited and no environmental data was collected. The Boise River is severely impacted by cultural eutrophication. No information is available to document if Lucky Peak Project contributed or not to this problem in FY 2000.

Requests for funding and resources were sent through supervisory channels but Program Management Division placed water quality funding as low priority

Problems with drinking water or swim beach water quality identified by District Natural Resources Management Branch personnel included the following:

Barclay Bay and Turner Gulch drinking fountains still closed because of contamination due to underground line leakage. However, potable water is available at the pump-house.

b. Proposed activities for 2001.

- ✓ Begin acquisition of limnological data below the dam at the diversion structure

to verify the exceptional quality of the water discharged by the project.

- ✓ Conduct water quality monitoring as required by the USACE regulations from five in-reservoir stations and below the dam outlet.
- ✓ Review chemical data and adjust sampling as needed.
- ✓ Work with Idaho water Resources and DEQ to solve any persistent water problems