WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Marine Water Column Monitoring Program Annual Data Report for Wateryear 1990

August 1992
Publication No. 92-77
Printed on Recycled Paper

The Department of Ecology is an Equal Opportunity and Affirmative Action employer and shall not discriminate on the basis or race, creed, color, national origin, sex, marital status, sexual orientation, age, religion, or disability as defined by applicable state and/or federal regulations or statutes.

If you have special accommodation needs, please contact the Environmental Investigations and Laboratory Services Program, Ambient Monitoring Section, Jan Newton at (206) 407-6675 (Voice). Ecology's telecommunications device for the deaf (TDD) number at Ecology Headquarters is (206) 438-8721

For additional copies for this publication please contact:

Department of Ecology
Publications Distributions Office
at Post Office Box 47600
(206) 407-7472
Refer to Publications Number 92-77

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Marine Water Column Monitoring Program Annual Data Report for Wateryear 1990

prepared by
Carol Janzen

Environmental Investigations
and Laboratory Services Program
Ambient Monitoring Program
Washington State Department of Ecology
Olympia, Washington 98504-7710

Printed on Recycled Paper

TABLE OF CONTENTS

LIST OF TABLES ii

LIST OF FIGURES iii

GLOSSARY v

ACKNOWLEDGEMENTS vi

ABSTRACT vii

MARINE WATER COLUMN MONITORING HISTORY 1

MONITORING STRATEGY 1

LONG-TERM MONITORING 2
- Data Collection 4
- Quality Assurance/Quality Control (QA/QC) 5
- Data Management 5
- Data Analysis 8

RESULTS 8
- Summary 8
- Hydrographic Conditions 12
  - Georgia Strait (GRG002) 12
  - Saratoga Passage (SAR003) 18
  - Bellingham Bay (BLL009) 18
- Fecal Coliform Bacteria 20
- Nutrients and Chlorophyll *a* 22
- Dissolved Oxygen 28

CONCLUSIONS 35
- Recommendations 36

REFERENCES 37

LIST OF TABLES

Page

Table 1. Sample types and depths for long-term monitoring stations during Wateryear 1990. 4

Table 2. Manchester Laboratory remark codes and definitions for water quality data. 6

Table 3. Wateryear 1990 stations and the wateryears sampled. 11

Table 4. Discharge data from three major North Puget Sound rivers for Wateryear 1990. (October 1989 - September 1990) 17

Table 5. Hydrographic profile data for Station BLL009, February 1990. 21

Table 6. Wateryear 1990 water column stations that exceeded a fecal coliform bacteria count of 14 organisms/100 mL one or more times. 22

Table 7. Monthly fecal coliform counts from the Nooksack, Snohomish, and Skagit Rivers for Wateryear 1990. 23

LIST OF FIGURES

Page

Figure 1. Map of the Puget Sound basins and the delineations of regions used for the marine water monitoring program 3

Figure 2. Ecology's ambient monitoring data flow diagram for the marine water monitoring program. 7

Figure 3. Puget Sound long-term marine water monitoring stations for Wateryear 1990. 9

Figure 4. Washington outer coast long-term marine water monitoring stations for Wateryear 1990 10

Figure 5. A temperature versus salinity diagram showing how sigma-t varies as a function of these two variables 13

Figure 6. Density (sigma-t) isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990 . . 14

Figure 7. Temperature isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990 . . 15

Figure 8. Salinity isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990 . . 16

Figure 9. Temperature and salinity profile at stations SAR003 for August 1990 19

Figure 10. Surface nitrate-nitrite concentrations at North Sound stations for Wateryear 1990; (a) stations BLL009, SAR003, PSS019, (b) stations GRG002, PAH008 24

Figure 11. Surface orthophosphate concentrations at North Sound stations for Wateryear 1990; (a) stations BLL009, SAR003, PSS019, (b) stations GRG002, PAH008 26

Figure 12. Surface chlorophyll *a* concentrations at North Sound stations for Wateryear 1990; (a) stations BLL009, SAR003, PSS019, (b) stations GRG002, PAH008 27

LIST OF FIGURES (Continued)

Page

Figure 13. Dissolved oxygen isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990 29

Figure 14. Light transmissometer profile at SAR003 in August 1990 31

Figure 15. Light transmissometer profile at SAR003 in April 1990 32

Figure 16. Light transmissometer profile at SAR003 in May 1990 33

Figure 17. Light transmissometer profile at BLL009 in February 1990 34

GLOSSARY

Anoxic: A water quality condition in which there is little or no dissolved oxygen in the water. Anoxia usually occurs in late summer and early fall near the bottom of lakes and marine embayments.

Core Stations: Stations sampled 12 months a year, every year.

Floating Stations: Stations sampled usually 12 months a year, but are not revisited on any set schedule. Often, they are sampled for limited parametric coverage and for one year only.

Halocline: A layer of rapidly changing salinity, analogous to the thermocline.

Hypoxic: A water quality condition where there is a low concentration of oxygen in the water. Hypoxia occurs under similar conditions as anoxia.

Pycnocline: A layer of rapidly changing density, analogous to the halocline. The pycnocline is primarily controlled by the halocline.

Rotating Stations: Stations sampled 12 months a year, but revisited on a three year cycle (every three years).

Sigma-t: The density that a particle of water would have if it were at atmospheric pressure. Sigma-t is typically quoted without units. In formulae they must be treated as having units of kg/m^3.

Stratification: Defined as the layering of the water column due to changed density throughout the water column; less dense water will overlay more dense water. Density stratification of the water column depends primarily on salinity, temperature, and the amount of vertical mixing (i.e., caused by winds and tides).

Thermocline: A region below the mixed layer of rapid temperature change. Characteristically, the thermocline varies with the season becoming stronger (steeper gradient) and deeper in the summer when the mixed layer is warmer, and weaker and shallower in the winter when the mixed layer cools.

Upwelling: Upwelling is an equilibrium process which replaces surface water that has been "pushed" offshore by winds or currents. Deep water, rich in nutrients, and sometimes lower in dissolved oxygen, is brought inshore to replace the displaced surface water. Upwelling also occurs due to bathymetric features along the sea floor, such as sills as seen in Puget Sound.

ACKNOWLEDGEMENTS

Data Collection: Carol Janzen and Bernie Strong

Computer Support: Dave Hallock, Greg Pelletier, and John Tooley.

Review: Dick Cunningham, Dave Hallock, Will Kendra, Pamela Sparks, and Lisa Eisner of Environmental Investigations and Laboratory Services Program at the Department of Ecology; Frank Meriwether of Shellfish Program at the Department of Health; Andrea Copping from the Puget Sound Water Quality Authority; James Smullen at Roy F. Weston for technical advice.

Database Management: Bob James.

Word Processing: Kelly Carruth, Kim Douglas, and Barbara Tovrea.

ABSTRACT

The Washington State Department of Ecology (Ecology) monitors the State's marine water quality. Marine water monitoring presently includes the waters of Puget Sound, Grays Harbor, and Willapa Bay. The goals of the program include characterizing spatial and temporal trends in water quality, identifying significant changes in key water quality indicators, supporting water quality management programs, and providing baseline water quality data to the public. Ecology initiated continuous monitoring efforts in 1972.

Since 1988, Ecology has been coordinating its monitoring efforts with the Puget Sound Ambient Monitoring Program (PSAMP), managed by the Puget Sound Water Quality Authority and participating implementing agencies. As a result of this coordination, additional marine water column monitoring tasks are being undertaken in Puget Sound. Near coastal monitoring in Grays Harbor and Willapa Bay has remained relatively unchanged.

The Ambient Monitoring Section supplies water quality information to a variety of data users including environmental planners and managers, private consulting firms, educational institutions, and the general public. Over 100 marine data requests are received annually.

Wateryear 1990 (October 1989 through September 1990) consisted of monthly monitoring at 24 stations in Puget Sound. A total of six stations were monitored monthly in Grays Harbor and Willapa Bay.

The purpose of this first annual report for the Marine Water Column Monitoring Program is to disseminate the Wateryear 1990 marine water column data. A basic program description, including methods for data collection and analyses, quality assurance/control procedures, and data management is included. Complete data analysis was not incorporated in the report, namely due to budget constraints. This report does attempt to guide the reader through some limited discussions of data at select stations, highlighting considerations for interpretation.

MARINE WATER COLUMN MONITORING HISTORY

The Washington State Department of Ecology (Ecology) initiated its statewide marine water monitoring program in 1967. The program became an ongoing continuous monitoring program by 1972. The program's initial purpose was to examine marine water quality on a regular basis to determine existing conditions, and to identify spatial and temporal water quality trends. Since the program's inception and until the late 1980s, changes made to the original monitoring program consisted primarily of relocation of stations.

In the mid 1980s, Puget Sound's changing water quality became an increasing concern. A regulatory plan to improve the Sound's water quality was issued (PSWQA, 1988; 1989; 1990; and 1991), which in part, recommended the establishment of a comprehensive environmental monitoring program. Consequentially, the Puget Sound Ambient Monitoring Program (PSAMP) was developed by an interdisciplinary committee of water quality professionals known as the Monitoring Management Committee (MMC). The PSAMP Plan (MMC, 1988) recommended that Ecology modify its existing Puget Sound water monitoring program to better meet the PSAMP Plan objectives. To assure proper implementation of PSAMP, a PSAMP Steering Committee, made up of participating agencies and chaired by the Puget Sound Water Quality Authority, was formed. This committee meets monthly and discusses recent developments in the PSAMP program, approves individual monitoring task plans, reviews changes to be made to the program, and coordinates cross-agency monitoring efforts.

Ecology has completed a detailed marine water monitoring implementation plan (Janzen, 1992), using the guidance contained in the 1988 PSAMP Report (MMC, 1988). Included in Ecology's plan are expanded goals and objectives for the marine water column program. The expanded goals are to: 1) continue to characterize and interpret spatial and temporal patterns of ambient water quality conditions; 2) identify significant changes in key environmental indicators; 3) provide water quality information to support specific programs of Ecology and programs in the Puget Sound Water Quality Management Plan; 4) determine the effectiveness of regulatory activities; 5) support environmental research activities; and 6) provide baseline water quality data to interested parties. The plan also describes in detail the marine water monitoring strategies, quality assurance/quality control procedures, data management, and safety considerations for marine water column monitoring implementation.

MONITORING STRATEGY

Ecology's original marine water monitoring program consisted solely of monthly sampling at multiple sites for eight months per year (from April through October). Parameters sampled included nutrients (nitrogen and phosphorus), fecal coliform bacteria, dissolved oxygen, temperature, salinity, and Secchi depths (water clarity). This singular monitoring approach was deemed inadequate by the MMC for monitoring of marine waters, and changes to the program were initiated in 1988 as a result.

In order to meet the PSAMP marine water monitoring goals recommended by the MMC, a three-tiered monitoring strategy was established. The first tier involves long-term monitoring at several stations throughout the marine waters 12 months a year. These stations are sampled monthly. Long-term monitoring will help characterize annual trends in water quality, as well as help identify emerging water quality problems.

The second tier, referred to as seasonal monitoring, entails frequent and intensive monitoring of areas where water quality conditions appear to be episodic or seasonal. Seasonal monitoring will improve characterizations of water quality conditions in embayments.

The third tier, referred to as solstice monitoring, is semi-annual biological sampling conducted daily over a twenty-eight day period bracketing the summer and winter solstices (June 21 and December 21). Solstice monitoring will help describe nutrient and phytoplankton dynamics occurring in the nearshore areas of the Sound. This tier may make use of citizen volunteer monitors.

In Wateryear 1990, only the long-term monitoring tier was implemented with existing Ecology funds. Additional funding will be needed to start implementation of the other monitoring tiers. Seasonal monitoring is scheduled to start in the spring of 1992. Solstice monitoring will likely be initiated in the summer of 1993.

LONG-TERM MONITORING

Long-term monitoring is accomplished by sampling monthly at core, rotating, and floating stations. Core stations, located throughout Puget Sound, Grays Harbor, and Willapa Bay, provide a continuous monthly base of uninterrupted water quality data. Rotating stations, aimed at increasing the geographic coverage of the core station network, provide an interrupted record of data and have a sampling cycle of once every three years. Sampling rotating stations is conducted on a monthly basis for a one-year period. The Puget Sound rotating stations are grouped regionally (South, Central, North Sound) (Figure 1) to correspond with the rotations in the other PSAMP tasks (i.e., sediment monitoring). Floating stations are optional, located in response to specific questions, and usually sampled for one year only. The number of floating stations sampled (usually one to two per year) depends on requests from Ecology's Regional offices, permit writers, and other data users, as well as available funding. Due to the short sampling duration at floating stations, these data have limited specific uses.

The overall parameter list for long-term marine water column monitoring is extensive and includes physical, biological, and chemical measures (Table 1).

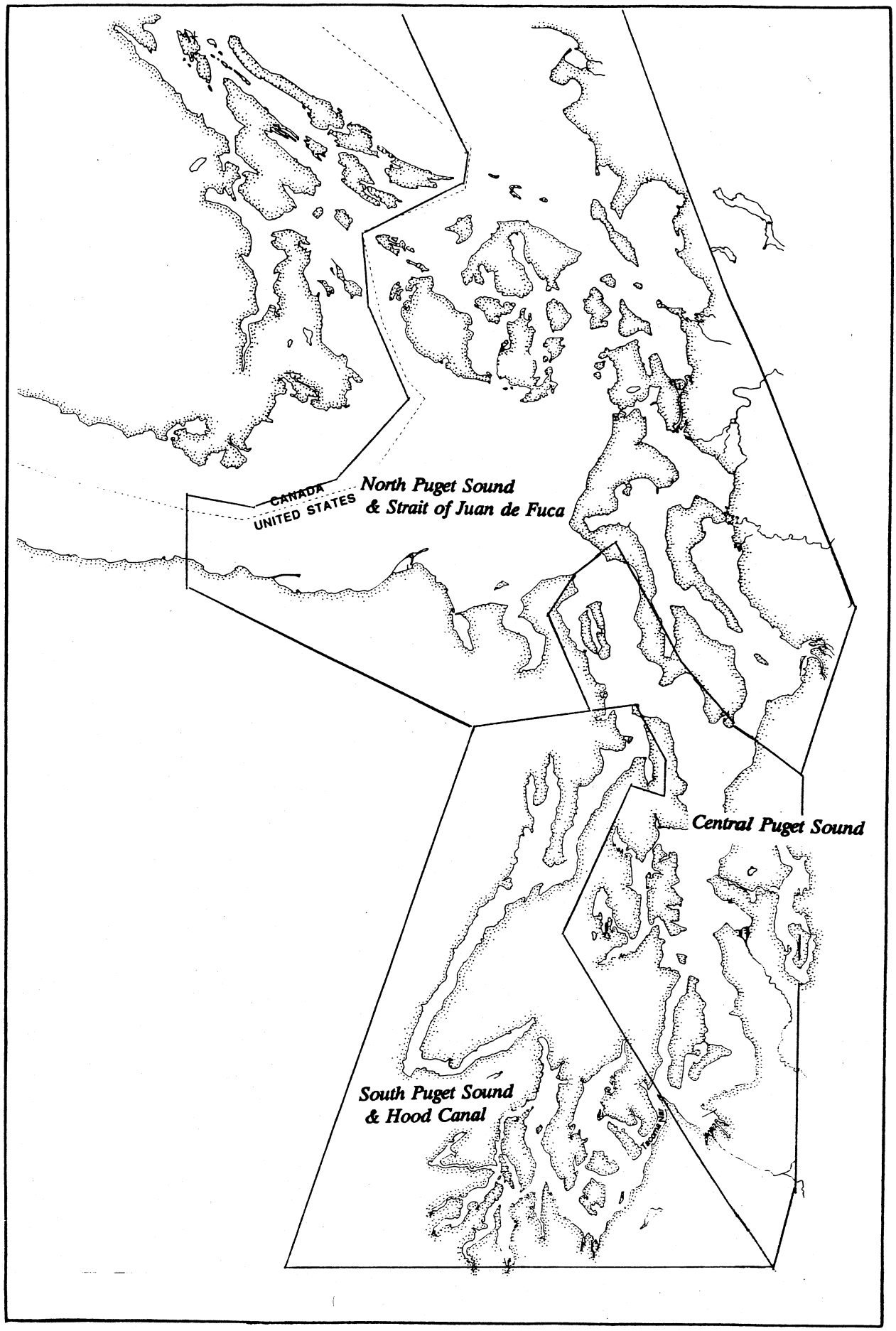


Figure 1. Map of the Puget Sound basins and the delineations of regions used for the marine water monitoring program.

Table 1. Sample types and depths for long-term monitoring stations during Wateryear 1990.

Sample Type: Parameter		Depths (meters)
CTD Profiles:		
Temperature (°C)		0-30
Conductivity (Siemens/m)		0-30
Salinity (ppt)		0-30
Density (sigma-t)		0-30
pH		0-30
Dissolved oxygen (mg/L)		0-30
Light Transmissivity (percentage)		0-30
Discrete Water Samples:		
Nutrients (mg/L) *		0, 10, 30
Chlorophyll *a* (μg/L)		0, 10, 30
Fecal Coliform Bacteria	(organisms/mL)	0

* Nutrients include ammonia, nitrite, nitrate/nitrite, orthophosphorus, and total phosphorus

Data Collection

A floatplane is used for long-term monitoring sample collection. Use of the floatplane allows a large geographic area to be covered in an eight-hour period. Once on station, conductivity-temperature-depth (CTD) profiles and water samples are collected through an observation hatch in the rear floor of the seaplane. Navigation is accomplished with land marks, buoys, and line-of-sight.

A Sea-Bird Electronics Seacat® CTD profiler is used for collecting water column profile data. The Seacat has a 256K memory which stores continuous profile data internally until the data can be downloaded onto a computer. Data are recorded at two scans per second, with a reading being taken at approximately every 25 centimeters. Additional sensors that measure pH, dissolved oxygen, and light transmittance are interfaced with the basic CTD unit. CTD vertical profiles were conducted to 30 meters, where depth permitted. Sampling procedures followed the manufacturer's instructions (Sea-Bird Electronics, 1990).

Water samples for nutrients, chlorophyll *a*, and dissolved oxygen analysis were collected using a 1.2 liter Niskin water sampler. Discrete samples were collected just beneath the surface, at ten, and 30 meters. Fecal coliform bacteria samples were collected at the surface of each station as well. Data collection techniques followed the Recommended Protocols for Measuring Conventional Water Column Variables in Puget Sound (PSEP, 1990).

Water samples collected during the marine water quality surveys were analyzed by Ecology's environmental laboratory near Manchester, Washington (Manchester Laboratory). The Recommended Protocols For Measuring Conventional Water Column Variables in Puget Sound (PSEP, 1990), Ecology's Laboratory Users Manual (Ecology, 1986) and Standard Methods (APHA, 1989) were used during laboratory analyses.

Quality Assurance/Quality Control (QA/QC)

CTD sensors measuring pH, dissolved oxygen, and light transmittance were calibrated once a month at Ecology's ambient monitoring office. Discrete water samples for dissolved oxygen and salinity were collected during each flight and analyzed to verify CTD sensor performance. Salinity, temperature, and pressure sensor checks were done in the laboratory, but calibration coefficients were generated annually by the factory, or sooner if checks indicated additional calibration adjustments were needed. Annual factory calibrations were completed by Sea-Bird Electronics at the Northwest Regional Calibration Center (NRCC), located in Seattle, Washington.

During each survey day in Wateryear 1990, one station was randomly selected for water sample replication. Three separate bottle casts were taken at each selected station. These samples were analyzed for nutrients and chlorophyll *a*. Duplicate samples for fecal coliform bacteria analysis were also collected at these stations. Results were collected to describe field as well as laboratory variability.

Manchester Laboratory conducted a continuous data quality assurance/quality control (QA/QC) program. The program included matrix spikes, standard checks, laboratory blanks, and annual instrument calibrations. The lab assigned remark codes to indicate data quality (Table 2). Further detail on Manchester's QA/QC procedures are outlined in the Manchester Quality Assurance Manual (Ecology, 1988).

Once the Ambient Monitoring staff received the laboratory data, the data went through additional QA checks using computer applied evaluations, holding time exceedance checks and coefficient of variation calculations. Following the data validation and data checks by ambient staff, final quality codes were assigned.

Data Management

Marine water quality data collected as part of Ecology's monitoring program are currently available on request from Ecology's Ambient Monitoring Section in Olympia, Washington. The data collected for marine and freshwater are maintained on the Ambient Management System (Syverson, 1991). The data are also available from EPA's nationwide database, EPA STORET. Marine monitoring data are processed and archived according to the flow diagram shown in Figure 2.

Table 2. Manchester Laboratory remark codes and definitions for water quality data.

Remark Code	Definition
B	Analyte is found in the blank as well as the sample, indicating a possible/probable blank contamination.
J	Estimated value; value not accurate.
M	Presence of material verified but not quantified.
U or K	Compound was analyzed for but not detected. The number is the minimum detection limit.
UJ	Compound was analyzed for but not detected. The number is the estimated detection limit.
C	The value is one of, or the sum of both, benzo(b)fluoranthene and benzo(k)fluoranthene.
x	Many background organisms.
S	Spreader.
H	Over holding time. Analysis run.
G	Improper container
L	Total plate count over 200.
Z	Sample low due to interfering substance.
D	Sample high due to interfering substance.
IS	Interfering substance.
P	Greater than. (>)

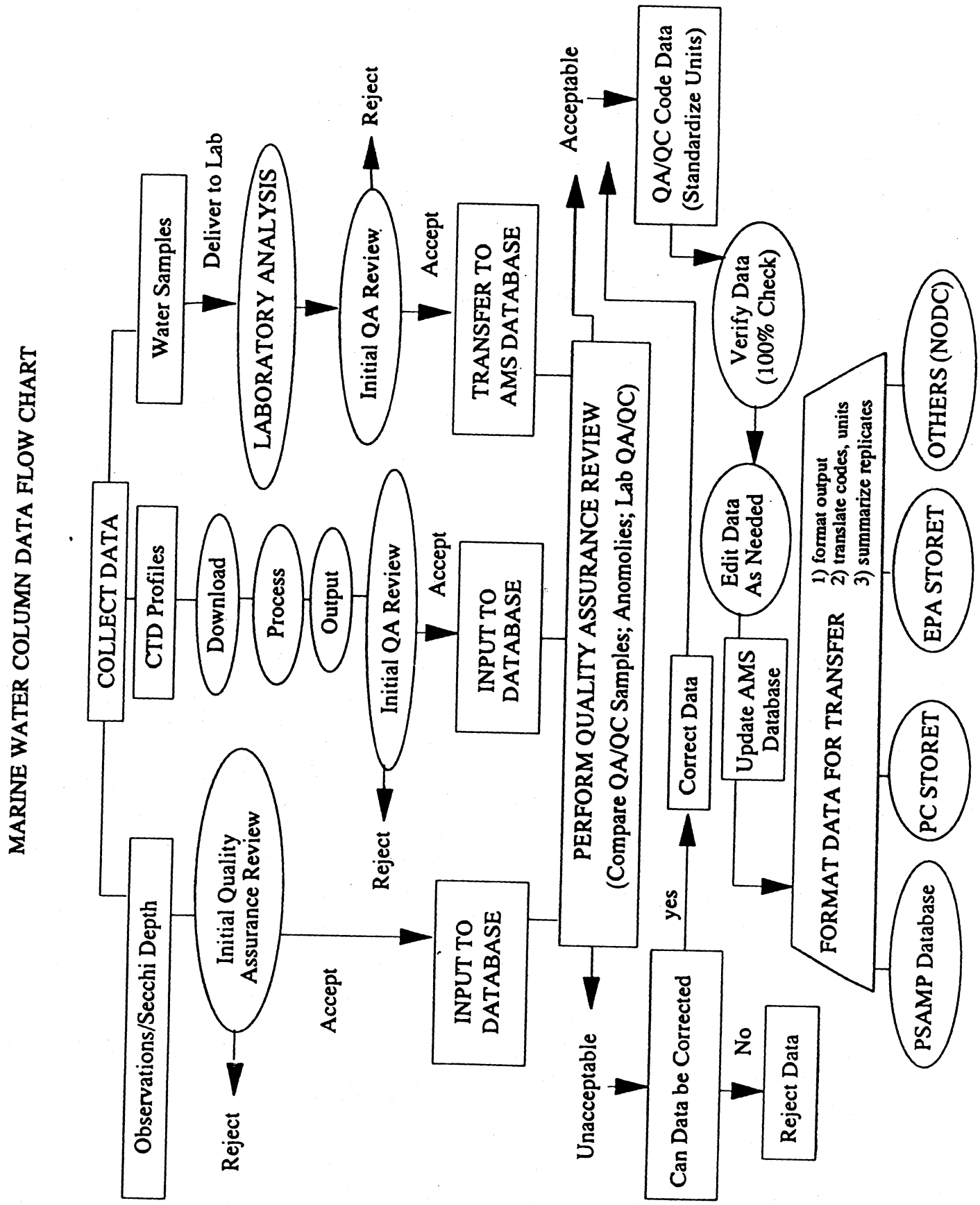


Figure 2. Ecology's ambient monitoring data flow diagram for the marine water monitoring program.

A Puget Sound database (PSAMP Database), managed by Puget Sound Water Quality Authority, has been developed to accept the monitoring data from each PSAMP monitoring task. Ecology's marine water quality data will be submitted to the PSAMP Database annually.

Data Analysis

The effects of naturally occurring environmental variables on water quality (e.g. tidal activity, freshwater inputs, and climatological change) are currently being investigated. The assessments need to be completed at each individual station and at each discrete depth prior to detailed trend analysis, in order to interpret possible cause-effect relationships in the long-term data (Janzen, *et al.*, 1991). In addition, parameter precision and accuracy from sampling and analytical practices are under investigation to assess additional variables inherent to the database. Discussions of the results of these investigations will appear in future reports.

Time series and bar plots of monthly data at select stations, along with general discussions, are included in this report.

RESULTS

Summary

Samples were collected from the surface to 30 meters (depending on water depth) at 24 long-term water column stations in urban and rural embayments throughout Puget Sound (Figure 3). Six monitoring stations were visited monthly in the coastal estuaries, Grays Harbor, and Willapa Bay (Figure 4). A total of 35 surveys were conducted in Wateryear 1990. Surveys were completed with three separate flight routes each month. Seven hundred water quality samples were collected during 270 station visits. Table 3 is a listing of Wateryear 1990 stations and the years each station has been sampled. The complete set of Wateryear 1990 data are presented in Appendix A as individual station reports.

Due to resource constraints, only the results from the Northern Puget Sound stations are discussed in this report. These stations (listed below) were analyzed to describe the variety of water column conditions in North Puget Sound:

Bellingham Bay (BLL009)
Georgia Strait (GRG002)
Port Angeles (PAH008)
Possession Sound (PSS019)
Saratoga Passage (SAR003)

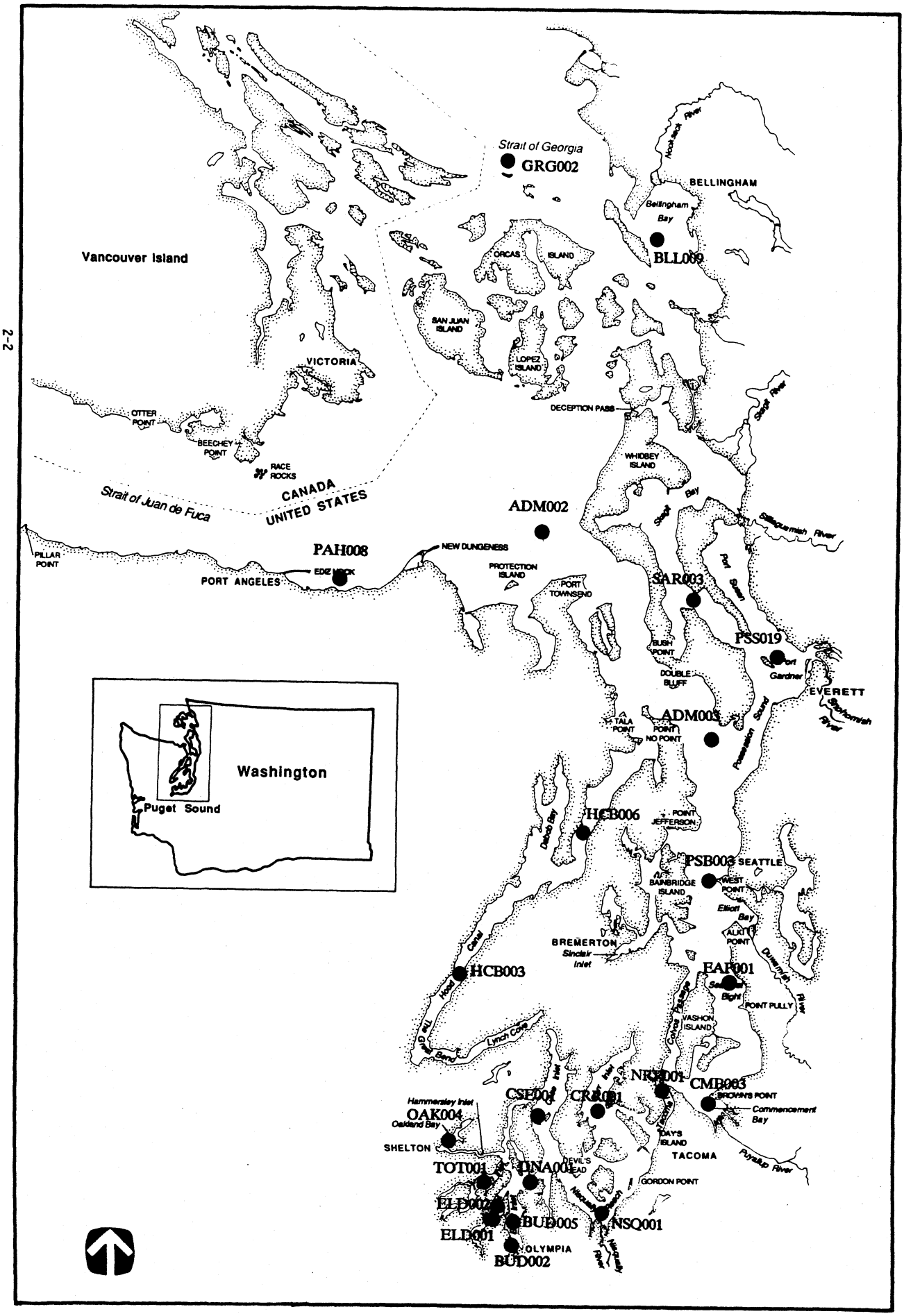


Figure 3. Puget Sound long-term marine water monitoring stations for Wateryear 1990.

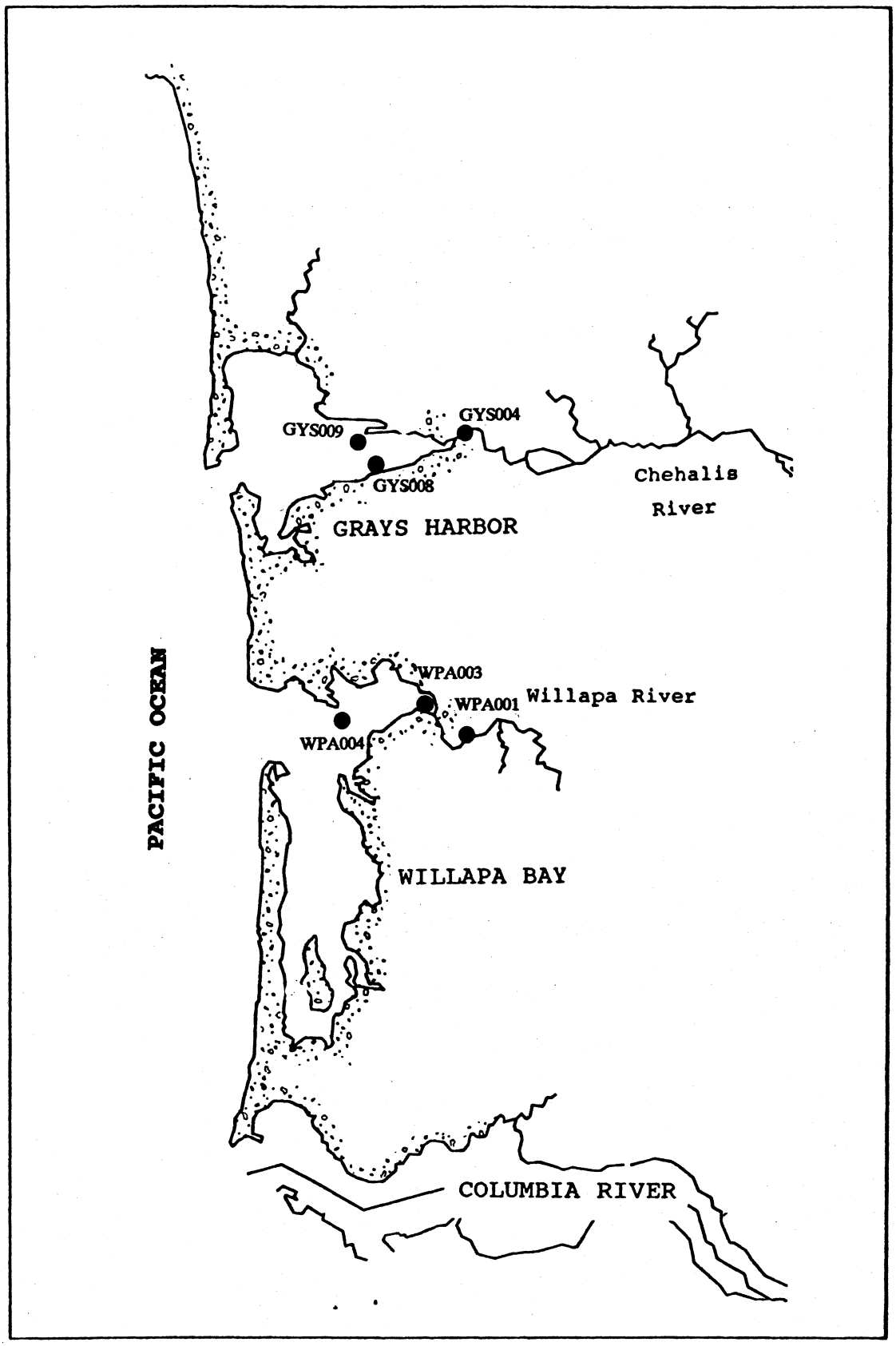


Figure 4. Washington outer coast long-term marine water monitoring stations for Wateryear 1990.

Table 3. Wateryear 1990 stations and the wateryears sampled.

Station No.	Location	Wateryears Sampled
ADM002	North Outer Admiralty Inlet	1989-90
ADM003	South Outer Admiralty Inlet	1989-90
BLL009	Bellingham Bay	1967-70, 1978-90
BML001	Burley Mintor Lagoon	1989-90
BUD002	Inner Budd Inlet	1967-70, 1977-90
BUD005	Budd Inlet	1967-75, 1977-90
CMB003	Commencement Bay	1967-70, 1977-90
CRR001	Carr Inlet	1967-70, 1977-90
CSE00I	Case Inlet	1967-70, 1978-90
DNA001	Dana Passage	1985, 1989-90
EAP001	East Passage	1989-90
ELD001	Eld Inlet	1967-70, 1977-90
ELD002	Inner Eld Inlet	1989-90
GRG002	Georgia Strait	1989-90
GYS004	Grays Harbor - Chehalis River	1967-70, 1975-90
GYS008	Grays Harbor - South Channel	1967-60, 1975-76, 1982-90
GYS009	Grays Harbor - North Channel	1967-70, 1975-90
HCB003	Hood Canal - Eldon	1968-70, 1977-90
HCB006	Hood Canal - Bangor	1976-90
NRR001	Tacoma Narrows - Pt. Defiance	1967-70, 1977-90
NSQ001	Nisqually Reach - Delta	1967-70, 1977-90
OAK004	Oakland Bay	1967-70, 1975, 1978-90
PAH008	Port Angeles - Morse Creek	1967-90
PSB003	Puget Sound Main Basin - West Pt.	1967-70, 1977-90
PSS019	Possession Sound - Gedney Is.	1980-90
SAR003	Saratoga Passage	1978-90
TOT001	Totten Inlet	1967-70, 1 978-90
WPA001	Willipa Bay - Willipa River	1967-75, 1977-90
WPA003	Willipa Bay - Johnson Slough	1967-75, 1977-90
WPA004	Willipa Bay - Toke Point	1967-75, 1977-90

Hydrographic Conditions

Density stratification of the water column depends on salinity, temperature, and the amount of vertical mixing (*i.e.*, caused by winds and tides). Stratification of the water column is usually seasonal, with stronger vertical gradients during summer months when vertical mixing is reduced and surface temperatures are warmer. In winter months, the mixed layer extends deeper because of increased mixing of the water column from stronger and more persistent wind events. In addition to mixing, surface water temperature decreases in winter months, further reducing the degree of density structure, since the temperature difference between surface and depth is decreased. Freshwater inputs play a major role in water column density (freshwater is considerably less dense than saltwater), and generally affect density gradients more than temperature changes. The relationship of temperature and salinity with density is non-linear, especially with respect to temperature. Density is less sensitive to temperature changes at low temperatures than high temperatures. Density increases approximately one part in 1000 as follows (Figure 5):

1. For a change in temperature of -5°C;
2. For a change in salinity of +1 part per thousand; or
3. For a change in pressure of +2000 kPa (200 dbar ~ 200 meters).

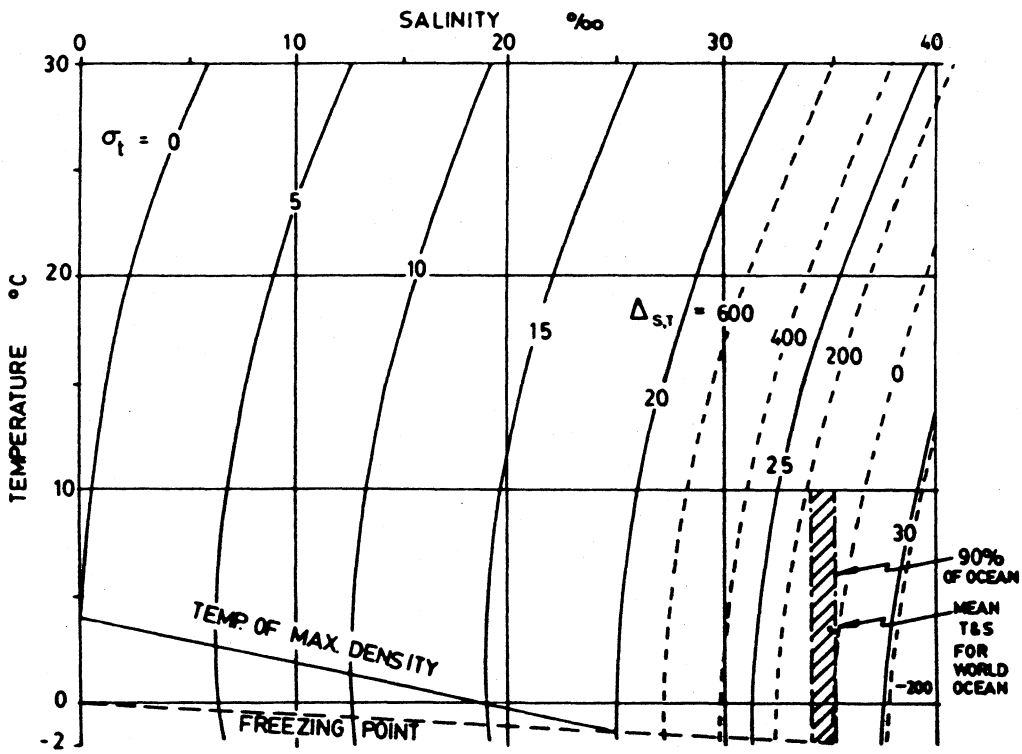
In oceanographic applications, a modified value known as sigma-t (σ_t) is used (Pond and Pickard, 1983). Sigma-t is used because of its brevity, and because it allows a much better estimate of what the density differences between two water types would be if they were at the same depth level, therefore, sigma-t is a better indicator of static stability than unmodified density values (Pickard and Emery, 1982).

Due to density sensitivity to salinity changes, during periods when freshwater inputs are high and ambient marine water temperatures are lower (late fall through winter), the water column may exhibit strong density stratification.

Hydrographic conditions vary throughout Puget Sound as a result of varying mixing regimes and locations of freshwater and oceanic inputs. To illustrate monthly changes in water column stratification, isopleth plots were generated using data from three physically distinct North Sound stations: GRG002, SAR003, and BLL009.

<u>Georgia Strait (GRG002)</u>

GRG002, in the Straits of Georgia, represents a fairly well mixed water column station, as seen in the hydrographic isopleth plots for density (Figure 6a), temperature (Figure 7a), and salinity (Figure 8a). Density stratification occurred to some degree in June (as indicated by the closely spaced horizontal lines on the isopleth), which was a high discharge period for major northern rivers (Table 4). By comparing salinity and temperature isopleths, it is clear that overall density structure at this time was controlled mainly by freshwater discharge rather than by seasonal changes in temperature.



(Adapted from: Pickard and Emery, 1982).

Figure 5. A temperature versus salinity diagram showing how sigma-t varies as a function of these two variables.

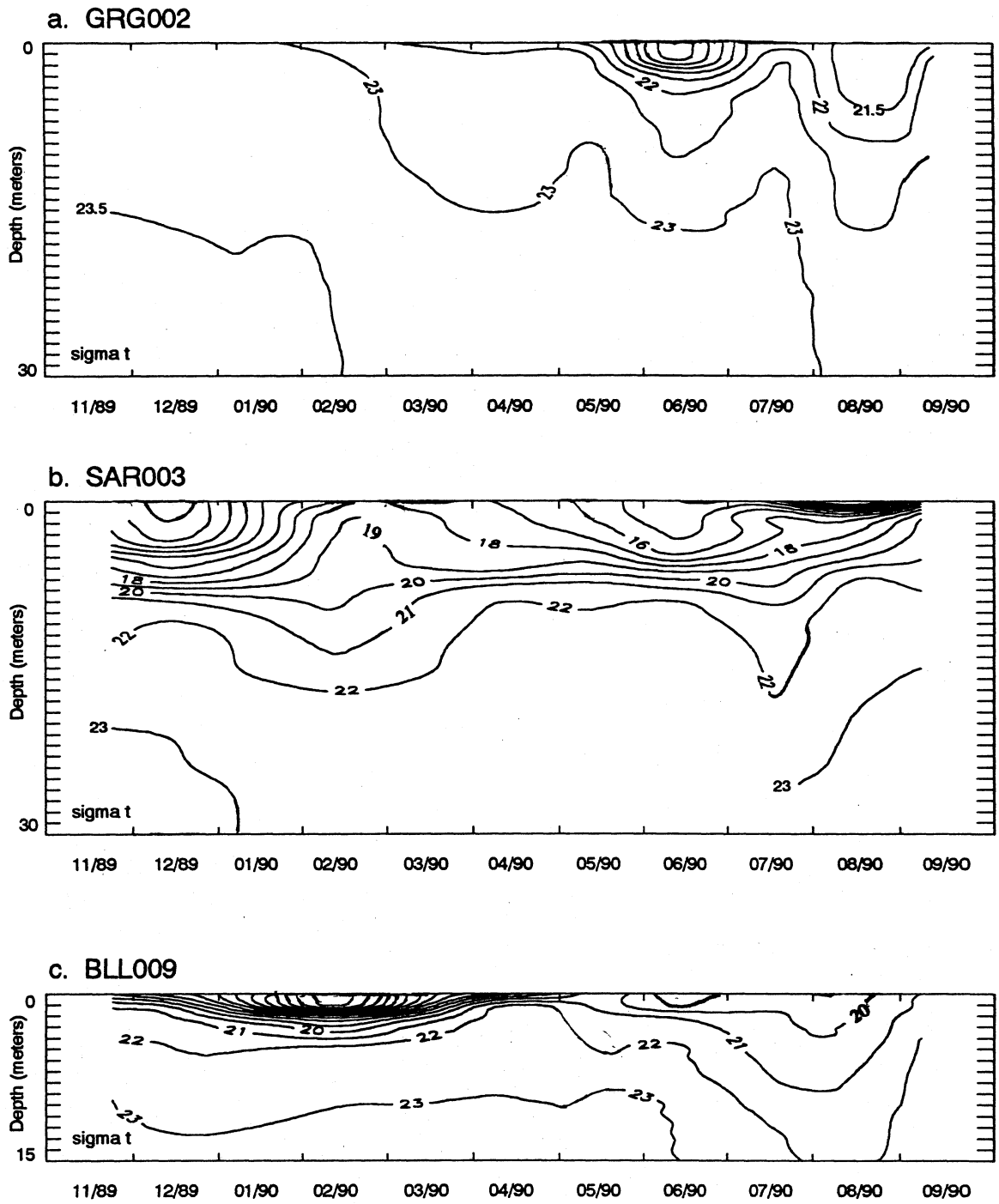


Figure 6. Density (sigma-t) isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990.

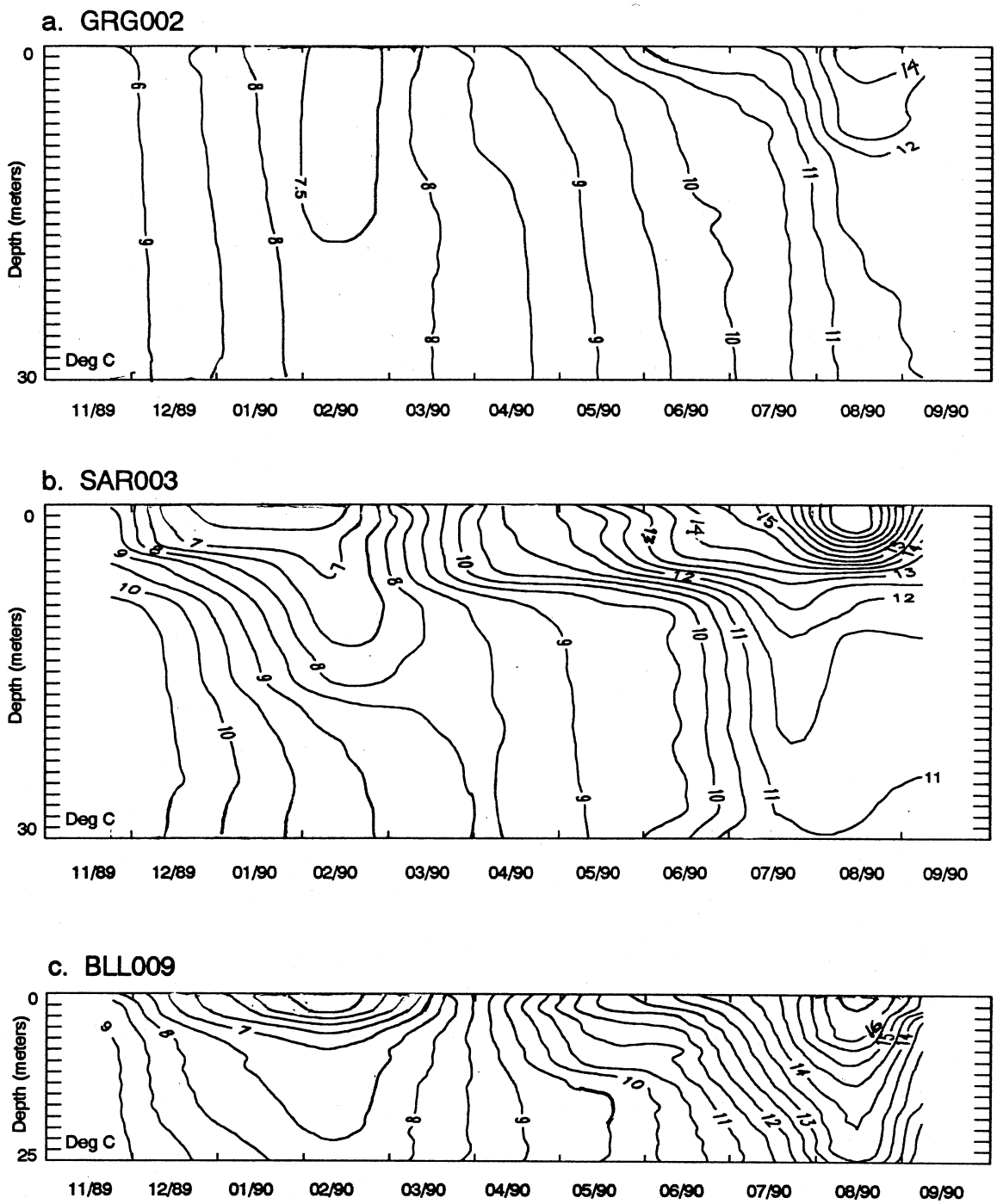


Figure 7. Temperature isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990.

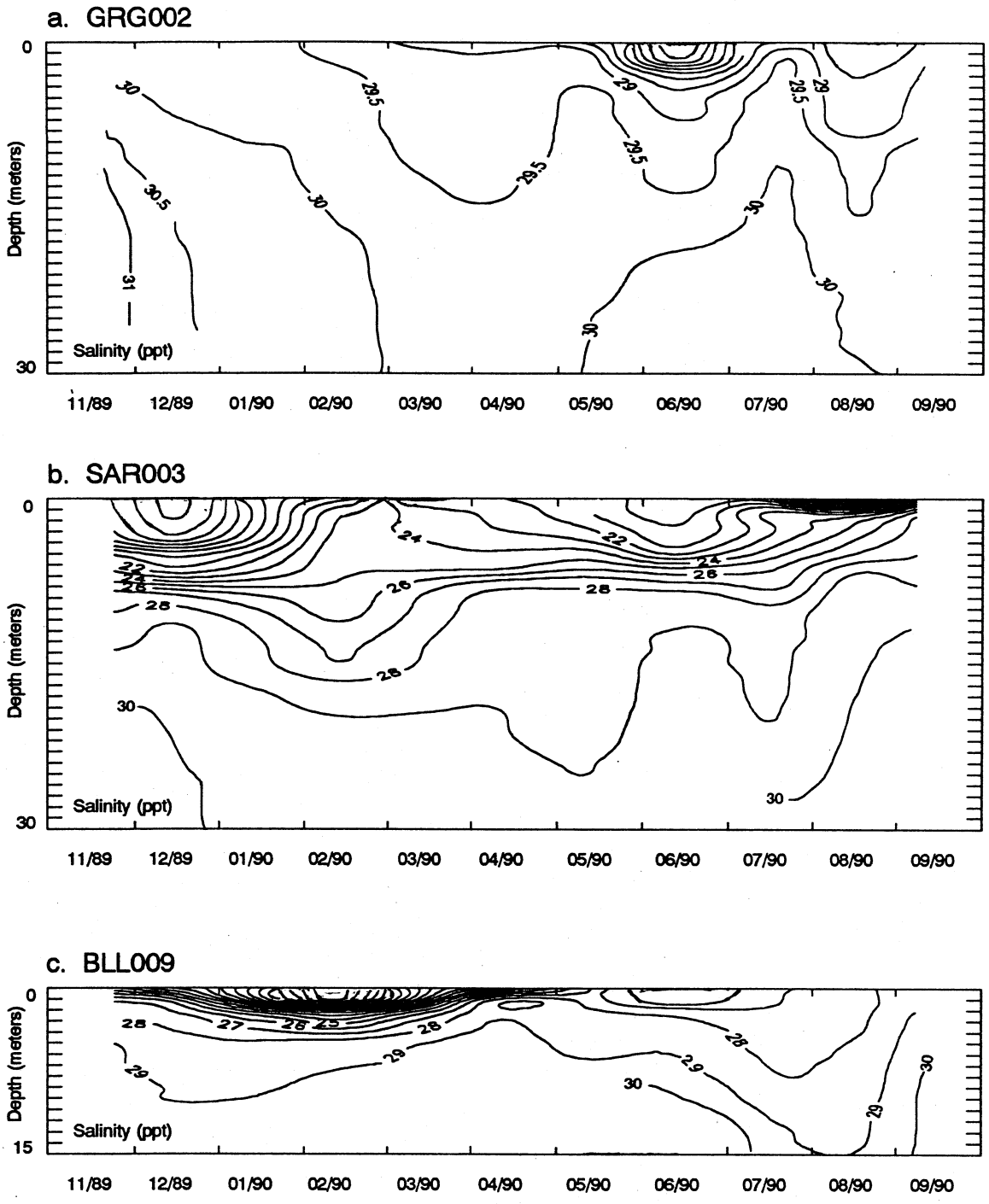


Figure 8. Salinity isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990.

Table 4. Discharge data from three major North Puget Sound rivers for Wateryear 1990 (October 1989 - September 1990). (January river discharge data are not included since no North Sound water quality data was available for January.)

	November		December		February		March		April		May		June		July		August		September	
River	Day	Flow	Day	Flow	Day	Flow	Day	Flow	Day	Flow	Day	Flow	Day	Flow	Day	Flow	Day	Flow	Day	Flow
Nooksack River	18	4280	11	5840	10	13100	10	5930	07	3890	12	3460	09	6750	22	2860	11	2010	10	1300
	19	4410	12	5050	11	21100	11	5100	08	4030	13	3340	10	8090	23	2910	12	2140	11	1270
	20*	6740	13*	4490	12*	15100	12*	4100	09*	3580	14*	3540	11*	10600	24*	2590	13*	2280	12*	1230
Mean	9570		5560		5439		3804		4449		3640		6456		3381		1872		NA‡	
Min	1190		2260		3180		2870		3290		2830		4110		2220		1150		NA	
Max	47900		23200		21100		6760		6410		6630		11900		4770		4360		NA	
Snohomish River	18	12400	11	16900	10	28500	10	14500	07	12200	12	9850	09	18500	22	4480	11	e 2310	10	e 2560
	19	11800	12	13700	11	42700	11	12800	08	12500	13	10000	10	18900	23	4460	12	e 2310	11	e 2740
	20*	13500	13*	11800	12*	33000	12*	10500	09*	11400	14*	11100	11*	22800	24*	e 3970+	13*	e 2260	12*	e 2700
Mean	19400		14970		12970		10080		14300		11630		16040		6290		e 2535		e 222	
Min	3440		4870		7840		7740		9110		9160		9650		9780		e 1990		e 1560	
Max	56300		65700		42700		14500		22100		19800		24300		3240		e 4070		e 4350	
Skagit River	18	23100	11	27300	10	29200	10	20900	07	18300	12	17500	09	22800	22	17300	11	10900	10	8630
	19	22700	12	24900	11	39900	11	20600	08	18500	13	16400	10	24800	23	18500	12	10000	11	8430
	20*	27300	13*	23200	12*	33500	12*	18900	09*	18700	14*	17700	11*	29400	24*	18300	13*	10500	12*	8000
Mean	29940		24750		19940		17320		19820		17460		24930		21640		11100		8986	
Min	10300		9580		15000		14000		15300		13400		20000		13800		7660		7720	
Max	84000		88200		39900		21300		25700		25400		29700		31000		15900		14000	

* Marine surveys conducted on these days
‡ not available
+ e = estimated values
* mean, minimum, and maximum values are for the entire monthly record
Data courtesy of U.S. Geological Survey

Water column temperatures in the fall ranged from 9-10°C, and decreased gradually through March to less than 8°C. The temperature then proceeded to increase, and by August, surface (upper 5 meters) temperatures were 14°C. Noticeable changes in thermal stratification started in late May to early June, when surface temperatures increased 2-3°C (Figure 7a). A salinity gradient (halocline), showing a change in salinity of 5 ppt, also formed in the upper 5 meters during this warming period (Figure 8a).

Saratoga Passage (SAR003)

Station SAR003 exhibited stronger vertical gradients than Georgia Strait (Figures 6b, 7b, and 8b). As with GRG002, density isopleths tended to follow the same pattern as the salinity isopleths (Figures 6b and 8b).

The temperature isopleths for SAR003 showed cooler surface temperatures (6-9°C) in the fall and winter months (November through February) compared to the temperatures (9-11°C) at depth ($z > 5$ meters). This condition was likely due to atmospheric cooling and reduced solar radiation associated with shorter days. In late winter (March), temperature gradients broke down and the water column appeared to be homogenous to 30 meters depth, with slight changes in temperature (0.5°C) and salinity (5 ppt) occurring at approximately 8 meters. As the spring and summer months approached, the surface temperatures increased and formed the basis for thermal stratification by June, with near surface temperatures about 4°C higher than at 10 meters. A strong thermocline developed at around 7-10 meters by June. In August there was a temperature difference of about 6°C from the surface to 10 meters. Excluding the period in mid- to late-winter during the thermal stratification breakdown, the thermocline tended to occur between 5-8 meters throughout most of the year.

Fall and early winter salinity gradients were fairly strong, showing differences in salinity of 10-13 ppt at the surface to 10 meters depth (Figure 8b). This was likely due to high and frequent freshwater discharges that occurred during this period (Table 4). During mid-winter through spring months (February through April), salinity gradients were weaker, with changes in salinity of 5 ppt over a 30 meter interval. Salinity gradients became more well defined again by June, possibly due to increased freshwater inputs, as indicated by June discharge values from the Skagit River (Table 4). By mid- to late-summer, changes in salinity at depths below 2 meters were reduced and were more dependent on episodic freshwater inputs to the system, as seen in August (Table 4). Salinity stratification near the surface (upper 5 meters) was strong in late July and August with changes in salinity from surface to 0.5 meters depth of 12 ppt, and a total change of 24 ppt in the upper meter (Figure 9).

Bellingham Bay (BLL009)

Density stratification at BLL009 appeared to be greatest during winter months (December - March) (Figure 6c). This pattern is also seen in the salinity isopleths (Figure 8c). Rainfall and

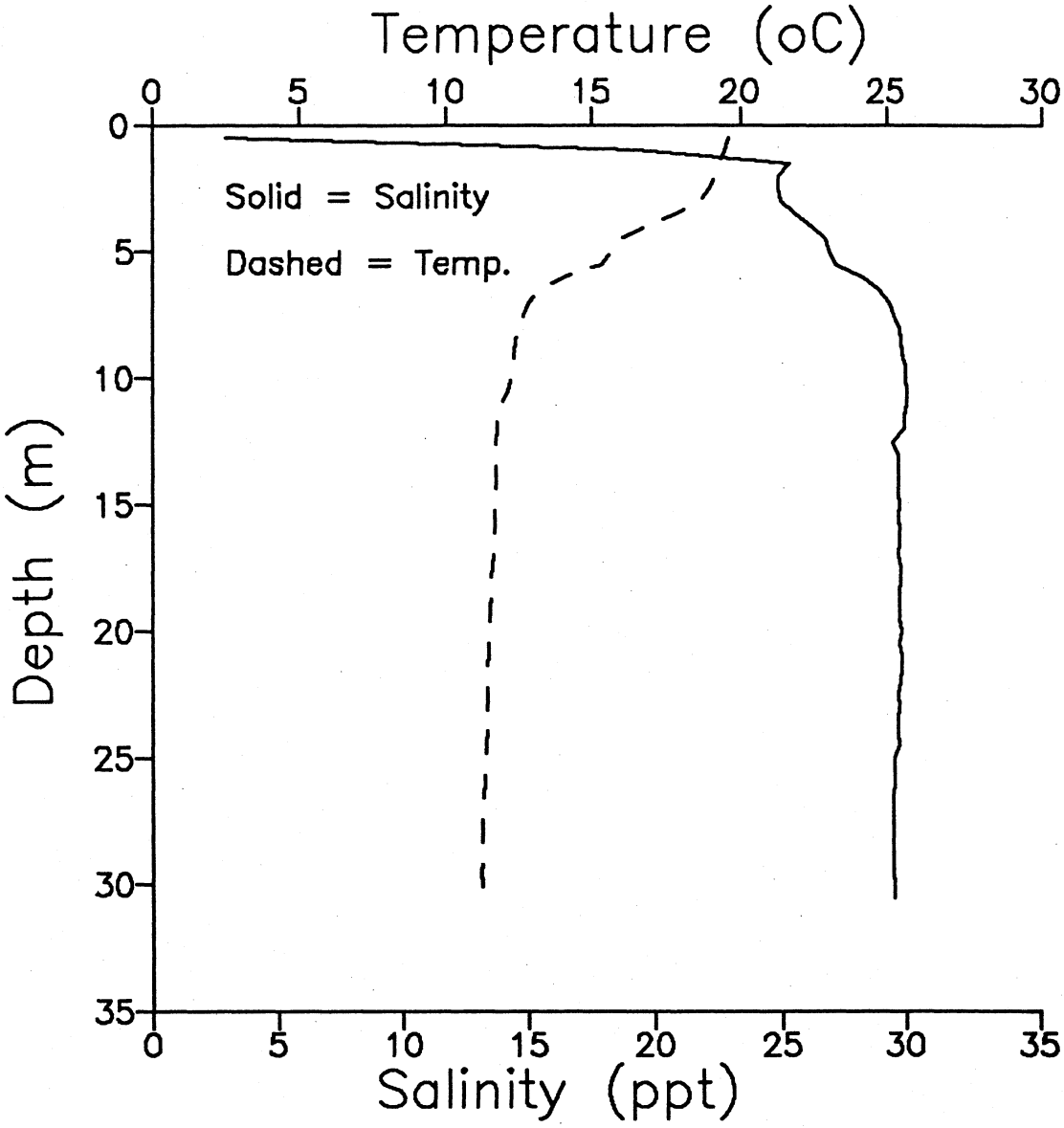


Figure 9. Temperature and salinity profile at stations SAR003 for August 1990.

consequent discharge from surrounding rivers played an important role in this regime (Table 4 - Nooksack River).

The thermal structure at BLL009 followed a similar pattern at times to that seen at SAR003 (Figures 7b and 7c). Temperature stratification broke down in the fall and early winter months (November through January), with no apparent thermocline. Cooler water overlaid warmer water (temperature differences of 2-3°C) during the winter months (January through March), as surface water cooling occurred, likely due to reduced ambient air temperatures and episodic increases in river discharge (Figures 7c and 8c; Table 4, Nooksack River). The temperature stratification (thermocline) remained weak until May. Slight temperature stratification began to appear in May, and by June, there was a temperature difference of 2°C from surface to 15 meters depth. During July/August, the differences in temperature were as high as 4°C from surface to depth, with a gradual thermocline residing in the upper 2-5 meters.

As mentioned above, vertical salinity gradients were greatest in the winter months, likely due to increased river discharge from winter storm events (Figure 8c; Table 4). Differences in salinity of 29 ppt (from 0-29 ppt) were experienced in the upper 8 meters in February (Table 5), but differences usually were around 4-6 ppt (from 25-29 ppt) during other winter months. The halocline and pycnocline resided in the upper 5 meters throughout most of winter (Figure 8c). During the spring months (April through June), salinity gradients lessened and became more shallow. By June, salinity gradients had increased slightly, showing changes in salinities of 3 ppt in the upper 3 meters. Salinity stratification broke down during the remaining months of summer, likely due to diminished freshwater discharge.

Fecal Coliform Bacteria

Fecal coliform bacteria, though usually not harmful themselves, are indicators of pathogenic bacteria and viruses. Fecal coliform bacteria are present in human and animal wastes, but may be detected in high numbers in areas where discharges from wood product industries occur. Fecal coliform bacteria criteria for Class A and AA waters in Washington State begin limiting water usage (i.e., shellfish harvesting) when geometric mean values of fecal counts rise above 14 organisms per 100 milliliters (mL). Public agencies step up regulatory activities, including monitoring, when these criterion exceedances occur.

The criterion for fecal coliform bacteria states that the bacteria count shall not exceed a geometric mean value of 14 organisms/100 mL, with not more than 10 percent of samples exceeding 43 organisms/100 mL. This dual criterion takes into account high variability encountered with fecal coliform bacteria samples. Due to the variability, calculation of geometric means using monthly fecal coliform bacteria data may produce misleading results, since monthly data represent single snapshots in time (only one sample taken at each site each month). This criterion is more applicable to intensive survey data, when multiple samples are collected. For instance, the Department of Health uses these limits based on the results of at

Table 5. Hydrographic profile data for Station BLL009, February 1990.

meters	temp	cond (S/m)	salinity	pH	oxy (mg/l)	% light
1.000	4.5	0.72419	6.71	7.7	13.2	0.14
2.000	5.2	2.12550	21.06	7.4	11.8	0.84
3.000	6.2	2.46371	24.12	7.3	11.6	12.48
4.000	6.6	2.72868	26.62	7.4	11.1	31.97
5.000	7.0	2.93185	28.51	7.5	10.7	50.54
6.000	7.0	2.92741	28.46	7.6	10.6	54.20
7.000	7.1	2.97350	28.89	7.6	10.4	59.24
8.000	7.2	3.00425	29.15	7.7	10.2	60.68
9.000	7.2	3.01905	29.27	7.7	10.1	61.63
10.000	7.3	3.03095	29.35	7.8	9.9	62.44
11.000	7.3	3.04864	29.51	7.8	9.8	62.91
12.000	7.3	3.06633	29.67	7.8	9.7	63.00
13.000	7.4	3.09242	29.85	7.8	9.8	65.18
14.000	7.6	3.10953	29.94	7.8	9.8	68.11
15.000	7.6	3.12092	30.01	7.8	9.6	70.61

least 15 or more samples (F. Meriwether 1992, Personal Communication). During the marine water column monitoring program, should the fecal coliform bacteria counts at ambient stations exceed 14 organisms/100 mL or approach 43 organisms/100 mL several times in a year, the station is highlighted for further investigation by intensive monitoring efforts designed to determine public health threats.

Additionally, routine ambient fecal coliform bacteria samples should not be used solely to determine if public health is threatened. As indicated above, fecal coliform is an indicator organism. To fully understand the public health threat, a series of samples need to be collected and the source(s) identified. Fecal coliform bacteria should be used with additional water quality information to determine possible sources.

At the majority of Ecology's water column monitoring stations, fecal coliform bacteria levels remained at or below the detection limit of 1 organism/100 mL during wateryear 1990 (Appendix A). This is expected at offshore stations located away from direct and indirect sources of pollutants, such as wastewater treatment outfalls, failing shoreline septic systems, or river mouths.

Occasionally during Wateryear 1990, above detection levels of fecal coliform bacteria counts occurred near urban areas, frequently in South Puget Sound, and in coastal riverine stations (Table 6). For the sake of discussion, Table 6 lists those stations that exceeded 14 org/100 mL one or more times. These above detection limit results are within the range of expected values at offshore stations and could have resulted from a variety of events, such as increased discharge from rivers and storm sewers during the rainy season. High counts (greater than

Table 6. Wateryear 1990 water column stations that exceeded a fecal coliform bacteria count of 14 organisms/100 mL one or more times. (Survey dates in parentheses.)

Station	(Region)	Highest count		2nd Highest count		3rd Highest count	
+ PSS019	(North)	36	(20Nov89)	30	(12Mar90)	18	(09Apr90& 11Jun90)
* BLL009	(North)	180	(12Feb90)	NA		NA	
+ CMB003	(Central)	640	(29Jan90)	86	(27Nov89)	23	(18Dec89 & 19Jan90)
BML001	(South)	26	(29Jan90)	21	(23Oct89)	NA	
ELD002	(South)	28	(29Jan90)	NA		NA	
+ BUD005	(South)	80	(05Jun90)	56	(05Dec89)	36	(14Nov89)
* BUD002	(South)	380	(14Nov89)	320	(05Jun90)	260	(05Dec89)
* NSQ001	(South)	57	(14Nov89)	52	(05Jun90)	37	(05Dec89)
ELD001	(South)	27	(05Dec89)	NA		NA	
TOT001	(South)	22	(05Dec89)	NA		NA	
OAK004	(South)	147	(05Dec89)	24	(06Feb90)	18	(14Nov89)
* GYS004	(Coast)	360	(14Nov89)	210	(17Jan90)	140	(05Jun90)
+ GYS008	(Coast)	730	(14Nov89)	260	(17Jan90)	58	(05Mar90)
+ GYS009	(Coast)	520	(17Jan90)	290	(14Nov89)	38	(16July90)
* WPA003	(Coast)	120	(05Jun90)	NA		NA	
* WPA001	(Coast)	120	(05Jun90)	78	(05Mar90)	51	(07Aug90)

NA Not Applicable
* Stations situated close to major river input
+ Near river inputs, but offshore

140 organisms/100 mL) of fecal coliform bacteria often occur during storm events that follow periods of dry weather. Point and nonpoint source pollution directly entering rivers and streams also contribute to nearshore marine fecal coliform bacteria contamination. To demonstrate monthly riverine fecal coliform bacteria levels, monthly counts from the Nooksack, Snohomish, and Skagit Rivers, collected during Ecology's 1990 freshwater monitoring program, are presented in Table 7.

The Department of Health Shellfish Program expends a considerable effort sampling for fecal coliform bacteria contamination. The Department of Health collects not only water samples in given areas (namely shellfish growing areas), but also samples and analyzes shellfish tissue. Their monitoring efforts are designed to protect public health interests, thus their data is more useful in determining beneficial uses.

Nutrients and Chlorophyll *a*

Phytoplankton growth in marine water relies upon several environmental conditions such as sunlight for photosynthesis, water column stability (stratification), water temperatures, and nutrient availability.

Table 7. Monthly fecal coliform bacteria counts from the Nooksack, Snohomish, and Skagit Rivers for Wateryear 1990. (Data collected as part of the Ambient Freshwater Monitoring Program, Ecology.)

Date	Nooksack River	Snohomish River	Skagit River
17 Oct 89	84	200 L*	14
20 Nov 89	170	80	9
12 Dec 89	71	69	9
23 Jan 90	390	96	2
20 Feb 90	430	9	27
20 Mar 90	220	ND+	3
17 Apr 90	96	75	5
22 May 90	460	55	2
19 Jun 90	80	11	12
24 Jul 90	46	65	5
21 Aug 90	1900 J++	49	52
18 Sep 90	110	84	18 S

Note: Ambient Freshwater Stations are as follows:
Nooksack River at Brennen
Snohomish River at Snohomish
Skagit River at Mount Vernon

* L = Greater Than
\+ ND = No Data
++ J = Estimated Value

Since seasons bring different environmental conditions to the Pacific Northwest, corresponding seasonal algal growing cycles are observed in many of the State's coastal waters (Collias and Lincoln, 1977; Stober and Chew, 1984). In Puget Sound, the timing of these cycles vary with geographic locations.

As a result of these seasonal fluctuations, one would expect dissolved nutrient concentrations to show strong seasonal fluctuations, especially in near surface waters where the majority of photosynthetic growth occurs. For the North Puget Sound stations, the three sites that had a shallow mixed layer (BLL009, PSS019, and SAR003) showed a strong seasonal nutrient concentration fluctuation for Wateryear 1990 (Figure 10a). The two stations that had a deeper mixed layer (GRG002 and PAH008) did not show as dramatic a fluctuation (Figure 10b).

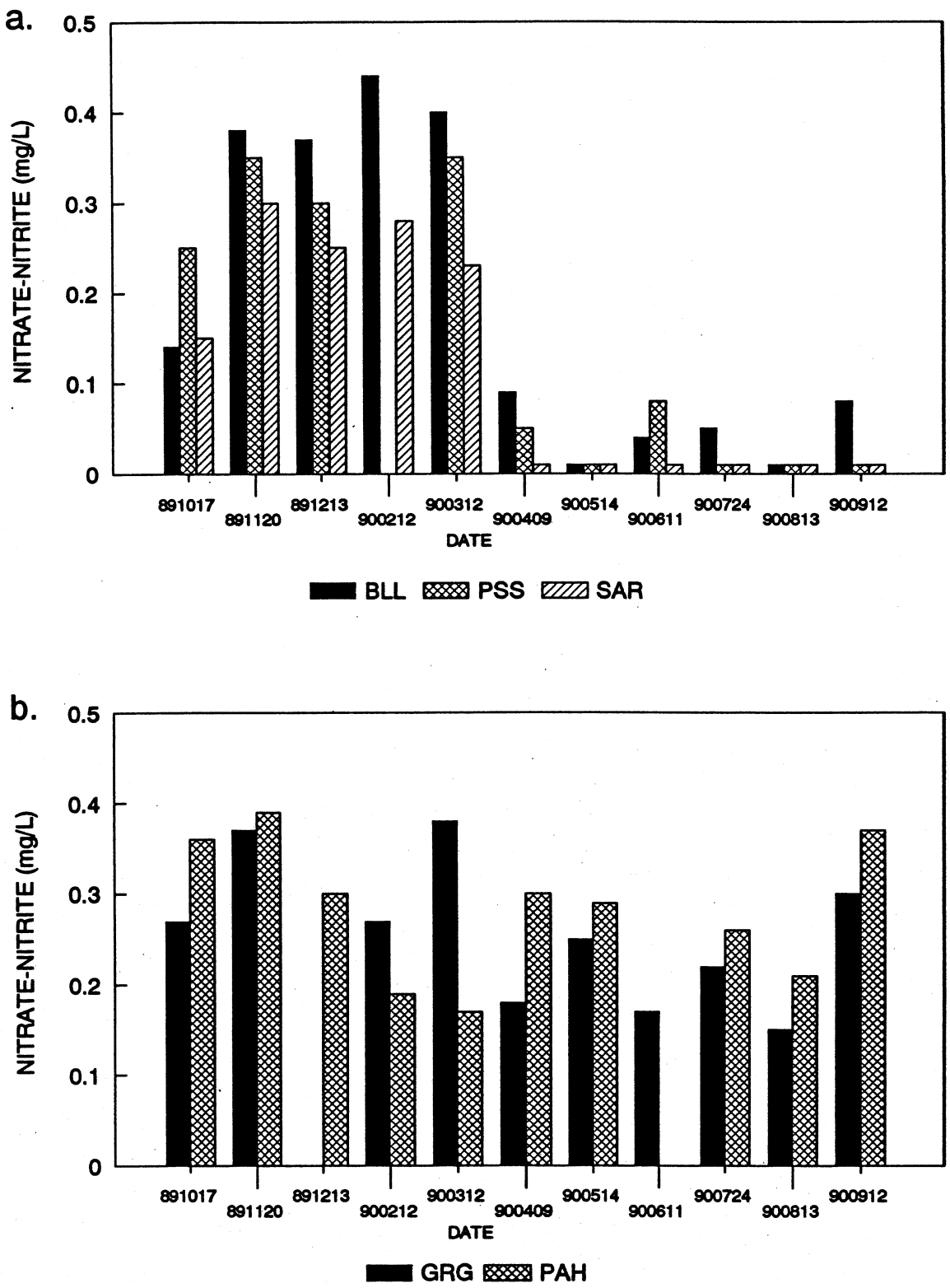


Figure 10. Surface nitrate-nitrite concentrations at North Sound stations for Wateryear 1990; (a) stations BLL009, SAR003, PSS019, (b) stations GRG002, PAH008.

Plots of surface nitrate-nitrite (Figure 10a) and orthophosphorus (Figure 11a) concentrations showed that stations BLL009, PSS019, and SAR003 had seasonal nutrient fluctuations.

From October 1989 through March 1990, nitrate-nitrite concentrations in the upper 5 meters were consistently high compared to late spring and summer 1990. By late spring, nitrogen concentrations had dropped nearly 95 percent relative to winter and early spring. Nitrate-nitrite concentrations at BLL009 and PSS019 increased slightly in June, possibly as a result of increased freshwater runoff (Figure 8c, Table 4). Nitrate-nitrite was again depleted in July at PSS019 and in August at BLL009, and remained low (at or below detection limits) through September. Orthophosphorus concentrations showed a similar pattern at these stations, but with less severe fluctuations (Figure 11a).

Nutrients used by phytoplankton during growth are expected to show a decrease in concentration following a bloom period. In turn, low phytoplankton growth, as indicated by chlorophyll *a* concentration, is expected during periods of low nutrient availability. At BLL009, a spring bloom likely occurred during April (Figure 12a). By May, nitrogen nutrients were depleted (Figures 10a). The data from stations SAR003 and PSS019 showed that surface chlorophyll *a* concentrations were fairly low for the periods following depletion of surface nutrients (June, July and August) (Figure 12a). Surface chlorophyll *a* concentrations for BLL009 were lowest during May and June, then began to increase to a peak concentration during August. The August bloom may have been due to the slight nutrient increases seen in the June/July data, as well as water column stratification and sunlight availability. The slight decline in chlorophyll *a* concentrations at BLL009 during September may have been due to increases in mixing depth and decreases in sunlight availability.

The same time series for stations GRG002 and PAH008 showed less fluctuation in nutrient concentrations throughout the year (Figures 10b and 11b). At station GRG002, surface nitrogen and phosphate concentrations were reduced only by about 40 percent during the late spring and summer months. The relatively higher nutrient concentrations experienced at GRG002 were probably a result of vigorous mixing (demonstrated in the isopleth plots) as well as rapid flushing, which limits phytoplankton proliferation, reducing the uptake of nutrients by phytoplankton. Continuous mixing and flushing not only will replenish surface waters with nutrients, but will also reduce the likelihood of algal blooms, as seen in the low chlorophyll *a* concentration time series for GRG002 (Figure 12b). This is because a deeper mixed layer will cause the algal cells to spend less time in the photic zone (area of light availability for photosynthesis). At GRG002 from the beginning of the growing season (April) through the summer months, chlorophyll *a* concentrations remained relatively low when compared to stations with a shallow surface mixed layer (BLL009, SAR003, and PSS019).

At station PAH008, the lowest nitrogen concentrations occurred during the late winter and early spring months of February and March, increasing and remaining somewhat higher for the remainder of the year. The higher summer concentrations may have been a result of summer upwelling along the southern shores of the Strait of Juan de Fuca, caused primarily by the

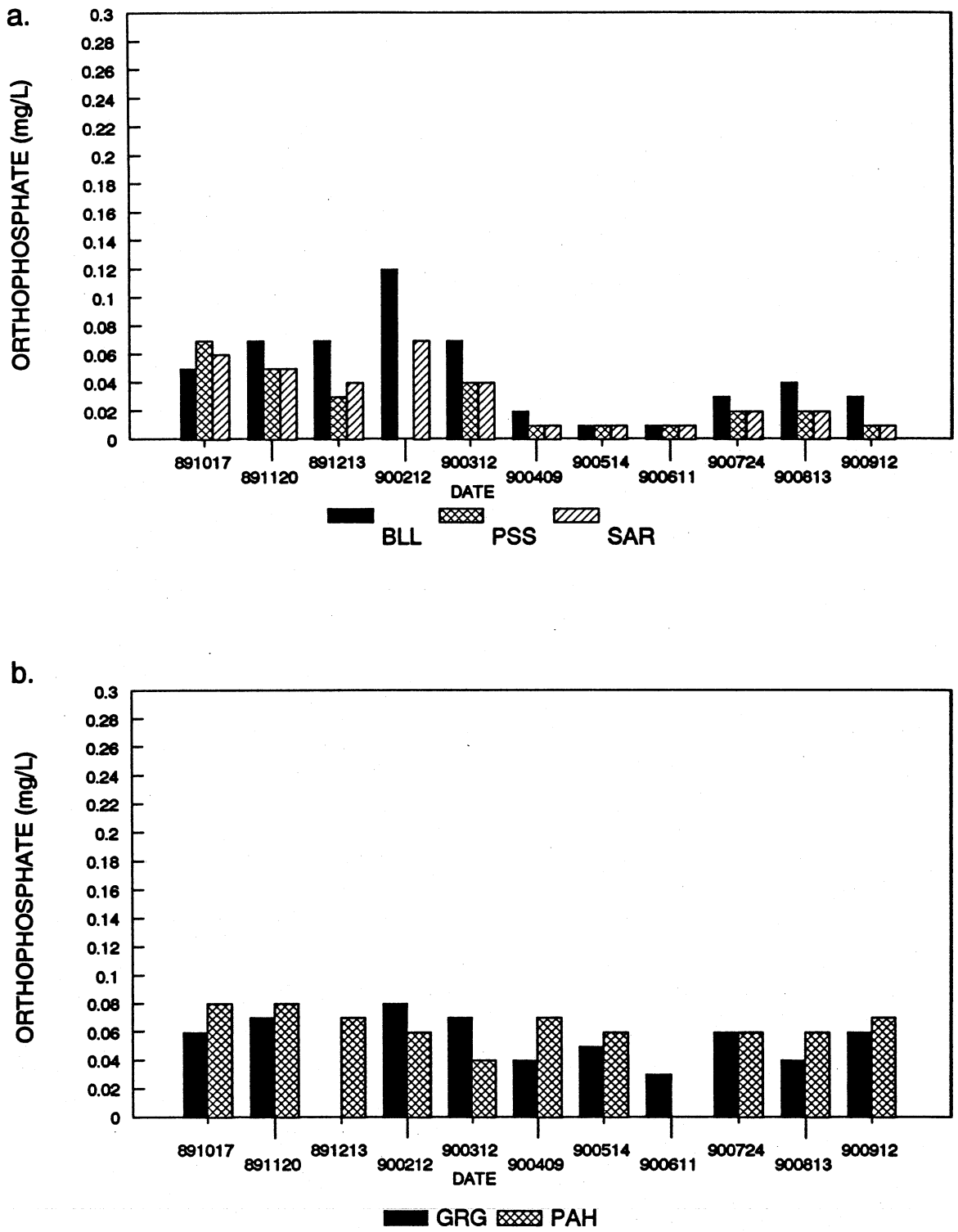


Figure 11. Surface orthophosphate concentrations at North Sound stations for Wateryear 1990; (a) stations BLL009, SAR003, PSS019, (b) stations GRG002, PAH008.

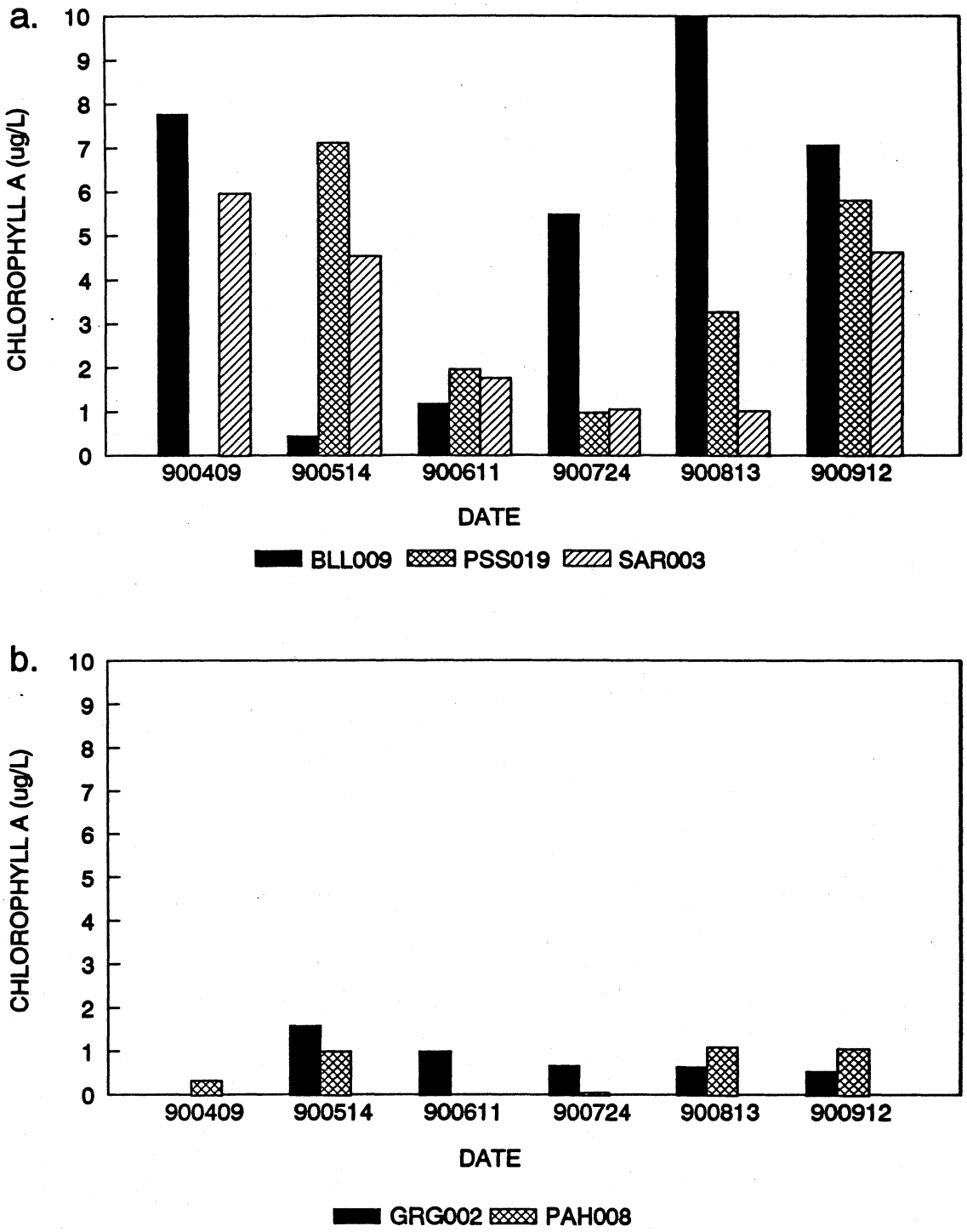


Figure 12. Surface chlorophyll *a* concentrations at North Sound stations for Wateryear 1990; (a) stations BLL009, SAR003, PSS019, (b) stations GRG002, PAH008.

prevailing summer northwesterly winds (Thompson, 1981), as well as limited plankton growth in the area due to flushing and lack of a stratified water column (PAH008 has a deep mixed layer).

Upwelling brings nutrient rich, deeper waters to the surface to replace surface water that has been pushed offshore by wind action. Chlorophyll *a* data at PAH008 showed a similar pattern at GRG002 (Figure 12b), with limited concentrations throughout most of the year, indicating low phytoplankton population and little seasonal fluctuation.

Due to the patchiness of chlorophyll *a* in the environment, a higher sampling frequency and density is needed to adequately assess the chlorophyll *a* data and nutrient correlations. In future monitoring, efforts should be made to improve the chlorophyll *a* sampling component (*i.e.*, replicate sample collection at each site, additional sampling depths in the water column).

Dissolved Oxygen

Dissolved oxygen concentrations in Puget Sound vary diurnally (day to night) and seasonally. All ambient dissolved oxygen samples are taken during daylight hours, thus diurnal changes are not discussed, nor are the effects of time of day on dissolved oxygen considered. Other factors affecting dissolved oxygen concentrations in estuaries like Puget Sound include water column stability and stratification (*i.e.*, mixing and circulation), algal growth and die-off (photosynthesis generates oxygen while organic decay uses oxygen), respiration of aquatic organisms, upwelling of deep, less oxygenated oceanic water, freshwater inputs, and pollutant inputs (*i.e.*, organic wastes that increase the biological oxygen demand).

In surface and subsurface waters, photosynthesizing algae grow, thus oxygen levels may increase during the growing season due to oxygen production. As the summer progresses, the algae die and sink, and the decaying process begins. As the algae decay, oxygen is used up, and unless newly oxygenated waters replace the oxygen depleted water, conditions near the waters bottom can become hypoxic (low dissolved oxygen concentrations) or even anoxic (zero concentration of dissolved oxygen). These conditions are influenced by circulation. For example, in sluggishly circulating embayments that become stratified, there is a tendency toward hypoxic and anoxic conditions near the bottom of the water column. This is partially due to the fact that oxygen depleted water is not being mixed or replaced with oxygenated near surface water. Furthermore, a stratified water column is a prime condition for enhancement of algal blooms, which will later die, sink, and decay, thus adding to oxygen depletion.

In the North Sound areas discussed in this report, hypoxic/anoxic conditions were not observed in Wateryear 1990 (Figures 13a, 13b, 13c). These areas have substantial mixing or flushing, and may not experience enough biological growth/die-off to cause hypoxic/anoxic conditions in late summer. Furthermore, intruding deep seawater, though lower in dissolved oxygen than shallower estuarine waters, likely replaces oxygen depleted bottom waters at most of these North Sound stations.

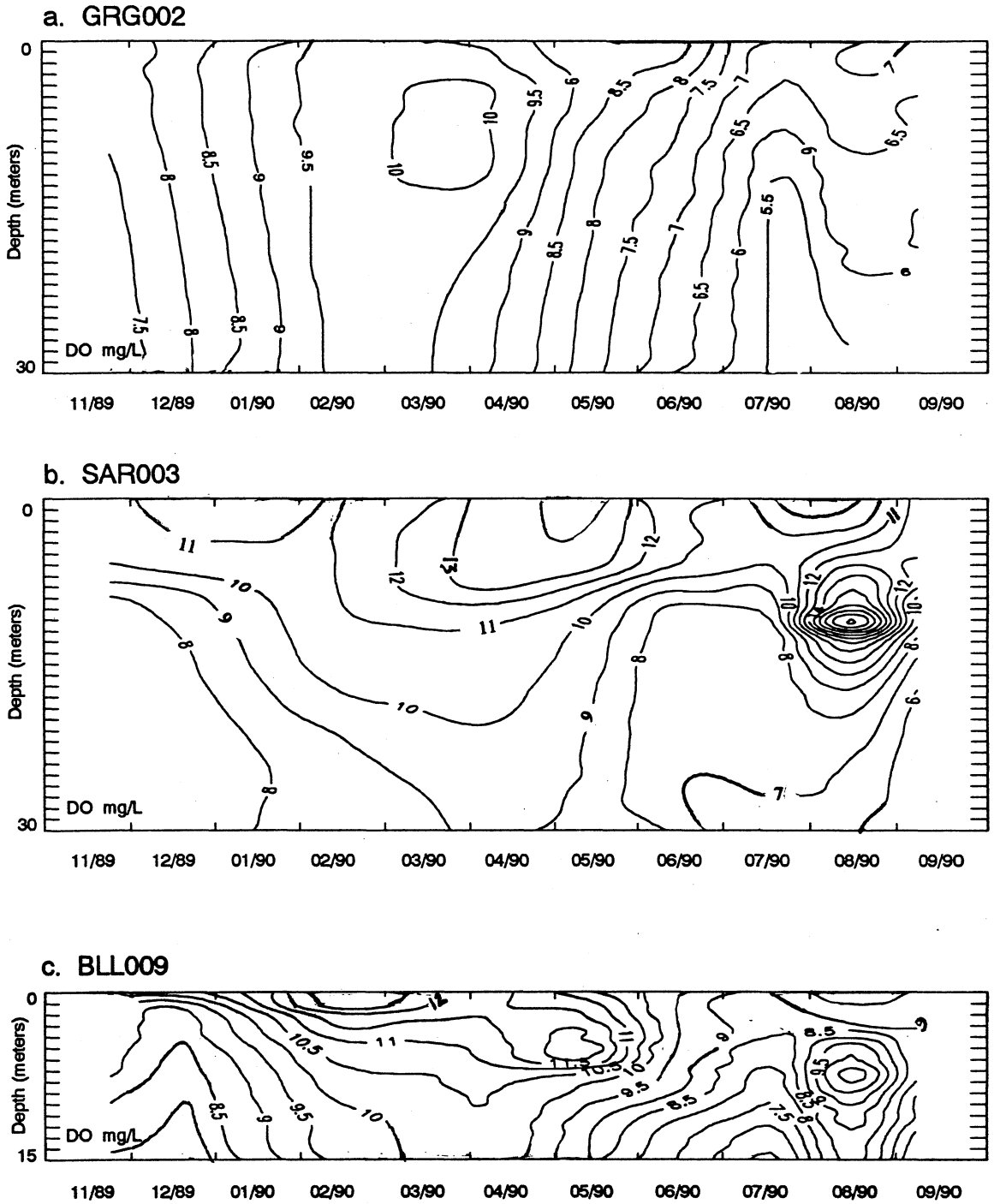


Figure 13. Dissolved oxygen isopleths for (a) Georgia Strait, (b) Saratoga Passage, and (c) Bellingham Bay from November 1989 through September 1990.

In the fall and winter months, average dissolved oxygen concentrations at GRG002 concentrations were between 7-10 milligrams per liter (mg/L). Dissolved oxygen levels dropped in the summer months by 2-3 mg/L, and remained lower, especially at depth (30 meters), until fall (Figure 13a). These lower concentrations could have been a result of the Strait water mixing with incoming oceanic waters which tend to be lower in dissolved oxygen (Collias and Lincoln, 1977).

Station SAR003 showed two distinct periods of relatively high oxygen concentrations in subsurface waters -- during late April/May, and in August (Figure 13b). During April and May, oxygen concentrations reached as high as 14.0 mg/L in the upper 7 meters of the water column, compared to the typical winter values of 10.0 to 11.0 mg/L at the surface and 8 mg/L at depth. Surface chlorophyll *a* concentrations were somewhat high during this time period (Figure 12a). In August, oxygen values peaked at 5-10 meter depths, reaching 17 mg/L (Dissolved Oxygen saturation was 192%), a difference of at least 8 mg/L from the surface concentration. Light transmissometer data from August showed low light transmittance at 3-5 meters, which indicates along with the high oxygen values, that a phytoplankton bloom may have been occurring between 3 and 10 meters (Figure 14). The light transmissometer's lowest value occured around 4-5 meters, whereas the oxygen peak occured around 11 meters. This discrepancy in the depths of occurrence is likely due to the slower response time of the dissolved oxygen sensor to such a rapid oxygen concentration change. Ideally, the dissolved oxygen probe records a change every four seconds. If this were the case, the oxygen peak would be better placed around the 6-meter depth. This corresponds better to the instantaneous light transmissometer readings. Similar light transmittance values were seen during the April/May event as well (Figures 15 and 16).

In the months of November through March, and again in June through July, oxygen distribution in the water column at station SAR003 appeared to be fairly homogenous, with little difference in dissolved oxygen concentrations from surface to depth (the total change in dissolved oxygen was 3 mg/L).

The overall relatively high dissolved oxygen concentrations experienced at SAR003 throughout the year, as compared to GRG002 may have been a result of continuous inputs of highly oxygenated water from the Skagit and Snohomish Rivers, as well as more photosynthetic activity during the growing season.

Dissolved oxygen isopleths for BLL009 indicated that the highest near surface oxygen concentrations occurred in February, March, May, and August (Figure 13c). The mid-winter highs (13 mg/L in February) in the upper 3-5 meters of the water column are likely due to increased freshwater discharge and surface mixing. Light transmittance data showed very low readings for surface waters during this period, indicating increased turbidity (Figure 17). Freshwater inputs can cause higher dissolved oxygen concentrations in the very upper surface layer, unlike algal growth which tends to cause higher oxygen concentrations at many different depths in the photic zone. In April/May, elevated oxygen concentrations at 5 meters could have been a result of increased phytoplankton growth.

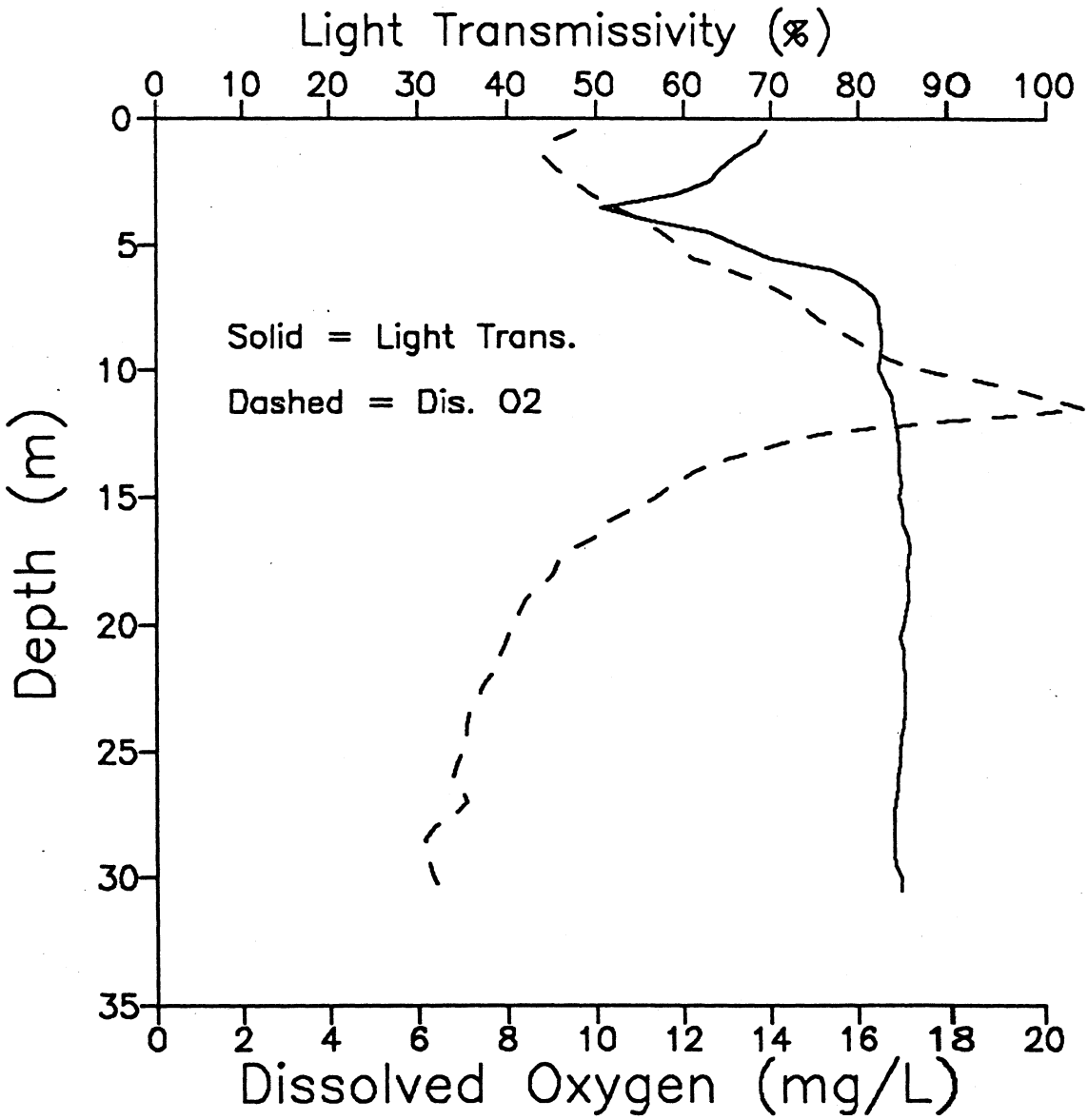


Figure 14. Light transmissometer profile at SAR003 in August 1990.

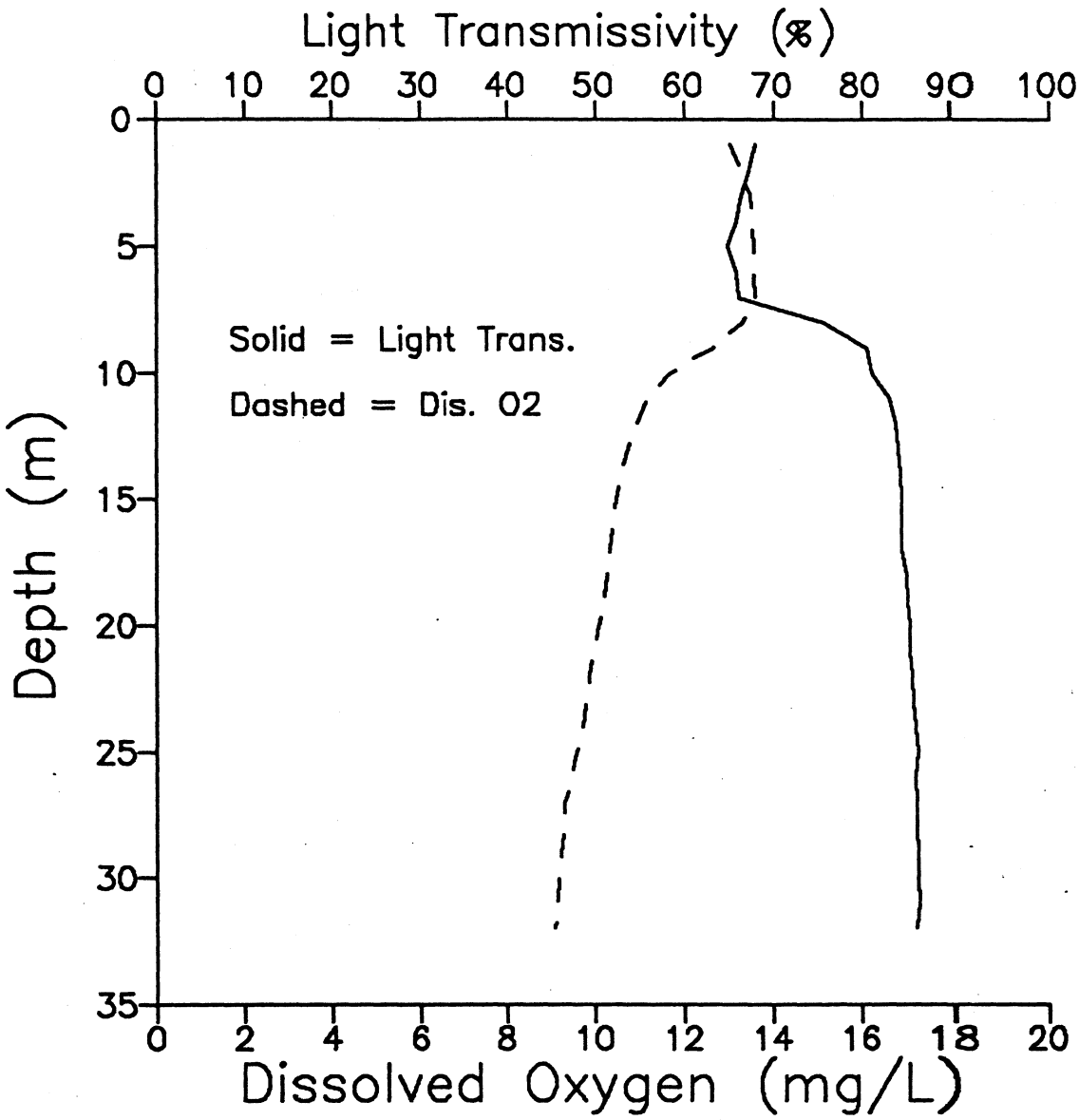


Figure 15. Light transmissometer profile at SAR003 in April 1990.

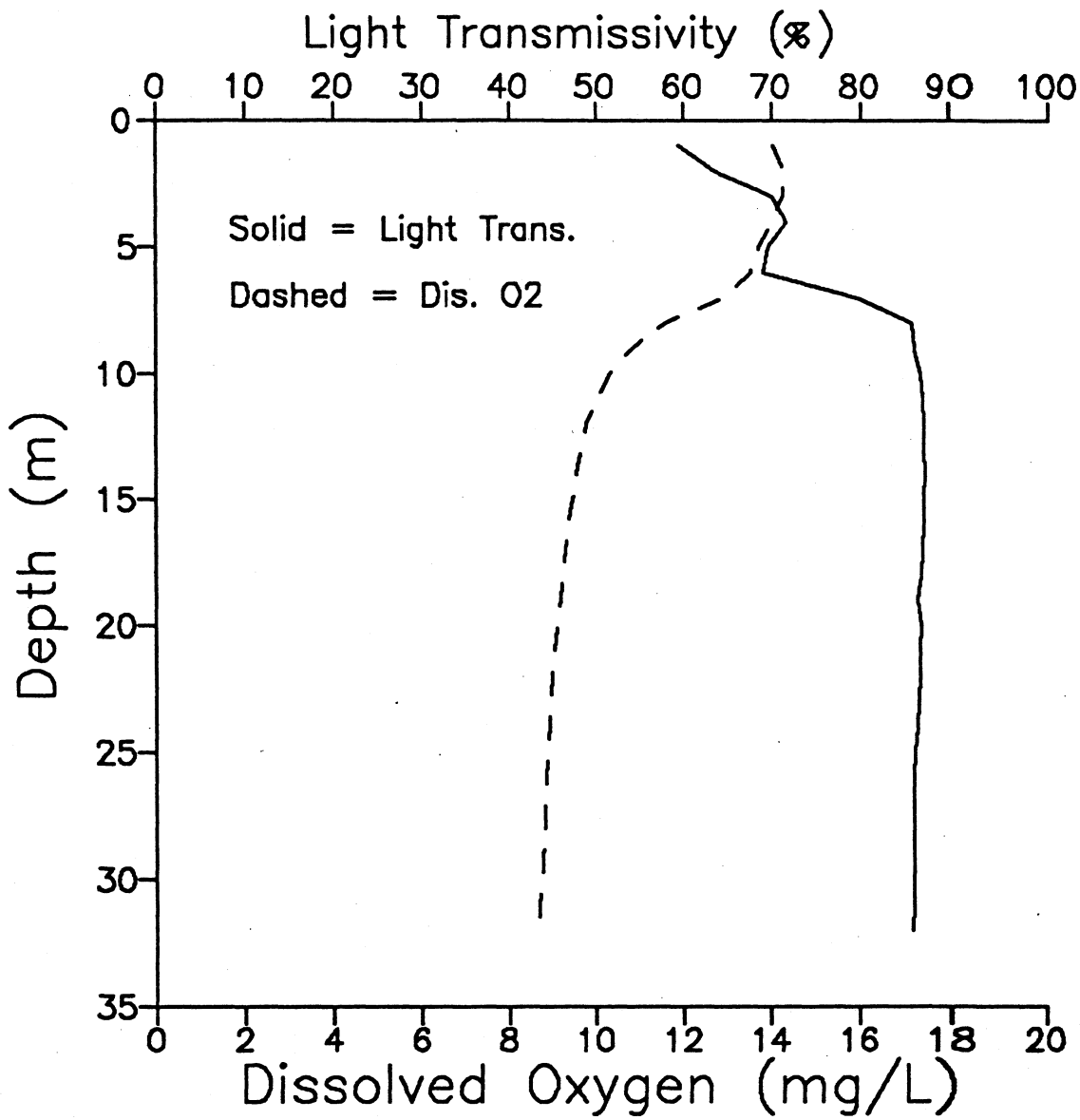


Figure 16. Light transmissometer profile at SAR003 in May 1990.

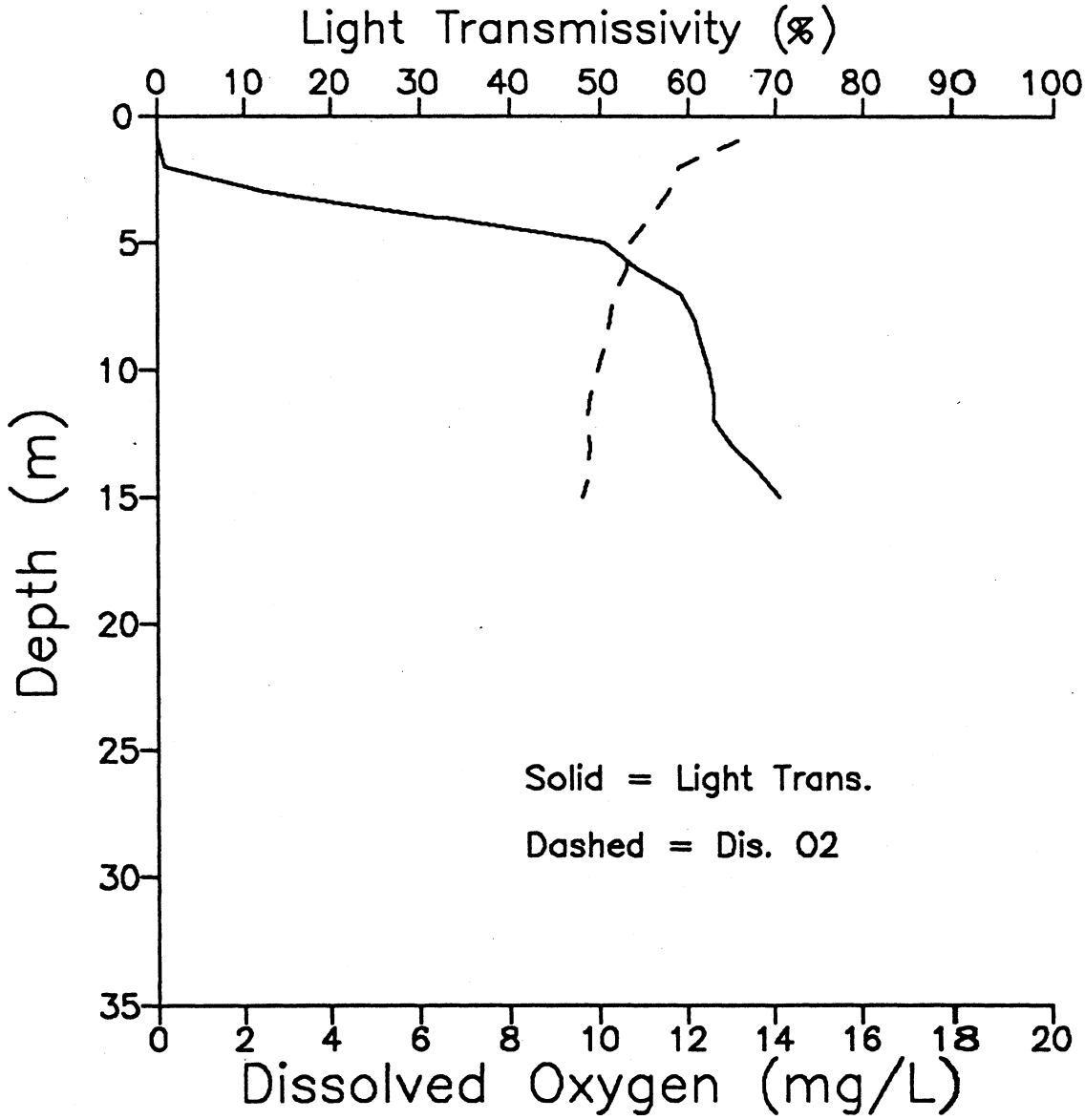


Figure 17. Light transmissometer profile at BLL009 in February 1990.

The BLL009 oxygen isopleths also showed two periods of weakened oxygen stratification, which corresponded to the periods of weak thermal stratification (Figures 7c and 13c). These periods were from November to February, and from June to July. The dissolved oxygen concentrations were still relatively high during these periods (9-10 mg/L), but not well stratified. Station BLL009, located in shallow Bellingham Bay, likely experienced strong vertical mixing, which combined with increased discharge of highly oxygenated water from the Nooksack River, could have produced a water column well mixed with highly oxygenated water during these periods of the year. February sampling occurred during a series of considerable storm events. Bellingham salinity data (Figure 8c) reflects this more so than the other two sites due to proximity to the Nooksack River.

CONCLUSIONS

Overall, water quality in Puget Sound appears to be good. As seen in the North Puget Sound station data discussed in this report, a variety of physical, biological, and chemical processes can be implied at different locations.

Fecal coliform bacteria during Wateryear 1990 exceeded a value of 14 organisms/100mL one or more times at 16 stations throughout Puget Sound and the coastal estuaries. The majority of these exceedances occurred in South Puget Sound embayments and in Grays Harbor during high discharge periods (November-January, and June).

Key conditions that affect biological growth in Puget Sound include water column stratification, nutrient availability, and sunlight. Of the five North Puget Sound stations discussed, three stations (BLL009, SAR003, and PSS019) showed nutrient depletion during the growing period (summer months). They also showed strong vertical density gradients during the growing season. The phenomenon of nutrient depletion at these three locations implies phytoplankton activity, which can rapidly deplete the water column of the nutrients during bloom events. The other two stations (GRG002 and PAH008) did not show nutrient depletion and also appeared to be well mixed vertically, as seen in density profile isopleth plots.

Biological growth in turn, can affect oxygen concentrations throughout the water column in two ways: during phytoplankton proliferation, oxygen concentrations will increase; after the phytoplankton die and settle in the water column (sometimes at the bottom or on density gradients), oxygen is used up during the decay process. Other factors affecting oxygen in the water column include mixing from winds and tides, freshwater inputs, and the oxygen concentrations of the incoming oceanic waters. Of the three stations (BLL009, SAR003, PSS019) that showed nutrient depletion, often oxygen concentrations were synonymously showing peaks at various subsurface depths, indicating photosynthesizing algal blooms. Water column light transmissometer data (an instantaneous measure of turbidity), often showed low values in the proximity of the oxygen peaks, further indicating the presence of phytoplankton. At these same stations (BLL009, SAR003, and PSS019), oxygen concentrations were also high during high riverine discharge periods, which likely reflected oxygenated freshwater water inputs mixing with the ambient marine water column. These high oxygen values differed from those

caused by biological growth in that they were usually restricted to the very surface of the water column. None of these three stations showed low oxygen concentrations in the upper 30 meters of the water column near the end of summer, indicating that the water bodies were well flushed, or that they were able to assimilate the existing growth and decay process effects; however, until sampling occurs to the bottom of the deeper sites (SAR003 and PSS019), conclusions on the effects of algal growth on the late summer dissolved oxygen concentrations at depth should not be made.

Stations GRG002 and PAH008 appeared to be well mixed throughout the year, with slight density gradients formed during the spring discharge period at GRG002. These stations did not show nutrient depletion, and chlorophyll *a* concentrations remained low, even during the growing season. These results imply that the phytoplankton blooms require a more stratified water column, as well as an area where they won't be flushed out before they can undergo logarithmic growth.

Recommendations

In future studies, emphasis should be made to better quantify the algal blooms by sampling at more depths in the photic zone of the water column. Better correlations between nutrient, dissolved oxygen, and chlorophyll *a* concentrations can then be made. Phytoplankton samples should also be collected during the peak bloom periods to identify the species present.

Fecal coliform sampling is proving to be highly variable in space and time, with most exceedances in water quality criteria consistently occurring in the same embayments. To better statistically quantify these counts, more samples should be collected during each site visit in the areas with frequent exceedances. Perhaps it would also be useful to collect mutiple samples during times when the counts appear the highest, such as during high discharge periods following dry periods (December, June).

Additional monitoring components, namely seasonal monitoring, will improve assessments of biological, physical, and chemical processes occurring in the marine waters of the State. Monthly sampling can give qualitative information on seasonal patterns, but the broad spatial and temporal sampling frequency prohibits conclusive correlations of the various parametric data. Furthermore, the affects of the tides on the water column stratification will need to be better quantified, and this can only be done with more frequent sampling intervals (hours) and additional spatial coverage in the given areas.

Further analysis of the existing database will lend a view as to where nutrient depletion may be occurring, the range of months in which it occurs, and what the other chemical and physical conditions are at the time. Once the areas have been identified, seasonal monitoring efforts aimed at answering these types of questions can be conducted.

REFERENCES

American Public Health Association (APHA), American Water Works Association (AWWA), and Water Pollution Control Federation (WPCF), 1989. Standard Methods for the Examination of Water and Wastewater. 17th edition.

Collias, Eugene E., and John H. Lincoln, 1977. A Study of the Nutrients in the Main Basin of Puget Sound. Prepared for the Municipality of Metropolitan Seattle. Seattle, WA, 1977.

Janzen, Carol D., 1992. The Ambient Marine Water Column Monitoring Plan: Final Report. Prepared for Washington State Department of Ecology, Environmental Investigations and Laboratory Services Program, Olympia, WA.

Janzen, Carol D., Kent S. Short, and Lon Hachmeister, 1991. Long-term Marine Water Quality and Climatological Trends in the Pacific Northwest. Prepared for OCEANS '91 Conference, October 1-3, 1991, Honolulu, HI.

Meriweather, Frank, 1992. Personal Communication. Washington State Department of Health, Shellfish Division.

Monitoring Management Committee (MMC), 1988. Puget Sound Ambient Monitoring Program. Final Report. Prepared for the Puget Sound Water Quality Authority, Seattle, WA.

Pickard, George L., and William J. Emery, 1982. Descriptive Physical Oceanography, an Introduction. Fourth (SI) enlarged edition. Pergamon Press.

Pond, Stephen and George L. Pickard, 1983. Introductory Dynamical Oceanography. Second Edition, Pergamon Press.

Puget Sound Estuary Program (PSEP), 1990. "Recommended Protocols for Measuring Conventional Water Column Variables in Puget Sound." Prepared by PTI Environmental Services, Bellevue, WA. *In*: Recommended Protocols and Guidelines for Measuring Selected Environmental Variables in Puget Sound. U.S. Environmental Protection Agency Region 10, Seattle, WA. (Looseleaf)

Puget Sound Water Quality Authority (PSWQA), 1987. Puget Sound Water Quality Management Plan. Seattle, WA (revised 1989, 1990 and 1991).

Sea-Bird Electronics, Inc., 1990. SEACAT SBE-19 Conductivity, Temperature, Depth Recorder Operating Manual. Sea-Bird Electronics, Inc. Bellevue, WA.

Stober Q.J., K.K. Chew, 1984. Renton Sewage Treatment Plant Project: Seahurst Baseline Study. Volume 3. Water Column Ecology. Prepared for the Municipality of Metropolitan Seattle, Seattle, WA.

Syverson, Terry, 1991. Ambient Monitoring Database Manual. Prepared for the Washington State Department of Ecology Ambient Monitoring Section, through Department of Information Systems. Olympia, WA.

Thompson, Richard E., 1981. Oceanography of the British Columbia Coast. Department of Fisheries and Oceans, Ocean Physics Division, Institute of Ocean Sciences. Sidney, B.C., Canada.

Washington State Department of Ecology, 1986. Laboratory User's Manual. Prepared by Environmental Investigations and Laboratory Services Program, Olympia, WA, (revised August 1988).

Washington State Department of Ecology, 1988. Quality Assurance Manual. Manchester Laboratory, Manchester Washington.

APPENDIX A

ADM002
ADMIRALTY INLET NEAR PROTECTION ISLAND
48 11 15.0 122 50 30.0 2F000 Elev= 0 ft
53031 Washington Jefferson Co. PACIFIC NORTHWEST
PUGET SOUND (Quilcene/Snow-17) 131117
21540000 Reach=17110019 0.000 Drg= 0 sqmi
AMBNT/OCEAN/RMP

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	1320	000	11.5			7.7	43500	0.4		1K	7.5	31.00
	1325	010	10.8			7.7	43900	0.7				31.00
	1330	030	10.5			7.7	44300	0.6				31.00
89/11/20	1355	000	9.4	7.3	77.1	7.9			81.2	1K	7.0	30.53
	1410	010	9.3	7.4	78.2	7.9			81.4			30.74
	1420	023	9.0	6.5	68.6	7.9			80.9			31.60
89/12/13	1305	000	8.9	8.0	83.5	7.9			78.3	1K	4.0	30.24
	1310	010	8.8	7.7	80.4	7.9			75.6			30.56
	1315	025	8.8	7.5	78.4	7.9			73.9			30.75
90/02/12	1450	000	7.8	9.3	94.9	7.8			73.5	1K	6.3	30.45
	1500	010	7.8	9.7	99.0	7.9			76.0			30.46
	1510	030	7.8	9.7	99.0	7.9			75.6			30.48
90/03/12	1045	000								1K	6.2	30.78
	1050	010										30.74
	1055	030										30.73
90/04/09	1045	000	8.4	8.2	85.0	7.9			82.3	1K	7.6	30.80
	1050	010	8.4	8.3	86.0	7.9			82.0			30.80
	1055	030	8.4	8.3	86.0	8.0			82.4			30.82
90/07/24	1420	000	10.7	5.7	62.0	7.9			82.5	1K	10.0	30.74
	1425	010	10.4	5.5	59.6	7.9			81.6			31.02
	1430	030	9.9	5.1	54.8	7.9			80.3			31.42
90/08/13	1435	000	12.1	7.2	80.3	7.9			80.1	1K	10.5	30.31
	1445	010	11.2	6.4	70.3	7.9			84.3			30.69
	1455	030	10.4	5.9	64.1	7.9			86.0			31.59
90/09/12	1520	000	11.5	5.7	63.0	7.9			85.7	1K	12.0	30.75
	1525	010	11.0	5.8	63.6	7.9			84.7			31.08
	1530	030	10.0	5.0	54.0	7.9			85.6			31.94

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	1320	000	0.30	0.01K	0.01	0.070	0.070	426263		
	1325	010	0.31	0.01K	0.01	0.070	0.070	426264		
	1330	030	0.32	0.01K	0.01	0.070	0.080	426265		
89/11/20	1355	000	0.38	0.01K	0.01K	0.070	0.080	476263		
	1410	010	0.38	0.01K	0.01K	0.070	0.080	476264		
	1420	023	0.39	0.01K	0.01K	0.080	0.080	476265		
89/12/13	1305	000	0.34	0.01K	0.01K	0.070		506263		
	1310	010	0.34	0.01K	0.01K	0.070		506264		
	1315	025	0.34	0.01K	0.01K	0.070		506264		
90/02/12	1450	000	0.26	0.01K	0.01K	0.080	0.080	76263		
	1500	010	0.26	0.01K	0.01K	0.080	0.080	76264		
	1510	030	0.26	0.01K	0.01K	0.070	0.080	76265		
90/03/12	1045	000	0.37	0.01K	0.01K	0.070	0.080	116263		
	1050	010	0.37	0.01K	0.01K	0.070	0.080	116264		
	1055	030	0.37	0.01K	0.01K	0.070	0.070	116265		
90/04/09	1045	000	0.29	0.01K	0.02	0.060	0.070	156263		
	1050	010	0.29	0.01K	0.01	0.060	0.070	156264		
	1055	030	0.29	0.01K	0.01K	0.060	0.070	156265		
90/07/24	1420	000	0.25	0.01K	0.01K	0.060	0.070	306263	0.34	0.48
	1425	010	0.25	0.01K	0.01	0.060	0.070	306264	0.40	0.47
	1430	030	0.27	0.01K	0.01K	0.070	0.070	306265	0.32	0.41
90/08/13	1435	000	0.20	0.01K	0.01K	0.050	0.050	336263	1.41	1.34
	1445	010	0.22	0.01K	0.02	0.060	0.050	336264	0.84	1.22
	1455	030	0.24	0.01K	0.02	0.060	0.060	336265	0.47	0.84
90/09/12	1520	000	0.33	0.01K	0.01	0.060	0.060	376263	0.69	0.73
	1525	010	0.33	0.01K	0.01	0.060	0.060	376264	0.43	0.76
	1530	030	0.37	0.01K	0.01	0.070	0.070	376265	0.26	0.63

ADM003
ADMIRALTY INLET NEAR POINT NO POINT
47 52 45.0 122 28 55.0 2F000 Elev= 0 ft
53035 Washington Kitsap Co. PACIFIC NORTHWEST
PUGET SOUND (Kitsap-15) 131115
21540000 Reach=17110019 0.000 Drg= 0 sqmi
AMBNT/OCEAN/RMP

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	0940	000	12.1			7.9	43500	0.6		4	11.0	31.00
	0945	010	11.8			8.0	42700	0.4				32.00
	0950	030	11.8			8.0	42500	0.4				31.00
89/12/18	1155	000	8.3	8.4	83.7	7.9			77.7	5S	6.5	25.49
	1200	010	9.3	7.5	78.1	7.9			81.4			28.80
	1205	030	9.5	7.1	74.7	7.9			81.0			29.56
90/01/29	1015	000	8.6	8.2	84.7	7.7			80.0	1K	7.5	29.72
	1020	010	8.6	8.4	86.8	7.7			80.4			29.72
	1025	030	8.6	8.4	86.8	7.7			80.4			29.73
90/02/26	1100	000	7.2	10.5	100.8	7.9			72.7	1K	5.0	23.75
	1120	010	7.7	9.7	97.4	7.9			81.2			28.54
	1130	025	7.7	9.4	94.5	7.9			81.2			28.70
90/03/20	1000	000	9.4			8.0				1K	4.3	26.95
	1005	010	8.8			8.8						26.78
	1010	030	8.4			7.9						27.69
90/04/16	1000	000	13.5	11.2	118.2	8.4			62.2	1K	4.0	17.23
	1005	010	9.2	10.7	111.2	8.1			75.1			28.70
	1010	030	8.6	9.2	94.9	8.0			84.5			29.49
90/05/21	1005	000	11.2	8.6	93.3	8.1			85.7	1	16.0	28.96
	1015	010	10.0	9.0	95.5	8.1			87.6			29.25
	1025	030	9.3	7.9	82.9	8.0			87.2			29.76
90/06/19	1005	000	14.6	11.0	120.4	8.4			45.4	1K	2.0	19.52
	1015	010	10.8	8.3	89.4	8.0			76.7			29.05
90/07/31	1005	000	15.5	8.0	93.9				67.1	1K	4.1	27.80
	1015	010	12.9	7.9	89.0				85.2			29.40
	1025	030	12.4	7.1	79.3				86.2			29.55
90/08/27	1000	000	14.1	8.5	97.4	8.0			75.3	1K	6.6	28.31
	1010	010	13.0	8.0	90.4	8.0			81.1			29.61
	1020	030	12.4	7.1	79.6	7.9			84.3			30.13
90/09/17	1100	000	14.1	9.7	111.4	8.2			64.2	1K	6.0	28.72

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	0940	000	0.26	0.01	0.02	0.080	0.080	436300		
	0945	010	0.26	0.01	0.02	0.080	0.080	436301		
	0950	030	0.26	0.01	0.02	0.080	0.080	436302		
89/12/18	1155	000	0.30	0.01K	0.01K	0.070	0.070	516300		
	1200	010	0.31	0.01K	0.01K	0.070	0.080	516301		
	1205	030						516302		
90/01/29	1015	000	0.30	0.01K	0.01K	0.080	0.080	56300		
	1020	010	0.30	0.01K	0.01K	0.070	0.080	56301		
	1025	030						56302		
90/02/26	1100	000	0.33	0.01K	0.01K	0.070	0.070	96300		
	1120	010	0.35	0.01K	0.01K	0.080	0.080	96301		
	1130	025	0.34	0.01K	0.01K	0.080	0.080	96302		
90/03/20	1000	000	0.23	0.01K	0.01	0.060	0.070	126300		
	1005	010	0.24	0.01K	0.01K	0.060	0.070	126301		
	1010	030	0.34	0.01K	0.01K	0.080	0.080	126302		
90/04/16	1000	000	0.02	0.01K	0.01K	0.010K	0.020	166300		
	1005	010	0.18	0.01K	0.01	0.050	0.070	166301		
	1010	030	0.24	0.01K	0.02	0.070	0.070	166302	0.95	1.52
90/05/21	1005	000	0.16	0.01	0.08	0.050	0.060	216300	0.23	0.59
	1015	010	0.19	0.01	0.04	0.060	0.060	216301	0.01	0.47
	1025	030	0.24	0.01	0.04	0.060	0.070	216302	0.04	0.43
90/06/19	1005	000	0.01K	0.01K	0.01K	0.010K	0.020	256300	2.90	3.01
	1015	010	0.05	0.01K	0.01K	0.020	0.040	256301	6.98	6.48
	1025	030	0.26	0.01K	0.02	0.070	0.070	256302	0.11	0.44
90/07/31	1005	000	0.09	0.01K	0.01K	0.030	0.040	316300	5.07	3.53
	1015	010	0.26	0.01K	0.02	0.060	0.060	316301	0.64	0.60
	1025	030	0.28	0.01K	0.01K	0.060	0.060	316302	0.27	0.38
90/08/27	1000	000	0.11	0.01K	0.01K	0.040	0.050	356300	4.29	3.59
	1010	010	0.20	0.01K	0.01K	0.050	0.060	356301	1.89	1.90
	1020	030	0.23	0.01K	0.02	0.040	0.070	356302	0.67	0.94
	1100	030	0.23	0.01K	0.02	0.040	0.070	356302	0.67	0.94
90/09/17	1100	000	0.07	0.01K	0.01K	0.030	0.050	386300	3.86	4.26
	1110	010	0.25	0.01	0.02	0.060	0.070	386301	0.22	0.32
	1120	030	0.26	0.01	0.02	0.070	0.080	386302	0.09	0.33

BLL009
BELLINGHAM BAY NR POINT FRANCES
48 41 10.0 122 35 54.0 1F 0 Elev= 0 ft
53073 Washington Whatcom Co. PACIFIC NORTHWEST
PUGET SOUND (Nooksack-01) 131101
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	1245	000	12.1			7.9	40800	0.5		1K	5.5	29.00
	1250	010	11.3			7.8	42400	0.4				30.00
89/11/20	1315	000	9.1	10.0	102.2	8.0			53.2	1K	1.8	26.58
	1320	010	9.3	8.5	89.2	8.0			73.9			29.91
89/12/13	1220	000	7.1	8.9	86.5	7.9			47.0	1K	1.8	25.83
	1225	010	8.3	8.1	82.6	7.8			63.9			28.88
90/02/12	1400	000	4.5	13.1	105.3	7.7			0.1	180S	0.2	6.72
	1415	010	7.3	9.9	99.1	7.8			62.4			29.35
90/03/12	1120	000								1K	1.8	25.46
	1125	010										29.66
90/04/09	1135	000	9.2	11.5	119.7	8.3			64.9	1K	3.4	28.94
	1140	010	8.8	10.5	108.9	8.1			66.3			29.68
90/05/14	1405	000	12.2	11.3	124.0	8.6			73.0	1K	4.5	27.56
	1410	006	10.9	12.4	133.6	8.4			62.9			28.81
90/06/11	1425	000	12.6	9.4	101.7	8.3			55.8	1	3.2	24.20
	1435	010	10.2	8.7	93.1	8.0			71.4			29.87
90/07/24	1325	000	14.8	8.3	95.7	8.2			59.3	1K	2.8	27.12
	1335	010	12.9	7.7	86.2	8.1			75.2			28.49
90/08/13	1350	000	16.8	9.5	114.0	8.5			35.7	1K	1.5	27.44
	1400	010	14.4	9.8	113.1	8.2			76.1			28.51
90/09/12	1450	000	14.5	8.7	100.8	8.2			74.9	1	7.3	28.88
	1455	010	12.2	7.1	79.1	8.1			84.1			29.76

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	1245	000	0.14	0.01K	0.02	0.050	0.060	426261		
	1250	010	0.24	0.01K	0.02	0.060	0.070	426262		
89/11/20	1315	000	0.38	0.01K	0.05	0.070	0.070	476261		
	1320	010	0.38	0.01K	0.01K	0.070	0.080	476262		
89/12/13	1220	000	0.37	0.01K	0.02	0.070	0.070	506261		
	1225	010	0.35	0.01K	0.01	0.070	0.080	506262		
90/02/12	1400	000	0.44	0.04	0.10J	0.120	0.090	76261		
	1415	010	0.28	0.01K	0.01K	0.080	0.090	76262		
90/03/12	1120	000	0.40	0.01K	0.01	0.070	0.070	116261		

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/03/12	1125	010	0.38	0.01K	0.01K	0.080	0.080	116262		
90/04/09	1135	000	0.09	0.01K	0.01K	0.020	0.040	156261	7.78	6.48
	1140	010	0.20	0.01K	0.01K	0.040	0.060	156262	4.92	4.75
90/05/14	1405	000	0.01K	0.01K	0.01K	0.010K	0.020	206261	0.45	0.68
	1410	006	0.16	0.01K	0.02	0.040	0.050	206262	2.83	3.07
90/06/11	1425	000	0.04	0.01K	0.02	0.010	0.020	246261	1.19	1.29
	1435	010	0.22	0.01K	0.03	0.050	0.060	246262	0.07	0.79
90/07/24	1325	000	0.05	0.01K	0.01K	0.030	0.060	306261	5.49	3.95
	1335	010	0.13	0.01K	0.01K	0.040	0.050	306262	2.22	1.71
90/08/13	1350	000	0.01K	0.01K	0.01K	0.040	0.150	336261	60.20	43.20
	1400	010	0.03	0.01K	0.01K	0.020	0.030	336262	1.99	2.23
90/09/12	1450	000	0.08	0.01K	0.01	0.030	0.050	376261	7.07	4.31
	1455	010	0.25	0.01K	0.02	0.050	0.050	376262	0.49	0.61

BML001
HENDERSON BAY AT BURLEY LAGOON
47 22 40.0 122 37 57.0 2F000 Elev= 0 ft
53053 Washington Pierce Co. PACIFIC NORTHWEST
PUGET SOUND (Kitsap-15) 131115
21540000 Reach=17110019 0.000 Drg= 0 sqmi
AMBNT/OCEAN/RMP

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1155	000	12.7			8.0	41200	0.5		21	10.1	30.00
	1200	010	12.7			7.9	42400	0.5				32.00
89/11/27	1225	000	9.9	9.3	98.6	8.1			76.5	1	5.5	29.52
	1240	010	10.5	9.3	100.2	8.0			79.6			29.94
89/12/18	1520	000	9.9	7.5	79.7	7.9			71.4	1	6.0	29.75
	1530	010	10.0	7.8	83.1	7.9			80.4			29.84
90/01/29	1305	000	6.7	11.1	107.4	7.9			47.4	26	1.6	26.40
	1310	010	7.6	10.8	108.0	7.9			76.9			28.30
90/02/26	1435	000	7.8	9.8	98.6	7.9			76.5	1K	6.5	28.42
	1440	010	7.7	9.8	98.6	7.9			78.3			28.72
90/03/20	1220	000	10.0			8.3				1K	6.7	26.04
	1225	010	9.2			8.2						26.84
90/04/16	1235	000	10.7	10.4	111.2	8.0			65.7	1K	4.5	28.24
	1240	010	8.9	11.5	118.8	8.1			50.7			28.80
90/05/21	1405	000	13.5	10.3	116.5	8.5			71.1	1K	5.3	28.19
	1415	010	10.0	10.7	113.4	8.2			75.9			29.07
90/06/19	1330	000	16.4	9.9	118.5	8.2			68.9	1K	3.8	28.24
	1340	010	12.4	10.8	120.0	8.3			76.0			28.82
90/07/31	1415	000	18.8	10.8	135.9	8.3			54.5	1K	3.2	28.93
	1420	010	13.7	11.2	128.2	8.4			84.1			29.33
90/08/27	1435	000								1	4.6	
90/09/17	1505	000	16.1			8.5			62.6	1K	4.0	29.35

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1155	000	0.19	0.02	0.04	0.070	0.090	436315		
	1200	010	0.22	0.02	0.06	0.080	0.090	436316		
89/11/27	1225	000	0.31	0.02	0.01	0.080	0.090	486315		
	1240	010	0.31	0.02	0.01	0.080	0.090	486316		
89/12/18	1520	000	0.31	0.01K	0.01	0.080	0.090	516315		
	1530	010	0.31	0.01K	0.01K	0.080	0.100	516316		
90/01/29	1305	000	0.32	0.01K	0.02	0.080	0.090	56315		
	1310	010	0.30	0.01K	0.01K	0.080	0.080	56316		
90/02/26	1435	000	0.36	0.01K	0.01K	0.080	0.080	96315		
	1440	010	0.36	0.01K	0.01K	0.080	0.090	96316		
90/03/20	1220	000	0.03	0.01K	0.01K	0.010	0.020	126315	2.10	0.96
	1225	010	0.11	0.01K	0.01K	0.030	0.050	126316	2.22	1.22

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/04/16	1235	000	0.10	0.01K	0.04	0.040	0.060	166315	4.59	3.38
	1240	010	0.14	0.01K	0.03	0.050	0.070	166316	8.68	5.57
90/05/21	1405	000	0.01K	0.01K	0.01K	0.010	0.030	216315	0.89	1.12
	1415	010	0.15	0.01K	0.01	0.050	0.060	216316	4.97	5.47
90/06/19	1330	000	0.01K	0.01K	0.01K	0.010	0.030	256315	2.57	1.75
	1340	010	0.02	0.01K	0.01K	0.020	0.060	256316	2.63	1.98
90/07/31	1415	000	0.01K	0.01K	0.01K	0.030	0.050	316315	7.57	3.67
	1420	010	0.16	0.01K	0.02	0.050	0.070	316316	1.71	1.18
90/08/27	1435	000	0.06	0.01K	0.01K	0.030	0.060	356315	10.40	8.15
	1445	010	0.19	0.02	0.06	0.050	0.070	356316	1.61	1.38
90/09/17	1505	000	0.01K	0.01K	0.01K	0.020	0.040	386315	5.39	4.51
	1515	010	0.23	0.02	0.04	0.070	0.080	386316	1.75	1.65

BUD002
BUDD INLET S END OLYMPIA PT DOCK
47 03 06.0 122 54 18.0 2F 0 Elev= 0 ft
53067 Washington Thurston Co. PACIFIC NORTHWEST
Puget Sound 131191
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	0945	000	15.5			7.9	34200	1.2		9	4.5	24.00
	1000	010	15.0			7.7	42300	0.8				29.00
89/11/14	0930	000	10.5	8.8	87.0	7.7			22.2	380L	0.8	16.97
	0935	010	11.7			7.7			69.6			29.75
89/12/05	1110	000	10.4	9.9	95.4	7.5			2.2	260S	0.5	13.28
	1125	010	10.6	7.8	84.0	7.7			70.4			29.56
90/01/16	0925	000	8.3	9.0	86.0	7.3			7.5	51	1.8	19.27
	0930	009	9.3	7.9	82.0	7.7			56.3			28.23
90/02/06	1000	000	16.1	9.1	92.4	7.2			26.9	19S	0.9	1.36
	1030	010	8.3	9.5	96.5	7.5			65.1			28.25
90/03/05	0935	000	8.4	10.0	94.0	7.5			33.9	28	2.0	16.45
	0945	010	8.0	9.0	90.4	7.6			55.7			27.67
90/04/02	1000	000	10.1	8.7	87.3	7.9			8.8	1J	2.1	20.68
	1005	010	8.8	9.2	94.2	7.8			52.7			27.88
90/05/08	0935	000	11.5	7.9	81.9	7.9			55.3	10	2.1	20.99
	0940	010	10.2	8.3	87.9	8.0			31.6			28.46
90/06/05	0950	000	13.0	9.0	90.6	7.8			19.6	320	2.0	11.20
	1000	009	11.2	8.1	87.8	7.9			46.3			28.81
90/07/16	0940	000	18.3	11.3	136.7	8.3			32.8	35	2.1	24.14
	0950	010	13.9	6.2	71.0	7.8			72.0			28.83
90/08/07	0950	000	17.6	6.7	78.7	7.7			59.2	31	2.4	21.56
	1000	009	14.8	4.0	46.7	7.6			73.8			29.02
90/09/05	0935	000	16.7	7.2	84.9	7.8			58.1	43	4.0	24.90
	0945	010	15.1	4.6	54.1	7.8			64.0			29.34

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	0945	000	0.04	0.01K	0.12	0.090	0.110	416200		
	1000	010	0.02	0.01K	0.13	0.090	0.110	416201		
89/11/14	0930	000	0.35	0.02	0.07	0.060	0.080	466200		
	0935	010	0.17	0.02	0.08	0.080	0.100	466201		
89/12/05	1110	000	0.38	0.02	0.07	0.100	0.070	496200		
	1125	010	0.33	0.02	0.04	0.100	0.090	496201		
90/01/16	0925	000	0.38	0.01	0.05	0.080	0.080	36200		

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/01/16	0930	009	0.33	0.01	0.05	0.090	0.100	36201		
90/02/06	1000	000	0.37	0.01K	0.09	0.080	0.090	66200		
	1030	010	0.31	0.01K	0.01	0.090	0.090	66201		
90/03/05	0935	000	0.36	0.01K	0.05	0.070	0.080	106200		
	0945	010	0.31	0.01K	0.02	0.080	0.090	106201		
90/04/02	1000	000	0.29	0.01K	0.04	0.040	0.060	146200		
	1005	010	0.33	0.01K	0.04	0.070	0.080	146201		
90/05/08	0935	000	0.16	0.01K	0.18	0.060	0.080	196200	0.86	1.48
	0940	010	0.14	0.01K	0.12	0.060	0.100	196201	16.40	15.10
90/06/05	0950	000	0.15	0.01K	0.18	0.050	0.070	236200	2.59	4.63
	1000	009	0.11	0.01K	0.16	0.090	0.120	236201	11.89	12.10
90/07/16	0940	000	0.04	0.01K	0.03	0.060	0.100	296200	6.96	5.93
	0950	010	0.02	0.01K	0.14	0.110	0.120	296201	1.35	1.44
90/08/07	0950	000	0.05	0.01K	0.10	0.100	0.120	326200	4.90	4.84
	1000	009	0.01K	0.01K	0.14	0.140	0.150	326201	0.62	0.99
90/09/05	0935	000	0.07	0.02	0.17	0.100	0.130	366200	4.72	4.27
	0945	010	0.04	0.01K	0.17	0.100	0.130	366201	5.45	4.24

BUD005
BUDD INLET-OLYMPIA SHOAL AT HORN
47 05 32.0 122 55 01.0 2F 0 Elev= 0 ft
53067 Washington Thurston Co. PACIFIC NORTHWEST
PUGET SOUND (Deschutes-13) 131113
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1020	000	15.2			8.1	41100	0.8		1K	5.0	29.00
	1025	010	14.9			8.0	41300	0.6				30.00
89/11/14	0955	000	10.9			7.8			69.6	36	4.1	29.04
	1000	010	11.4	8.6	94.3	7.8			72.7			29.80
89/12/05	1135	000	10.5	8.1	84.5	7.8			30.0	56S	1.0	25.31
	1150	010	10.6	7.9	84.9	7.9			74.6			29.40
90/01/16	1040	000	8.0	8.7	85.4	7.6			35.1	8	3.5	24.30
	1045	010	9.2	8.6	88.8	7.8			74.6			27.85
90/02/06	1035	000	7.6	9.5	93.6	7.8			59.7	8	2.1	26.14
	1055	010	8.3	9.0	91.3	7.7			70.4			28.09
90/03/05	0950	000	9.0	10.2	101.5	7.8			70.1	3	4.5	23.07
	1000	010	8.1	9.7	97.8	7.8			72.7			27.86
90/04/02	1015	000	11.1	12.3	128.2	8.2			35.9	1J	2.4	23.21
	1020	010	8.8	10.6	108.7	7.9			68.7			28.06
90/05/08	0945	000	11.3	11.0	117.8	8.3			58.9	2	2.0	26.59
	0950	010	10.2	10.5	111.4	8.2			54.5			28.60
90/06/05	1015	000	12.6	9.2	101.3	8.3			28.2	80	4.5	26.87
	1020	009	11.1	8.7	94.2	8.0			43.7			28.85
90/07/16	1005	000	20.7	13.5	175.0	8.6			49.6	1K	2.6	27.93
	1015	010	13.8	11.9	136.1	8.1			50.9			28.99
90/08/07	1010	000	20.5	15.0	193.6	8.6			60.2	1K	2.0	27.82
	1020	010	14.7	8.3	96.7	7.9			67.3			29.16
90/09/05	1010	000	18.6	13.6	169.1	8.4			55.2	2	3.2	27.62
	1020	009	15.0	7.9	92.8	8.1			61.1			29.40

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1020	000	0.01K	0.01K	0.02	0.070	0.090	416202		
	1025	010	0.06	0.01K	0.06	0.070	0.080	416203		
89/11/14	0955	000	0.19	0.02	0.08	0.080	0.090	466202		
	1000	010	0.18	0.02	0.05	0.080	0.090	466203		
89/12/05	1135	000	0.35	0.01	0.06	0.090	0.080	496202		
	1150	010	0.33	0.01	0.03	0.090	0.080	496203		
90/01/16	1040	000	0.38	0.01	0.06	0.090	0.090	36202		

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/01/16	1045	010	0.35	0.01K	0.01	0.090	0.090	36203		
90/02/06	1035	000	0.32	0.01K	0.03	0.090	0.080	66202		
	1055	010	0.31	0.01K	0.01K	0.090	0.090	66203		
90/03/05	0950	000	0.32	0.01K	0.03	0.070	0.080	106202		
	1000	010	0.32	0.01K	0.01K	0.080	0.090	106203		
90/04/02	1015	000	0.06	0.01K	0.01K	0.010	0.050	146202	8.97	11.50
	1020	010	0.34	0.01K	0.02	0.070	0.080	146203	2.42	2.85
90/05/08	0945	000	0.01K	0.01K	0.01K	0.010	0.050	196202	5.71	15.00
	0950	010	0.14	0.01K	0.04	0.050	0.070	196203	7.67	8.52
90/06/05	1015	000	0.02	0.01K	0.01	0.030	0.050	236202	1.34	2.10
	1020	009	0.14	0.01	0.14	0.090	0.120	236203	9.69	9.65
90/07/16	1005	000	0.01K	0.01K	0.01K	0.030	0.050	296202	1.74	1.60
	1015	010	0.01K	0.01K	0.01K	0.080	0.100	296203	5.91	3.89
90/08/07	1010	000	0.01K	0.01K	0.01K	0.040	0.060	326202	3.41	3.11
	1020	010	0.03	0.01K	0.04	0.070	0.080	326203	2.98	2.76
90/09/05	1010	000	0.01K	0.01K	0.01K	0.050	0.090	366202	4.37	3.83
	1020	009	0.07	0.01K	0.08	0.070	0.100	366203	5.78	4.66

CMB003
COMMENCEMENT BAY
47 17 26.0 122 26 56.0 2F 0 Elev= 0 ft
53053 Washington Pierce Co. PACIFIC NORTHWEST
PUGET SOUND (Puyallup/White-10) 131110
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1115	000	11.8			7.9	38300	1.1		19	5.0	17.00
	1120	010	12.0			8.0	42300	0.4				31.00
	1125	030	12.0			8.0	43000	0.3				32.00
89/11/27	1130	000	9.4	9.0	89.4	7.9			30.6	86	2.8	21.47
	1140	010	11.0	7.6	82.9	7.9			79.0			30.29
	1145	027	11.0	7.5	81.9	7.9			84.9			30.45
89/12/18	1415	000	8.9	8.4	83.8	7.9			60.6	23	6.5	23.71
	1420	010	10.3	7.6	81.3	7.9			83.0			29.58
	1425	027	10.3	7.3	78.2	7.9			83.9			29.76
90/01/29	1150	000	7.2	10.5	98.6	7.7			24.8	640J	0.8	20.45
	1215	025	9.1	8.2	85.6	7.7			80.8			29.14
	1220	010	9.1	8.6	89.7	7.7			78.9			29.40
90/02/26	1310	000	8.3	9.9	96.8	7.8			62.9	2	4.5	22.72
	1315	010	8.1	9.2	93.5	7.8			79.6			28.95
	1320	030	8.1	8.9	90.6	7.9			81.2			29.13
90/03/20	1135	000	9.7			7.9				7	5.0	19.12
	1140	010	8.5			7.8						27.44
	1145	030	8.5			7.8						27.28
90/04/16	1125	000	11.1	10.0	95.2	7.7			29.5	9	1.5	8.79
	1140	010	8.6	9.3	95.7	7.9			85.4			29.14
	1150	030	8.5	8.9	91.4	7.9			85.7			29.25
90/05/21	1250	000	10.5	8.6	91.6	8.1			86.3	1K	14.0	28.29
	1300	010	9.7	8.8	92.8	8.1			86.4			29.27
	1310	030	9.4	8.4	88.1	8.1			84.6			29.47
90/06/19	1220	000	13.6	9.9	106.9	8.1			63.4	23	4.3	20.64
	1235	010	10.8	8.4	90.6	8.0			86.2			29.29
	1240	030	10.4	7.8	83.5	8.0			88.4			29.43
90/07/31	1150	000	15.0	8.7	99.9				41.9	21	0.7	25.95
	1200	010	12.4	7.7	85.9				84.6			29.48
	1210	029	12.1	7.2	79.9				79.0			29.46
90/08/27	1220	000	14.3	8.5	97.0	7.9			62.8	2	6.4	27.14
	1230	010	12.7	7.7	86.7	8.0			87.8			29.84
	1240	030	12.1	6.1	67.9	7.8			73.7			29.94
90/09/17	1350	000	14.3			8.0			64.6	2	4.2	26.93

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1115	000	0.26	0.02	0.05	0.090	0.090	436309		
	1120	010	0.25	0.02	0.02	0.080	0.080	436310		
	1125	030	0.25	0.01	0.02	0.070	0.070	436311		
89/11/27	1130	000	0.39	0.01K	0.03	0.080	0.090	486309		
	1140	010	0.35	0.01K	0.01K	0.080	0.090	486310		
	1145	027	0.35	0.01K	0.01K	0.080	0.090	486311		
89/12/18	1415	000	0.34	0.01K	0.03	0.080	0.090	516309		
	1420	010	0.31	0.01K	0.01K	0.080	0.090	516310		
	1425	027	0.32	0.01K	0.01K	0.080	0.100	516311		
90/01/29	1150	000	0.39	0.01K	0.05	0.080	0.090	56309		
	1215	025	0.31	0.01K	0.01K	0.080	0.090	56311		
	1220	010	0.31	0.01K	0.01	0.080	0.090	56310		
90/02/26	1310	000	0.38	0.01K	0.02	0.070	0.080	96309		
	1315	010	0.37	0.01K	0.01K	0.080	0.170	96310		
	1320	030	0.37	0.01K	0.01K	0.080	0.090	96311		
90/03/20	1135	000	0.33	0.01K	0.03	0.070	0.070	126309		
	1140	010	0.35	0.01K	0.01K	0.080	0.080	126310	0.07	0.49
	1145	030	0.35	0.01K	0.01K	0.080	0.080	126311		
90/04/16	1125	000	0.16	0.01K	0.02	0.050	0.060	166309	0.59	0.70
	1140	010	0.26	0.01K	0.03	0.070	0.070	166310	0.29	0.41
	1150	030	0.27	0.01K	0.02	0.070	0.070	166311	0.19	0.24
90/05/21	1250	000	0.20	0.01	0.05	0.060	0.060	216309	0.14	0.20
	1300	010	0.21	0.01	0.04	0.060	0.060	216310	0.45	0.69
	1310	030	0.23	0.01	0.03	0.060	0.060	216311	0.40	0.63
90/06/19	1220	000	0.10	0.01K	0.02	0.030	0.040	256309	1.21	2.02
	1235	010	0.20	0.01K	0.03	0.060	0.060	256310	0.56	0.85
	1240	030	0.21	0.01K	0.03	0.060	0.060	256311	0.06	0.11
90/07/31	1150	000	0.19	0.01K	0.02	0.050	0.070	316309	1.78	1.59
	1200	010	0.25	0.01K	0.03	0.060	0.080	316310	0.61	0.62
	1210	029	0.31	0.01K	0.02	0.060	0.070	316311	0.39	0.32
90/08/27	1220	000	0.18	0.01K	0.01	0.040	0.070	356309	6.56	5.08
	1230	010	0.23	0.01K	0.01K	0.050	0.060	356310	0.24	0.75
	1240	030	0.28	0.01K	0.01K	0.050	0.070	356311	0.03	0.28
90/09/17	1350	000	0.22	0.01	0.04	0.070	0.080	386309	1.00	0.93
	1400	010	0.24	0.01	0.02	0.060	0.070	386310	0.28	0.34
	1410	030	0.26	0.01	0.01	0.060	0.070	386311	0.12	0.26

CRR001
CARR INLET OFF GREEN POINT
47 16 36.0 122 42 30.0 2F 0 Elev= 0 ft
53053 Washington Pierce Co. PACIFIC NORTHWEST
PUGET SOUND (Kitsap-15) 131115
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1210	000	13.0			8.0	41900	0.4		1K	9.6	31.00
	1215	010	13.3			8.0	42700	0.4				31.00
	1220	030	13.3			8.0	42900	0.4				31.00
89/11/27	1250	000	11.0	8.2	89.5	7.9			84.1	1	7.8	30.30
	1300	010	10.9	8.3	90.4	7.9			84.1			30.30
	1310	025	10.9	8.3	90.4	8.0			84.9			30.30
90/01/29	1320	000	8.4	9.8	100.3	7.8			84.0	1	6.8	29.04
	1335	010	8.5	10.0	102.6	7.8			83.9			29.08
	1345	028	9.1	8.8	91.6	7.7			80.7			29.27
90/02/26	1505	000	7.7	9.7	97.4	7.9			80.3	1K	7.6	28.50
	1510	010	7.6	9.8	98.2	7.9			80.3			28.54
	1515	030	7.6	9.4	94.3	7.9			82.0			28.69
90/03/20	1245	000	9.5			8.3				1K	7.2	26.71
	1250	010	8.7			8.1						26.77
	1255	030	8.6			8.0						27.43
90/04/16	1300	000	12.9	12.8	143.2	8.3			74.6	1K	5.2	28.31
	1305	010	9.4	14.9	155.6	8.3			55.0			28.86
	1310	030	8.8	10.2	105.2	8.0			81.2			28.91
90/05/21	1435	000	11.7	12.3	134.8	8.5			52.8	1K	4.4	28.86
	1445	010	10.6	11.3	121.2	8.3			75.4			29.02
	1455	030	9.9	9.7	102.6	8.2			86.3			29.09
90/06/19	1400	000	14.7	10.8	125.7	8.3			84.6	1K	7.0	28.93
	1410	010	11.4	9.9	108.1	8.1			80.2			29.24
	1420	030	10.7	8.3	89.4	8.0			84.4			29.26
90/07/31	1445	000	16.3	12.2	146.7	8.4			56.5	1K	5.9	29.25
	1450	010	13.2	8.8	99.7	8.2			85.4			29.34
	1455	030	12.5	7.6	84.9	8.0			88.5			29.35
90/08/27	1500	000	17.3	13.3	163.1	8.4			61.0	1K	4.2	29.31
	1510	010	13.5	9.4	107.3	8.1			76.8			29.50
	1520	030	13.1	7.0	79.3	8.0			87.7			29.68
90/09/17	1530	000	15.2			8.3			73.5	1	8.0	29.65

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1210	000	0.22	0.01	0.04	0.080	0.080	436317		
	1215	010	0.23	0.01	0.03	0.080	0.080	436318		
	1220	030	0.23	0.01	0.04	0.080	0.080	436319		
89/11/27	1250	000	0.34	0.01K	0.01K	0.080	0.090	486317		
	1300	010	0.34	0.01K	0.01K	0.080	0.090	486318		
	1310	025	0.34	0.01K	0.01K	0.080	0.090	486319		
90/01/29	1320	000	0.31	0.01K	0.01K	0.080	0.090	56317		
	1335	010	0.31	0.01K	0.01K	0.080	0.090	56318		
	1345	028	0.31	0.01K	0.01K	0.090	0.090	56319		
90/02/26	1505	000	0.36	0.01K	0.01K	0.080	0.080	96317		
	1510	010	0.36	0.01K	0.01K	0.080	0.080	96318		
	1515	030	0.37	0.01K	0.01K	0.080	0.100	96319		
90/03/20	1245	000	0.07	0.01K	0.01K	0.020	0.030	126317		
	1250	010	0.30	0.01K	0.01K	0.070	0.070	126318		
	1255	030	0.30	0.01K	0.01K	0.070	0.070	126319		
90/04/16	1300	000	0.01K	0.01K	0.01K	0.020	0.020	166317		
	1305	010	0.15	0.01K	0.02	0.040	0.060	166318		
	1310	030	0.22	0.01K	0.03	0.060	0.070	166319		
90/05/21	1435	000	0.01K	0.01K	0.01K	0.020	0.040	216317	8.33	7.91
	1445	010	0.10	0.01K	0.02	0.040	0.050	216318	4.85	6.26
	1455	030	0.18	0.01K	0.04	0.060	0.060	216319	0.92	1.62
90/06/19	1400	000	0.01K	0.01K	0.01K	0.010	0.030	256317	0.96	0.76
	1410	010	0.12	0.01K	0.02	0.040	0.060	256318	3.16	3.43
	1420	030	0.19	0.01K	0.04	0.060	0.060	256319	0.67	0.91
90/07/31	1445	000	0.01K	0.01K	0.01K	0.020	0.040	316317	5.22	1.45
	1450	010	0.21	0.01K	0.03	0.050	0.060	316318	1.32	1.20
	1455	030	0.25	0.01K	0.03	0.060	0.060	316319	0.42	0.23
90/08/27	1500	000	0.01K	0.01K	0.01K	0.020	0.030	356317	2.22	1.75
	1510	010	0.16	0.01K	0.01	0.040	0.060	356318	5.60	5.21
	1520	030	0.20	0.01K	0.03	0.050	0.070	356319	0.27	0.36
90/09/17	1530	000	0.03	0.01K	0.01K	0.030	0.050	386317	1.02	0.97
	1535	010	0.23	0.02	0.03	0.070	0.070	386318	0.81	1.17
	1545	030	0.24	0.02	0.05	0.070	0.090	386319	0.15	0.38

CSE001
CASE INLET OFF SOUTHERN HERON IS
47 15 53.0 122 50 35.0 2F 0 Elev= 0 ft
53053 Washington Pierce Co. PACIFIC NORTHWEST
PUGET SOUND (Kitsap-15) 131115
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1240	000	14.0			8.0	42200	0.4		1K	8.0	30.00
	1245	010	14.0			8.1	42300	0.3				31.00
	1250	030	13.9			7.9	42300	0.4				31.00
89/11/27	1325	000	10.8	8.4	91.0	8.0			79.8	1K	6.3	29.95
	1340	010	10.8	8.5	92.1	8.0			79.6			29.95
	1350	028	10.8	8.5	92.1	8.0			79.9			29.96
90/01/29	1415	000	8.3	9.8	99.6	7.8			75.6	1K	3.7	28.37
	1420	010	8.4	9.6	97.8	7.8			76.6			28.41
	1430	027	8.6	9.1	93.3	7.8			75.0			28.69
90/02/26	1540	000	7.8	9.8	97.9	8.0			32.1	1K	6.7	27.48
	1545	010	7.9	9.6	96.6	7.9			75.4			28.23
	1550	030	8.1	8.9	90.2	7.9			69.4			28.63
90/03/20	1305	000	9.9			7.9				1K	12.0	26.03
	1310	010	9.0			7.9						26.79
	1315	030	8.5			7.8						27.30
90/04/16	1320	000	12.9	13.5	150.8	8.4			65.5	1K	3.8	28.09
	1325	010	9.0	11.9	123.1	8.1			79.4			28.74
	1330	028	8.8	9.7	100.0	8.0			77.4			28.80
90/05/21	1515	000	11.8	11.7	128.3	8.4			58.6	1K	3.5	28.68
	1525	010	10.9	10.9	117.5	8.3			65.3			28.80
	1535	030	10.2	9.6	102.1	8.2			75.8			28.96
90/06/19	1430	000	13.5	9.6	108.9	8.1			71.8	1K	4.0	28.66
	1440	010	11.5	8.5	92.9	8.0			83.4			29.07
	1450	030	11.2	8.1	88.0	8.0			79.7			29.10
90/07/31	1505	000								1K	3.3	
90/08/27	1525	000	17.3	12.0	147.1	8.4			79.1	1K	5.7	29.23
	1535	010	14.4	8.6	99.8	8.1			81.6			29.43
	1545	030	13.6	7.1	81.2	8.0			79.2			29.60
90/09/17	1610	000	16.2			8.3			73.5	1K	5.5	29.56

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1240	000	0.16	0.01K	0.06	0.080	0.080	436320		
	1245	010	0.16	0.01K	0.06	0.080	0.080	436321		
	1250	030	0.19	0.01	0.05	0.080	0.080	436322		
89/11/27	1325	000	0.33	0.01	0.02	0.080	0.090	486320		
	1340	010	0.32	0.02	0.02	0.080	0.090	486321		
	1350	028	0.33	0.01	0.01	0.080	0.090	486322		
90/01/29	1415	000	0.32	0.01K	0.01K	0.090	0.090	56320		
	1420	010	0.32	0.01K	0.01K	0.090	0.090	56321		
	1430	027	0.32	0.01K	0.01K	0.090	0.090	56322		
90/02/26	1540	000	0.35	0.01K	0.01K	0.080	0.080	96320		
	1545	010	0.37	0.01K	0.01K	0.080	0.090	96321		
	1550	030	0.37	0.01K	0.01K	0.090	0.090	96322		
90/03/20	1305	000	0.32	0.01K	0.02	0.080	0.080	126320		
	1310	010	0.33	0.01K	0.01	0.080	0.080	126321		
	1315	030	0.35	0.01K	0.01	0.080	0.080	126322		
90/04/16	1320	000	0.01K	0.01K	0.01K	0.010	0.020	166320	2.35	4.72
	1325	010	0.19	0.01K	0.03	0.060	0.060	166321	1.41	2.97
	1330	028	0.22	0.01K	0.03	0.070	0.060	166322	1.03	1.42
90/05/21	1515	000	0.01K	0.01K	0.01K	0.010	0.030	216320	6.87	5.45
	1525	010	0.06	0.01K	0.02	0.030	0.050	216321	7.30	6.56
	1535	030	0.14	0.01K	0.04	0.050	0.050	216322	1.77	1.99
90/06/19	1430	000	0.07	0.01K	0.01	0.030	0.050	256320	3.18	2.27
	1440	010	0.15	0.01K	0.05	0.060	0.060	256321	0.78	0.97
	1450	030	0.16	0.01K	0.05	0.060	0.070	256322	0.60	0.82
90/07/31	1505	000	0.01K	0.01K	0.01K	0.030	0.070	316320	19.90	9.83
	1510	010	0.16	0.01K	0.03	0.050	0.060	316321	2.19	1.43
	1515	030	0.21	0.01K	0.05	0.060	0.070	316322	0.49	0.31
90/08/27	1525	000	0.01K	0.01K	0.01K	0.030	0.050	356320	2.41	1.98
	1535	010	0.10	0.01K	0.03	0.050	0.070	356321	2.34	2.17
	1545	030	0.17	0.01K	0.04	0.060	0.070	356322	0.39	0.54
90/09/17	1610	000	0.05	0.01K	0.01K	0.050	0.070	386320	9.43	7.20
	1620	010	0.11	0.01K	0.03	0.060	0.070	386321	6.02	4.05
	1630	030	0.19	0.01	0.04	0.070	0.070	386322	0.85	1.04

DNA001
DANA PASSAGE NEAR BRISCO POINT
47 09 42.0 122 52 14.0 1F 0 Elev= 0 ft
53067 Washington Thurston Co. PACIFIC NORTHWEST
PUGET SOUND (Deschutes-13) 131113
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1100	000	15.0			8.2	42000	0.4		1K	6.5	30.00
	1105	010	14.6			8.1	41700	0.4				31.00
	1110	030	14.7			8.1	41300	0.5				30.00
89/11/14	1055	000	11.3	5.9	64.5	7.9			0.4	10	5.3	29.62
	1115	010	11.4	7.6	83.3	7.9			73.6			29.82
	1130	030	11.3			8.1						30.01
89/12/05	1230	000	10.6	7.7	82.5	7.9			5.6	9	4.4	28.84
	1240	010	10.6	8.0	85.9	7.9			73.0			29.12
	1255	030	10.6	7.8	84.0	7.9			75.1			29.65
90/01/16	1130	000	9.3	8.3	86.4	7.9			69.7	1	3.6	28.60
	1135	010	9.3	8.4	87.4	7.9			68.4			28.59
	1140	030	9.3	8.3	86.4	7.9			69.6			28.40
90/02/06	1135	000	8.0	9.6	96.6	7.7			72.8	1	3.9	27.91
	1200	010	8.2	9.6	97.4	7.7			76.4			28.44
	1235	030	8.6	9.0	92.4	7.7			74.8			28.89
90/03/05	1035	000	8.3	9.3	94.3	7.9			76.1	1K	4.9	28.02
	1045	010	8.1	9.3	94.0	7.9			74.2			28.17
	1055	030	8.1	9.1	92.2	7.9			74.3			28.59
90/04/02	1100	000	9.2	8.8	88.8	7.9			38.4	1K	4.7	27.72
	1105	010	8.9	9.6	98.7	7.9			73.8			28.13
	1115	029	8.5	9.2	94.1	7.9			76.3			28.60
90/05/08	1045	000	11.5	11.8	128.3	8.4			41.4	1	2.0	28.27
	1050	010	10.5	11.3	120.5	8.3			57.0			28.46
	1055	029	10.2	10.6	112.4	8.2			61.3			28.57
90/06/05	1115	000	12.0	9.5	104.5	8.2			71.2	1	5.5	28.53
	1120	010	11.6	9.8	107.0	8.2			71.9			28.62
	1125	030	11.2	9.1	98.7	8.1			75.7			28.81
90/07/16	1120	000	14.3	9.3	107.5	8.1			71.7	1K	5.7	29.05
	1130	010	13.6	9.2	104.9	8.1			78.0			29.11
	1140	030	12.6	7.7	86.1	8.0			80.6			29.20
90/08/07	1100	000	14.9	9.2	107.6	8.1			76.1	1K	6.0	29.15
	1110	010	14.9	9.2	107.7	8.1			75.8			29.17
	1120	030	14.8	8.9	104.0	8.1			76.1			29.19
90/09/05	1120	000	15.1	8.2	96.5	8.1			70.5	1	5.5	29.42
	1130	010	15.1	8.1	95.3	8.1			72.2			29.40
	1140	030	15.2	8.3	97.8	8.1			71.7			29.38

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1100	000	0.11	0.01K	0.03	0.070	0.060	416206		
	1105	010	0.16	0.01K	0.04	0.070	0.070K	416207		
	1110	030	0.17	0.01K	0.04	0.070	0.080	416208		
89/11/14	1055	000	0.19	0.02	0.04	0.080	0.090	466206		
	1115	010	0.19	0.02	0.04	0.080	0.090	466207		
	1130	030	0.19	0.02	0.04	0.080	0.090	466208		
89/12/05	1230	000	0.34	0.01K	0.02	0.090	0.080	496206		
	1240	010	0.34	0.01K	0.02	0.090	0.080	496207		
	1255	030	0.35	0.01K	0.01K	0.090	0.080	496208		
90/01/16	1130	000	0.35	0.01K	0.01K	0.090	0.090	36206		
	1135	010	0.35	0.01K	0.01K	0.080	0.090	36207		
	1140	030	0.35	0.01K	0.01K	0.090	0.090	36208		
90/02/06	1135	000	0.31	0.01K	0.01K	0.090	0.090	66206		
	1200	010	0.31	0.01K	0.01K	0.090	0.080	66207		
	1235	030						66208		
90/03/05	1035	000	0.32	0.01K	0.01K	0.080	0.090	106206		
	1045	010	0.32	0.01K	0.01K	0.080	0.090	106207		
	1055	030	0.33	0.01K	0.01K	0.080	0.090	106208		
90/04/02	1100	000	0.30	0.01K	0.01	0.060	0.070	146206	2.87	4.01
	1105	010	0.33	0.01K	0.01	0.070	0.080	146207	1.26	2.21
	1115	029	0.34	0.01K	0.02	0.070	0.080	146208	0.71	1.33
90/05/08	1045	000	0.13	0.01K	0.02	0.040	0.060	196206	7.67	6.75
	1050	010	0.13	0.01K	0.02	0.040	0.060	196207	3.43	3.96
	1055	029	0.12	0.01K	0.02	0.040	0.060	196208	4.65	5.90
90/06/05	1115	000	0.09	0.01K	0.02	0.030	0.060	236206	3.56	5.31
	1120	010	0.16	0.01K	0.05	0.050	0.060	236207	1.67	2.09
	1125	030	0.16	0.01K	0.05	0.050	0.060	236208	1.24	1.91
90/07/16	1120	000	0.08	0.01K	0.01K	0.050	0.060	296206	2.59	2.29
	1130	010	0.12	0.01K	0.02	0.050	0.060	296207	3.05	2.26
	1140	030	0.16	0.01K	0.03	0.060	0.060	296208	0.48	0.62
90/08/07	1100	000	0.09	0.01K	0.02	0.060	0.070	326206	5.91	4.21
	1110	010	0.09	0.01K	0.02	0.060	0.070	326207	4.54	3.09
	1120	030	0.09	0.01K	0.02	0.060	0.070	326208	4.92	4.29
90/09/05	1120	000	0.08	0.01K	0.02	0.060	0.090	366206	5.40	5.14
	1130	010	0.08	0.01K	0.02	0.060	0.090	366207	4.65	4.22
	1140	030	0.08	0.01K	0.02	0.060	0.090	366208	5.76	5.15

EAP001
EAST PASSAGE NEAR THREE TREE POINT
47 25 02.0 122 22 45.0 2F000 Elev= 0 ft
53033 Washington King Co. PACIFIC NORTHWEST
PUGET SOUND (Duwamish/Green-09) 131109
21540000 Reach=17110019 0.000 Drg= 0 sqmi
AMBNT/OCEAN/RMP

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1045	000	12.0			8.0	42700	0.2		1K	12.5	31.00
	1050	010	12.0			8.0	42800	0.3				31.00
	1055	030	12.1			8.0	42800	0.2				31.00
89/11/27	1050	000	10.3	8.5	91.1	8.0			85.7	1K	10.7	29.88
	1105	010	10.3	8.7	93.3	8.0			86.8			29.86
	1115	030	10.9	8.0	87.1	7.9			87.0			30.38
89/12/18	1335	000	10.0	6.9	73.4	7.9			84.6	1K	10.7	29.59
	1340	010	10.0	7.7	81.9	7.9			84.7			29.68
	1345	030	10.2	7.5	80.2	7.9			84.5			29.81
90/01/29	1105	000	8.6	9.3	95.8	7.8			82.5	3	7.9	29.34
	1110	010	8.6	9.4	96.8	7.8			82.6			29.34
	1115	030	8.7	9.3	96.0	7.8			83.1			29.38
90/02/26	1225	000	8.1	9.5	96.7	7.9			81.3	1K	7.5	29.12
	1230	010	8.1	9.4	95.6	7.9			81.7			29.14
	1240	030	8.1	9.1	92.7	7.9			82.2			29.25
90/03/20	1105	000	9.9			7.9				1	7.5	25.42
	1110	010	9.4			7.9						26.80
	1115	030	8.6			7.8						27.52
90/04/16	1105	000	9.6	9.7	102.0	7.9			86.3	1K	11.2	29.14
	1105	010	9.1	9.8	101.9	7.9			86.4			29.07
	1110	030	8.6	9.3	95.8	7.9			85.8			29.26
90/05/21	1210	000	11.4	9.0	97.9	8.2			85.7	1K	15.0	28.68
	1220	010	10.2	9.0	95.9	8.1			88.2			29.27
	1230	030	9.2	8.1	84.7	8.1			88.5			29.61
90/06/19	1125	000	14.5	12.6	144.0	8.4			55.3	1K	2.8	26.78
	1135	010	11.6	10.5	114.9	8.1			74.5			28.95
	1140	030	10.3	7.9	84.5	8.0			88.0			29.53
90/07/31	1120	000	14.5	9.3	108.2				78.9	1K	6.9	29.47
	1130	010	13.5	8.9	101.5				83.4			29.49
	1140	030	12.2	7.4	82.3				87.1			29.60
90/08/27	1120	000	13.5	10.8	123.4	8.3			59.4	1	6.9	29.73
	1130	010	12.8	8.3	93.7	8.0			86.2			29.91
	1140	030	12.5	6.9	77.4	7.9			87.5			30.00
90/09/17	1240	000	14.2	9.0	104.2	8.1			83.4	1K	16.0	29.66
	1250	010		7.4	50.6							
	1300	030		6.5	44.5							

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1045	000	0.25	0.01	0.02	0.070	0.080	436306		
	1050	010	0.25	0.01	0.02	0.070	0.070	436307		
	1055	030	0.24	0.01	0.02	0.070	0.070	436308		
89/11/27	1050	000	0.34	0.01K	0.01K	0.080	0.090	486306		
	1105	010	0.35	0.01K	0.01K	0.080	0.090	486307		
	1115	030	0.35	0.01K	0.01K	0.080	0.090	486308		
89/12/18	1335	000	0.31	0.01K	0.01K	0.080	0.080	516306		
	1340	010	0.31	0.01K	0.01K	0.080	0.080	516307		
	1345	030	0.31	0.01K	0.01K	0.080	0.090	516308		
90/01/29	1105	000	0.31	0.01K	0.01K	0.080	0.090	56306		
	1110	010	0.31	0.01K	0.01K	0.080	0.090	56307		
	1115	030	0.31	0.01K	0.01	0.080	0.090	56308		
90/02/26	1225	000	0.36	0.01K	0.01K	0.080	0.080	96306		
	1230	010	0.36	0.01K	0.01K	0.090	0.090	96307		
	1240	030	0.36	0.01K	0.01K	0.090	0.090	96308		
90/03/20	1105	000	0.32	0.01K	0.01K	0.070	0.070	126306		
	1110	010	0.33	0.01K	0.01K	0.080	0.080	126307		
	1115	030	0.35	0.01K	0.01K	0.080	0.080	126308		
90/04/16	1105	000	0.24	0.01K	0.02	0.060	0.070	166306		
	1105	010	0.24	0.01K	0.02	0.070	0.070	166307		
	1110	030	0.26	0.01K	0.02	0.070	0.070	166308		
90/05/21	1210	000	0.13	0.01K	0.05	0.050	0.050	216306	0.22	0.32
	1220	010	0.18	0.01	0.04	0.050	0.060	216307	0.10	0.46
	1230	030	0.24	0.01	0.04	0.060	0.060	216308	0.03	0.42
90/06/19	1125	000	0.01K	0.01K	0.01K	0.010K	0.030	256306	0.71	1.49
	1135	010	0.14	0.01K	0.01	0.040	0.060	256307	3.84	3.98
	1140	030	0.22	0.01K	0.03	0.060	0.060	256308	0.17	0.24
90/07/31	1120	000	0.18	0.01K	0.01K	0.040	0.060	316306	1.42	1.21
	1130	010	0.22	0.01K	0.01K	0.050	0.060	316307	3.89	2.96
	1140	030	0.29	0.01K	0.01K	0.060	0.060	316308	0.43	0.45
90/08/27	1120	000	0.01K	0.01K	0.01K	0.050	0.140	356306	47.10	40.10
	1130	010	0.16	0.01K	0.01K	0.030	0.060	356307	2.93	2.67
	1140	030	0.24	0.01K	0.01	0.050	0.060	356308	0.25	0.45
90/09/17	1240	000	0.17	0.01	0.01K	0.050	0.060	386306	1.94	1.47
	1250	010	0.23	0.01	0.01	0.060	0.070	386307	1.08	0.90
	1300	030	0.25	0.01	0.01	0.060	0.070	386308	0.16	0.17

ELD001
ELD INLET NEAR FLAPJACK POINT
47 06 23.0 122 56 55.0 2F 0 Elev= 0 ft
53067 Washington Thurston Co. PACIFIC NORTHWEST
PUGET SOUND (Deschutes-13) 131113
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1115	000	15.6			8.2	40800	1.1		1K	4.6	29.00
	1120	010	15.3			8.2	40600	1.0				29.00
89/11/14	1145	000	10.7	8.7	93.5	7.9			63.5	1	3.5	28.97
	1200	010	11.3	8.4	91.8	7.9			70.2			29.61
89/12/05	1315	000	10.3	8.9	92.6	7.9			39.2	27	1.8	25.55
	1330	010	10.4	8.4	89.9	7.9			73.6			29.31
90/01/16	1220	000	8.6	8.7	87.2	7.9			69.8	4	3.5	25.36
	1225	010	9.2	8.8	90.9	7.9			66.1			27.81
90/02/06	1245	000	7.1	10.2	99.5	7.8			67.7	2	2.7	26.31
	1320	010	8.2	9.4	95.1	7.7			68.7			27.98
90/03/05	1100	000	8.7	9.6	97.3	7.9			78.7	1K	5.3	26.71
	1110	010	8.1	9.3	93.6	7.9			70.1			27.57
90/04/02	1125	000	10.8	9.7	102.9	8.0			78.7	1K	5.5	26.78
	1130	010	9.0	10.5	108.1	7.9			65.7			27.99
90/05/08	1115	000	11.2	11.0	118.7	8.4			48.4	1K	1.9	28.11
	1120	010	10.7	11.3	121.0	8.3			43.7			28.45
90/06/05	1245	000	13.6	10.9	123.5	8.3			74.7	1K	6.5	28.15
	1250	010	11.6	10.0	109.3	8.2			69.4			28.73
90/07/16	1200	000	17.3	14.5	177.0	8.5			63.4	1	4.0	28.63
	1210	010	14.6	11.0	127.8	8.2			67.6			28.97
90/08/07	1140	000	18.3	13.4	167.1	8.3			54.0	1K	1.9	28.93
	1150	010	15.4	8.8	103.9	8.0			53.2			29.11
90/09/05	1200	000	18.2	11.7	145.6	8.3			51.9	1K	2.1	28.96
	1210	010	15.5	7.2	85.3	8.1			67.8			29.33

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1115	000	0.01K	0.01K	0.02	0.070	0.100	416209		
	1120	010	0.01K	0.01K	0.03	0.060	0.100	416210		
89/11/14	1145	000	0.19	0.02	0.09	0.070	0.090	466209		
	1200	010	0.18	0.02	0.06	0.070	0.090	466210		
89/12/05	1315	000	0.37	0.01	0.10	0.080	0.080	496209		
	1330	010	0.33	0.01	0.10	0.090	0.080	496210		
90/01/16	1220	000	0.37	0.01K	0.04	0.080	0.080	36209		

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/01/16	1225	010	0.35	0.01K	0.02	0.090	0.090	36210		
90/02/06	1245	000	0.31	0.01K	0.01	0.100	0.080	66209		
	1320	010	0.31	0.01K	0.01K	0.090	0.080	66210		
90/03/05	1100	000	0.31	0.01K	0.01	0.070	0.090	106209		
	1110	010	0.32	0.01K	0.01	0.080	0.090	106210		
90/04/02	1125	000	0.24	0.01K	0.01	0.060	0.060	146209		
	1130	010	0.33	0.01K	0.02	0.070	0.080	146210		
90/05/08	1115	000	0.01K	0.01K	0.01	0.020	0.040	196209	1.99	1.86
	1120	010	0.09	0.01K	0.03	0.030	0.060	196210	7.12	8.67
90/06/05	1245	000	0.01K	0.01K	0.01K	0.020	0.040	236209	1.31	1.50
	1250	010	0.10	0.01K	0.06	0.040	0.070	236210	2.80	3.14
90/07/16	1200	000	0.01K	0.01K	0.01K	0.050	0.060	296209	4.86	3.07
	1210	010	0.03	0.01K	0.01K	0.050	0.070	296210	5.84	4.71
90/08/07	1140	000	0.01K	0.01K	0.01K	0.070	0.080	326209	4.29	4.00
	1150	010	0.01K	0.01K	0.01K	0.060	0.090	326210	8.20	5.97
90/09/05	1200	000	0.01K	0.01K	0.01K	0.050	0.090	366209	2.50	4.95
	1210	010	0.03	0.01K	0.04	0.070	0.110	366210	7.87	5.97

ELD002
ELD INLET AT YOUNG COVE
47 05 47.0 122 58 27.0 2F000 Elev= 0 ft
53067 Washington Thurston Co. PACIFIC NORTHWEST
PUGET SOUND (Deschutes-13) 131113
21540000 Reach=17110019 0.000 Drg= 0 sqmi
AMBNT/OCEAN/RMP

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1305	000	14.0				41500	0.5		1K	8.1	30.00
89/11/27	1405	000	10.3	8.4	89.6	7.9			71.1		3.8	29.13
90/01/29	1440	000	7.6	9.3	88.2	7.7			19.1	28	1.5	20.50
90/02/26	1610	000	8.7	9.8	97.3	7.9			35.7	3	4.1	23.70
90/03/20	1340	000	10.0			7.9				1K	7.0	25.36
90/04/16	1400	000	14.8	11.9	136.5	8.2			65.2	1K	3.5	26.44
90/05/21	1545	000	12.5	9.8	108.7	8.4			63.8	1K	3.5	28.23
90/06/19	1505	000	14.0	11.5	131.7	8.2			57.0	1K	2.6	28.52
90/07/31	1550	000								1K	2.5	
90/08/27	1600	000	18.0	13.0	161.2	8.3			41.7	1K	2.1	29.02
90/09/17	1700	000								1K		

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1305	000	0.11	0.01K	0.08	0.070	0.080	436323		
89/11/27	1405	000	0.31	0.02	0.07	0.080	0.100	486323		
90/01/29	1440	000	0.37	0.01K	0.03	0.080	0.080	56323		
90/02/26	1610	000	0.35	0.01K	0.03	0.080	0.070	96323		
90/03/20	1340	000	0.31	0.01K	0.02	0.070	0.070	126323	0.92	0.08
90/04/16	1400	000	0.01K	0.01K	0.01K	0.010K	0.030	166323	1.85	2.81
90/05/21	1545	000	0.01K	0.01K	0.01K	0.020	0.040	216323	2.90	2.85
90/06/19	1505	000	0.02	0.01K	0.01	0.030	0.060	256323	7.40	6.09
90/07/31	1550	000	0.01K	0.01K	0.01K	0.070	0.120	316323	23.30	12.90
90/08/27	1600	000	0.01K	0.01K	0.01K	0.030	0.060	356323	1.32	2.71
90/09/17	1700	000	0.01	0.01K	0.06	0.070	0.110	386323	5.13	5.71

GRG002
STRAIT OF GEORGIA NEAR PATOS ISLAND
48 48 30.0 122 57 10.0 2F000 Elev= 0 ft
53055 Washington San Juan Co. PACIFIC NORTHWEST
PUGET SOUND (San Juan-02) 131102
21540000 Reach=17110003 0.000 Drg= 0 sqmi
AMBNT/OCEAN/RMP

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	1215	000	11.4			7.8	40900	0.3		2	8.5	28.00
	1220	010	11.0			7.8	42600	0.5				30.00
	1225	030	10.9			7.7	42500	0.4				31.00
89/11/20	1230	000	9.3	7.4	77.7	7.9			82.0	1K	7.4	29.94
	1240	010	9.3	7.4	77.9	7.9			80.6			30.33
	1250	029	9.3	7.1	74.9	7.9			79.5			30.50
90/02/12	1305	000	7.3	9.7	97.1	7.8			79.7	1K	6.9	29.39
	1320	010	7.5	9.8	98.9	7.8			80.4			29.84
	1335	030	7.8	9.4	95.7	7.8			80.9			30.13
90/03/12	1150	000								1K	6.6	30.56
	1155	010										30.77
	1200	030										30.50
90/04/09	1220	000	8.7	9.6	98.9	8.2			79.2	1K	7.4	28.97
	1225	010	8.6	10.1	103.8	8.2			78.2			29.00
	1230	030	8.3	9.0	92.3	8.0			83.6			29.69
90/05/14	1325	000	9.8	8.5	89.9	8.1			74.5	1K	6.4	29.47
	1330	010	9.1	8.2	85.7	8.0			79.0			29.82
	1335	030	9.0	7.7	80.4	8.0			81.5			30.04
90/06/11	1330	000	11.4	8.9	94.0	8.1			70.3	1K	5.3	24.33
	1340	010	9.9	7.5	79.4	8.0			78.6			29.21
	1350	030	9.5	6.6	69.8	7.9			80.2			30.31
90/07/24	1235	000	11.6	6.5	71.4	8.0			80.6	1K	8.5	29.59
	1245	010	10.8	5.7	61.8	7.9			81.1			29.94
	1255	030	10.5	5.4	58.2	7.9			80.7			30.12
90/08/13	1300	000	13.7	7.1	80.5	7.9			80.4	1K	9.5	28.00
	1310	010	11.9	6.5	71.8	7.9			83.5			29.35
	1320	030	11.2	5.8	63.4	7.9			84.5			30.04
90/09/12	1410	000	12.7	7.0	78.3	8.0			80.7	1K	9.4	28.92
	1415	010	11.8	6.3	69.6	8.0			83.4			29.72
	1420	029	11.6	5.9	65.0	7.9			83.7			29.87

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	1215	000	0.27	0.01K	0.01K	0.060	0.070	426258		
	1220	010	0.29	0.01K	0.01K	0.070	0.070	426259		
	1225	030	0.30	0.01K	0.01K	0.070	0.070	426260		
89/11/20	1230	000	0.37	0.01K	0.01K	0.070	0.080	476258		
	1240	010	0.37	0.01K	0.01K	0.070	0.080	476259		
	1250	029	0.38	0.01K	0.01K	0.070	0.080	476260		
90/02/12	1305	000	0.27	0.01K	0.01K	0.080	0.100	76258		
	1320	010	0.28	0.01K	0.01K	0.080	0.090	76259		
	1335	030	0.28	0.01K	0.01K	0.080	0.080	76260		
90/03/12	1150	000	0.38	0.01K	0.01K	0.070	0.080	116258		
	1155	010	0.37	0.01K	0.01K	0.070	0.080	116259		
	1200	030	0.38	0.01K	0.01K	0.070	0.080	116260		
90/04/09	1220	000	0.18	0.01K	0.01K	0.040	0.050	156258		
	1225	010	0.23	0.01K	0.01	0.050	0.060	156259		
	1230	030	0.26	0.01K	0.01K	0.060	0.060	156260		
90/05/14	1325	000	0.25	0.01K	0.01K	0.050	0.070	206258	1.61	1.73
	1330	010	0.27	0.01K	0.01	0.060	0.060	206259	1.28	1.55
	1335	030	0.30	0.01K	0.01	0.070	0.070	206260	0.45	0.71
90/06/11	1330	000	0.17	0.01K	0.02	0.030	0.040	246258	1.01	0.92
	1340	010	0.23	0.01K	0.02	0.050	0.050	246259	1.11	1.08
	1350	030	0.31	0.01K	0.01	0.060	0.060	246260	0.48	0.56
90/07/24	1235	000	0.22	0.01K	0.01K	0.060	0.060	306258	0.69	0.81
	1245	010	0.25	0.01K	0.01K	0.060	0.060	306259	0.25	0.43
	1255	030	0.26	0.01K	0.01K	0.060	0.070	306260	0.13	0.39
90/08/13	1300	000	0.15	0.01K	0.01K	0.040	0.050	336258	0.66	0.72
	1310	010	0.22	0.01K	0.01	0.050	0.050	336259	0.35	0.79
	1320	030	0.23	0.01K	0.02	0.060	0.050	336260	0.23	0.68
90/09/12	1410	000	0.30	0.01K	0.01K	0.060	0.060	376258	0.56	0.80
	1415	010	0.31	0.01K	0.01	0.060	0.060	376259	0.38	0.63
	1420	029	0.31	0.01K	0.01K	0.060	0.060	376260	0.27	0.63

GYS004
GRAYS HBR-CHEHALIS R AT STRD OIL
46 58 41.0 123 47 00.0 2F 0 Elev= 0 ft
53027 Washington Grays Harbor Co. PACIFIC NORTHWEST
COASTAL (Lower Chehalis-22) 131222
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/STREAM

INDEX 1312099
MILES 0001.40 . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1230	000	16.4			8.0	29400	3.4		23X	2.4	20.00
	1235	010	16.3			7.9	31600	3.7				21.00
89/11/14	1330	000	9.1	10.8	93.7	7.7			7.5	360	0.5	0.75
	1345	010	10.2	10.2	97.2	7.3			3.1			12.24
90/01/17	1200	000	7.6	10.9	90.9	6.5			4.8	210	0.5	0.13
	1210	010	7.6	11.5	96.1	6.5			5.8			0.40
90/03/05	1230	000	7.9	11.9	101.6	7.6			28.6	45S	1.1	2.74
	1235	010	7.8	12.2	104.4	7.6						3.65
90/04/02	1300	000	10.1	10.9	97.9	7.6			38.8	58J	1.0	2.75
	1310	009	10.1	10.8	97.9	7.5			29.8			4.21
90/05/08	1255	000	14.6	9.4	94.0	7.6			26.3	41	1.0	4.16
	1300	010	13.4	9.3	94.6	7.6			3.2			11.62
90/06/05	1420	000	13.2	10.0	95.0	7.7			17.2	140	1.0	0.36
	1425	010	14.0	8.7	89.4	7.2			17.7			11.16
90/07/16	1355	000	21.1	7.4	84.6	7.5			21.6	15	1.3	5.10
	1400	010	19.6	6.5	76.1	7.4			7.4			14.32
90/08/07	1330	000	19.2	6.8	80.6	7.5			4.6	31	0.6	17.79
	1340	010	18.9	6.7	79.3	7.5			1.4			18.49
90/09/05	1400	000	19.1	6.9	82.4	7.7			12.5	25	0.7	19.36
	1410	010	19.0	6.9	82.7	7.8			7.1			20.37

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1230	000	0.19	0.01K	0.09	0.040	0.060	416215		
	1235	010	0.18	0.01	0.10	0.040	0.060	416216		
89/11/14	1330	000	0.74	0.01K	0.03	0.020	0.040	466215		
	1345	010	0.34	0.01K	0.07	0.020	0.090	466216		
90/01/17	1200	000	0.86	0.01	0.03	0.030	0.060	36215		
	1210	010	0.83	0.01	0.03	0.040	0.060	36216		
90/03/05	1230	000	0.51	0.01K	0.02	0.020	0.030	106215		
	1235	010	0.47	0.01K	0.03	0.020	0.040	106216		
90/04/02	1300	000	0.44	0.01K	0.02	0.020	0.030	146215	1.07	0.67
	1310	009	0.40	0.01K	0.03	0.020	0.070	146216	1.40	0.88
90/05/08	1255	000	0.33	0.01K	0.04	0.020	0.040	196215	0.64	1.08

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/05/08	1300	010	0.26	0.01K	0.08	0.040	0.090	196216	2.68	3.16
90/06/05	1420	000	0.33	0.01K	0.01K	0.010	0.030	236215	2.50	2.99
	1425	010	0.20	0.01K	0.12	0.030	0.050	236216	0.53	2.64
90/07/16	1355	000	0.16	0.01K	0.05	0.020	0.040	296215	1.28	2.89
	1400	010	0.13	0.01	0.10	0.040	0.070	296216	1.53	3.39
90/08/07	1330	000	0.17	0.01	0.10	0.030	0.060	326215	2.57	4.33
	1340	010	0.15	0.02	0.18	0.050	0.110	326216	2.78	6.48
90/09/05	1400	000	0.12	0.01	0.10	0.050	0.080	366215	1.85	3.91
	1410	010	0.09	0.01	0.10	0.050	0.140	366216	2.23	6.66

GYS008
GRAYS HARBOR AT MID SOUTH CHAN
46 56 15.0 123 54 43.0 2F 0 Elev= 0 ft
53027 Washington Grays Harbor Co. PACIFIC NORTHWEST
COASTAL (Lower Chehalis-22) 131222
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1245	000	16.7			7.6	34500	4.3		4	2.0	23.00
	1250	010	16.6			7.8	36800	24.0				25.00
89/11/14	1355	000	10.1	10.6	96.5	7.5			4.5	730L	0.5	4.91
	1400	007	10.1	10.2	99.2	7.8			6.8			15.71
90/01/17	1230	000	8.0	10.7	94.1	7.2			12.9	260S	0.6	7.22
	1235	004	8.2	10.5	95.0	7.2			5.2			11.18
90/03/05	1245	000	8.1	11.8	104.5	7.5			17.7	58S	0.7	8.05
	1250	003	8.1	11.5	104.0	7.5			0.2			11.42
90/04/02	1320	000	10.9	10.5	100.9	7.7			27.9	13J	1.2	10.96
	1325	003	10.4	10.0	98.7	7.6			12.1			17.00
90/05/08	1320	000	14.5	9.4	100.8	7.9			30.7	1K	1.1	16.60
	1325	005	12.4	9.3	97.9	8.0			3.7			20.57
90/06/05	1445	000	15.3	8.7	92.2	7.6			13.5	6	1.0	11.85
	1450	004	14.7	8.4	90.6	7.7			25.5			16.81
90/07/16	1420	000	19.3	7.3	88.5	7.7			1.5	16X	0.5	21.39
	1430	004	18.7	7.3	87.8	7.8			1.0			21.91
90/08/07	1355	000	17.7	6.8	83.1	7.7			6.9	1	0.5	27.57
	1405	006	17.3	6.8	82.6	7.7			3.1			27.82
90/09/05	1430	000	19.3	7.3	90.6	7.9			28.3	8	1.3	25.11
	1440	007	17.5	7.0	85.2	8.0			47.4			27.47

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1245	000	0.16	0.01	0.09	0.050	0.070	416217		
	1250	010	0.13	0.01	0.07	0.050	0.190	416218		
89/11/14	1355	000	0.55	0.01K	0.06	0.020	0.060	466217		
	1400	007	0.25	0.01K	0.06	0.030	0.050	466218		
90/01/17	1230	000	0.66	0.01	0.05	0.030	0.040	36217		
	1235	004	0.52	0.02	0.04	0.050	0.110	36218		
90/03/05	1245	000	0.43	0.01K	0.03	0.020	0.040	106217		
	1250	003	0.36	0.01K	0.04	0.040	0.110	106218		
90/04/02	1320	000	0.32	0.01K	0.03	0.030	0.040	146217		
	1325	003	0.23	0.01K	0.05	0.040	0.080	146218		
90/05/08	1320	000	0.19	0.01K	0.04	0.030	0.050	196217	0.95	1.55

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/05/08	1325	005	0.16	0.01K	0.04	0.030	0.070	196218	1.54	2.03
90/06/05	1445	000	0.18	0.01K	0.08	0.020	0.050	236217	0.71	1.30
	1450	004	0.11	0.01K	0.07	0.030	0.050	236218	1.26	2.35
90/07/16	1420	000	0.09	0.01	0.03	0.040	0.080	296217	6.30	6.88
	1430	004	0.08	0.01	0.02	0.040	0.080	296218	4.89	5.19
90/08/07	1355	000	0.12	0.01	0.07	0.050	0.090	326217	4.00	7.55
	1405	006	0.12	0.01	0.06	0.060	0.090	326218	2.52	7.30
90/09/05	1430	000	0.05	0.01	0.02	0.040	0.070	366217	4.97	6.38
	1440	007	0.05	0.01K	0.02	0.040	0.060	366218	1.34	2.58

GYS009
GRAYS HARBOR AT MOON IS REACH
46 57 53.0 123 56 54.0 2F 0 Elev= 0 ft
53027 Washington Grays Harbor Co. PACIFIC NORTHWEST
COASTAL (Lower Chehalis-22) 131222
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1255	000	16.7			8.0	37700	2.4		5	1.5	25.00
	1300	010	16.2			8.0	38800	1.6				27.00
89/11/14	1410	000	10.2			7.5			7.7	290L	0.5	6.20
	1435	010	10.7			8.1			8.9			23.62
90/01/17	1300	000	8.2	11.4	100.6	7.0			6.3	520S	0.5	7.04
	1310	005	8.4	10.8	100.3	7.0			5.2			14.54
90/03/05	1305	000	8.1	11.7	103.8	7.6			29.7	33S	0.8	8.36
	1315	009	8.6	10.6	104.2	7.8			5.9			22.51
90/05/08	1355	000	13.4	9.3	100.1	8.0			39.0	1K	1.6	20.84
	1400	010	11.2	8.5	90.0	8.0			23.6			25.29
90/06/05	1515	000	16.1	8.9	95.0	7.8			31.9	21	1.3	10.20
	1520	010	14.4	8.4	92.1	8.0			10.6			20.54
90/07/16	1440	000	19.4	7.2	85.9	7.7			11.5	38X	0.7	18.30
	1450	008	18.4	7.2	89.6	7.8			3.2			28.35
90/08/07	1420	000								3	1.0	
90/09/05	1450	000	19.2	7.7	96.0	8.0			37.7	12	1.6	26.18
	1455	010	16.3	6.9	82.9	8.0			52.7			29.03

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1255	000	0.12	0.01K	0.05	0.040	0.050	416219		
	1300	010	0.10	0.01K	0.05	0.040	0.040	416220		
89/11/14	1410	000	0.54	0.01K	0.06	0.030	0.040	466219		
	1435	010	0.11	0.01K	0.04	0.030	0.050	466220		
90/01/17	1300	000	0.64	0.01	0.05	0.030	0.040	36219		
90/03/05	1305	000	0.38	0.01K	0.03	0.020	0.040	106219		
	1315	009	0.19	0.01K	0.03	0.030	0.090	106220		
90/05/08	1355	000	0.18	0.01K	0.03	0.030	0.040	196219	1.64	1.75
	1400	010	0.15	0.01K	0.03	0.030	0.060	196220	1.36	1.72
90/06/05	1515	000	0.18	0.01K	0.08	0.020	0.040	236219	3.16	4.32
	1520	010	0.06	0.01K	0.05	0.020	0.050	236220	1.36	1.87
90/07/16	1440	000	0.11	0.01	0.10	0.050	0.070	296219	2.56	2.66
	1450	008	0.09	0.01K	0.06	0.050	0.070	296220	2.34	3.23
90/08/07	1420	000	0.11	0.01K	0.05	0.040	0.060	326219	2.31	4.59

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/08/07	1430	010	0.12	0.01K	0.05	0.050	0.140	326220	3.91	12.80
90/09/05	1450	000	0.04	0.01K	0.03	0.040	0.060	366219	1.94	3.38
	1455	010	0.07	0.01K	0.03	0.040	0.050	366220	1.24	2.44

HCB003
HOOD CANAL AT ELDON
47 32 17.0 123 00 30.0 2F 0 Elev= 0 ft
53045 Washington Mason Co. PACIFIC NORTHWEST
PUGET SOUND (Skokomisk/Dosewallips-16) 131116
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	0920	000	11.7			8.3	37900	0.6		1K	4.5	26.00
	0925	010	11.3			7.8	41100	0.5				29.00
	0930	030	10.8			7.5	41900	0.3				30.00
89/11/20	0945	000	9.9	8.9	89.9	7.9			10.5	1	12.0	22.27
	1000	010	10.5	6.9	74.4	7.8			87.9			30.05
	1015	025	10.4	5.8	62.6	7.8			86.2			30.57
89/12/13	0945	000	6.5	10.1	91.0	7.9			55.8	1K	4.4	16.70
	0950	010	9.8	7.5	79.3	7.7			85.3			29.35
	0955	026	10.3	6.2	66.7	7.7			87.9			30.47
90/02/12	1015	000	8.2	7.5	74.0	7.5			18.4	1K	2.0	24.37
	1030	010	9.4	7.3	76.6	7.5			78.9			29.47
	1045	030	9.3	7.0	73.6	7.6			83.6			30.05
90/03/12	1350	000								1K	5.1	22.80
	1355	010										29.35
	1400	030										30.35
90/04/09	1615	000	12.2	11.6	125.1	8.4			82.3	1K	8.1	24.94
	1620	010	9.4	13.9	145.1	8.4			81.1			28.75
	1625	023	8.5	7.4	76.3	7.9			85.1			29.71
90/05/14	1045	000	12.3	9.5	103.5	8.3			77.3	1K	6.4	26.16
	1050	010	9.8	9.2	97.3	8.1			83.8			29.36
	1100	030	8.9	6.5	67.6	7.8			85.8			29.81
90/06/11	1000	000	11.4	8.6	93.1	8.1			5.1	1K	4.5	28.03
	1010	010	10.8	8.9	95.6	8.0			64.5			28.61
	1020	030	9.2	5.8	60.8	7.7			85.1			29.96
90/07/24	1010	000	19.3	8.3	102.8	8.2			82.0	1K	8.0	24.87
	1020	010	13.2	10.4	117.9	8.3			77.4			29.45
	1030	030	11.2	6.7	73.1	8.0			85.7			29.70
90/08/13	1030	000	20.4	8.4	107.2	8.1			82.4	1K	8.5	26.30
	1040	010	12.6	10.3	115.5	8.2			75.8			29.56
	1050	030	10.6	5.2	56.1	7.7			87.4			29.83
90/09/12	0955	000	15.5	9.4	110.2	8.2			75.3	1	6.1	27.70
	1005	010	12.0	8.9	98.8	8.0			83.6			29.80
	1015	026	10.2	3.8	40.7	7.7			87.5			29.98

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	0920	000	0.01K	0.01K	0.01K	0.020	0.040	426250		
	0925	010	0.20	0.01K	0.01K	0.060	0.080	426251		
	0930	030	0.38	0.01K	0.01K	0.100	0.100	426252		
89/11/20	0945	000	0.30	0.01K	0.01K	0.070	0.070	476250		
	1000	010	0.39	0.01K	0.01K	0.090	0.090	476251		
	1015	025	0.39	0.01K	0.01K	0.090	0.090	476252		
89/12/13	0945	000	0.20	0.01K	0.01K	0.030	0.060	506250		
	0950	010	0.33	0.01K	0.01K	0.080	0.210	506251		
	0955	026	0.35	0.01K	0.01K	0.090	0.080	506252		
90/02/12	1015	000	0.26	0.01K	0.01K	0.080	0.090	76250		
	1030	010	0.28	0.01K	0.01K	0.090	0.090	76251		
	1045	030	0.29	0.01K	0.01K	0.090	0.090	76252		
90/03/12	1350	000	0.21	0.01K	0.01K	0.050	0.060	116250		
	1355	010	0.34	0.01K	0.01K	0.080	0.080	116251		
	1400	030	0.40	0.01K	0.01K	0.080	0.090	116252		
90/04/09	1615	000	0.01K	0.01K	0.01K	0.010	0.020	156250	0.34	0.37
	1620	010	0.02	0.01K	0.01K	0.030	0.030	156251	0.73	1.51
	1625	023	0.34	0.01K	0.02	0.080	0.090	156252	0.50	1.45
90/05/14	1045	000	0.01K	0.01K	0.01K	0.020	0.040	206250	0.95	1.02
	1050	010	0.26	0.01K	0.01	0.070	0.070	206251	0.86	1.30
	1100	030	0.39	0.01K	0.01K	0.090	0.090	206252	0.15	0.55
90/06/11	1000	000	0.07	0.01K	0.01K	0.040	0.060	246250	6.49	5.89
	1010	010	0.17	0.01K	0.01K	0.050	0.070	246251	1.01	1.07
	1020	030	0.39	0.01K	0.01K	0.090	0.100	246252	0.27	0.68
90/07/24	1010	000	0.01K	0.01K	0.01K	0.030	0.030	306250	0.08	0.06
	1020	010	0.05	0.01K	0.01K	0.030	0.050	306251	0.36	0.98
	1030	030	0.22	0.01K	0.01K	0.060	0.070	306252	0.10	0.62
90/08/13	1030	000	0.01K	0.01K	0.01K	0.030	0.040	336250	0.39	0.39
	1040	010	0.13	0.01K	0.01K	0.050	0.060	336251	1.57	1.59
	1050	030	0.28	0.01K	0.01K	0.080	0.090	336252	0.14	0.41
90/09/12	0955	000	0.02	0.01K	0.01K	0.030	0.040	376250	1.75	1.31
	1005	010	0.32	0.01K	0.01	0.070	0.080	376251	1.14	2.32
	1015	026	0.45	0.01K	0.01K	0.090	0.090	376252	0.14	0.67

HCB006
HOOD CANAL NEAR KING SPIT
47 44 52.0 122 43 49.0 2F 0 Elev= 0 ft
53035 Washington Kitsap Co. PACIFIC NORTHWEST
PUGET SOUND (Kitsap-15) 131115
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/STREAM

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	0950	000	11.4			7.7	42300	0.5		1	7.4	30.00
	0955	010	11.2			7.8	42200	0.5				29.00
	1000	030	11.2			7.8	42300	0.5				29.00
89/11/20	1030	000	9.8	9.2	95.0	8.0			36.7	1K	9.5	25.96
	1045	010	10.0	8.0	85.3	7.9			80.1			30.05
	1100	027	10.5	7.3	78.8	7.9			76.5			30.21
89/12/13	1035	000	7.6	9.0	88.7	7.9			77.3	1K	4.7	26.20
	1040	010	8.8	8.1	83.5	7.8			78.9			28.90
	1045	027	9.1	7.8	81.4	7.8			78.9			29.69
90/02/12	1100	000	8.1	7.9	80.2	7.6			30.0	1K	9.1	28.82
	1115	010	8.1	9.0	91.6	7.7			80.7			29.25
	1130	030	8.1	9.1	92.7	7.8			80.2			29.28
90/03/12	1315	000								1K	5.0	27.64
	1320	010										29.48
	1325	030										30.34
90/04/09	1525	000	12.3	11.8	125.9	8.5			74.9	1K	4.5	22.96
	1530	010	9.5	11.3	118.0	8.2			70.6			28.57
	1535	030	8.6	8.0	82.7	8.0			78.3			29.90
90/05/14	1140	000	12.7	10.6	116.8	8.4			75.5	1K	5.9	26.60
	1145	010	10.4	10.0	107.1	8.2			74.5			29.44
	1150	030	9.6	7.6	80.3	8.0			75.9			29.95
90/06/11	1050	000	13.5	10.5	118.3	8.3			67.8	1K	4.7	27.60
	1100	010	11.2	9.4	102.5	8.1			70.7			29.58
	1110	030	10.0	6.7	71.5	7.9			79.8			30.16
90/07/24	1045	000	19.3	8.5	108.7	8.3			81.2	1K	11.5	29.94
	1055	010	15.1	7.5	87.9	8.1			84.4			28.88
	1105	030	11.9	6.2	68.7	8.0			85.1			29.94
90/08/13	1110	000	20.2	8.8	112.9	8.1			84.3	1	7.4	27.82
	1120	010	14.1	8.7	100.5	8.1			72.9			29.55
	1130	030	12.1	6.2	69.1	7.9			79.1			30.19
90/09/12	1040	000	15.4	9.4	110.9	8.2			80.1	1K	9.1	28.91
	1045	010	12.7	7.1	80.0	8.0			81.4			30.05
	1050	030	12.1	5.9	65.9	7.9			78.9			30.48

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	0950	000	0.30	0.01K	0.01K	0.080	0.080	426253		
	0955	010	0.31	0.01K	0.01K	0.080	0.080	426254		
	1000	030	0.32	0.01K	0.01K	0.080	0.090	426255		
89/11/20	1030	000	0.30	0.01K	0.01K	0.070	0.070	476253		
	1045	010	0.36	0.01K	0.01K	0.080	0.080	476254		
	1100	027	0.37	0.01K	0.01K	0.080	0.090	476255		
89/12/13	1035	000	0.30	0.01K	0.01K	0.070	0.070	506253		
	1040	010	0.33	0.01K	0.01K	0.080	0.080	506254		
	1045	027	0.34	0.01K	0.01K	0.080	0.080	506255		
90/02/12	1100	000	0.28	0.01K	0.01K	0.080	0.090	76253		
	1115	010	0.28	0.01K	0.01K	0.080	0.080	76254		
	1130	030	0.28	0.01K	0.01K	0.080	0.080	76255		
90/03/12	1315	000	0.15	0.01K	0.01K	0.040	0.060	116253		
	1320	010	0.34	0.01K	0.01K	0.080	0.080	116254		
	1325	030	0.38	0.01K	0.01K	0.080	0.070	116255		
90/04/09	1525	000	0.01K	0.01K	0.01K	0.010K	0.020	156253		
	1530	010	0.24	0.01K	0.01	0.060	0.070	156254		
	1535	030	0.27	0.01K	0.03	0.070	0.070	156255		
90/05/14	1140	000	0.01K	0.01K	0.01K	0.020	0.030	206253	0.60	0.88
	1145	010	0.23	0.01K	0.02	0.060	0.060	206254	1.08	1.29
	1150	030	0.29	0.01K	0.03	0.070	0.070	206255	0.25	0.54
90/06/11	1050	000	0.01K	0.01K	0.01K	0.020	0.030	246253	2.27	2.45
	1100	010	0.12	0.01K	0.01	0.040	0.060	246254	4.65	3.64
	1110	030	0.33	0.01K	0.03	0.080	0.070	246255	0.24	0.76
90/07/24	1045	000	0.01K	0.01K	0.01K	0.020	0.030	306253	0.23	0.37
	1055	010	0.12	0.01K	0.01K	0.040	0.050	306254	0.32	0.58
	1105	030	0.23	0.01K	0.01K	0.070	0.100	306255	0.15	0.40
90/08/13	1110	000	0.01K	0.01K	0.01K	0.030	0.030	336253	0.68	0.71
	1120	010	0.09	0.01K	0.01K	0.040	0.060	336254	5.47	5.30
	1130	030	0.19	0.01K	0.04	0.060	0.060	336255	1.05	1.98
90/09/12	1040	000	0.03	0.01K	0.01K	0.030	0.030	376253	1.09	1.26
	1045	010	0.27	0.01K	0.01K	0.060	0.060	376254	0.78	1.30
	1050	030	0.29	0.01K	0.02	0.070	0.070	376255	0.33	0.73

NRR001
TACOMA NARROWS NR POINT DEFIANCE
47 19 00.0 122 32 55.0 2F 0 Elev= 0 ft
53053 Washington Pierce Co. PACIFIC NORTHWEST
PUGET SOUND (Chambers/Clover-12) 131112
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1135	000	11.9			8.0	42900	0.4		1K	10.0	31.00
	1140	010	11.7			8.0	42700	0.4				31.00
	1145	030	11.7			8.0	43000	0.5				32.00
89/11/27	1155	000	10.9	6.9	75.2	7.9			78.2	1K	8.7	30.47
	1210	010	10.9	7.4	80.6	7.9			83.6			30.38
	1215	029	10.9	7.4	80.6	7.9			84.2			30.40
89/12/18	1450	000	10.3	7.2	77.1	7.9			6.5	1K	6.8	29.73
	1455	010	10.3	7.5	80.4	7.9			80.3			29.93
	1500	029	10.3	7.5	80.4	7.9			80.0			29.93
90/01/29	1235	000	8.9	8.6	89.2	7.7			78.0	3	5.2	29.40
	1240	010	8.9	8.7	90.3	7.7			77.1			29.43
	1245	030	8.9	8.7	90.3	7.7			77.5			29.50
90/02/26	1345	000	8.1	9.5	96.5	7.9			79.5	2	7.2	28.83
	1355	010	8.1	9.4	95.5	7.9			79.7			28.99
	1410	030	8.1	9.3	94.7	7.9			79.6			29.29
90/03/20	1155	000	9.1			7.9				1K	9.1	26.53
	1200	010	8.7			7.9						26.28
	1205	030	8.4			7.8						27.90
90/04/16	1220	000	9.0	9.6	99.6	7.9			80.4	4	7.5	29.11
	1225	010	8.9	10.0	103.4	8.0			80.2			29.00
	1230	030	8.9	9.8	101.4	8.0			80.5			28.99
90/05/21	1330	000	9.0	7.5	78.2	8.0			84.1	1K	11.5	29.78
	1340	010	9.0	7.7	80.3	8.0			83.9			29.82
	1350	030	9.0	7.7	80.3	8.0			84.2			29.79
90/06/19	1250	000	9.9	6.6	70.2	7.8			84.5	1K	7.5	29.88
	1300	010	9.9	6.9	73.4	7.9			84.1			29.87
	1310	030	9.9	6.9	73.4	7.8			84.1			29.89
90/07/31	1350	000	11.7	6.4	70.6				82.5	1K	9.6	29.77
	1400	010	11.3	6.3	68.9				82.3			29.85
	1410	030	11.3	6.2	67.9				82.4			29.88
90/08/27	1400	000	13.2	8.1	92.0	8.0			84.4	1K	10.0	29.73
	1410	010	12.3	6.7	74.9	7.9			84.4			30.06
	1420	029	12.2	6.3	70.3	7.9			84.1			30.13
90/09/17	1425	000	12.2			7.8			81.7	2	9.0	30.51

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1135	000	0.26	0.01	0.02	0.080	0.080	436312		
	1140	010	0.27	0.01	0.02	0.080	0.080	436313		
	1145	030	0.26	0.01	0.02	0.080	0.080	436314		
89/11/27	1155	000	0.34	0.01K	0.01K	0.080	0.090	486312		
	1210	010	0.35	0.01K	0.01K	0.080	0.090	486313		
	1215	029	0.35	0.01K	0.01K	0.080	0.090	486314		
89/12/18	1450	000	0.32	0.01K	0.01K	0.080	0.090	516312		
	1455	010	0.32	0.01K	0.01K	0.080	0.090	516313		
	1500	029	0.32	0.01K	0.01K	0.080	0.080	516314		
90/01/29	1235	000	0.32	0.01K	0.01K	0.080	0.090	56312		
	1240	010	0.32	0.01K	0.01K	0.080	0.090	56313		
	1245	030	0.32	0.01K	0.01K	0.080	0.090	56314		
90/02/26	1345	000	0.37	0.01K	0.01K	0.080	0.080	96312		
	1355	010	0.37	0.01K	0.01K	0.080	0.080	96313		
	1410	030	0.37	0.01K	0.01K	0.080	0.080	96314		
90/03/20	1155	000	0.33	0.01K	0.01K	0.080	0.070	126312		
	1200	010	0.33	0.01K	0.01K	0.080	0.070	126313		
	1205	030	0.35	0.01K	0.01K	0.080	0.080	126314		
90/04/16	1220	000	0.22	0.01K	0.02	0.060	0.070	166312		
	1225	010	0.22	0.01K	0.01K	0.060	0.070	166313		
	1230	030	0.22	0.01K	0.02	0.060	0.060	166314		
90/05/21	1330	000	0.28	0.02	0.03	0.070	0.070	216312	0.13	0.45
	1340	010	0.29	0.02	0.03	0.070	0.070	216313	0.18	0.44
	1350	030	0.30	0.02	0.02	0.070	0.070	216314	0.05	0.88
90/06/19	1250	000	0.26	0.01K	0.02	0.070	0.070	256312	0.17	0.47
	1300	010	0.27	0.01K	0.02	0.070	0.070	256313	0.07	0.28
	1310	030	0.27	0.01K	0.02	0.070	0.070	256314	0.07	0.26
90/07/31	1350	000	0.33	0.01K	0.01K	0.060	0.070	316312	0.59	0.53
	1400	010	0.33	0.01K	0.01K	0.060	0.070	316313	0.47	0.50
	1410	030	0.34	0.01K	0.01K	0.060	0.070	316314	0.20	0.39
90/08/27	1400	000	0.19	0.01K	0.01K	0.040	0.060	356312	1.36	1.09
	1410	010	0.24	0.01K	0.01K	0.050	0.070	356313	0.76	0.78
	1420	029	0.25	0.01K	0.01K	0.050	0.070	356314	0.58	0.59
90/09/17	1425	000	0.31	0.01	0.01K	0.070	0.080	386312	0.11	0.58
	1435	010	0.31	0.01	0.01K	0.070	0.070	386313	0.11	0.44
	1445	030	0.31	0.01	0.01K	0.070	0.080	386314	0.09	0.42

NSQ001
NISQUALLY REACH AT NISQUALLY R
47 06 45.0 122 41 50.0 2F 0 Elev= 0 ft
53067 Washington Thurston Co. PACIFIC NORTHWEST
PUGET SOUND (Nisqually-11) 131111
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1040	000	14.3			8.1	41400	0.3		1K	6.1	30.00
	1045	010	14.2			8.1	43400	0.4				30.00
89/11/14	1030	000	9.9	8.3	83.9	7.9			0.5	57	0.3	22.36
	1035	010	11.3	7.3	80.1	7.8			77.5			30.29
89/12/05	1205	000	10.3	7.9	81.0	7.7			1.1	37	0.4	23.33
	1215	010	10.8	7.9	85.7	7.9			80.4			30.03
90/01/16	1115	000	8.6	9.5	93.0	7.9			2.7	15	0.5	21.97
	1125	010	9.3	8.6	89.6	7.9			58.7			28.81
90/02/06	1105	000	7.7	9.8	96.4	7.7			61.4	2	4.2	25.55
	1125	010	8.5	9.2	94.3	7.7			78.2			29.00
90/03/05	1010	000	8.3	9.1	92.3	7.9			75.8	1	6.0	27.99
	1025	010	8.1	9.1	92.3	7.8			78.0			28.71
90/04/02	1040	000	9.2	9.9	94.6	7.8			8.2	9J	4.9	16.21
	1045	008	8.8	9.8	100.8	7.9			78.0			28.46
90/05/08	1010	000	10.1	9.6	100.3	8.1			61.6	1	2.9	26.68
	1015	010	9.9	10.0	105.5	8.1			70.2			28.74
90/06/05	1040	000	11.6	9.5	100.2	8.2			5.8	52	5.7	23.39
	1050	010	11.1	9.5	102.8	8.1			78.6			28.85
90/07/16	1040	000	13.1	8.4	94.9	8.0			84.1	1K	14.0	29.20
	1050	010	12.4	8.0	89.2	8.0			86.2			29.26
90/08/07	1030	000	14.8	8.7	100.1	8.0			63.5	20	6.5	26.84
	1040	010	13.9	8.7	99.9	8.0			80.8			29.30
90/09/05	1045	000								19	6.7	

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1040	000	0.17	0.01K	0.03	0.070	0.080	416204		
	1045	010	0.21	0.01K	0.03	0.070	0.070	416205		
89/11/14	1030	000	0.21	0.01	0.03	0.080	0.090	466204		
	1035	010	0.21	0.01	0.02	0.070	0.090	466205		
89/12/05	1205	000	0.35	0.01K	0.01	0.090	0.080	496204		
	1215	010	0.35	0.01K	0.01K	0.080	0.080	496205		
90/01/16	1115	000	0.38	0.01K	0.03	0.080	0.090	36204		
	1125	010	0.35	0.01K	0.01K	0.080	0.090	36205		

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/02/06	1105	000	0.32	0.01K	0.01K	0.080	0.080	66204		
	1125	010	0.31	0.01K	0.01K	0.090	0.080	66205		
90/03/05	1010	000	0.31	0.01K	0.01K	0.080	0.090	106204		
	1025	010	0.32	0.01K	0.01K	0.080	0.090	106205		
90/04/02	1040	000	0.32	0.01K	0.01	0.060	0.070	146204		
	1045	008	0.34	0.01K	0.01	0.070	0.070	146205		
90/05/08	1010	000	0.16	0.01K	0.02	0.030	0.060	196204	0.91	1.80
	1015	010	0.16	0.01K	0.01	0.040	0.060	196205	2.08	1.60
90/06/05	1040	000	0.14	0.01K	0.02	0.050	0.060	236204	1.92	2.36
	1050	010	0.18	0.01	0.03	0.050	0.060	236205	1.59	1.86
90/07/16	1040	000	0.16	0.01K	0.02	0.060	0.060	296204	0.85	0.82
	1050	010	0.17	0.01K	0.02	0.060	0.060	296205	0.62	0.50
90/08/07	1030	000	0.11	0.01K	0.02	0.050	0.070	326204	4.90	4.17
	1040	010	0.15	0.01K	0.02	0.060	0.070	326205	4.70	3.40
90/09/05	1045	000	0.10	0.01K	0.02	0.050	0.080	366204	3.08	2.78
	1055	010	0.12	0.01K	0.02	0.060	0.080	366205	4.19	3.83

OAK004
OAKLAND BAY NEAR EAGLE POINT
47 12 49.0 123 04 35.0 2F 0 Elev= 0 ft
53045 Washington Mason Co. PACIFIC NORTHWEST
PUGET SOUND (Kennedy/Goldsboro-14) 131114
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1150	000	16.1			8.2	39600	1.1		2	3.8	29.00
	1200	010	15.8			8.2	40300	1.2				29.00
89/11/14	1245	000	10.6			7.8			40.4	18	1.5	23.29
	1300	006	10.7			7.8			49.0			25.47
89/12/05	1410	000	9.8	9.9	95.4	7.7			11.7	147S	0.7	15.43
	1425	010	9.8	9.9	101.5	7.9			46.9			24.84
90/01/16	1255	000	8.4	9.2	87.2	7.8			12.6	11	2.2	17.76
	1300	010	8.5	9.4	92.6	7.9			57.1			23.12
90/02/06	1355	000	5.9	11.8	102.7	7.6			35.3	24	1.4	13.66
	1430	007	7.0	10.7	101.5	7.6			61.4			22.58
90/03/05	1150	000	8.6	10.1	98.2	7.8			68.1	3	3.0	20.88
	1155	010	8.3	9.6	95.3	7.8			67.9			24.96
90/04/02	1205	000	10.8	9.9	102.2	8.0			41.3	3J	3.5	22.71
	1215	009	10.0	10.2	105.6	7.9			65.8			25.71
90/05/08	1215	000	14.2	8.7	97.3	8.2			48.9	1K	1.8	24.37
	1220	007	13.1	10.3	113.5	8.3			45.3			25.38
90/06/05	1340	000	16.8	7.6	88.4	7.9			37.2	7	1.5	22.35
	1345	009	14.1	8.6	97.1	8.0			51.3			26.01
90/07/16	1300	000	19.2	10.3	129.6	8.2			71.6	1	5.0	27.70
	1310	008	18.9	10.3	129.0	8.2			68.4			27.80
90/08/07	1240	000	21.1	9.8	127.5	8.1			67.0	1K	2.1	27.31
	1250	008	18.8	11.1	139.1	8.3			67.2			28.20
90/09/05	1315	000	19.6	5.7	72.0	7.8			44.5	2	2.0	27.05
	1325	004	18.1	7.5	92.6	7.9			53.4			27.96

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1150	000	0.01K	0.01K	0.01K	0.070	0.070	416213		
	1200	010	0.01K	0.01K	0.01K	0.060	0.080	416214		
89/11/14	1245	000	0.19	0.01	0.08	0.070	0.080	466213		
	1300	006	0.19	0.01	0.08	0.070	0.090	466214		
89/12/05	1410	000	0.35	0.01K	0.06	0.070	0.070	496213		
	1425	010	0.34	0.01	0.07	0.080	0.080	496214		
90/01/16	1255	000	0.34	0.01K	0.04	0.070	0.070	36213		

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/01/16	1300	010	0.36	0.01K	0.03	0.080	0.080	36214		
90/02/06	1355	000	0.28	0.01K	0.02	0.050	0.050	66213		
	1430	007	0.31	0.01K	0.02	0.080	0.080	66214		
90/03/05	1150	000	0.29	0.01K	0.01	0.070	0.080	106213		
	1155	010	0.31	0.01K	0.02	0.080	0.080	106214		
90/04/02	1205	000	0.23	0.01K	0.01	0.050	0.060	146213		
	1215	009	0.29	0.01K	0.01	0.060	0.080	146214		
90/05/08	1215	000	0.01K	0.01K	0.01	0.030	0.040	196213	1.79	1.88
	1220	007	0.01K	0.01K	0.01K	0.030	0.050	196214	5.83	5.54
90/06/05	1340	000	0.08	0.01K	0.05	0.040	0.060	236213	2.15	2.56
	1345	009	0.08	0.01K	0.04	0.040	0.060	236214	1.52	1.82
90/07/16	1300	000	0.01K	0.01K	0.01K	0.060	0.060	296213	1.82	1.78
	1310	008	0.01K	0.01K	0.01K	0.040	0.060	296214	2.37	2.39
90/08/07	1240	000	0.01K	0.01K	0.01K	0.070	0.080	326213	3.32	2.84
	1250	008	0.01K	0.01K	0.01K	0.070	0.090	326214	9.55	6.57
90/09/05	1315	000	0.05	0.01	0.06	0.080	0.100	366213	1.31	2.24
	1325	004	0.03	0.01K	0.02	0.060	0.090	366214	5.55	6.26

PAH008
PORT ANGLES HBR AT MORSE CREEK
47 07 18.0 123 21 00.0 1F 0 Elev= 0 ft
53009 Washington Clallam Co. PACIFIC NORTHWEST
PUGET SOUND (Elwha/Dungeness-18) 131118
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	1030	000	9.6			7.7	45500	0.4		5	12.8	33.00
	1035	010	9.4			7.7	44900	0.4				33.00
89/11/20	1125	000	8.8	6.0	63.3	7.8			74.3	1	5.1	32.06
	1140	010	8.7	6.0	63.3	7.9			84.0			32.29
89/12/13	1130	000	8.4	7.3	76.0	7.9			82.2	1	5.0	31.44
	1135	010	8.6	7.0	73.3	7.9			79.4			31.68
90/02/12	1215	000	7.6	9.8	99.4	7.9			68.8	1K	4.6	30.23
	1230	010	7.6	10.0	101.6	7.9			66.7			30.49
90/03/12	1235	000								1K	6.3	30.50
	1240	010										30.56
90/04/09	1440	000	8.7	7.5	78.6	7.9			75.0		6.5	31.41
	1445	010	8.1	7.0	72.9	7.9			82.8			32.32
90/05/14	1225	000	9.4	8.5	90.4	8.0			78.0	1K	7.4	31.36
	1230	010	9.0	7.8	82.4	8.0			81.2			31.70
90/07/24	1145	000	10.7	6.4	69.9	7.9			85.6	1	13.2	31.36
	1155	010	10.0	5.9	63.7	7.9			86.0			31.69
90/08/13	1205	000	11.4	7.6	84.1	7.9			85.2	1K	12.0	31.15
	1215	010	10.8	7.2	78.9	7.9			83.9			31.54
90/09/12	1145	000	10.4	5.4	58.9	7.8			85.3	1K	14.1	31.95
	1155	010	9.8	5.0	53.9	7.8			85.7			32.28

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	1030	000	0.36	0.01K	0.01K	0.080	0.080	426256		
	1035	010	0.36	0.01K	0.01K	0.080	0.080	426257		
89/11/20	1125	000	0.39	0.01K	0.01	0.080	0.080	476256		
	1140	010	0.40	0.01K	0.01K	0.080	0.080	476257		
89/12/13	1130	000	0.30	0.01K	0.01K	0.070	0.070	506256		
	1135	010	0.32	0.01K	0.01K	0.070	0.070	506257		
90/02/12	1215	000	0.19	0.01K	0.01K	0.060	0.060	76256		
	1230	010	0.19	0.01K	0.01K	0.060	0.060	76257		
90/03/12	1235	000	0.17	0.01K	0.01K	0.040	0.040	116256		
	1240	010	0.19	0.01K	0.01K	0.040	0.050	116257		
90/04/09	1440	000	0.30	0.01K	0.02	0.070	0.070	156256	0.34	0.48

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/04/09	1445	010	0.33	0.01K	0.01K	0.070	0.070	156257	0.25	0.52
90/05/14	1225	000	0.29	0.01K	0.01	0.060	0.060	206256	1.02	1.26
	1230	010	0.30	0.01K	0.01	0.060	0.070	206257	0.52	0.76
90/07/24	1145	000	0.26	0.01K	0.01K	0.060	0.070	306256	0.07	0.28
	1155	010	0.27	0.01K	0.01K	0.070	0.070	306257	0.16	0.32
90/08/13	1205	000	0.21	0.01K	0.01	0.060	0.060	336256	1.12	1.28
	1215	010	0.22	0.01K	0.01	0.060	0.060	336257	1.95	2.24
90/09/12	1145	000	0.37	0.01K	0.01K	0.070	0.070	376256	1.08	1.04
	1155	010	0.37	0.01K	0.01K	0.070	0.070	376257	0.48	0.66

PSB003
PUGET SOUND AT WEST POINT
47 39 36.0 122 26 30.0 2F 0 Elev= 0 ft
53033 Washington King Co. PACIFIC NORTHWEST
Puget Sound 131191
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/23	1020	000	12.0			8.0	42400	0.3		12	10.5	31.00
	1025	010	11.9			8.0	42500	0.4				31.00
	1030	030	11.7			8.0	43200	0.4				31.00
89/11/27	1000	000	10.3	8.2	87.7	7.9			84.5	11	8.1	29.49
	1015	010	10.6	7.9	85.4	7.9			86.5			30.13
	1030	022	10.7	7.9	85.6	7.9			86.5			30.22
89/12/18	1245	000	9.1	8.3	85.7	7.9			82.1	1K	8.3	28.17
	1250	010	9.2	8.5	88.2	7.9			84.0			28.59
	1255	030	10.0	7.7	81.7	7.9			83.9			29.37
90/02/26	1140	000	8.0	9.6	97.2	7.9			78.7	2	6.0	28.75
	1150	010	8.0	9.4	95.2	7.9			81.3			28.86
	1205	026	8.1	9.2	93.6	7.9			82.0			29.08
90/03/20	1035	000	9.7			7.9				2	5.3	25.08
	1040	010	8.8			7.9						27.07
	1045	030	8.8			7.8						27.50
90/04/16	1030	000	9.3	10.6	110.3	7.9			79.5	1K	6.7	28.64
	1035	010	8.8	9.8	101.3	7.9			82.1			29.17
	1040	030	8.8	9.3	96.2	7.9			84.0			29.25
90/05/21	1050	000	10.4	8.7	92.9	8.1			85.9	1K	14.5	28.94
	1100	010	9.9	8.7	92.1	8.1			86.1			29.29
	1110	027	9.4	8.3	87.2	8.0			85.0			29.63
90/06/19	1050	000	13.7	11.5	129.1	8.3			59.0	1K	2.5	26.38
	1055	010	11.5	10.2	111.1	8.1			68.0			28.59
	1105	025	10.5	8.4	90.1	7.9			81.7			29.40
90/07/31	1040	000	13.7	8.2	93.8				73.5	1K	5.3	29.29
	1050	010	13.2	8.0	90.7				79.2			29.40
	1100	030	12.2	7.2	80.1				83.8			29.57
90/08/27	1050	000	12.9	8.4	94.9	8.0			79.1	1K	8.8	29.84
	1100	010	12.7	7.7	86.7	7.9			83.5			29.92
	1110	030	12.7	7.3	82.2	7.9			85.3			29.95
90/09/17	1150	000	12.7	6.7	75.5	7.9			82.1	1	16.0	30.10

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/23	1020	000	0.25	0.02	0.02	0.080	0.080	436303		
	1025	010	0.25	0.02	0.02	0.080	0.080	436304		
	1030	030	0.26	0.01	0.03	0.080	0.080	436305		
89/11/27	1000	000	0.35	0.01K	0.01K	0.080	0.090	486303		
	1015	010	0.35	0.01K	0.01K	0.080	0.090	486304		
	1030	022	0.35	0.01K	0.01K	0.080	0.090	486305		
89/12/18	1245	000	0.32	0.01K	0.01K	0.080	0.090	516303		
	1250	010	0.31	0.01K	0.01K	0.080	0.090	516304		
	1255	030	0.31	0.01K	0.01K	0.080	0.090	516305		
90/02/26	1140	000	0.36	0.01K	0.09	0.100	0.110	96303		
	1150	010	0.36	0.01K	0.01K	0.080	0.090	96304		
	1205	026	0.37	0.01K	0.01K	0.080	0.090	96305		
90/03/20	1035	000	0.34	0.01K	0.01K	0.070	0.070	126303		
	1040	010	0.32	0.01K	0.01K	0.070	0.070	126304		
	1045	030	0.34	0.01K	0.01K	0.080	0.080	126305		
90/04/16	1030	000	0.21	0.01K	0.01	0.060	0.070	166303	1.77	1.67
	1035	010	0.24	0.01K	0.02	0.070	0.070	166304	2.08	1.69
	1040	030	0.25	0.01K	0.02	0.070	0.070	166305	1.22	1.56
90/05/21	1050	000	0.16	0.01	0.05	0.050	0.060	216303	0.17	0.34
	1100	010	0.18	0.01	0.04	0.050	0.060	216304	0.44	0.53
	1110	027	0.22	0.01	0.05	0.060	0.060	216305	0.23	0.44
90/06/19	1050	000	0.03	0.01K	0.01K	0.020	0.050	256303	3.64	2.59
	1055	010	0.12	0.01K	0.02	0.040	0.050	256304	1.89	1.76
	1105	025	0.21	0.01K	0.04	0.060	0.070	256305	0.54	0.88
90/07/31	1040	000	0.22	0.01K	0.01K	0.050	0.070	316303	2.37	1.99
	1050	010	0.23	0.01K	0.01K	0.050	0.060	316304	1.78	1.74
	1100	030	0.30	0.01K	0.03	0.060	0.070	316305	0.17	0.05
90/08/27	1050	000	0.19	0.01K	0.03	0.050	0.080	356303	8.21	6.84
	1100	010	0.21	0.01K	0.01K	0.040	0.070	356304	3.58	2.79
	1110	030	0.23	0.01K	0.01	0.050	0.070	356305	0.62	0.80
90/09/17	1150	000	0.24	0.01	0.03	0.070	0.070	386303	0.24	0.42
	1200	010	0.25	0.01	0.04	0.070	0.070	386304	0.15	0.23
	1210	030	0.26	0.01	0.02	0.070	0.070	386305	0.14	0.32J

PSS019
POSSESSION SOUND OFF EAST GEDNEY ISLAND
48 00 40.0 122 18 00.0 2F 0 Elev= 0 ft
53061 Washington Snohomish Co. PACIFIC NORTHWEST
PUGET SOUND (Snohomish-07) 131107
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	1410	000	17.3			7.7	39500	0.5		1	7.9	27.00
	1415	010	12.4			7.6	42300	0.3				29.00
	1420	030				9.0	42700	0.4				30.00
89/11/20	1510	000	9.3	10.7	102.1	7.9			63.2	36	2.5	15.52
	1515	010	10.7	8.0	85.8	7.9			83.5			28.77
	1520	025	10.8	7.6	82.5	7.9			84.9			30.23
89/12/13	1430	000	6.7	12.3	108.1	7.8			51.9	2	1.9	12.10
	1435	010	10.2	8.2	86.8	7.8			80.7			28.29
90/03/12	0940	000								30X	1.7	15.85
	0945	010										28.10
	0950	030										29.58
90/04/09	0925	000	21.7	7.2	85.6	8.1			56.0	18	2.3	10.02
	0930	010	20.4	8.1	100.6	7.7			82.3			21.87
	0935	030	17.7	7.0	83.4	7.6			86.4			23.40
90/05/14	1550	000	11.3	12.2	125.6	8.6			60.5	1	3.6	20.69
	1555	010	10.3	11.0	116.5	8.3			78.0			28.07
	1605	030	9.1	8.9	92.7	8.0			86.0			29.34
90/06/11	1600	000	12.8	11.2	113.5	8.4			44.6	18	2.8	13.08
	1610	010	10.3	8.8	93.6	8.0			85.8			28.66
	1620	030	9.2	7.4	77.3	7.9			86.4			29.50
90/07/24	1540	000	17.0	9.5	111.4	8.3			75.0	1K	7.0	23.06
	1545	010	13.1	9.7	109.1	8.2			82.4			28.54
	1550	030	11.2	7.0	76.2	8.0			88.4			29.44
90/08/13	1600	000	16.3	10.9	128.9	8.2			65.9	1K	4.6	26.62
	1610	010	12.4	8.5	94.7	8.1			83.9			29.14
	1620	030	11.4	6.6	72.2	7.9			87.1			29.53
90/09/12	1625	000	14.8	13.4	98.2	8.5			47.8	1	2.6	27.46
	1630	010	11.7	6.9	76.0	7.9			86.0			29.66
	1635	030	11.5	5.5	60.4	7.9			86.3			29.86

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	1410	000	0.25	0.01K	0.01	0.070	0.070	426269		
	1415	010	0.28	0.01K	0.11	0.080	0.080	426270		
	1420	030	0.33	0.01K	0.01K	0.080	0.080	426271		
89/11/20	1510	000	0.35	0.01K	0.04	0.050	0.060	476269		
	1515	010	0.36	0.01K	0.01K	0.080	0.080	476270		
	1520	025	0.36	0.01K	0.01K	0.080	0.090	476271		
89/12/13	1430	000	0.30	0.01K	0.02	0.030		506269		
	1435	010						506270		
90/03/12	0940	000	0.35	0.01K	0.02	0.040	0.050	116269		
	0945	010	0.37	0.01K	0.01K	0.070	0.080	116270		
	0950	030	0.40	0.01K	0.01K	0.080	0.080	116271		
90/04/09	0925	000	0.05	0.01K	0.01	0.010K	0.010	156269		
	0930	010	0.27	0.01K	0.01	0.060	0.070	156270		
	0935	030	0.34	0.01K	0.01	0.080	0.070	156271		
90/05/14	1550	000	0.01K	0.01K	0.01K	0.010K	0.020	206269	7.12	3.97
	1555	010	0.16	0.01K	0.03	0.050	0.060	206270	3.81	2.73
	1605	030	0.28	0.01	0.03	0.070	0.070	206271	0.24	0.55
90/06/11	1600	000	0.08	0.01K	0.02	0.010	0.020	246269	1.97	1.97
	1610	010	0.26	0.01K	0.02	0.060	0.070	246270	0.66	1.02
	1620	030	0.35	0.01K	0.01K	0.070	0.070	246271	0.08	0.25
90/07/24	1540	000	0.01K	0.01K	0.01	0.020	0.030	306269	0.99	0.84
	1545	010	0.14	0.01K	0.01K	0.050	0.050	306270	1.04	1.27
	1550	030	0.23	0.01K	0.01K	0.060	0.070	306271	0.11	0.31
90/08/13	1600	000	0.01K	0.01K	0.01K	0.020	0.030	336269	3.28	3.18
	1610	010	0.21	0.01K	0.01K	0.060	0.060	336270	0.67	1.19
	1620	030	0.25	0.01K	0.01K	0.060	0.060	336271	0.14	0.67
90/09/12	1625	000	0.01K	0.01K	0.01K	0.010	0.030	376269	5.81	7.99
	1630	010	0.34	0.01K	0.01K	0.070	0.060	376270	0.17	0.83
	1635	030	0.37	0.01K	0.01K	0.070	0.070	376271	0.06	1.03

SAR003
SARATOGA PASSAGE OFF EAST POINT
48 06 28.0 122 29 25.0 2F 0 Elev= 0 ft
53029 Washington Island Co. PACIFIC NORTHWEST
PUGET SOUND (Island-06) 131106
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/STREAM

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/17	1345	000	12.9			7.9	38600	0.3		1K	8.5	27.00
	1350	010	12.2			7.7	42000	0.4				29.00
	1355	030	12.1			7.6	42300	0.5				30.00
89/11/20	1435	000	9.2	10.4	100.1	8.0			78.8	1K	5.0	17.29
	1445	010	10.8	7.6	81.2	7.8			83.6			27.85
	1450	026	10.9	7.3	79.5	7.9			85.7			30.35
89/12/13	1355	000	6.9	11.3	100.5	7.8			41.8	1	1.9	13.30
	1400	010	10.3	8.2	86.9	7.6			80.3			28.18
	1405	025	10.6	7.0	75.6	7.8			82.7			30.11
90/02/12	1525	000	6.4	10.5	99.1	8.0			73.6	1K	5.6	23.87
	1535	010	7.1	10.9	105.7	7.9			81.2			25.52
	1545	030	9.2	8.2	85.7	7.7			80.5			29.61
90/03/12	1015	000								1K	4.5	24.82
	1020	010										26.30
	1025	030										29.92
90/04/09	1000	000	10.9	13.0	134.5	8.6			68.0	1K	3.8	22.76
	1005	010	8.7	11.7	120.1	8.2			81.1			28.55
	1010	030	8.4	9.2	94.3	7.9			86.6			29.20
90/05/14	1505	000	11.8	14.0	145.9	8.9			59.5	1K	4.2	20.86
	1515	010	9.3	10.3	107.1	8.1			87.0			28.52
	1525	030	9.0	8.8	91.3	8.0			86.4			29.08
90/06/11	1520	000	13.5	11.5	122.7	8.5			41.7	1K	3.0	19.10
	1530	010	9.5	7.9	82.8	7.9			86.4			29.00
	1540	030	9.3	7.0	73.3	7.9			86.0			29.45
90/07/24	1455	000	15.9	9.7	111.3	8.3			73.3	1K	6.0	22.98
	1500	010	12.3	9.6	106.2	8.2			85.4			28.40
	1505	030	11.0	6.9	74.8	8.0			87.0			29.31
90/08/13	1520	000	19.0	9.5	103.1	8.3			69.6	1K	4.0	2.91
	1530	010	11.9	17.4	192.9	8.0			82.5			29.99
	1540	030	11.0	6.5	70.5	7.8			85.1			29.51
90/09/12	1605	000	14.0	13.0	147.6	8.5			44.0	1K	2.5	27.25
	1610	010	11.8	8.2	90.3	8.0			76.9			29.20
	1615	030	11.3	5.0	54.7	7.8			82.7			29.93

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/17	1345	000	0.15	0.01K	0.01	0.060	0.070	426266		
	1350	010	0.28	0.01K	0.01K	0.080	0.080	426267		
	1355	030	0.33	0.01K	0.01K	0.090	0.080	426268		
89/11/20	1435	000	0.30	0.01K	0.03	0.050	0.060	476266		
	1445	010	0.36	0.01K	0.01K	0.080	0.090	476267		
	1450	026	0.36	0.01K	0.01K	0.080	0.090	476268		
89/12/13	1355	000	0.25	0.01K	0.02	0.040		506266		
	1400	010	0.33	0.01K	0.01K	0.080		506267		
	1405	025	0.33	0.01K	0.01K	0.080		506268		
90/02/12	1525	000	0.28	0.01K	0.01K	0.070	0.080	76266		
	1535	010	0.28	0.01K	0.01K	0.070	0.080	76267		
	1545	030	0.29	0.01K	0.01K	0.090	0.090	76268		
90/03/12	1015	000	0.23	0.01K	0.01K	0.040	0.060	116266		
	1020	010	0.26	0.01K	0.01K	0.050	0.070	116267		
	1025	030	0.40	0.01K	0.01K	0.090	0.090	116268		
90/04/09	1000	000	0.01K	0.01K	0.01K	0.010K	0.010	156266	5.98	3.55
	1005	010	0.26	0.01K	0.01	0.060	0.070	156267	4.37	3.75
	1010	030	0.32	0.01K	0.02	0.070	0.070	156268	1.77	2.28
90/05/14	1505	000	0.01K	0.01K	0.01K	0.010K	0.020	206266	4.54	2.53
	1515	010	0.23	0.01K	0.04	0.060	0.070	206267	0.19	0.63
	1525	030	0.32	0.01K	0.02	0.070	0.080	206268	0.11	0.28
90/06/11	1520	000	0.01K	0.01K	0.01K	0.010K	0.020	246266	1.77	2.48
	1530	010	0.33	0.01K	0.01K	0.070	0.080	246267	0.05	0.20
	1540	030	0.38	0.01K	0.01K	0.080	0.080	246268	0.06	0.28
90/07/24	1455	000	0.01K	0.01K	0.01K	0.020	0.040	306266	1.06	0.74
	1500	010	0.10	0.01K	0.01	0.040	0.060	306267	0.63	0.61
	1505	030	0.23	0.01K	0.01K	0.060	0.070	306268	0.16	0.24
90/08/13	1520	000	0.01K	0.01K	0.01K	0.020	0.030	336266	1.02	0.96
	1530	010	0.20	0.01K	0.01K	0.060	0.060	336267	0.66	0.83
	1540	030	0.27	0.01K	0.01K	0.070	0.070	336268	0.14	0.36
90/09/12	1605	000	0.01K	0.01K	0.01K	0.010	0.040	376266	4.63	6.41
	1610	010	0.28	0.01K	0.01K	0.060	0.060	376267	2.82	3.54
	1615	030	0.37	0.01K	0.01K	0.070	0.070	376268	0.15	1.12

TOT001
TOTTEN INLET NEAR WINDY POINT
47 09 52.0 122 57 48.0 2F 0 Elev= 0 ft
53045 Washington Mason Co. PACIFIC NORTHWEST
PUGET SOUND (Kennedy/Goldsboro-14) 131114
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1130	000	15.6			8.3	42500	0.7		1K	4.7	29.00
	1135	010	15.6			8.3	41800	0.6				30.00
89/11/14	1215	000	11.0			7.9			50.8	5	3.7	28.56
	1225	010	10.9	8.5	91.5	7.9			66.6			28.58
89/12/05	1345	000	10.2	7.7	80.1	7.9			28.1	22S	1.9	25.75
	1400	010	10.3	8.4	89.1	7.9			67.8			28.34
90/01/16	1235	000	8.7	9.0	90.2	7.9			63.0	1K	2.4	25.04
	1240	010	8.9	9.1	92.3	7.9			66.9			26.22
90/02/06	1325	000	7.3	10.8	105.4	7.8			64.3	1K	3.1	25.68
	1350	010	7.6	10.5	103.6	7.8			66.8			26.29
90/03/05	1120	000	8.6	9.6	96.6	7.9			69.1	1K	3.9	25.98
	1135	010	8.3	9.6	96.4	7.9			69.7			26.64
90/04/02	1145	000	10.1	9.8	102.5	7.9			60.5	1K	4.4	26.81
	1150	010	9.6	9.8	101.6	7.9			70.6			27.13
90/05/08	1150	000	13.0	11.0	122.5	8.4			50.6	1K	2.0	27.36
	1155	010	11.9	11.5	125.6	8.4			40.3			27.77
90/06/05	1315	000	14.8	10.8	124.8	8.3			46.8	1K	3.3	27.59
	1320	010	13.4	11.7	131.9	8.3			55.9			28.02
90/07/16	1230	000	16.8	11.3	136.8	8.3			70.9	1	5.3	28.77
	1240	010	16.5	10.8	130.0	8.3			67.6			28.76
90/08/07	1210	000	19.6	12.0	153.3	8.3			71.0	1K	3.4	28.87
	1220	010	17.8	12.4	153.1	8.3			56.7			28.91
90/09/05	1230	000	18.3	9.4	117.2	8.2			59.0	1K	3.4	28.96
	1240	010	17.1	9.4	114.7	8.2			59.7			29.08

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1130	000	0.02	0.01K	0.01K	0.060	0.070	416211		
	1135	010	0.02	0.01K	0.01K	0.080	0.070	416212		
89/11/14	1215	000	0.18	0.02	0.07	0.070	0.080	466211		
	1225	010	0.18	0.02	0.07	0.070	0.090	466212		
89/12/05	1345	000	0.36	0.01	0.10	0.090	0.090	496211		
	1400	010	0.34	0.01K	0.05	0.090	0.080	496212		
90/01/16	1235	000	0.37	0.01K	0.02	0.080	0.080	36211		

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/01/16	1240	010	0.37	0.01K	0.02	0.080	0.080	36212		
90/02/06	1325	000	0.32	0.01K	0.02	0.080	0.080	66211		
	1350	010	0.32	0.01K	0.01	0.080	0.080	66212		
90/03/05	1120	000	0.31	0.01K	0.01K	0.070	0.080	106211		
	1135	010	0.32	0.01K	0.01K	0.080	0.090	106212		
90/04/02	1145	000	0.29	0.01K	0.01	0.060	0.070	146211	2.73	3.33
	1150	010	0.31	0.01K	0.01	0.060	0.070	146212	2.00	2.50
90/05/08	1150	000	0.01K	0.01K	0.01K	0.010	0.030	196211	2.47	2.64
	1155	010	0.01K	0.01K	0.01K	0.010	0.040	196212	6.49	5.51
90/06/05	1315	000	0.01K	0.01K	0.01K	0.020	0.040	236211	2.88	2.58
	1320	010	0.03	0.01K	0.01	0.030	0.050	236212	5.98	5.71
90/07/16	1230	000	0.01K	0.01K	0.01K	0.040	0.050	296211	1.62	1.15
	1240	010	0.03	0.01K	0.01K	0.040	0.060	296212	3.28	2.80
90/08/07	1210	000	0.01K	0.01K	0.01K	0.060	0.080	326211	5.22	4.78
	1220	010	0.01K	0.01K	0.01K	0.080	0.100	326212	14.60	10.00
90/09/05	1230	000	0.01K	0.01K	0.01K	0.050	0.090	366211	5.64	5.60
	1240	010	0.01K	0.01K	0.01K	0.060	0.090	366212	8.92	7.00

WPA001
WILLAPA RIVER AT RAYMOND
46 41 15.0 123 44 55.0 2F 0 Elev= 0 ft
53049 Washington Pacific Co. PACIFIC NORTHWEST
COASTAL (Willapa-24) 131224
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/STREAM

INDEX 1312137
MILES 0006.40 . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1440	000	17.4			7.8	33900	2.3		19	1.7	24.00
	1445	010	17.3			7.7	35900	3.4				25.00
90/01/17	1355	000	8.0	7.7	64.9	7.7			38.5	20	1.0	0.21
	1400	010	8.6	7.5	64.7	7.5			4.9			1.73
90/03/05	1425	000	8.4	11.6	100.8	7.5			37.7	78	1.2	3.69
	1435	006	8.4	11.2	99.7	7.4			32.1			7.81
90/04/02	1510	000	11.4	9.9	92.6	7.5			26.8	21J	1.0	4.61
	1515	010	11.1	9.3	93.7	7.6			6.5			17.96
90/05/08	1505	000	14.7	10.9	110.6	8.0			30.6	12	1.4	6.42
	1510	008	13.7	10.0	103.2	7.9			19.5			12.92
90/06/05	1700	000	15.3	8.4	87.1	7.4			37.9	120	1.5	7.96
	1705	007	15.2	8.0	85.4	7.4			19.0			13.47
90/07/16	1600	000	22.6	8.5	104.1	7.9			26.8	32	1.5	12.32
	1610	008	21.6	6.2	77.5	7.6			10.0			19.16
90/08/07	1645	000	21.6	5.8	73.7	7.7			12.8	51	0.6	21.98
	1655	005	21.6	5.8	73.7	7.7			12.9			21.93
90/09/05	1645	000	20.2	7.2	88.7	7.7			4.5	45	0.7	21.08
	1650	009	20.2	7.2	88.8	7.7			2.2			21.34

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1440	000	0.09	0.01K	0.09	0.030	0.050	416225		
	1445	010	0.08	0.01K	0.10	0.030	0.050	416226		
90/01/17	1355	000	1.01J	0.01K	0.03	0.020	0.030	36225		
	1400	010						36226		
90/03/05	1425	000	0.53	0.01K	0.02	0.010	0.030	106225		
	1435	006	0.30	0.01K	0.03	0.020	0.040	106226		
90/04/02	1510	000	0.35	0.01K	0.03	0.010K	0.020	146225		
	1515	010	0.11	0.01K	0.06	0.020	0.090	146226		
90/05/08	1505	000	0.36	0.01K	0.02	0.010K	0.040	196225	5.12	3.72
	1510	008	0.19	0.01K	0.02	0.010	0.030	196226	1.49	2.87
90/06/05	1700	000	0.18	0.01K	0.03	0.010K	0.030	236225	3.03	0.55
	1705	007	0.11	0.01K	0.04	0.020	0.040	236226	1.26	2.19
90/07/16	1600	000	0.01K	0.01K	0.01K	0.010K	0.020	296225	3.41	2.57

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/07/16	1610	008	0.01K	0.01K	0.03	0.040	0.160	296226	3.21	9.05
90/08/07	1645	000	0.01	0.01K	0.01	0.030	0.060	326225	17.90	10.90
	1655	005	0.01K	0.01K	0.02	0.030	0.120	326226	4.71	11.70
90/09/05	1645	000	0.02	0.01K	0.02	0.030	0.090	366225	13.10	11.60
	1650	009	0.02	0.01K	0.02	0.030	0.160	366226	7.91	12.90

WPA003
WILLAPA RIVER AT JOHNSON SLOUGH
46 42 15.0 123 50 10.0 2F 0 Elev= 0 ft
53049 Washington Pacific Co. PACIFIC NORTHWEST
Washington Coast 131291
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/STREAM

INDEX 1312137
MILES 0000.40 . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1425	000	17.5			8.0	39300	2.0		3	1.6	17.00
	1430	010	17.5			8.0	39200	1.8				27.00
90/01/17	1340	000	8.3	10.9	99.5	7.8			34.5		0.8	12.13
	1345	006	8.7	10.5	102.1	7.9			5.5	4		20.60
90/03/05	1410	000	8.7	11.0	101.8	7.8			38.0	10	1.2	12.90
	1420	004	8.8	10.7	102.2	7.8			23.3			17.53
90/04/02	1450	000	12.0	9.7	98.1	7.9			36.1	2J	1.5	15.49
	1455	004	11.0	9.5	99.0	8.0			23.3			23.51
90/05/08	1445	000	14.6	9.7	104.6	8.1			31.4	1	1.6	17.19
	1450	007	12.6	9.2	98.1	8.1			22.9			21.90
90/06/05	1635	000	16.3	9.1	99.9	7.9			25.0	120	1.3	14.39
	1640	008	15.4	7.9	88.2	7.9			17.8			20.28
90/07/16	1530	000	21.7	7.7	97.2	8.0			25.1	6	1.5	20.40
	1540	005	20.5	7.1	90.5	7.9			6.9			25.83
90/08/07	1620	000	19.3	7.1	89.9	8.0			19.9	1	1.0	28.45
	1630	004	18.9	7.0	88.2	8.0			3.8			28.73
90/09/05	1610	000	20.1	7.0	88.6	8.0			31.7	8	1.3	25.89
	1620	008	19.2	6.9	86.4	8.0			29.7			26.87

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1425	000	0.05	0.01K	0.05	0.040	0.050	416223		
	1430	010	0.05	0.01K	0.05	0.040	0.050	416224		
90/01/17	1340	000	0.53	0.01K	0.04	0.020	0.030	36223		
	1345	006						36223		
90/03/05	1410	000	0.33	0.01K	0.02	0.010	0.030	106223		
	1420	004	0.25	0.01K	0.02	0.020	0.040	106224		
90/04/02	1450	000	0.14	0.01K	0.03	0.010	0.030	146223	2.49	2.60
	1455	004	0.05	0.01K	0.03	0.020	0.040	146224	3.53	2.82
90/05/08	1445	000	0.10	0.01K	0.01	0.010K	0.020	196223	1.39	1.78
	1450	007	0.04	0.01K	0.03	0.020	0.050	196224	1.97	3.10
90/06/05	1635	000	0.08	0.01K	0.01K	0.010K	0.030	236223	3.66	3.23
	1640	008	0.03	0.01K	0.02	0.020	0.040	236224	1.31	3.56
90/07/16	1530	000	0.01K	0.01K	0.01K	0.020	0.030	296223	1.34	1.81

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/07/16	1540	005	0.01K	0.01K	0.02	0.030	0.060	296224	1.63	2.58
90/08/07	1620	000	0.01K	0.01K	0.01K	0.040	0.050	326223	2.44	3.69
	1630	004	0.01K	0.01K	0.01K	0.040	0.080	326224	2.57	5.61
90/09/05	1610	000	0.01K	0.01K	0.01K	0.030	0.050	366223	2.60	3.32
	1620	008	0.01K	0.01K	0.01	0.040	0.080	366224	2.35	5.81

WPA004
WILLAPA BAY AT TOKE POINT
46 41 13.0 123 58 20.0 2F 0 Elev= 0 ft
53049 Washington Pacific Co. PACIFIC NORTHWEST
COASTAL (Willapa-24) 131224
21540000 Reach= 0.000 Drg= 0 sqmi
AMBNT/OCEAN

INDEX
MILES . . . . . .

DATE FROM TO	TIME	DEPTH METER	10 WATER TEMP CENT	300 DO MG/L	301 DO SATUR PERCENT	400 PH SU	95 CNDUCTVY LAB @ 25C UMHO	82079 TURBIDTY LAB NTU	74 TURB TRANS %	31616 FEC COLI MFM-FCBR /100ML	78 TRANSP SECCHI METERS	480 SALINITY PPTH
89/10/10	1410	000	16.4			8.2	41300	1.2		2	4.0	29.00
	1415	010	16.1			8.2	41200	1.5				29.00
90/01/17	1330	000	8.1	10.8	101.9	8.0			52.2	2	1.5	18.10
	1335	008	8.6	10.7	106.2	8.1			53.8			23.97
90/03/05	1340	000	9.3	11.1	106.5	8.0			43.1	1K	4.2	16.46
	1350	010	9.1	10.9	107.2	8.1			34.0			20.93
90/04/02	1430	000	11.6	9.4	99.0	8.1			56.6	1J	2.3	23.16
	1435	009	10.8	9.4	100.0	8.1			61.0			27.20
90/05/08	1420	000	11.5	9.6	104.2	8.1			51.2	1K	2.5	28.09
	1425	009	10.1	9.6	103.1	8.1			48.6			30.72
90/06/05	1615	000	16.4	8.4	96.4	8.1			39.8	1K	1.7	21.40
	1620	009	14.6	8.5	96.1	8.2			47.8			24.72
90/07/16	1510	000	18.7	7.6	94.8	8.1			50.5	1K	2.4	27.76
	1520	010	16.6	8.4	101.8	8.2			59.3			29.51
90/08/07	1545	000	15.7	8.9	107.0	8.1			25.8	1K	2.0	31.00
	1555	005	15.2	9.0	107.4	8.1			44.7			31.27
90/09/05	1540	000	16.2	7.7	92.9	8.1			67.8	1	3.1	30.03
	1550	010	16.0	7.7	92.6	8.1			69.6			30.15

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
89/10/10	1410	000	0.01	0.01K	0.01K	0.020	0.040	416221		
	1415	010	0.02	0.01K	0.01K	0.030	0.040	416222		
90/01/17	1330	000	0.32	0.01K	0.03	0.020	0.030	36221		
90/03/05	1340	000	0.22	0.01K	0.01	0.020	0.030	106221		
	1350	010	0.16	0.01K	0.01	0.020	0.030	106222		
90/04/02	1430	000	0.05	0.01K	0.02	0.020	0.030	146221	1.61	1.56
	1435	009	0.03	0.01K	0.02	0.020	0.030	146222	1.31	1.00
90/05/08	1420	000	0.09	0.01K	0.01	0.030	0.040	196221	2.45	2.30
	1425	009	0.15	0.01K	0.02	0.030	0.060	196222	3.96	3.77
90/06/05	1615	000	0.02	0.01K	0.01K	0.010	0.030	236221	1.82	2.28
	1620	009	0.01K	0.01K	0.01K	0.010	0.030	236222	1.59	2.55
90/07/16	1510	000	0.01K	0.01K	0.01K	0.030	0.040	296221	1.33	1.53
	1520	010	0.01K	0.01K	0.01	0.030	0.040	296222	2.04	4.14

MORE DATES NEXT PAGE

DATE FROM TO	TIME	DEPTH METER	630 NO2+NO3 N-TOTAL MG/L	615 NO2-N TOTAL MG/L	610 NH3+NH4- N TOTAL MG/L	70507 PHOS-T ORTHO MG/L P	665 PHOS-TOT MG/L P	8 LAB IDENT. NUMBER	32211 CHLRPHYL A UG/L CORRECTD	32218 PHEOPHTN A UG/L
90/08/07	1545	000	0.02	0.01K	0.02	0.030	0.050	326221	6.94	8.68
	1555	005	0.02	0.01K	0.01	0.020	0.050	326222	8.42	11.10
90/09/05	1540	000	0.05	0.01K	0.02	0.030	0.050	366221	1.97	2.49
	1550	010	0.05	0.01K	0.02	0.030	0.050	366222	2.37	2.78