



Willapa River Total Maximum Daily Load Study Data Summary Report

Abstract

As part of the *Willapa River Dissolved Oxygen and Fecal Coliform Bacteria Total Maximum Daily Load Study*, the Department of Ecology conducted a series of surveys in 1998. This interim report presents data collected during those surveys, including both laboratory data and field water quality and flow data from both instantaneous meter and continuous datalogger measurements. A summary of the Quality Assurance/Quality Control analysis of the data is also provided. Data showed that temperature, FC bacteria, and DO levels failed to meet criteria at mainstem and tributary monitoring sites throughout the basin. Several permitted point sources also had high bacteria levels. Ecology will use the data in this report to conduct a detailed scientific analysis and to recommend TMDL pollutant limitations for the Willapa River basin, to be published in a final report separately at a later date.

Introduction

The Willapa River basin drains into northeastern Willapa Bay, Washington. Ecology has listed the Willapa River under Section 303(d) of the federal Clean Water Act as not meeting water quality standards for dissolved oxygen (DO), fecal coliform (FC) bacteria, and temperature, because of inadequate controls of point or nonpoint sources.

Section 303(d) requires the states and U. S. Environmental Protection Agency (EPA) to establish Total Maximum Daily Loads (TMDLs) for all waterbodies on the Section 303(d) list. EPA must approve all TMDLs established by the state of Washington. A complete TMDL includes the following:

- Description of applicable water quality standards and relevant sources of pollutants;
- Technical analysis to determine the pollutant capacity of the waterbody;
- Allocations of pollutant loading to various sources;
- Margin of safety to account for scientific uncertainty;
- Method to account for seasonal variation;
- Monitoring plan and implementation strategy;
- Public participation in the TMDL development process.

In 1997, the Southwest Regional Office section of the Washington State Department of Ecology (Ecology) Water Quality Program conducted a Watershed Needs Assessment that included the Willapa River watershed (Ecology, 1997). The Willapa River was identified as a high priority for a TMDL technical study of dissolved oxygen and fecal coliform bacteria problems. (Other activities have been identified to address the temperature listings.) Ecology's Water Quality Program requested that the Environmental Assessment Program conduct the TMDL study, in partnership with state and local agencies and local citizens.

This report summarizes the data collected as part of the *Willapa River Dissolved Oxygen and Fecal Coliform Bacteria Total Maximum Daily Load Study*. Also included is a summary of the Quality Assurance and Quality Control (QA/QC) analysis of the data. The second phase of this study will use these data to conduct a detailed scientific analysis of DO and bacteria and to recommend TMDL pollutant limitations for the Willapa River basin. Final reports for the Willapa River TMDL are scheduled to be published in the summer of 2000.

Figure 1 shows the study area and the locations sampled. The entire mainstem Willapa River was evaluated from near the headwaters below Patton Creek, downstream to the mouth of the river at Willapa Bay near Johnson Slough. Loading sources to the Willapa River monitored during the surveys included major tributaries, permitted dischargers (municipal wastewater treatment plants [WWTPs], fish processors, and a fish hatchery), and urban and industrial stormwater drains.

Methods

Field personnel collected water quality data during a series of surveys in 1998. The methods used in these surveys are described in the Quality Assurance Project Plans (QAPPs) (Pickett, 1998a;b). The data actually collected may vary from the planned monitoring described in the QAPPs where field conditions required adjustments. A list of parameters measured, abbreviations used in this report, target accuracy and detection limits, and analytical methods are provided in Table 1.

Twelve surveys were conducted between late April and early December 1998. During all of the surveys, field staff collected bacteria and specific conductivity samples and measured specific conductivity and temperature. Four surveys (during the first week of May, August, September, and November) collected a broader suite of parameters for the dissolved oxygen (DO) study, including laboratory analysis for total suspended solids (TSS), chloride, salinity, nutrients, biochemical oxygen demand (BOD), and chlorophyll *a*, as well as field measurements of dissolved oxygen and pH. During eight of 12 surveys, Hydrolab[®] multi-parameter dataloggers were installed to record field measurements at hourly or half-hourly intervals over several days. Estimates of salinity and DO percent saturation were derived from conductivity, temperature, and DO measurements.

Remote equipment collected stream water level measurements continuously at two mainstem and seven tributary sites; these measurements were converted into a continuous flow record for most of the survey period. Appendix A provides a detailed description of methodology for the continuous stream gaging. The U.S. Geological Survey (USGS) also collects flow data at their Willapa River near Willapa gaging site (station 12013500).

Table 1. Summary of Field and Laboratory Target Accuracy, Detection Limits, and Methods.

Parameter	Abbr.	Accuracy	Method¹
<u>Field Measurements</u>			
Velocity		± 0.05 feet/second	Current meter
Specific Conductivity	SpCond	± 5 % (at 25°C)	Field Meter (Electrode)
pH	pH	± 0.2 standard units	Field Meter (Electrode)
Temperature	Temp	± 0.2 °C	Red Liquid Thermometer Field Meter (Thermistor)
Dissolved Oxygen	DO	± 0.1 mg/L ± 0.2 mg/L	Winkler Modified Azide (EPA 360.2) Field meter (Polarographic Probe)
<u>General Chemistry</u>		Reporting Limit	
Specific Conductivity	Cond	1 µmho/cm	Conductivity Bridge
Total Suspended Solids	TSS	1 mg/L	SM 2540
Salinity	Salin	0.01 ppt	UNESCO, 1981
Chloride	Clrd	0.1 mg/L	EPA 330.0
5-day BOD	BOD5	2 mg/L	EPA 405.1
Ultimate BOD	UBOD	2 mg/L	SM 5210C
Ammonia nitrogen	NH3	0.01 mg/L	EPA 350.1
Nitrate + nitrite nitrogen	NO2/3	0.01 mg/L	EPA 353.2
Total persulfate nitrogen	TPN	0.01 mg/L	SM 4500 NO3-F Modified
Ortho-phosphate	Orth-P	0.005 mg/L	EPA 365.3
Total phosphorus	TP	0.01 mg/L	EPA 365.3
Chlorophyll <i>a</i>	Chla	1.0 µg/L	SM 10200H(3)
Fecal coliform	FC	1 cfu/100mL	SM Membrane Filter 9222D
Enterococcus	Entero	1 cfu/100mL	SM Membrane Filter 9230C
<p>¹EPA = Methods for the chemical analysis of water and wastes. Environmental Monitoring Supply Laboratory. U.S. Environmental Protection Agency. Cincinnati, OH. EPA-600/4-74-020. 1983.</p> <p>SM = Standard methods for the examination of water and wastewater, 20th edition (1998). American Public Health Association, American Water Works Association, and Water Environment Federation. Washington, D.C.</p> <p>UNESCO, 1981. Background papers and supporting data on the Practical Salinity Scale 1978. UNESCO Technical Papers in Marine Science 37, Paris, France.</p>			

At several survey monitoring sites, flows were measured once during each survey (except for the December survey when the basin was flooding). In addition, during the August and September surveys flows were measured at every perennial tributary upstream of the USGS gage at Camp One Road. The tributary flows were summed to develop a calculated flow balance for the mainstem Willapa River.

Laboratory samples were taken directly into the sample bottle, or with a Van-Dorn or Kemmerer sampler, or with an automatic compositor. All bacteria samples were taken directly into the sample bottle.

Field measurements from fish processors and municipal WWTPs were made with an Orion[®] Model 250A pH meter, a Beckman conductivity meter, and a YSI 55 DO meter. Laboratory samples were collected at the WWTPs from the end of the chlorine contact chambers, and at Coast Seafoods and East Point Seafoods from their settling tanks immediately prior to the final discharge pipe. At the WWTPs and seafood processors, all laboratory samples (except for bacteria) were collected with automatic compositors, except at South Bend Packers where all samples were collected as grabs.

During the four DO surveys, ambient field measurements were made with Hydrolab[®] multi-parameter meters. For the other eight surveys, ambient conductivity was measured with Orion[®] Model 130 or Beckman conductivity meters, and temperature was measured either with a thermistor included in the conductivity meters, a spirit thermometer, or with a bi-metal thermometer.

Survey conditions varied widely. The weather was dry during most of the surveys from April through October, except for drizzly weather in July. November surveys were conducted during rainy conditions. The December survey took place after extremely heavy rains when the river was experiencing flood conditions.

For comparison of data to water quality standards, salinity levels were evaluated. Marine standards apply at salinities of 10 ppt or greater for FC bacteria, and at 1 ppt or greater for all other parameters. Upstream and tributary stations were consistently fresh, while downstream mainstem stations were consistently marine. Some of the mainstem sites and tributaries had salinities that varied between fresh and marine. All salinity data for each site during each survey were averaged to determine whether marine or freshwater standards applied during that survey. For FC standards, salinity values for multiple surveys were averaged using the same averaging periods as used for the bacteria geometric means.

For evaluation of standards, replicate data points were averaged for all parameters. Instantaneous measurements for DO and temperature were compared to standards. To evaluate FC bacteria compliance with standards, a 60-day period was chosen, because a shorter period included too few surveys, and a longer period bridged significantly different seasonal conditions and could have hidden non-compliance periods. The 60-day period incorporated the results of either three

or four surveys. Each period was evaluated for the geometric mean and 90th percentile value for comparison to standards. Only periods with at least three surveys of data were considered to contain sufficient data to evaluate compliance with standards.

Data Quality

Appendix B gives a detailed summary of the data QA/QC analysis. Data collected in the Willapa River TMDL study are usable subject to certain qualifications:

- Qualifiers are provided in the data tables that place conditions on the laboratory data.
- Data variability must be taken into consideration when interpreting results and applying data to other analyses.

With only a few exceptions, samples and field measurements are representative of the mainstem or tributary flows measured. Survey stations for some of the tributary sources in the lower river were subject to tidal reversal, and some of these sources had tide gates. These sites may represent a mixture of the tributary water and river water that backed up the tributary or leaked back through the gates.

Ecology and Pacific County staff collected and analyzed replicate FC bacteria samples to evaluate comparability of their data. Although the number of replicates is small, the data met data quality objectives and appear to be comparable.

Results

Results from survey monitoring and laboratory analysis can be found in Appendix C. Stations are identified in the data tables by a mainstem (MS) or tributary (Trib) river mile (RM), based on USGS topographic maps and on Phinney and Bucknell (1975). Appendix D presents graphs of DO and other selected parameters collected by remote datalogger deployment. Because of the volume of data, this publication does not include the complete set of datalogger data, which can be obtained by request or from the Ecology World Wide Web site (<http://www.wa.gov/ecology/>).

Table C.1 contains the daily mean stream flows measured at three Willapa River and seven tributary sites. These flows are also shown in Figure 2. The hydrologic characteristics of the watersheds represented by these flow stations are fairly uniform across the river basin. Streams react fairly quickly to rain events and return to baseflow quickly. For their watershed areas summer flows are mostly very low, although a few stations showed relatively higher summer base flow (Fork Creek, Stringer Creek, and the South Fork Willapa River). Flow in the Willapa River at the USGS gaging station during the summer of 1998 reached one of the lowest levels on record.

The response of the watershed to rainfall and summer drought is consistent with the geology of the basin. The alluvium in the valley bottoms is shallow and bedrock is near the surface throughout the basin (Pitz, 1998). This results in little retention of stormwater and little storage of ground water to maintain summer base flow.

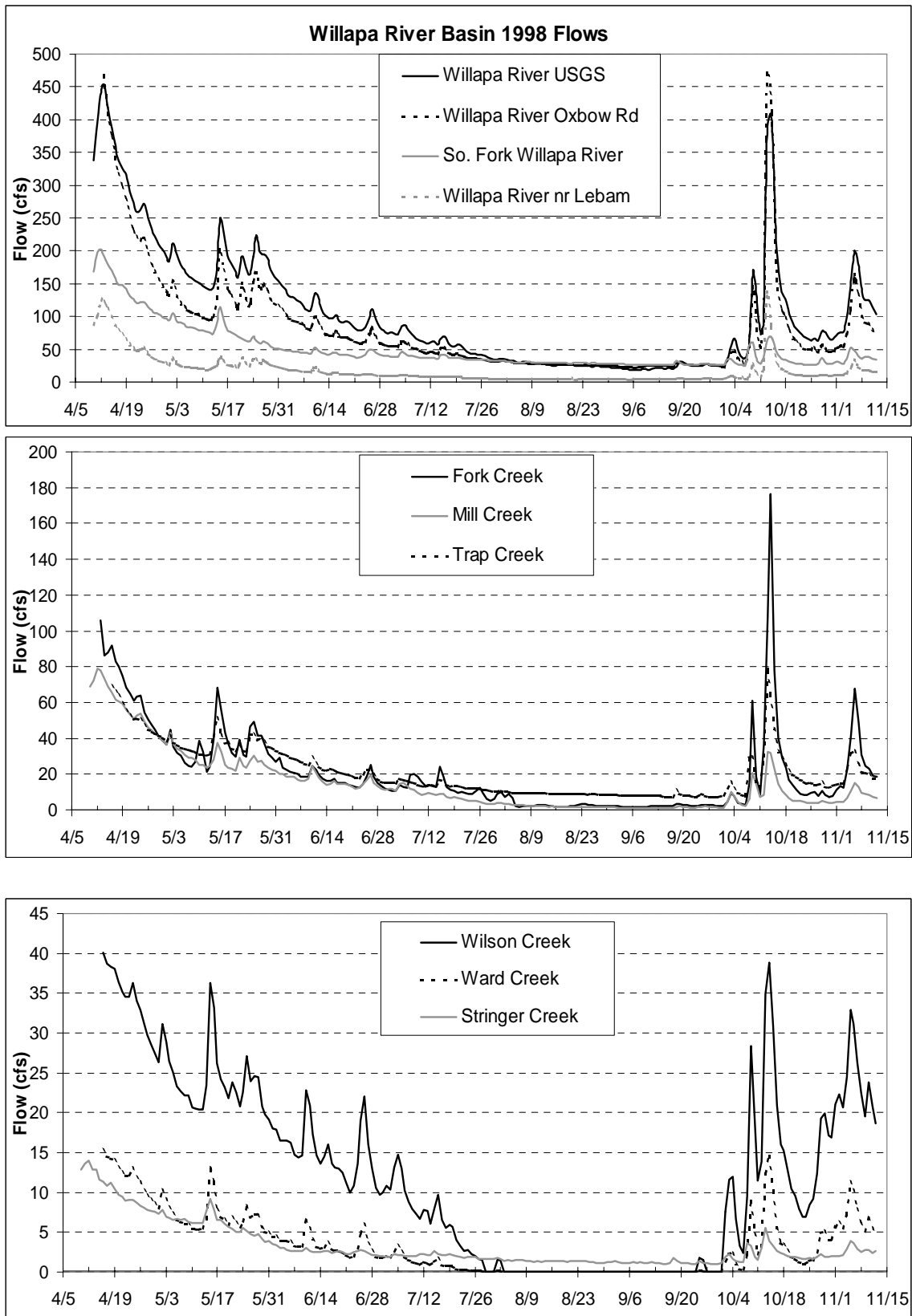


Figure 2. Measured Flows in the Willapa River Basin.

Table C.2 contains individual flow measurements from surveys. The pattern of very low flow summer flows was consistent with the continuous flow monitoring. However during the summer Falls Creek flows remain relatively high and are about twice as high as flows in the Willapa River above their confluence.

Figure 3 shows the flow balances for the August and September surveys. The calculated and observed flows by river mile for the two surveys are shown in the upper charts, and the difference between the summed and observed flows are shown in the lower charts. During the summer Fork and Trap creeks account for about three-quarters of the flow in the Willapa River above Camp One Road. The rest of the flow comes mostly from the headwaters and Falls, Stringer, and Mill creeks.

The difference between summed and observed flows can be explained by measurement error, diversions from the river, or losses from the river due to seepage. Differences of 10% to 20% could be explained by error, but larger differences probably represent physical processes. The river in the lower valley runs over sedimentary bedrock, and no water has been found in this formation. Therefore, although seepage through fractures cannot be ruled out, it is unlikely. This suggests that during the summer months water users withdraw up to 30% of river flow before it reaches Camp One Road, and during extreme low flows that percentage may be even higher.

Table C.3 presents laboratory results from the surveys for the FC bacteria part of the study. Enterococci bacteria were measured because at the time this study was being planned Ecology was considering this bacteria strain for a freshwater quality standard; the data will be analyzed separately from this study. The next section presents the analysis of fecal coliform bacteria patterns.

Tables C.4 and C.5 present laboratory and ultimate BOD (UBOD) test results from the dissolved oxygen surveys. Table C.6 contains the results of field measurements during the surveys. The second phase of this study will use these data for modeling and analysis. The next section discusses how these measurements comply with the state water quality standards.

UBOD:BOD5 ratios from the WWTPs were fairly high (between 3 and 5) compared to typical results from municipal treatment plants. EPA suggests using a value of 1.47 in the absence of other data, and ratios of 1.5 to 2 have been common in other Ecology studies. The high ratio is associated with low decay rates (“k”). These plants may have a mixed UBOD with a fast reacting component and a slow reacting component. The slow reacting component dominates the final UBOD result and produces a high ratio with a low decay rate. This issue will be considered in how the UBOD and decay rates are used in the model.

Cosmopolitan Engineering Group (1998) conducted field measurements on September 2, 1998 during the Ecology survey. They measured DO, conductivity, and temperature at multiple profiles in the lower Willapa River with a new Sea-Bird SBE 19DO meter with YSI probe. Uncorrected residuals for Cosmopolitan’s field verification DO samples (using the Winkler titration method) were consistent with the Ecology profile data. In comparing the Seabird and

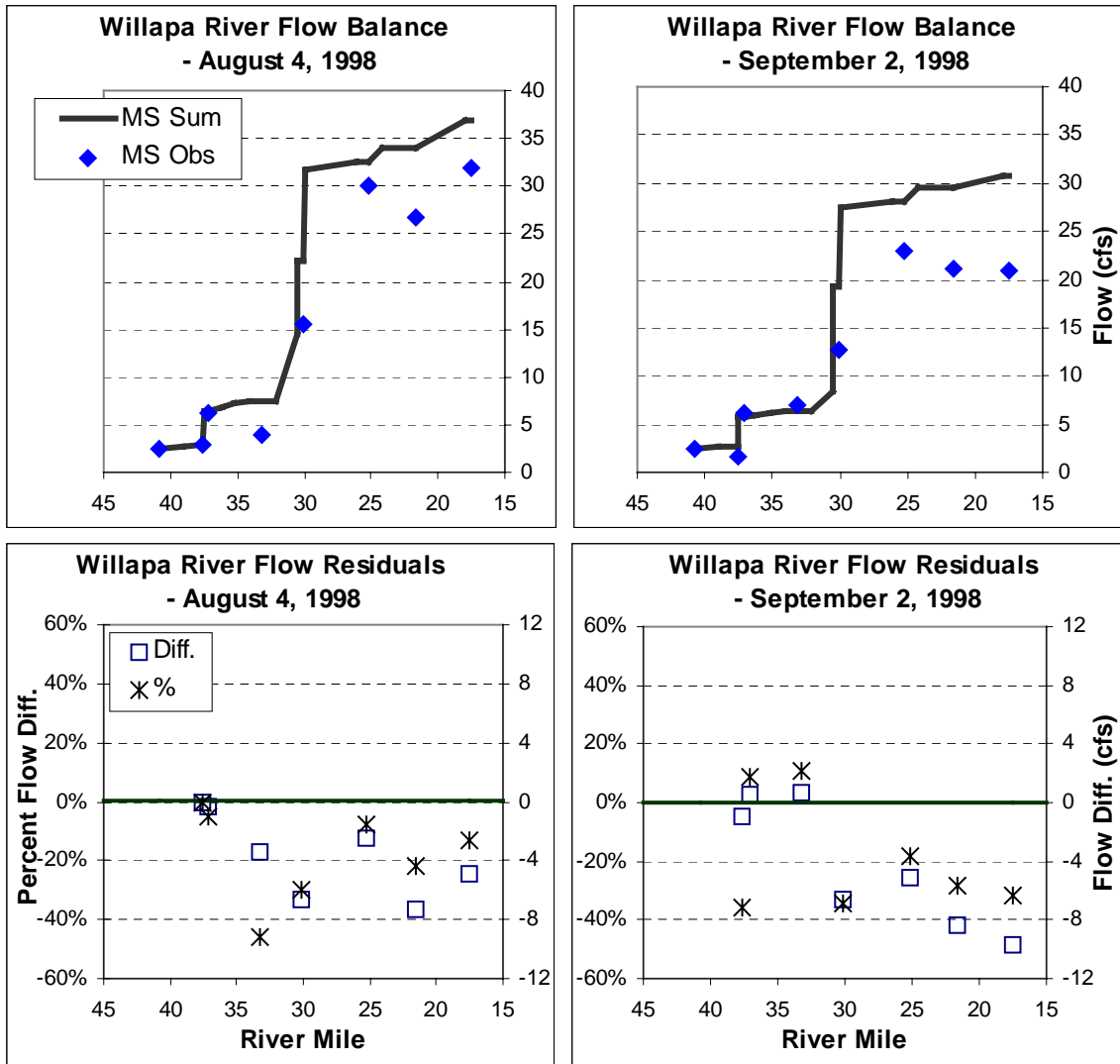


Figure 3. Willapa River Summer Flow Balance and Residuals.

Hydrolab data, although there are no side-by-side data, the temperature, salinity, and surface DO values compare fairly well. However, the two meters do not agree for many of the deeper DO measurements. In most locations the Hydrolab DO profiles decline with depth at a much greater rate than the Seabird profiles. The reason for this discrepancy is not clear. Possibly because the Seabird casts measured a profile in 30 to 70 seconds (the Hydrolab casts took 6 to 10 minutes), the Seabird was unable to capture the lower DO levels near the bottom due to the rapidity of the profiling. Cosmopolitan's data will be used in model development, but the inconsistency between Hydrolab and Seabird data will be taken into account.

Figures D.1 through D.8. in Appendix D show Hydrolab® Datasonde datalogger dissolved oxygen measurements for the eight periods when the dataloggers were deployed. At Camp One Road, percent saturation of DO is also displayed in the figures, to show the diurnal cycle of oxygen productivity and respiration. This site shows a strong signal of photosynthetic

productivity, with the highest oxygen concentration and saturation levels in the afternoon and the lowest levels in the morning. By early November (Figure D.8) the productivity signal has almost disappeared.

At the three marine deployment sites, salinity instead of percent saturation is shown in the figures, which helps to show the cycles of tidal flow. The plot from Raymond in Figure D.1 shows DO and salinity patterns that are unusually variable and must be interpreted with caution. Computer modeling in the second phase of this study may shed some light on the accuracy of these measurements. The data shown in the other plots in Appendix D appear to be relatively “well-behaved”.

In general, DO at the marine sites followed seasonal and tidal patterns. DO was lower during summer months when water temperatures were elevated. DO also tended to be higher at the high tides and lower at low tides. This may in part reflect cooler oceanic water entering at high tide, but may also result from the local effects of channel conditions and pollutant loading. Computer modeling in the second phase of this study may shed more light on the causes of these patterns.

Compliance with Standards

The Willapa River TMDL survey results were reviewed for their compliance with state water quality standards. All ammonia nitrogen levels in surface waters met applicable criteria, and only a few isolated pH readings fell below the range specified in the standards. The 1998 303d list includes no listings for ammonia or pH in the study area, which is supported by these data.

Temperature measurements were compared to the criteria of 18°C for freshwater and 16°C for marine water. Table 2 shows the stations where temperatures exceeded those standards. Stations with only one reading in a survey are noted. Temperatures above criteria were found from May through October, with high temperatures most widespread in early August. Although natural conditions likely contribute to high water temperatures in the Willapa basin, a scientific study would be necessary to determine the contribution of human activities to temperature conditions. Such a study is not planned at this time, but will likely occur at a future date.

Table 3 shows stations where DO fell below the freshwater criteria of 8 mg/L or the marine criteria of 6 mg/L. Only stations where more than one measurement fell below standards are shown (because of the uncertainty associated with a single data point, and consistent with Ecology policy regarding 303d listing). Three sites with low DO were freshwater: the Willapa River at the Camp One Road bridge where DO dropped below standards in the morning hours, and the tributaries Fern Creek and Skidmore Slough. The rest of the stations with low DO are in marine waters. Low DO was most widespread during the early September survey. The detailed analysis planned for the second phase of this study must be completed before conclusions about the causes of low DO can be made.

Table 2. Sites with Temperatures Above Water Quality Standards.

MS RM	Trib RM	Station Name	Site Code	May 4-7	Jun 16-17	Jul 14-15	Jul 31-Aug 6	Aug 28-Sep 3	Sep 22-23	Oct 6-7	Nov 2-4
36.2	0.4	Fern Creek at Elk Prairie Rd	FERN				F*				
30.5	0.25	Fork Creek at State Hatchery	FORK				F*				
25.2		Willapa R at Oxbow Road	WROX					F*			
24.2	0.5	Stringer Ck at Highland-Stringer Rd	STRINGER				F				
21.4		Willapa R at SR 6 nr Menlo	WRMN			F*	F*	F*			
17.9	3.8	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2				F*				
17.9	0.3	Mill Creek at 1st Mill Ck Rd Br	MILLCK				F*				
17.5		Willapa R at Camp One Rd	WRC1		F	F	F	F			
13.7		Willapa R at Willapa Road	WRWI			F	M	M	M*		
12.0	0.1	Wilson Creek near Willapa	WILSON				M				
9.5		Willapa R near Ellis Slough	WREL-M				M	M			
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	M		M	M	M	M	M	
7.2	0.4	Riverdale Creek at Lions Club Park	RAYSW-3					M*			
7.1	1.0	South Fork Willapa R at Hwy 101	SFRK-M				M	M			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	M	M	M	M	M	M	M	
5.3	0.6	Skidmore Slough above tide gate	RAYSW-1			M*	M*	M*			
5.0		Willapa R at the Narrows	WRNA-M	M		M	M	M	M	M	
3.4	0.0	S Bend SW Pipe near Gardner's	SBSW-1				M*				
2.5		Willapa R below S Bend	WRSB-M	M*	M		M	M			
0.4		Willapa R at Johnson Sl	WRJS-M	M	M	M	M	M	M		
				F = measured temperatures exceeded freshwater criterion of 18 °C M = measured temperatures exceeded marine criterion of 16°C * = only one measurement this date							

Table 3. Stations with Dissolved Oxygen Below Water Quality Standards.

MS RM	Trib RM	Station Name	Site Code	July 15	Aug 4-5	Sept 1-2
36.20	0.4	Fern Creek at Elk Prairie Rd	FERN		X	X
17.50		Willapa R at Camp One Rd	WRC1	X	X	X
9.50		Willapa R near Ellis Slough	WREL-M			X
7.70		Willapa R at Hwy 101 Bridge	WRHY-M			X
7.10	1.0	South Fork Willapa R at Hwy 101	SFRK-M		X	X
6.40		Willapa R at Raymond (nr Port)	WRRM-M			X
5.30	0.6	Skidmore Slough above tide gate	RAYSW-1		X	X
5.00		Willapa R at the Narrows	WRNA-M			X
2.50		Willapa R below S Bend	WRSB-M			X
("X" = DO measurement below standards; sites with only one measurement below standards not included.)						

As discussed in Methods, FC bacteria levels from the TMDL surveys were averaged to determine compliance with water quality standards. Table 4 shows the results of that analysis. Only five sites met water quality standards for bacteria in the Willapa River watershed: the headwaters site on the mainstem Willapa River below Patton Creek, Trap and Stringer creeks, and upstream sites on Ward and Wilson creeks. Twenty-five stations exceeded the water quality standards for FC bacteria: 11 on the mainstem Willapa River and 14 on tributaries. High bacteria levels in Riverdale Creek were the subject of an intense investigation by city and county staff during the summer of 1998. Several potential sources were identified. Additional investigation of sources could be undertaken to determine possible sources of high bacteria levels in the Elk Prairie area (along Fern Creek and along the mainstem upstream of Swiss Park), and in the area upstream of the Route 6 bridge near Menlo. A detailed analysis of the sources causing the high bacteria levels will be the subject of the second phase of the study.

TMDL survey monitoring results were compared to effluent limitations for the five permitted point sources. Effluent quality for permitted dischargers fell within permit limits, except for the following:

- Coast Seafoods temperatures exceeded their permit limit of 18.3°C (65°F) during August and September surveys. However, since they use river water for rinsing and the river was around 21°C in August and 20°C in September, they are actually returning the water to the river cooler than they withdrew it.
- FC bacteria in the City of Raymond WWTP discharge exceeded weekly limits during the July and December surveys and monthly limits from November 3 through December 1.
- The two Pacific Hardwoods mills and the Weyerhaeuser mill both are covered under the stormwater NPDES general permit. Stormwater samples from all three sites had fairly high FC bacteria levels (750 to 40,000 #/100mL). This suggests the possibility that stormwater discharges from these facilities may not be meeting water quality standards and the requirements of the general permit. Klebsiella is the bacterial strain typically found in runoff from wood product sites. Although it is not a true coliform (associated with sewage and manure), it is included in the fecal coliform test and therefore falls under the water quality standards. Klebsiella was not separately measured in this study. Further evaluation will be necessary to determine the cause of high levels and compliance with standards.
- Coast Seafoods had surprisingly high FC bacteria levels in its effluent (as high as 300,000 #/100mL during the July survey). The high values may be causing a violation of water quality standards. The source of bacteria is uncertain, but it is probably not an animal source. Possibly the bacteria grow in the wastewater system with the wastewater as their food source. More investigation of these high levels of bacteria is needed.

Table 4. Compliance with Fecal Coliform Water Quality Standards at Monitoring Sites.

MS RM	Trib RM	Sampling Station	Site Code	Highest 10 th percentile			Highest geometric mean			Meets Standards?
				Value	Date	Standard	Value	Date	Standard	
41.20		Willapa R below Patton Creek	WRPA	64	July	200	39	May-Jul	100	yes
37.50	0.30	Falls Ck above Retreat Center	FALLS	294	November	200	58	Sep-Nov	100	NO
37.10		Willapa R at Swiss Picknik Rd	WRSW	790	July	200	522	Jul-Sep	100	NO
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	720	Early May	200	446	May-Jul	100	NO
33.20		Willapa R at Lebam	WRLE	540	Late May	200	344	May-Jul	100	NO
30.50	0.25	Fork Creek at State Hatchery	FORK	730	October	200	166	Sep-Oct	100	NO
30.00		Willapa R above Trap Creek	WRTR	160	August	200	104	Jun-Aug	100	NO
29.90	0.15	Trap Creek above Hwy 6	TRAP	63	August	200	45	Aug-Sep	100	yes
25.20		Willapa R at Oxbow Road	WROX	365	Late May	200	219	May-Jul	100	NO
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	69	October	200	42	Aug-Sep	100	yes
21.40		Willapa R at SR 6 near Menlo	WRMN	580	Late May	200	397	May-Jul	100	NO
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	194	June	200	152	Jun-Aug	100	NO
17.50		Willapa R at Camp One Rd	WRC1	330	July	200	141	Jul-Sep	100	NO
13.70		Willapa R at Willapa Road	WRWI	389	Late May	200	94	Oct-Dec	100	NO
12.00	0.9/1.2	Ward Creek below Fairchild Ck	WARD	85	Late Sept	200	51	Sep-Oct	100	yes
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	140	Late Sept	200	51	Sep-Oct	100	yes
12.00	0.10	Wilson Creek near Willapa	WILSON	240	Late May	200	127	May-Jul	100	NO
7.70		Willapa R at Hwy 101 Br	WRHY	417	Late May	43	60	Oct-Dec	14	NO
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	300000	July	200	35088	Jun-Aug	100	NO
7.10	4.20	So Fk Willapa R at Golf Course Rd	SFRK-F	185	August	200	130	Jul-Sep	100	NO
7.10	0.80	Drain at Bruckenhaus	RAYSW-5	82000	June	200	11615	May-Jul	100	NO
7.10	0.30	Raymond SW Drain north of PHW	RAYSW-6	302	November	200	94	Oct-Dec	100	NO
6.40		Willapa R at Raymond (near Port)	WRRR	464	Late May	43	62	May-Jul	14	NO
5.90	0.10	Raymond SW at Delaware St.	RAYSW-2	1300	Late May	200	312	Apr-Jun	100	NO
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	170	June	200	105	Jul-Sep	100	NO
5.00		Willapa R at the Narrows	WRNA	529	Late May	43	55	May-Jul	14	NO
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	10000	August	200	1889	Jul-Sep	100	NO
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	410	November	200	371	Oct-Dec	100	NO
3.10	0.00	Creek at Coast Seafoods	SBSW-2	3800	December	200	1755	May-Jul	100	NO
0.40		Willapa R at Johnson Slough	WRJS	94	November	43	16	May-Jul	14	NO

Conclusions and Recommendations

Ecology will incorporate the Willapa River TMDL study data into the second phase of the study, in which computer modeling and other analytical tools will be used to evaluate the Willapa River's compliance with water quality standards for FC bacteria and DO.

The data were evaluated for compliance with the state water quality standards. Temperature, FC bacteria, and DO levels failed to meet criteria at mainstem and tributary monitoring sites throughout the basin. These data support current 303d listings and may result in additional tributaries being added to the list. The second phase of this study will investigate causes of high FC bacteria and low DO. Water temperatures in the basin will be investigated as part of a future study.

Fecal coliform bacteria levels were above permit limitations for the City of Raymond Wastewater Treatment Plant during 1998. High bacteria levels were also seen in Coast Seafoods effluent and in stormwater runoff from the three wood products facilities in Raymond and South Bend. These compliance issues should be evaluated. Also, additional investigation of sources could be undertaken to determine possible sources of high bacteria levels in the Elk Prairie area (along Fern Creek and along the mainstem upstream of Swiss Park), and in the area upstream of the Route 6 bridge near Menlo.

References

- Cosmopolitan Engineering Group, 1998. Willapa River DO TMDL Additional Study. Cosmopolitan Engineering Group, Tacoma, WA.
- Ecology, 1997. Watershed Approach to Water Quality Management - Needs Assessment for the Lower Columbia Watershed. Publication WQ-97-08, Water Quality Program, Washington Department of Ecology, Olympia, WA.
- Phinney, L. A., and P. Bucknell, 1975. A Catalog of Washington Streams and Salmon Utilization, Volume 2, Coastal Region. Washington Department of Fisheries, Olympia, WA.
- Pickett, P.J., 1998a. Willapa River Fecal Coliform Bacteria Total Maximum Daily Load Study Quality Assurance Project Plan. Environmental Assessment Program, Washington Department of Ecology, Olympia, WA.
- Pickett, P.J., 1998b. Willapa River Dissolved Oxygen Total Maximum Daily Load Study Quality Assurance Project Plan. Environmental Assessment Program, Washington Department of Ecology, Olympia, WA.
- Pitz, C.F., 1998. Preliminary Findings, Willapa River Valley Groundwater Conditions, Willapa River TMDL, Memorandum to Paul Pickett dated April 1, 1998, Environmental Assessment Program, Washington Department of Ecology, Olympia, WA.

Abbreviations

<u>Name</u>	<u>Definition</u>
#/100mL	number of colonies per 100 milliliters
BOD	biochemical oxygen demand
°C	degrees celsius
cfu	colony forming units
EPA	U.S. Environmental Protection Agency
mg/l	milligram per liter
MS	mainstem
ppt	parts per thousand
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RM	river mile
TMDL	total maximum daily load
Trib	tributary
USGS	United States Geological Survey
WWTP	wastewater treatment plant

Waterbody numbers

WA-24-0020
WA-24-2010
WA-24-2020
WA-24-2030

Contacts

Paul J. Pickett Washington State Department of Ecology
Environmental Assessment Program
(360) 407-6685
ppic461@ecy.wa.gov

For additional copies of this publication, please contact the Department of Ecology Publications Distribution Office and refer to publication number 00-03-005.

PO Box 47600
Olympia, WA 98504-7600
(360) 407-7472
ecypub@ecy.wa.gov

The Department of Ecology is an equal opportunity agency and does not discriminate on the basis of race, creed, color, disability, age, religion, national origin, sex, marital status, disabled veteran's status, Vietnam Era veteran's status or sexual orientation.

If you have special accommodation needs or require this document in alternative format, please contact Shirley Rollins at (360) 407-6696 (voice). Ecology's telecommunication device for the deaf (TDD) number at Ecology Headquarters is (360) 407-6006.

Appendix A

Stream Discharge Monitoring

Appendix A

Stream Discharge Monitoring for the Willapa River TMDL by Art Larson

Ecology staff installed nine continuous streamflow stations to monitor the discharge of the Willapa River system. Each station was equipped with a Unidata datalogger, a Unidata 2-meter pressure transducer, a protective steel box to house the datalogger, a 10 ft. piece of Unistrut and an 8"x8" concrete block, both used to secure the transducer. A staff gage or other measuring point was also installed to independently measure stage height. Stations were established on the (1) Willapa River at Lebam, (2) Fork Creek, (3) Trap Creek, (4) the Willapa River at Oxbow, (5) Stringer Creek, (6) Mill Creek, (7) Ward Creek, and (8) the South Fork Willapa River. The stations were visited every two weeks from April through November 1998.

In addition to the continuous recording of stage, discharge rating equations were developed to convert the stage into streamflow. Five to six discharge measurements were made at each station. The measurements were made during the course of the study at different stream stages. When a discharge measurement was taken, the stage from the staff gage was read and recorded. The rating equations were calculated by regressing the discharge measurements against their respective staff gage reading. Pressure (psi) recorded by the datalogger was correlated with the staff gage and converted to stage in feet. These equations were then applied to the stage records to obtain a continuous record of streamflow.

The coefficient of determination (R^2) for these regressions ranged from 0.98 to 1.00. The 95% confidence interval for an R^2 of 0.98 ranges from about plus or minus 20% to 35% of the streamflow estimate, depending upon how far the estimate is above or below the mean of the regression. An R^2 of 0.99 has confidence intervals between about +/- 10% to 25%, and an R^2 of 1.00 has confidence intervals less than about +/- 15%. Thus, streamflow estimates for this study are at best within +/- 10% of their actual value (95% confidence level) and may range up to +/- 35% as the estimates are made near the extreme ends, both upper and lower, of the rating equation range.

Storm events in late November caused streamflow to greatly exceed the range of these rating equations. Streamflow at any station was not estimated when it exceeded 3 times (3x) the maximum discharge used in that station's rating equation. The error in the estimated discharge beyond the range of the rating curve (between 1X and 3X) may be quite large. The 95% confidence interval for an estimate outside the range of the rating equation may be +/- >100% of the estimated discharge.

The November storms also damaged three of the stations. Missing data were estimated by regressing existing data against that of a nearby station and using the resulting equation to estimate the missing records. The following is a description of each station and its associated data.

Willapa River at Lebam - The datalogger was installed on the left bank about 75 meters upstream from the Hiway 6 bridge at Lebam. Six discharge measurements were taken about 100 m upstream from the gage. Measurements used in the stream rating ranged from 7 to 135 cubic feet per second (cfs). The resulting rating equation was “Discharge (Q)=0.41(Stage^{4.8})” with an R² of 0.99. Streamflow was not estimated when it exceeded 400 cfs.

Fork Creek – The datalogger was installed on the right bank approximately 130 m upstream from the fish ladder at the State fish hatchery. Five discharge measurements were taken adjacent to the collection pens and ranged from 10 to 81 cfs. The rating equation was “Q=0.40(Stage^{5.96})” with an R² of 1.00. Streamflow was not estimated when it exceeded 250 cfs.

Trap Creek – The datalogger was installed on the left bank approximately ¼ mile upstream from Highway 6. Five discharge measurements, taken about 100 m upstream from the station, ranged from 14 to 48 cfs. The rating equation was “Q=0.04(Stage^{6.71})” with an R² of 1.00. Streamflow was not estimated above 150 cfs.

Willapa River at Oxbow – The datalogger was installed on the right bank about 175 m upstream from the county bridge. One high flow was measured from the bridge and four wading measurements were made just upstream of the bridge. Measured discharge ranged from 28 to 386 cfs. The rating equation was “Q=0.24(Stage^{5.5})” with an R² of 1.00. Streamflow was not estimated when it exceeded 1100 cfs.

Stringer Creek – The datalogger was installed on the downstream end of the box culvert under Hyland-Stringer Road. Five discharge measurements taken in the culvert or just upstream of the culvert, ranged from 2 to 12 cfs. The resulting rating equation was “Q=0.00002(Stage^{14.15})” with an R² of 0.97. Streamflow was not estimated beyond 36 cfs.

Mill Creek – The datalogger was installed on the right bank at the abandoned Butz Road bridge. Five discharge measurements were taken upstream of the bridge. Measured discharge ranged from 8 to 76 cfs. The rating equation was “Q=33.8(Stage^{3.0})” with an R² of 0.99. Streamflow was not estimated when it exceeded 250 cfs.

Wilson Creek – The datalogger was installed on the right bank just above the third bridge on Wilson Creek Road. The bridge is about 2.5 miles from the start of Wilson Creek Road. Five discharge measurements were taken just upstream of the bridge, ranging from 6 to 36 cfs. The resulting rating equation was “Q=218(Ln(Stage))-371” with an R² of 0.99. Streamflow was not estimated above 100 cfs.

Ward Creek – The datalogger was installed on the left bank near the turnouts off Ward Creek Road (near the A-700 and A-800 gates). However, the station was influenced by a downstream beaver dam and abandoned about half-way through the study. A new station was established further upstream. Although four discharge measurements were made at the original station, the ponding from the beaver dam made the stage record unreliable and a meaningful rating equation impossible. Although two discharge measurements were taken at the new station, this did not allow for a useful rating. Therefore, the streamflow of Ward Creek was estimated from Wilson Creek, a neighboring drainage.

The stage record for Ward Creek, when not influenced by ponding, was a mirror image of the stage record for Wilson Creek. A correlation between matching record segments had an R^2 of 0.99. To estimate streamflow from the Wilson Creek record, the measured discharge of Ward Creek was regressed against the corresponding discharge of Wilson Creek. This equation was then applied to the entire Wilson Creek record to obtain the streamflow for Ward Creek. The equation was “Ward Cr $Q=0.05(\text{Wilson Cr } Q^{1.55})$ ” with an R^2 of 0.97. The measured discharge for Ward Creek ranged from less than 1 to 62 cfs. The streamflow from Wilson Creek was not estimated when discharge exceeded 60 cfs.

South Fork Willapa River – The datalogger was installed on the bulkhead of the water treatment plant adjacent to the golf course. Discharge measurements were taken downstream near the corner of the treatment plant fence. Five measurements were made ranging from 34 to 152 cfs. The rating equation developed from these measurements was “ $Q=4.6(\text{Stage}^{4.23})$ ” with an R^2 of 0.98. Streamflow was not estimated when the discharge exceeded 450 cfs.

Appendix B

Data Quality Assurance/Quality Control

Appendix B

Data Quality Assurance/Quality Control

All field monitoring meters were calibrated according to manufacturer's specifications. Temperature thermistors in the meters are factory calibrated. All Hydrolab[®] meters were calibrated for specific conductance, DO, and pH prior to each survey, and checked against standards after each survey. All other meters were checked against standards before and after surveys. DO measured in the laboratory by the Winkler method from a saturated water bath was used as the standard for calibrating and checking Hydrolab[®] DO meter readings.

To measure the variability (bias and precision) of field data, sequential duplicate samples were taken of laboratory parameters, and field verification samples were taken for comparison with field measurements.

To compare paired values, the residual and the percent relative standard deviation (%RSD – the coefficient of variation expressed as a percentage) were calculated for each pair, and the root mean square (RMS) calculated for groups of data. In general, the RMS residual gives a measure of the magnitude of differences, while the %RSD gives a percent difference. In interpreting QA/QC results it is important to note that a pair of values that are low in magnitude with a low residual may have a high %RSD, while a pair of values high in magnitude with a high residual may have a low %RSD.

Data quality objectives for meter accuracy are shown in Table 1. For field parameters (with the exception of specific conductance) accuracy was assessed with the pairwise SD of meter readings compared to either field verification samples or standards. The %RSD was also used to assess accuracy, with a target of 5% for specific conductance and 10% for all other parameters.

Meter temperatures were spot-checked with a standard red liquid thermometer. Paired temperature readings had an overall RMS residual of 0.28 °C, which fell outside the target accuracy of ± 0.2 °C specified in the QAPP. However, the %RSD of the paired temperature measurements were all less than 6%, with a RMS %RSD of 1.5%. April temperature data (all measured with one meter and one thermometer) appeared to be particularly variable, and if April data are excluded, the overall RMS residual is 0.13 °C and the RMS %RSD is only 0.6%, which meets the data quality objectives. Post-calibration data for all meters also met data quality objectives, with the exception of Datasondes DS-8 and DS-9, which had residuals of about 0.3 °C. Temperature data are usable for this study, taking into account the higher variability noted for specific meters.

All pH standard checks were within the specified target accuracy (± 0.2 units), with the exception of Datasonde DS-5 during the early November survey, which had pH measurements about 0.35 above the standards. All pH data are usable for the study, with the bias taken into account for the exception noted.

Specific conductance readings were often outside the specified accuracy ($\pm 5\%$) for standard checks and field verification samples. The compensation factors programmed into the Orion meters sometimes appeared to be set to the wrong value. Data with consistent bias and the most

extreme error were corrected by multiplying by a correction factor determined by a linear correlation between the meter reading and the laboratory sample. The %RSD for corrected data ranged up to 28.3% for field verification pairs, and 21.6% for standard checks. Many of the conductivity readings appear to be highly variable, which must be taken into account during data analysis.

Conductivity is particularly important for the Hydrolab[®] meters, since high conductivity levels affect DO due to the salinity correction. Standards checks at the 10,000 $\mu\text{S}/\text{cm}$ range for Hydrolab[®] meters was 3% or better. For field verification samples, some pairs had %RSDs of 11% to 13%. An error in conductivity of 10% produces an error in the DO saturation of less than 2%. Therefore, the variability of the conductivity readings appears to have only a minor effect on DO readings.

DO field verification and post-survey standard checks were evaluated by meter and by survey. Data from laboratory Winkler titrations were judged to have greater accuracy than meter measurements, so DO values were corrected where field verification showed a strong bias by adding the average residual of the field verification pairs. In all cases DO data correction minimized bias and improved the relationship between meter results and laboratory DO data. The data reported in this publication have been corrected where appropriate.

Hydrolab[®] Reporter or Minisonde meters exhibited RMS SD values of less than 0.2 mg/L and %RSD values less than 3%, with the exception of one meter with a RMS SD of 0.25 mg/L and %RSD of 3.3%. Post-survey standards checks were generally good. Datasonde meters showed more variability in DO readings, with six meters (out of 26) exceeding RMS SD levels of 0.2 mg/L and ranging up to 0.5 mg/L. Datasonde %RSD values were 6% or less. Post-survey standard checks also indicated greater variability.

Replicate pairs of DO field measurements using the Winkler method had a pooled RMS SD of 0.14 mg/L, which is slightly above the QAPP data objectives, and a %RSD of 3.3%.

DO data are considered acceptable for use in the study, with the qualification that survey data from meters that showed high variability must be used with caution and the variability must be taken into account.

All laboratory analyses were performed within specified holding times. Data reported with qualifiers should be used with caution. All other data reported by Ecology's Manchester Laboratory may be used without qualification.

The data quality objectives for laboratory results were for no parameters to exceed 10% %RSD, except for results less than 10 times the reporting limit and FC bacteria results which should not exceed 50% %RSD. All parameters met this objective except for chlorophyll-*a*, total persulfate nitrogen, and total suspended solids. The %RSD for TPN is 11%, which is only slightly above the QAPP data quality objective. The %RSD for TSS was 19%, which did not appear to be skewed high due to low values, so the high variability must be taken into consideration.

Ultimate BOD water blanks, standard checks and replicates were evaluated for data quality. The water blank 35-day CBOD values all fell below the expected value. Three water blank BOD5

values were slightly above the expected value, while the rest were lower. The UBOD for sugar standards varied from -6.7% to 2.6% (standard methods calls for $\pm 2.1\%$ around a standard UBOD of 314.5 mg/L). Out of five standard checks, one was slightly higher than the standard range, and three were below the standard range.

The RMS %RSD values for UBOD field replicates and lab replicates were 18% and 14% respectively. The UBOD:BOD5 ratio (used for model inputs) had RMS %RSD values of 15% for field and 10% for lab replicates. Although this exceeds the data quality objective for laboratory results, the UBOD method requires fitting a time series to a second order function, so somewhat higher variability would not be unexpected. Most replicates were below 10% RSD, and a few outliers were responsible for the higher RMS. Overall the variability of UBOD results is acceptable, and will be taken into account when used in further analysis.

Pacific County staff collected upstream FC bacteria samples in coordination with Ecology's surveys. One pair of replicate samples was collected by Ecology and analyzed separately in Pacific County's and Ecology's laboratory, and one pair was collected by Pacific County and analyzed in the two laboratories. At two sites Pacific County and Ecology each took a sample and they were both analyzed at Ecology's laboratory. Although this is a very limited set of replicates, the results compared reasonably well (Table B.1). The pairwise %RSD met the quality objectives for this study, and residuals did not indicate any systematic bias.

Table B.1. Comparison of FC Bacteria Sample Splits.

Sampling Station	Collected by	Analyzed by	Station ID	Date	Time	FC #/100ml
Fork Creek at State Hatchery	Ecology	Ecology	FORK-2	11/17/98	13:33	8.0
Fork Creek at State Hatchery	Ecology	Pacific Co.	FORK-2	11/17/98	13:33	9.0
Fork Ck at A-400 Bridge	Pacific Co	Ecology	FORK-1	11/17/98	13:48	9.0
Fork Ck at A-400 Bridge	Pacific Co	Pacific Co.	FORK-1	11/17/98	13:48	3.0
Wilson Creek at 1st Weyco Br	Ecology	Ecology	WILSUP-1	12/1/98	12:53	23
Wilson Creek at 1st Weyco Br	Pacific Co	Ecology	WILSUP-1	12/1/98	12:53	17
Ward Creek blw Fairchild Ck	Ecology	Ecology	WARD	12/1/98	13:17	28
Ward Ck blw Fairchild Ck (Pac Co)	Pacific Co	Ecology	WARDUP	12/1/98	13:15	56
Ward Creek blw Fairchild Ck	Ecology	Ecology	WARD	12/1/98	13:17	41
Ward Ck blw Fairchild Ck (Pac Co)	Pacific Co	Ecology	WARDUP	12/1/98	13:15	56
RMS Pairwise %RSD						40.5%
RMS Pairwise SD						10.4

Appendix C
Survey Results

Table C.1

Table C.1. Daily Mean Stream Flow for Willapa River and Tributaries

Date	Willapa River USGS (cfs)	Willapa River Oxbow Rd (cfs)	Willapa River nr Lebam (cfs)	Trap Creek (cfs)	So. Fork Willapa River (cfs)	Stringer Creek (cfs)	Fork Creek (cfs)	Wilson Creek (cfs)	Mill Creek (cfs)	Ward Creek (cfs)
04/10/98	338		87		168	12.8			68.8	
04/11/98	396		100		197	13.6			72.2	
04/12/98	446		126		202	14.0			79.2	
04/13/98	454	468	124		191	12.9	105.9		77.6	
04/14/98	417	411	111		179	12.9	86.2		73.2	
04/15/98	387	374	100		170	11.6	88.0		69.1	
04/16/98	360	342	87	69.1	157	11.3	92.1	40.0	65.3	15.2
04/17/98	338	318	78	66.2	148	10.8	82.8	38.7	61.9	14.5
04/18/98	325	298	73	64.6	148	11.2	80.3	38.3	60.5	14.2
04/19/98	317	280	66	59.9	141	10.5	75.0	38.1	59.3	14.1
04/20/98	290	253	57	55.3	132	9.7	68.1	36.4	56.0	13.1
04/21/98	273	231	52	52.8	126	9.5	65.0	35.2	53.4	12.5
04/22/98	260	220	48	50.7	120	9.0	61.1	34.5	50.8	12.1
04/23/98	262	216	50	50.8	121	9.1	63.1	34.6	52.5	12.1
04/24/98	271	220	51	50.7	122	9.0	63.6	36.3	54.0	13.1
04/25/98	250	196	43	47.3	114	8.6	54.6	34.1	49.3	11.9
04/26/98	233	179	38	44.7	109	8.3	50.2	32.9	46.0	11.2
04/27/98	222	168	35	43.6	105	8.1	47.2	31.1	44.2	10.3
04/28/98	210	158	33	42.5	103	7.9	44.7	29.7	42.5	9.6
04/29/98	202	147	30	41.2	99	7.7	40.7	28.6	41.0	9.0
04/30/98	192	139	28	40.6	97	7.6	38.9	27.5	38.6	8.5
05/01/98	183	131	26	38.9	94	7.3	36.6	26.3	36.1	8.0
05/02/98	211	155	36	41.7	105	7.9	44.9	31.2	42.9	10.4
05/03/98	194	132	27	37.3	93	6.9	35.3	28.8	37.1	9.2
05/04/98	179	120	25	36.3	90	6.7	32.1	26.5	33.9	8.0
05/05/98	171	115	24	35.0	87	6.6	30.2	25.0	32.8	7.4
05/06/98	163	109	22	34.3	83	6.7	26.6	23.3	30.8	6.6
05/07/98	159	106	21	33.3	83	6.6	24.6	22.7	29.1	6.3
05/08/98	155	104	21	32.9	82	6.6	24.3	22.2	28.9	6.1
05/09/98	152	101	20	32.4	79	6.3	27.2	22.2	27.9	6.1
05/10/98	146	97	19	31.0	78	6.2	38.9	20.7	25.3	5.5
05/11/98	143	97	19	31.0	77	6.2	32.5	20.5	25.2	5.4
05/12/98	140	94	18	30.1	75	6.2	21.3	20.4	23.6	5.3
05/13/98	144	99	21	31.1	74	6.2	24.2	20.4	24.6	5.4
05/14/98	171	127	25	40.7	90	7.7	39.1	23.5	28.1	6.7
05/15/98	248	200	37	51.5	115	9.3	68.2	36.3	37.4	13.1
05/16/98	227	171	31	41.9	94	7.8	55.5	33.1	32.4	11.4
05/17/98	193	142	26	37.1	79	6.5	43.4	26.2	25.4	7.9
05/18/98	181	133	25	37.3	76	6.6	37.4	24.1	23.7	7.0
05/19/98	170	120	23	34.1	73	6.1	32.1	23.2	23.1	6.5
05/20/98	159	112	22	33.1	69	5.7	29.5	21.8	21.9	5.9
05/21/98	192	149	37	35.4	67	5.4	39.1	23.9	29.1	6.8
05/22/98	176	126	28	32.9	63	5.1	30.7	22.5	24.7	6.2
05/23/98	163	117	25	32.4	62	5.0	29.5	20.8	23.4	5.5
05/24/98	192	153	36	41.8	69	5.6	46.4	22.6	27.5	6.3
05/25/98	223	167	34	42.1	64	5.1	49.5	27.1	30.4	8.3
05/26/98	197	144	30	38.6	59	4.8	41.3	23.9	26.9	6.8

Table C.1. Daily Mean Stream Flow for Willapa River and Tributaries

Date	Willapa River USGS (cfs)	Willapa River Oxbow Rd (cfs)	Willapa River nr Lebam (cfs)	Trap Creek (cfs)	So. Fork Willapa River (cfs)	Stringer Creek (cfs)	Fork Creek (cfs)	Wilson Creek (cfs)	Mill Creek (cfs)	Ward Creek (cfs)
05/27/98	195	149	33	40.4	62	4.6	41.6	24.6	27.6	7.2
05/28/98	189	140	29	37.8	59	4.8	37.2	24.5	25.3	7.1
05/29/98	171	125	26	35.5	54	4.2	31.6	20.8	23.4	5.5
05/30/98	161	121	25	34.6	52	3.8	28.9	19.7	22.2	5.1
05/31/98	155	115	23	33.1	51	3.9	27.2	19.2	21.6	4.9
06/01/98	147	109	22	32.2	50	3.5	28.9	18.1	20.1	4.4
06/02/98	141	103	20	31.3	48	3.4	23.5	17.9	19.9	4.4
06/03/98	131	97	19	30.6	48	3.1	22.2	16.5	18.6	3.9
06/04/98	129	94	18	29.2	47	3.0	21.5	16.5	18.6	3.9
06/05/98	125	93	18	28.8	46	2.7	20.6	16.5	18.5	3.9
06/06/98	122	89	17	28.2	45	2.6	20.1	16.2	16.9	3.8
06/07/98	114	85	16	27.0	46	2.6	18.5	14.7	16.2	3.2
06/08/98	110	82	16	25.7	44	2.7	18.3	14.3	16.5	3.1
06/09/98	109	81	15	24.9	44	2.6	18.6	14.6	17.2	3.2
06/10/98	135	99	21	29.0	53	3.1	24.9	22.9	24.8	6.5
06/11/98	129	92	18	25.8	47	2.7	22.4	20.9	20.9	5.6
06/12/98	111	81	15	24.3	44	2.5	19.6	17.3	17.7	4.2
06/13/98	102	75	14	22.7	43	2.6	17.5	14.6	15.6	3.2
06/14/98	97	71	13	22.1	42	2.6	16.3	13.6	14.3	2.9
06/15/98	97	72	13	23.0	44	2.7	16.4	14.5	14.8	3.2
06/16/98	102	76	14	22.7	45	2.6	17.3	16.0	16.2	3.7
06/17/98	93	69	12	21.2	42	2.5	15.2	13.7	14.4	2.9
06/18/98	91	68	12	20.9	42	2.6	15.3	13.1	14.8	2.7
06/19/98	93	68	12	20.2	41	2.6	15.2	13.0	14.7	2.7
06/20/98	88	65	12	19.9	40	2.5	14.2	12.5	14.1	2.5
06/21/98	82	61	11	19.1	39	2.3	13.3	11.2	12.9	2.1
06/22/98	79	60	11	18.0	38	2.2	12.7	10.0	11.8	1.8
06/23/98	78	58	10	18.2	39	2.5	12.5	10.9	12.2	2.0
06/24/98	83	62	12	20.1	41	2.6	14.3	13.6	14.3	2.9
06/25/98	97	72	12	22.3	49	2.7	19.2	19.1	17.0	4.8
06/26/98	111	82	13	22.2	50	2.6	25.0	22.0	19.6	6.0
06/27/98	95	69	11	19.8	44	2.4	18.4	16.0	15.1	3.7
06/28/98	84	61	10	17.4	41	2.2	15.0	12.9	13.2	2.6
06/29/98	78	57	10	15.7	40	2.1	13.4	10.5	11.9	1.9
06/30/98	74	55	9	15.1	39	2.0	11.9	9.7	11.4	1.7
07/01/98	75	54	10	15.3	39	2.0	11.4	9.9	11.7	1.8
07/02/98	74	54	10	15.2	39	1.9	10.9	10.9	11.5	2.0
07/03/98	73	54	10	15.1	39	1.9	10.9	10.3	10.8	1.9
07/04/98	85	62	11	17.4	46	2.3	13.9	13.1	14.5	2.7
07/05/98	87	61	10	16.7	43	2.1	12.8	14.7	14.9	3.2
07/06/98	79	56	10	16.4	40	2.1	12.5	13.0	13.6	2.7
07/07/98	72	53	9	15.6	40	2.0	19.5	10.3	11.8	1.8
07/08/98	67	50	9	15.0	38	2.1	20.4	8.8	10.9	1.5
07/09/98	64	48	8	14.3	37	2.0	18.6	7.9	9.6	1.2
07/10/98	61	46	8	13.7	37	2.0	15.6	7.3	8.6	1.1
07/11/98	58	44	8	13.1	37	2.2	13.7	6.7	8.8	0.9
07/12/98	60	46	8	13.6	37	2.3	13.9	7.8	9.3	1.2

Table C.1. Daily Mean Stream Flow for Willapa River and Tributaries

Date	Willapa River USGS (cfs)	Willapa River Oxbow Rd (cfs)	Willapa River nr Lebam (cfs)	Trap Creek (cfs)	So. Fork Willapa River (cfs)	Stringer Creek (cfs)	Fork Creek (cfs)	Wilson Creek (cfs)	Mill Creek (cfs)	Ward Creek (cfs)
07/13/98	61	45	8	13.8	36	2.2	13.5	7.6	8.7	1.2
07/14/98	57	44	8	13.3	35	2.2	13.1	6.1	8.2	0.8
07/15/98	66	53	8	17.0	41	2.6	24.3	8.0	8.9	1.3
07/16/98	70	51	8	15.8	42	2.3	18.5	9.7	8.7	1.7
07/17/98	59	45	7	13.8	37	2.2	12.8	6.6	7.2	0.9
07/18/98	54	42	7	13.1	37	2.2	11.2	5.5	6.8	0.7
07/19/98	55	43	7	13.5	38	2.3	10.8	5.9	7.3	0.8
07/20/98	57 e	42	7	13.4	37	2.1	9.8	5.7	6.8	0.7
07/21/98	53 e	39	7	12.8	35	2.0	9.9	4.0	5.9	0.4
07/22/98	46	37	6	12.2	34	1.9	9.7	3.2	5.4	0.3
07/23/98	43	37	6	11.8	34	1.8	9.0	2.7	4.9	0.2
07/24/98	43	37	6	12.0	35	1.8	8.7	2.8	5.1	0.2
07/25/98	42	35	6	11.9	35	1.8	10.8	2.2	4.9	0.2
07/26/98	41	35	6	11.8	35	1.8	12.3	2.0	4.4	0.2
07/27/98	40	34	6	11.5	34	1.6	9.5	1.7	4.0	0.1
07/28/98	37	33	5	11.0	33	1.6	6.2	1.5	3.6	0.1
07/29/98	35	31	5	10.5	32	1.7	5.0	<1.5	3.6	<0.1
07/30/98	34	31	5	10.2	32	1.7	6.0	<1.5	3.5	<0.1
07/31/98	36	31	5	10.3	32	1.7	8.7	<1.5	4.0	<0.1
08/01/98	36	32	5	10.4	32	1.8	10.1	1.5	4.2	0.1
08/02/98	34	31	5	10.0	32	1.6	7.4	1.5	3.5	0.1
08/03/98	33	31	5	9.9	30	1.4	8.9	<1.5	3.2	<0.1
08/04/98	32	30	4	9.7	30	1.5	7.0	<1.5	2.9	<0.1
08/05/98	30	29	4	9.6	30	1.4	2.2	<1.5	2.9	<0.1
08/06/98	30	29	4	9.8	30	1.5	1.6	<1.5	2.9	<0.1
08/07/98	31	29	4	9.7	30	1.5	2.3	<1.5	2.8	<0.1
08/08/98	29	28	4	9.7	30	1.5	2.3	<1.5	2.5	<0.1
08/09/98	29	28	4	9.4	30	1.4	2.2	<1.5	2.4	<0.1
08/10/98	28	28	4	9.6	30	1.4	2.4	<1.5	2.3	<0.1
08/11/98	28	29	4	9.5	30	1.3	2.7	<1.5	2.3	<0.1
08/12/98	28	28	4	9.3	29	1.4	2.6	<1.5	2.3	<0.1
08/13/98	27	28	4	9.3	29	1.3	2.6	<1.5	2.0	<0.1
08/14/98	26	26	4	9.1	29	1.4	2.0	<1.5	1.9	<0.1
08/15/98	25	26	4	9.1	29	1.4	2.3	<1.5	2.1	<0.1
08/16/98	26	26	4	8.9	29	1.4	1.9	<1.5	1.9	<0.1
08/17/98	26	26	4	8.9	29	1.4	1.7	<1.5	1.9	<0.1
08/18/98	26	26	4	9.0	29	1.3	1.9	<1.5	1.7	<0.1
08/19/98	26	27	4	9.1	28	1.4	1.8	<1.5	1.7	<0.1
08/20/98	26	26	4	8.9	28	1.2	2.1	<1.5	1.6	<0.1
08/21/98	24	25	4	8.9	29	1.4	2.4	<1.5	1.6	<0.1
08/22/98	24	25	4	9.0	29	1.4	2.9	<1.5	1.5	<0.1
08/23/98	25	25	4	9.0	29	1.4	3.6	<1.5	1.8	<0.1
08/24/98	25	25	5	8.9	29	1.4	3.5	<1.5	1.9	<0.1
08/25/98	25	25	5	8.6	28	1.3	2.7	<1.5	1.7	<0.1
08/26/98	23	25	5	8.8	29	1.2	2.8	<1.5	1.5	<0.1
08/27/98	24	25	5	8.7	27	1.3	2.4	<1.5	1.5	<0.1
08/28/98	23	25	5	8.6	28	1.2	2.3	<1.5	1.5	<0.1

Table C.1. Daily Mean Stream Flow for Willapa River and Tributaries

Date	Willapa River USGS (cfs)	Willapa River Oxbow Rd (cfs)	Willapa River nr Lebam (cfs)	Trap Creek (cfs)	So. Fork Willapa River (cfs)	Stringer Creek (cfs)	Fork Creek (cfs)	Wilson Creek (cfs)	Mill Creek (cfs)	Ward Creek (cfs)
08/29/98	23	25	5	8.3	28	1.2	2.1	<1.5	1.5	<0.1
08/30/98	23	25	5	8.4	28	1.2	2.1	<1.5	1.4	<0.1
08/31/98	22	25	5	8.3	28	1.2	2.2	<1.5	1.5	<0.1
09/01/98	22	24	4	8.2	27	1.2	2.1	<1.5	1.4	<0.1
09/02/98	21	23	4	8.2	28	1.4	2.0	<1.5	1.2	<0.1
09/03/98	20	23	5	8.0	27	1.3	1.9	<1.5	1.2	<0.1
09/04/98	20	23	4	7.7	27	1.2	1.9	<1.5	1.1	<0.1
09/05/98	19	22	4	7.7	26	1.1	1.8	<1.5	1.0	<0.1
09/06/98	19	22	4	7.7	26	1.2	1.7	<1.5	0.9	<0.1
09/07/98	18	22	4	7.8	26	1.2	1.8	<1.5	1.0	<0.1
09/08/98	19	22	5	7.7	26	1.2	1.9	<1.5	0.9	<0.1
09/09/98	20	23	4	7.6	26	1.3	1.8	<1.5	0.9	<0.1
09/10/98	19	24	4	7.7	26	1.1	1.9	<1.5	1.0	<0.1
09/11/98	20	25	4	7.8	26	1.2	2.0	<1.5	0.9	<0.1
09/12/98	21	25	5	7.7	26	1.2	2.2	<1.5	1.1	<0.1
09/13/98	21	25	4	7.6	26	1.1	2.0	<1.5	1.2	<0.1
09/14/98	21	25	4	7.6	26	1.1	2.0	<1.5	1.2	<0.1
09/15/98	20	24	4	7.5	26	1.0	2.1	<1.5	1.2	<0.1
09/16/98	21	24	4	7.5	26	1.1	2.0	<1.5	1.0	<0.1
09/17/98	20	23	4	7.4	26	1.1	2.1	<1.5	1.1	<0.1
09/18/98	23	28	5	10.7	33	1.8	3.2	<1.5	1.7	<0.1
09/19/98	31	30	6	8.8	29	1.4	3.5	<1.5	2.5	<0.1
09/20/98	29	28	5	8.1	27	1.1	2.9	<1.5	1.8	<0.1
09/21/98	26	27	5	7.7	26	1.1	2.5	<1.5	1.5	<0.1
09/22/98	25	26	5	7.7	26	1.1	2.3	<1.5	1.4	<0.1
09/23/98	24	25	5	7.5	26	1.0	2.5	<1.5	1.4	<0.1
09/24/98	24	25	5	7.5	26	1.0	2.5	<1.5	1.5	<0.1
09/25/98	25	26	5	9.0	28	1.4	2.9	1.8	1.7	0.1
09/26/98	28	27	6	8.1	28	1.2	2.9	1.5	2.2	0.1
09/27/98	27	26	6	7.5	26	1.1	2.7	<1.5	1.9	<0.1
09/28/98	26	25	5	7.5	26	1.0	2.5	<1.5	1.8	<0.1
09/29/98	25	25	5	7.5	26	1.1	2.5	<1.5	1.5	<0.1
09/30/98	24	24	5	7.2	26	1.0	2.4	<1.5	1.4	<0.1
10/01/98	24	24	5	7.7	26	1.2	2.4	<1.5	1.3	<0.1
10/02/98	33	32	7	12.2	35	1.9	4.5	7.6	4.6	1.2
10/03/98	54	45	9	16.0	36	2.2	9.3	11.5	9.9	2.3
10/04/98	67	47	8	11.9	30	1.6	7.6	12.0	7.7	2.4
10/05/98	47	34	6	9.5	26	1.4	4.1	6.7	4.4	1.0
10/06/98	37	30	6	8.6	26	1.3	3.4	3.3	3.1	0.3
10/07/98	37	28	5	8.1	25	1.2	2.8	2.3	2.3	0.2
10/08/98	54	55	8	29.4	55	3.6	15.2	9.6	6.1	2.3
10/09/98	169	146	26	29.9	60	3.3	61.3	28.4	21.0	9.0
10/10/98	122	82	13	15.9	33	1.9	18.3	18.7	14.7	4.7
10/11/98	73	52	8	12.2	28	1.5	7.9	11.5	7.1	2.2
10/12/98	87	92	20	29.7	37	3.0	36.1	13.8	8.6	3.1
10/13/98	390	467	135	78.8	64	5.5	108.1	34.9	32.5	12.4
10/14/98	409	430	85	64.9	69	3.9	176.2	38.8	31.9	14.6

Table C.1. Daily Mean Stream Flow for Willapa River and Tributaries

Date	Willapa River USGS (cfs)	Willapa River Oxbow Rd (cfs)	Willapa River nr Lebam (cfs)	Trap Creek (cfs)	So. Fork Willapa River (cfs)	Stringer Creek (cfs)	Fork Creek (cfs)	Wilson Creek (cfs)	Mill Creek (cfs)	Ward Creek (cfs)
10/15/98	263	231	42	45.2	54	3.3	78.1	30.9	23.2	10.2
10/16/98	182	143	25	32.8	41	2.7	40.2	20.9	14.4	5.6
10/17/98	137	109	19	29.3	36	2.4	28.9	16.0	10.6	3.7
10/18/98	126	98	17	25.5	34	2.2	23.7	15.3	8.3	3.4
10/19/98	103	78	14	21.8	31	2.0	16.8	12.8	6.7	2.6
10/20/98	90	69	12	19.8	30	1.9	13.8	10.4	5.3	1.9
10/21/98	82	62	11	18.3	28	1.8	11.3	9.5	4.9	1.7
10/22/98	75	55	10	16.6	27	1.8	9.1	8.0	4.8	1.3
10/23/98	70	52	10	15.8	26	1.7	8.5	7.0	4.3	1.0
10/24/98	66	49	10	14.8	26	1.7	8.4	7.0	4.1	1.0
10/25/98	64	49	9	15.1	26	1.8	9.5	8.5	4.0	1.4
10/26/98	67	50	9	14.1	26	1.7	10.3	9.2	4.2	1.6
10/27/98	64	47	9	14.2	27	1.8	7.8	12.3	3.8	2.5
10/28/98	77	55	11	14.9	37	2.3	10.8	19.2	4.8	5.0
10/29/98	75	51	10	12.8	30	1.9	8.2	20.0	4.3	5.2
10/30/98	68	47	9	12.2	27	1.9	7.0	17.1	3.8	4.1
10/31/98	65	47	9	13.2	28	2.0	7.7	16.8	3.7	4.0
11/01/98	71	51	10	13.8	31	2.1	10.9	21.0	4.3	5.6
11/02/98	75	55	11	14.8	29	2.0	13.5	22.3	4.7	6.2
11/03/98	77	54	11	14.4	28	2.2	12.5	20.6	4.6	5.4
11/04/98	98	72	13	23.3	36	2.9	22.1	24.4	6.8	7.1
11/05/98	147	109	20	31.4	52	3.9	41.5	32.9	10.5	11.3
11/06/98	199	163	32	32.8	48	3.6	67.7	31.2	15.1	10.4
11/07/98	180	135	24	25.9	40	3.0	48.9	26.2	12.8	7.9
11/08/98	138	101	19	21.4	35	2.5	30.8	22.4	9.7	6.2
11/09/98	125	91	18	20.9	39	2.8	24.5	19.5	8.8	5.0
11/10/98	125	88	18	19.8	39	2.7	22.7	23.9	8.5	6.8
11/11/98	114	79	16	17.3	36	2.4	19.1	20.8	7.5	5.5
11/12/98	104	72	15	17.4	34	2.6	18.5	18.6	6.7	4.7
11/13/98	1120	>1100	>400	>150	>450	>36	>250	>100	55.2	>60
11/14/98	1430	>1100	269	>150	>450	20.0	>250	73.2	71.3	39.4
11/15/98	1380	>1100	>400	>150	>400	22.2	>250	66.0	71.2	33.2
11/16/98	1130	>1100	>350	>150	266	15.0	>250	56.6	61.3	26.2
11/17/98	725	886	203	>140	173	10.2	>250	40.9	45.0	15.8
11/18/98	581			105.7	139	8.7	196.2	35.1		12.4
11/19/98	532			106.0	130	9.0	>200	32.1		10.8
11/20/98	3600			>150	>450	>36	>250	>100		>40
11/21/98	4150			>150	>450	>36	>250	>100		>40
11/22/98	2710			>150	>450	>36	>250	>100		>40
11/23/98	2330			>150	>450	>36	>250	93.2		56.5
11/24/98	2520			>150	>450	>36	>250	91.8		55.2
11/25/98	8500			>150	>450	>36	>250	>100		>40
11/26/98	7470			>150	>450	>36	>250	>100		>40
11/27/98	3820			>150	>450	>36	>250			
11/28/98	2460			>150	>450	>36	>250			
11/29/98	2050			>150	>450	>36	>250			
11/30/98	1870			>150	>450	>36	>250			

Table C.1. Daily Mean Stream Flow for Willapa River and Tributaries

Date	Willapa River USGS (cfs)	Willapa River Oxbow Rd (cfs)	Willapa River nr Lebam (cfs)	Trap Creek (cfs)	So. Fork Willapa River (cfs)	Stringer Creek (cfs)	Fork Creek (cfs)	Wilson Creek (cfs)	Mill Creek (cfs)	Ward Creek (cfs)
12/01/98	3580			>150	>450	>36	>250			
12/02/98	7430			>150	>450	>36	>250			

Table C.2

Table C.2 Individual Flow Measurements from Surveys.

MS RM	Trib RM	Station Name	Site Code	Date Time		Average Channel		
						Flow (cfs)	Velocity (fps)	Area (sq ft)
41.20		Willapa R below Patton Creek	WRPA	4/21/98	10:20	14.1	1.2	11.5
41.20		Willapa R below Patton Creek	WRPA	5/6/98	10:15	10.2	1.2	8.1
41.20		Willapa R below Patton Creek	WRPA	5/26/98	11:29	11.6	1.0	11.6
41.20		Willapa R below Patton Creek	WRPA	6/16/98	11:50	7.2	0.8	8.6
41.20		Willapa R below Patton Creek	WRPA	7/14/98	11:40	4.9	0.6	7.6
41.20		Willapa R below Patton Creek	WRPA	8/4/98	10:57	2.4	0.4	6.1
41.20		Willapa R below Patton Creek	WRPA	9/1/98	10:20	1.5	0.3	5.1
41.20		Willapa R below Patton Creek	WRPA	9/22/98	10:55	1.2	0.3	4.7
41.20		Willapa R below Patton Creek	WRPA	10/6/98	11:04	1.9	0.3	6.3
41.20		Willapa R below Patton Creek	WRPA	11/3/98	11:25	4.2	0.5	8.0
41.20		Willapa R below Patton Creek	WRPA	11/17/98	11:45	33.6	1.8	18.4
39.05	0.10	Bear Creek at Elk Prairie Road		8/4/98	15:00	0.3	1.7	0.2
39.05	0.10	Bear Creek at Elk Prairie Road		9/1/98	15:25	0.2	1.0	0.2
37.50	0.30	Falls Ck abv Retreat Center	FALLS	8/4/98	12:33	3.6	0.5	7.9
37.50	0.30	Falls Ck abv Retreat Center	FALLS	9/1/98	15:00	3.0	0.6	4.8
37.50	0.30	Falls Ck abv Retreat Center	FALLS	9/22/98	11:35	3.0	1.0	2.9
37.50	0.30	Falls Ck abv Retreat Center	FALLS	10/6/98	13:35	4.2	1.1	3.7
37.50	0.30	Falls Ck abv Retreat Center	FALLS	11/3/98	10:42	7.1	1.0	7.3
37.50	0.30	Falls Ck abv Retreat Center	FALLS	11/17/98	11:30	52.4	2.8	18.8
37.10		Willapa R at Swiss Picknik Rd	WRSW	4/21/98	10:52	47.2	1.5	30.5
37.10		Willapa R at Swiss Picknik Rd	WRSW	5/6/98	10:44	28.8	1.1	26.6
37.10		Willapa R at Swiss Picknik Rd	WRSW	5/26/98	10:25	34.3	1.3	25.9
37.10		Willapa R at Swiss Picknik Rd	WRSW	6/16/98	12:50	19.0	1.0	19.0
37.10		Willapa R at Swiss Picknik Rd	WRSW	7/14/98	11:30	10.4	0.7	14.2
37.10		Willapa R at Swiss Picknik Rd	WRSW	8/4/98	10:46	6.1	0.5	12.8
37.10		Willapa R at Swiss Picknik Rd	WRSW	9/1/98	10:37	4.3	0.4	11.2
37.10		Willapa R at Swiss Picknik Rd	WRSW	9/22/98	11:50	5.1	0.4	13.7
37.10		Willapa R at Swiss Picknik Rd	WRSW	10/6/98	13:59	5.7	0.5	12.1
37.10		Willapa R at Swiss Picknik Rd	WRSW	11/3/98	11:38	11.9	0.5	22.6
37.10		Willapa R at Swiss Picknik Rd	WRSW	11/17/98	11:48	107.5	1.9	55.8
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	4/21/98	11:40	12.9	1.3	10.1
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	5/6/98	11:45	6.6	0.6	10.8
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	5/26/98	12:48	9.4	0.8	12.3
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	6/16/98	13:02	4.6	0.5	9.3
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	7/14/98	12:55	2.2	0.3	6.9
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	8/4/98	13:30	0.4	0.1	2.7
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	9/1/98	12:45	0.1	0.1	1.2
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	9/22/98	11:45	0.0	0.1	0.2
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	10/6/98	12:18	0.4	0.1	2.5

Table C.2 Individual Flow Measurements from Surveys.

MS RM	Trib RM	Station Name	Site Code	Date Time		Average Channel		
						Flow (cfs)	Velocity (fps)	Area (sq ft)
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	11/3/98	12:50	1.8	0.5	3.9
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	11/17/98	12:20	25.7	1.8	14.2
35.20	0.10	Pinnock Creek		8/4/98	14:00	0.3	0.8	0.4
35.20	0.10	Pinnock Creek		9/1/98	13:15	0.1	0.2	0.3
34.00	0.10	Half Moon Creek		8/4/98	13:30	0.2	2.5	0.1
32.10	0.10	Walker Creek		8/4/98	13:00	0.1	0.3	0.2
26.10	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	8/4/98	14:56	0.7	0.2	3.5
26.10	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	9/1/98	10:30	0.6	0.3	2.5
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	4/22/98	14:12	1.8	0.6	3.2
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	5/5/98	13:00	1.0	0.3	2.8
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	6/17/98	15:50	0.5	0.2	2.7
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	7/15/98	11:20	0.6	0.2	2.8
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	8/5/98	11:40	0.2	0.1	2.5
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	9/2/98	13:50	0.0	0.0	2.2
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	9/23/98	13:00	0.1	0.5	0.2
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	10/7/98	13:05	0.2	0.8	0.2
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	11/16/98	13:25	8.5	1.6	5.3
5.90	0.10	Raymond SW at Delaware St.	RAYSW-2	4/22/98	15:50	0.04	0.22	0.16

Table C.3

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
41.20		Willapa R below Patton Creek	WRPA	4/21/98	11:10		2.0	1.0
41.20		Willapa R below Patton Creek	WRPA	4/21/98	11:10		4.0	2.0
41.20		Willapa R below Patton Creek	WRPA	5/6/98	10:35		4.0	18
41.20		Willapa R below Patton Creek	WRPA	5/26/98	11:50	53	3.0	33
41.20		Willapa R below Patton Creek	WRPA	6/16/98	12:10		27	29
41.20		Willapa R below Patton Creek	WRPA	7/14/98	12:02		99	58
41.20		Willapa R below Patton Creek	WRPA	7/14/98	12:07		98	70
41.20		Willapa R below Patton Creek	WRPA	8/4/98	11:15		36	21 J
41.20		Willapa R below Patton Creek	WRPA	9/1/98	11:15		27	34
41.20		Willapa R below Patton Creek	WRPA	9/22/98	11:05		16	18
41.20		Willapa R below Patton Creek	WRPA	10/6/98	11:25		16	15
41.20		Willapa R below Patton Creek	WRPA	11/3/98	11:50		17	63
41.20		Willapa R below Patton Creek	WRPA	11/3/98	11:50		14	50
41.20		Willapa R below Patton Creek	WRPA	11/17/98	11:55	55	5.0	9.0
41.20		Willapa R below Patton Creek	WRPA	12/2/98	11:05		2.0	15
41.20		Willapa R below Patton Creek	WRPA	12/2/98	11:05		2.0	15
37.50	0.30	Falls Ck abv Retreat Center	FALLS	9/1/98	11:45	56		
37.50	0.30	Falls Ck abv Retreat Center	FALLS	9/22/98	11:34		70	35
37.50	0.30	Falls Ck abv Retreat Center	FALLS	9/22/98	11:35		75	40
37.50	0.30	Falls Ck abv Retreat Center	FALLS	10/6/98	14:09		32	30
37.50	0.30	Falls Ck abv Retreat Center	FALLS	11/3/98	10:47		78	320 J
37.50	0.30	Falls Ck abv Retreat Center	FALLS	11/3/98	10:49		66	270 J
37.50	0.30	Falls Ck abv Retreat Center	FALLS	11/17/98	11:40		7.0	34
37.50	0.30	Falls Ck abv Retreat Center	FALLS	12/2/98	10:47		1.0	9.0
37.50	0.30	Falls Ck abv Retreat Center	FALLS	12/2/98	10:50		1.0	21
37.10		Willapa R at Swiss Picknik Rd	WRSW	4/21/98	11:02		4.0	37
37.10		Willapa R at Swiss Picknik Rd	WRSW	5/6/98	10:54		15	240
37.10		Willapa R at Swiss Picknik Rd	WRSW	5/26/98	10:35		20	80
37.10		Willapa R at Swiss Picknik Rd	WRSW	6/16/98	13:00		46	220
37.10		Willapa R at Swiss Picknik Rd	WRSW	6/16/98	13:05		35	250
37.10		Willapa R at Swiss Picknik Rd	WRSW	7/14/98	11:40		92	790
37.10		Willapa R at Swiss Picknik Rd	WRSW	8/4/98	11:01		460	600 J
37.10		Willapa R at Swiss Picknik Rd	WRSW	9/1/98	10:53		92	300
37.10		Willapa R at Swiss Picknik Rd	WRSW	9/22/98	12:00		92	290
37.10		Willapa R at Swiss Picknik Rd	WRSW	9/22/98	12:05		88	370
37.10		Willapa R at Swiss Picknik Rd	WRSW	10/6/98	14:09	61	89	400
37.10		Willapa R at Swiss Picknik Rd	WRSW	11/3/98	11:50		31	240
37.10		Willapa R at Swiss Picknik Rd	WRSW	11/17/98	12:07		15	34
37.10		Willapa R at Swiss Picknik Rd	WRSW	12/2/98	11:00		11	72 J
37.10		Willapa R at Swiss Picknik Rd	WRSW	12/2/98	11:01		9.0	69
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	4/21/98	11:40		7.0	91
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	5/6/98	11:40		19	740 J
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	5/6/98	11:40		28	700 J
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	5/26/98	12:20		29	350
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	6/16/98	12:35	101	54	540
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	7/14/98	12:30		180	470
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	8/4/98	13:05		400	210 J

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	9/1/98	12:10	141	80	88
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	9/1/98	12:10		96	54
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	9/22/98	11:30		80	29
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	10/6/98	11:55		120	120
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	11/3/98	12:25		61	420
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	11/17/98	12:11		64	150
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	11/17/98	12:11		60	190
36.20	0.40	Fern Creek at Elk Prairie Rd	FERN	12/2/98	11:24	59	26	170
33.20		Willapa R at Lebam	WRLE	4/21/98	11:45	58	4.0	71
33.20		Willapa R at Lebam	WRLE	5/6/98	11:25		20	310
33.20		Willapa R at Lebam	WRLE	5/6/98	11:40		15	420
33.20		Willapa R at Lebam	WRLE	5/26/98	10:50		20	540
33.20		Willapa R at Lebam	WRLE	6/16/98	13:20	65	24	210
33.20		Willapa R at Lebam	WRLE	7/14/98	11:59		22	360
33.20		Willapa R at Lebam	WRLE	8/4/98	13:32		31	100 J
33.20		Willapa R at Lebam	WRLE	8/4/98	11:32		39	80 J
33.20		Willapa R at Lebam	WRLE	9/1/98	11:16		83	180
33.20		Willapa R at Lebam	WRLE	9/1/98	11:28		43	220
33.20		Willapa R at Lebam	WRLE	9/22/98	12:27		54	51
33.20		Willapa R at Lebam	WRLE	10/6/98	14:20		56	56
33.20		Willapa R at Lebam	WRLE	11/3/98	12:05		19	85
33.20		Willapa R at Lebam	WRLE	11/3/98	12:07		26	70
33.20		Willapa R at Lebam	WRLE	11/17/98	12:20		27	96
33.20		Willapa R at Lebam	WRLE	12/2/98	11:13		23	110
30.50	2.90	Fork Ck at A-400 Bridge	TRBKG-6	11/17/98	13:48			9.0
30.50	0.25	Fork Creek at State Hatchery	FORK	4/21/98	12:35		1.0	1.0 U
30.50	0.25	Fork Creek at State Hatchery	FORK	5/6/98	13:00		5.0	22
30.50	0.25	Fork Creek at State Hatchery	FORK	5/26/98	13:30		4.0	16
30.50	0.25	Fork Creek at State Hatchery	FORK	5/26/98	13:30		8.0	24
30.50	0.25	Fork Creek at State Hatchery	FORK	6/16/98	13:35		36	55
30.50	0.25	Fork Creek at State Hatchery	FORK	7/14/98	13:30	60	39	88
30.50	0.25	Fork Creek at State Hatchery	FORK	8/4/98	14:11		29	51 J
30.50	0.25	Fork Creek at State Hatchery	FORK	8/4/98	14:50	64		
30.50	0.25	Fork Creek at State Hatchery	FORK	9/1/98	13:15		66	71
30.50	0.25	Fork Creek at State Hatchery	FORK	9/22/98	12:10		46	100
30.50	0.25	Fork Creek at State Hatchery	FORK	9/22/98	12:10		55	77
30.50	0.25	Fork Creek at State Hatchery	FORK	10/6/98	12:55		35	730
30.50	0.25	Fork Creek at State Hatchery	FORK	11/3/98	13:50		12	46
30.50	0.25	Fork Creek at State Hatchery	FORK	11/17/98	13:14		4.0	6.0
30.50	0.25	Fork Creek at State Hatchery	FORK	11/17/98	13:33			8.0
30.50	0.25	Fork Creek at State Hatchery	FORK	12/2/98	11:52		9.0	41
30.00		Willapa R abv Trap Creek	WRTR	4/21/98	12:00		2.0	24
30.00		Willapa R abv Trap Creek	WRTR	4/21/98	12:10		6.0	22
30.00		Willapa R abv Trap Creek	WRTR	5/6/98	12:10		9.0	55
30.00		Willapa R abv Trap Creek	WRTR	5/26/98	11:10		9.0	88
30.00		Willapa R abv Trap Creek	WRTR	6/16/98	13:00		29	89
30.00		Willapa R abv Trap Creek	WRTR	7/14/98	12:10	64	34	80

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
30.00		Willapa R abv Trap Creek	WRTR	7/14/98	12:15		30	77
30.00		Willapa R abv Trap Creek	WRTR	8/5/98	6:38			160 J
30.00		Willapa R abv Trap Creek	WRTR	9/1/98	11:47		52	81
30.00		Willapa R abv Trap Creek	WRTR	9/1/98	11:49		80	75
30.00		Willapa R abv Trap Creek	WRTR	9/22/98	12:40		30	52
30.00		Willapa R abv Trap Creek	WRTR	10/6/98	14:36		37	66
30.00		Willapa R abv Trap Creek	WRTR	11/3/98	12:50		79	23
30.00		Willapa R abv Trap Creek	WRTR	11/17/98	12:30		11	57
30.00		Willapa R abv Trap Creek	WRTR	11/17/98	12:31		14	51
30.00		Willapa R abv Trap Creek	WRTR	12/2/98	11:26		18 J	89
29.90	1.00	Trap Creek at B-Line Bridge	TRBKG-5	9/1/98	13:04	59		
29.90	0.15	Trap Creek above Hwy 6	TRAP	4/21/98	12:55	48	1.0 U	1.0 U
29.90	0.15	Trap Creek above Hwy 6	TRAP	5/6/98	12:47		18	37
29.90	0.15	Trap Creek above Hwy 6	TRAP	5/26/98	11:20		3.0	18
29.90	0.15	Trap Creek above Hwy 6	TRAP	5/26/98	11:20		2.0	15
29.90	0.15	Trap Creek above Hwy 6	TRAP	6/16/98	13:50		1.0 U	25
29.90	0.15	Trap Creek above Hwy 6	TRAP	7/14/98	12:25		18	47
29.90	0.15	Trap Creek above Hwy 6	TRAP	8/4/98	13:05		41	67 J
29.90	0.15	Trap Creek above Hwy 6	TRAP	8/4/98	13:24		26	59 J
29.90	0.15	Trap Creek above Hwy 6	TRAP	9/1/98	13:20		39	28
29.90	0.15	Trap Creek above Hwy 6	TRAP	9/22/98	12:53		25	53
29.90	0.15	Trap Creek above Hwy 6	TRAP	10/6/98	14:44		34	22
29.90	0.15	Trap Creek above Hwy 6	TRAP	11/3/98	12:55		16	23
29.90	0.15	Trap Creek above Hwy 6	TRAP	11/17/98	12:41	49	5.0	30
29.90	0.15	Trap Creek above Hwy 6	TRAP	12/2/98	11:34		18 J	17
26.10	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	11/3/98	13:35	55		
25.20		Willapa R at Oxbow Road	WROX	4/21/98	12:48		4.0	3.0
25.20		Willapa R at Oxbow Road	WROX	5/6/98	13:20		9.0	27
25.20		Willapa R at Oxbow Road	WROX	5/26/98	11:50		120 J	360 J
25.20		Willapa R at Oxbow Road	WROX	5/26/98	11:50		130 J	370 J
25.20		Willapa R at Oxbow Road	WROX	6/16/98	14:05		10	110
25.20		Willapa R at Oxbow Road	WROX	7/14/98	12:35		11	260
25.20		Willapa R at Oxbow Road	WROX	8/4/98	13:52		60	11 J
25.20		Willapa R at Oxbow Road	WROX	8/4/98	14:05		73	31 J
25.20		Willapa R at Oxbow Road	WROX	9/1/98	13:57		7.0	100
25.20		Willapa R at Oxbow Road	WROX	9/22/98	13:20	68	33	81
25.20		Willapa R at Oxbow Road	WROX	10/6/98	14:55		17	180
25.20		Willapa R at Oxbow Road	WROX	10/6/98	14:56		20	160
25.20		Willapa R at Oxbow Road	WROX	11/3/98	14:24		17	31
25.20		Willapa R at Oxbow Road	WROX	11/17/98	13:04		8.0	55
25.20		Willapa R at Oxbow Road	WROX	12/2/98	11:53		25	110
24.80	1.60	Green Ck at Green Ck Rd Br	TRBKG-4	8/4/98	12:06	113		
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	4/21/98	12:36		1.0 U	5.0
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	5/6/98	13:57		2.0	2.0
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	5/26/98	11:40		1.0	40
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	6/16/98	14:20		17	12
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	6/16/98	14:25		10	8.0

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	7/14/98	12:45		63	22
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	8/4/98	15:18		9.5 J	68 J
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	9/1/98	13:43		54	33
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	9/22/98	13:04		59	32
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	10/6/98	15:02		28	80
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	10/6/98	15:03		26	60
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	11/3/98	13:55		14	12
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	11/17/98	12:56		9.0	32
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	11/17/98	12:57		3.0	28
24.20	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	12/2/98	11:46	47	5.0	12
21.40		Willapa R at SR 6 nr Menlo	WRMN	4/21/98	13:00		4.0	7.0
21.40		Willapa R at SR 6 nr Menlo	WRMN	5/6/98	14:00	61	20	37
21.40		Willapa R at SR 6 nr Menlo	WRMN	5/6/98	14:00		10	46
21.40		Willapa R at SR 6 nr Menlo	WRMN	5/26/98	13:50		53	580 J
21.40		Willapa R at SR 6 nr Menlo	WRMN	6/16/98	14:00		20	200 J
21.40		Willapa R at SR 6 nr Menlo	WRMN	7/14/98	14:08		17	540
21.40		Willapa R at SR 6 nr Menlo	WRMN	8/4/98	15:25		32	220 J
21.40		Willapa R at SR 6 nr Menlo	WRMN	8/4/98	15:25		23	200
21.40		Willapa R at SR 6 nr Menlo	WRMN	9/1/98	14:25		18	260
21.40		Willapa R at SR 6 nr Menlo	WRMN	9/22/98	12:45		38	100
21.40		Willapa R at SR 6 nr Menlo	WRMN	10/6/98	13:20	70	45	110
21.40		Willapa R at SR 6 nr Menlo	WRMN	11/3/98	14:45		28	49
21.40		Willapa R at SR 6 nr Menlo	WRMN	11/17/98	14:40		17	41
21.40		Willapa R at SR 6 nr Menlo	WRMN	12/2/98	12:12		18 J	96
21.40		Willapa R at SR 6 nr Menlo	WRMN	12/2/98	12:12		24 J	66
17.90	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	11/3/98	15:35	93		
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	4/21/98	13:25		3.0	15
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	4/21/98	13:25		2.0	21
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	5/6/98	14:25		7.0	23
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	5/26/98	14:03		27	30
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	6/16/98	14:30		34	180 J
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	6/16/98	14:30		38	210 J
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	7/14/98	14:27		44	140
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	8/4/98	16:10		150 J	130
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	9/1/98	15:06		19	66
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	9/22/98	13:10	96	28	12
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	10/6/98	13:40		67	92
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	10/6/98	13:40		65	92
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	11/3/98	15:15		16	25
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	11/17/98	14:59		13	26
17.90	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	12/2/98	12:32		9.0	46
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	4/21/98	13:15		4.0	4.0
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	4/22/98	13:20		5.0	27
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	4/22/98	13:20			28
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	4/22/98	18:25			32
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/5/98	11:10		14	65
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/5/98	18:10			27

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Enterococci #/100ml	FC #/100ml
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/6/98	15:35		9.0	53
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/26/98	12:10	61	13	120
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/27/98	8:15		22	320
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/27/98	14:20			230
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/16/98	14:40		1.0	38
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/17/98	10:35			60
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/17/98	17:00			43
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/17/98	17:00			38
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/17/98	10:35			80
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/14/98	13:03		29	330
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/14/98	13:05		22	330
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/15/98	10:23		23	84
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/15/98	15:13			140
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	8/4/98	15:46		11	100 J
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	8/5/98	9:40		76	78 J
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	8/5/98	9:40		58	82 J
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/1/98	14:17		7.5	150 J
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/2/98	9:25		52	180 J
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/22/98	13:25		39	53
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/23/98	12:25		24	130
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/6/98	14:00		20	100
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/7/98	11:00		23	91
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/3/98	16:00		14	100
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/4/98	13:00		27	29
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/4/98	13:00		28	43
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/16/98	12:27		53	230
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/17/98	15:08		8.0	46
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	12/1/98	11:30			220
17.50		Willapa R at Camp One Rd (Bullard Rd)	WRC1	12/2/98	12:51		26 J	120
13.70		Willapa R at Willapa Road	WRWI	4/22/98	13:45			69
13.70		Willapa R at Willapa Road	WRWI	4/22/98	18:05			71
13.70		Willapa R at Willapa Road	WRWI	5/5/98	11:45			49
13.70		Willapa R at Willapa Road	WRWI	5/5/98	17:05			19
13.70		Willapa R at Willapa Road	WRWI	5/5/98	17:05			26
13.70		Willapa R at Willapa Road	WRWI	5/27/98	8:15			490 J
13.70		Willapa R at Willapa Road	WRWI	5/27/98	13:40			290
13.70		Willapa R at Willapa Road	WRWI	5/27/98	13:40			330 J
13.70		Willapa R at Willapa Road	WRWI	6/17/98	11:05	72		54
13.70		Willapa R at Willapa Road	WRWI	6/17/98	16:35			29
13.70		Willapa R at Willapa Road	WRWI	7/15/98	10:50	100		46
13.70		Willapa R at Willapa Road	WRWI	7/15/98	10:50			39
13.70		Willapa R at Willapa Road	WRWI	7/15/98	15:00			39
13.70		Willapa R at Willapa Road	WRWI	8/5/98	12:10			84
13.70		Willapa R at Willapa Road	WRWI	9/2/98	8:40			54
13.70		Willapa R at Willapa Road	WRWI	9/2/98	12:45			32
13.70		Willapa R at Willapa Road	WRWI	9/23/98	7:55	4,260		34
13.70		Willapa R at Willapa Road	WRWI	9/23/98	7:55			22

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
13.70		Willapa R at Willapa Road	WRWI	9/23/98	12:00	3,990		33
13.70		Willapa R at Willapa Road	WRWI	10/7/98	9:10			69
13.70		Willapa R at Willapa Road	WRWI	10/7/98	12:15	3,900		60
13.70		Willapa R at Willapa Road	WRWI	11/4/98	6:55			18
13.70		Willapa R at Willapa Road	WRWI	11/4/98	12:20			64
13.70		Willapa R at Willapa Road	WRWI	11/16/98	12:05	63		210 J
13.70		Willapa R at Willapa Road	WRWI	11/16/98	16:51	66		140
13.70		Willapa R at Willapa Road	WRWI	11/16/98	16:51	66		160
13.70		Willapa R at Willapa Road	WRWI	12/1/98	11:12			110
13.70		Willapa R at Willapa Road	WRWI	36130	11:12			88
13.70		Willapa R at Willapa Road	WRWI	12/1/98	15:03	54	59	430 J
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	9/2/98	11:35		52	43
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	9/23/98	10:05	93	20	100
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	9/23/98	10:05		12	72
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	10/7/98	12:30		43	37
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	11/4/98	11:25		9.5	60
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	11/16/98	14:04		8.0	17
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	12/1/98	13:17		12	28
12.00	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	12/1/98	13:17		17	41
12.00	0.9/1.3	Ward Ck blw Fairchild Ck (Pac Co. site)	WARDUP	12/1/98	13:15			56
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	9/2/98	12:00	91	24	20
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	9/2/98	12:00		31	20
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	9/23/98	10:30		59	140
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	10/7/98	11:50		18	46
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	11/4/98	11:55		1.0	19
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	11/16/98	14:21		7.0	27
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	11/16/98	14:21		2.0	25
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	12/1/98	12:53		8.0	23
12.00	1.45	Wilson Creek at 1st Weyco Br	WILSUP	12/1/98	12:53			17
12.00	0.10	Wilson Creek near Willapa	WILSON	4/22/98	17:50		4.0	29
12.00	0.10	Wilson Creek near Willapa	WILSON	5/5/98	16:25		2.0	20
12.00	0.10	Wilson Creek near Willapa	WILSON	5/27/98	8:35		60	240 J
12.00	0.10	Wilson Creek near Willapa	WILSON	5/27/98	8:35		52	240 J
12.00	0.10	Wilson Creek near Willapa	WILSON	6/17/98	13:35			66
12.00	0.10	Wilson Creek near Willapa	WILSON	7/15/98	12:56		130	130
12.00	0.10	Wilson Creek near Willapa	WILSON	8/5/98	8:05		200	150 J
9.50		Willapa R near Ellis Slough	WREL-M	8/5/98	7:02	16,900		
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	4/22/98	11:20			2.0
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	4/22/98	15:21			8.0
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	4/22/98	11:00			2.0
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	4/22/98	11:10			1.0 U
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	4/22/98	15:15			3.0
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	5/5/98	16:25			54
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	5/5/98	16:23			16
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	5/5/98	16:24			11
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	5/27/98	9:26			170 J
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	5/27/98	9:28			160 J

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	5/27/98	9:24			180 J
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	5/27/98	12:25			1,300 J
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	5/27/98	12:22			780 J
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	6/17/98	10:16			11
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	6/17/98	12:55			11
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	6/17/98	10:12	15,800		17
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	6/17/98	10:14			20
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	6/17/98	12:50			17
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	7/15/98	10:03			10
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	7/15/98	12:20			59
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	7/15/98	12:21			55
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	7/15/98	10:02			12
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	7/15/98	12:15			45
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	8/5/98	7:28			90 J
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	8/5/98	11:30			17
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	8/5/98	7:26			66
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	8/5/98	11:26			13
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	8/5/98	11:28			9.0
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	9/2/98	11:12			13
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	9/2/98	11:13			7.0
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	9/2/98	7:34			66
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	9/2/98	7:33			61
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	9/23/98	8:26			4.0
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	9/23/98	8:27			8.0
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	9/23/98	11:18			39
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	9/23/98	8:24			12
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	9/23/98	11:14			31
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	10/7/98	8:43			49
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	10/7/98	12:16			19
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	10/7/98	8:39			53
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	10/7/98	8:40			40
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	10/7/98	12:15			27
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	11/4/98	7:48			37
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	11/4/98	11:47			14
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	11/4/98	7:47			23
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	11/4/98	11:46			13
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	11/16/98	11:28			160 J
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	11/16/98	15:00			210 J
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	11/16/98	15:01			190 J
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	11/16/98	11:26			170 J
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	11/16/98	14:55	1,560		310
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	12/1/98	11:50			40
7.70		Willapa R at Hwy 101 Br - left	WRHY-L	12/1/98	15:48			120
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	12/1/98	11:45			280
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	12/1/98	15:45			71
7.70		Willapa R at Hwy 101 Br - right	WRHY-R	12/1/98	15:46			65
7.50	0.10	Weyco SW Outfall W-9	WEY-SW9	11/4/98	9:10			77

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
7.40	0.10	Weyco SW Outfall W-8	WEY-SW8	11/4/98	9:30			7,300
7.40	0.10	Weyco SW Outfall W-8	WEY-SW8	11/4/98	9:30			40,000
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	4/22/98	14:25			87
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	5/5/98	13:00			580
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	6/17/98	16:10			16,000 J
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	6/17/98	16:10			16,000 J
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	7/15/98	11:33			300,000 J
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	8/5/98	11:45			9,000
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	9/2/98	14:58			5,600
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	9/23/98	13:05		2,300	1,500
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	10/7/98	13:10			690 J
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	10/7/98	13:10			780 J
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	11/16/98	13:48			250
7.20	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	12/1/98	16:10			9,500 J
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	4/22/98	15:10	64	2.0	2.0
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	5/5/98	14:00		2.0	3.0
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	5/5/98	14:00		1.0	6.0
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	5/27/98	13:05		11	140
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	6/17/98	11:35			43
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	7/15/98	14:35		80	110
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	7/15/98	14:35		79	180
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	8/5/98	10:50		27	185 J
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	9/2/98	10:40		55	84
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	9/23/98	9:40		29	57
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	10/7/98	10:20		49	39
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	10/7/98	10:20		36	45
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	11/4/98	10:55		18	52
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	11/16/98	14:47		61	25
7.10	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	12/1/98	12:03		6.0	33
7.10	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	7:58	24,500		
7.10	0.80	Drain at Bruckenhaus	RAYSW-5	5/27/98	10:55	1,640		3,900 J
7.10	0.80	Drain at Bruckenhaus	RAYSW-5	6/17/98	14:00	1,790		82,000 J
7.10	0.80	Drain at Bruckenhaus	RAYSW-5	7/15/98	12:37			4,900
7.10	0.40	PHW/Raymond SW	PHW-SW1	11/4/98	8:00			750
7.10	0.30	Raymond SW Drain north of PHW	RAYSW-6	11/4/98	8:10			210
7.10	0.30	Raymond SW Drain north of PHW	RAYSW-6	11/4/98	8:10			435
7.10	0.30	Raymond SW Drain north of PHW	RAYSW-6	11/16/98	15:56			14
7.10	0.30	Raymond SW Drain north of PHW	RAYSW-6	12/1/98	15:57	837		170
7.10	0.30	Raymond SW Drain north of PHW	RAYSW-6	12/1/98	15:57			230
7.10	0.10	Weyco SW Outfall W-2	WEY-SW2	11/4/98	9:55			510
7.00	0.00	Raymond WWTP	RAYTP	4/22/98	8:10			11
7.00	0.00	Raymond WWTP	RAYTP	4/22/98	15:20			3.0
7.00	0.00	Raymond WWTP	RAYTP	5/5/98	12:40			5.0
7.00	0.00	Raymond WWTP	RAYTP	5/6/98	12:50	1,560	3.0	1.0
7.00	0.00	Raymond WWTP	RAYTP	5/27/98	10:40			1.0
7.00	0.00	Raymond WWTP	RAYTP	5/27/98	15:00			2.0
7.00	0.00	Raymond WWTP	RAYTP	5/27/98	15:10			3.0

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
7.00	0.00	Raymond WWTP	RAYTP	6/17/98	11:15			2.0
7.00	0.00	Raymond WWTP	RAYTP	6/17/98	11:20			3.0
7.00	0.00	Raymond WWTP	RAYTP	6/17/98	14:45			6.0
7.00	0.00	Raymond WWTP	RAYTP	7/15/98	10:30	2,110		4,600 J
7.00	0.00	Raymond WWTP	RAYTP	7/15/98	15:10			2,200 J
7.00	0.00	Raymond WWTP	RAYTP	9/2/98	10:10			60
7.00	0.00	Raymond WWTP	RAYTP	9/2/98	13:30			40
7.00	0.00	Raymond WWTP	RAYTP	9/2/98	13:30	1,960		20
7.00	0.00	Raymond WWTP	RAYTP	9/23/98	10:35			96
7.00	0.00	Raymond WWTP	RAYTP	9/23/98	10:25			120
7.00	0.00	Raymond WWTP	RAYTP	9/23/98	14:10			140
7.00	0.00	Raymond WWTP	RAYTP	10/7/98	11:15			81
7.00	0.00	Raymond WWTP	RAYTP	10/7/98	14:30			80
7.00	0.00	Raymond WWTP	RAYTP	11/3/98	10:00			69
7.00	0.00	Raymond WWTP	RAYTP	11/4/98	11:05			84
7.00	0.00	Raymond WWTP	RAYTP	11/4/98	11:15			40
7.00	0.00	Raymond WWTP	RAYTP	11/16/98	10:50	1,450		340
7.00	0.00	Raymond WWTP	RAYTP	11/16/98	15:15			160
7.00	0.00	Raymond WWTP	RAYTP	11/16/98	15:20			190
7.00	0.00	Raymond WWTP	RAYTP	12/1/98	8:55			320
7.00	0.00	Raymond WWTP	RAYTP	12/1/98	14:25	527		960
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	4/22/98	11:38			3.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	4/22/98	15:44			3.0
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	4/22/98	11:30			1.0
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	4/22/98	15:32	14,300		2.0
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	4/22/98	15:39			2.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	5/5/98	14:49			3.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	5/5/98	14:50			8.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	5/5/98	17:31			9.0
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	5/5/98	14:52			4.0
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	5/5/98	17:36			16
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	5/27/98	9:11			180 J
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	5/27/98	9:09			2,100 J
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	5/27/98	10:55			260 J
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	5/27/98	10:51			390 J
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	5/27/98	10:54			570 J
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	6/17/98	10:24			15
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	6/17/98	13:03			14
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	6/17/98	10:22			46
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	6/17/98	13:00			9.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	7/15/98	10:16			27
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	7/15/98	12:28			34
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	7/15/98	10:13			23 J
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	7/15/98	10:14			17
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	7/15/98	12:26			43
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	8/5/98	8:00			41

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	8/5/98	12:20			20
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	8/5/98	12:21			15
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	8/5/98	7:59			35
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	8/5/98	12:18			9.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	9/2/98	8:14			17
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	9/2/98	8:15			28
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	9/2/98	12:00			8.0
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	9/2/98	8:13			42
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	9/2/98	11:59			4.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	9/23/98	8:43			14
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	9/23/98	11:40			10
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	9/23/98	8:40	33,500		9.0
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	9/23/98	11:41			12
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	9/23/98	11:42			9.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	10/7/98	9:03			56
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	10/7/98	12:24			15
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	10/7/98	9:00			48
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	10/7/98	9:01			51
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	10/7/98	12:23			19
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	11/4/98	8:26			18
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	11/4/98	12:38			6.0
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	11/4/98	12:39			17
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	11/4/98	8:25			40
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	11/4/98	12:37			12
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	11/16/98	11:50			170 J
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	11/16/98	11:51			150 J
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	11/16/98	15:12			150 J
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	11/16/98	11:46			160
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	11/16/98	15:10			170 J
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	12/1/98	12:01			130
6.40		Willapa R at Raymond (nr Port) - left	WRRRA-L	12/1/98	15:57			270
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	12/1/98	11:58			32
6.40		Willapa R at Raymond (nr Port) - right	WRRRA-R	12/1/98	15:55			280
5.90	0.10	Raymond SW at Delaware St.	RAYSW-2	4/22/98	15:50			130
5.90	0.10	Raymond SW at Delaware St.	RAYSW-2	5/5/98	14:30			180
5.90	0.10	Raymond SW at Delaware St.	RAYSW-2	5/27/98	11:15			1,300
5.90	0.10	Raymond SW at Delaware St.	RAYSW-2	11/16/98	15:19			14
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	5/27/98	10:20	372		120
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	6/17/98	12:00			46
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	7/15/98	14:12			170
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	8/5/98	7:38			54
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	8/5/98	7:38			88
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	9/2/98	7:40			100
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	9/23/98	8:25			53
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	10/7/98	9:35			79
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	11/16/98	16:20			51
5.30	0.60	Skidmore Slough above tide gate	RAYSW-1	12/1/98	15:40			14

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
5.30	0.50	Skidmore Slough at 101 bridge	RAYSW-7	4/22/98	16:15			3.0
5.30	0.50	Skidmore Slough at 101 bridge	RAYSW-7	4/22/98	16:15			14
5.30	0.50	Skidmore Slough at 101 bridge	RAYSW-7	5/5/98	16:05			13
5.00		Willapa R at the Narrows - left	WRNA-L	4/22/98	11:50			1.0 U
5.00		Willapa R at the Narrows - left	WRNA-L	4/22/98	16:05			2.0
5.00		Willapa R at the Narrows - left	WRNA-L	4/22/98	16:08			2.0
5.00		Willapa R at the Narrows - right	WRNA-R	4/22/98	11:43			1.0
5.00		Willapa R at the Narrows - right	WRNA-R	4/22/98	15:59			3.0
5.00		Willapa R at the Narrows - left	WRNA-L	5/5/98	13:50			6.0
5.00		Willapa R at the Narrows - left	WRNA-L	5/5/98	13:51			7.0
5.00		Willapa R at the Narrows - left	WRNA-L	5/5/98	17:56			2.0
5.00		Willapa R at the Narrows - right	WRNA-R	5/5/98	13:54			7.0
5.00		Willapa R at the Narrows - right	WRNA-R	5/5/98	17:55			1.0
5.00		Willapa R at the Narrows - left	WRNA-L	5/27/98	8:58			310 J
5.00		Willapa R at the Narrows - left	WRNA-L	5/27/98	10:41			690 J
5.00		Willapa R at the Narrows - right	WRNA-R	5/27/98	9:00			540 J
5.00		Willapa R at the Narrows - right	WRNA-R	5/27/98	10:42			680 J
5.00		Willapa R at the Narrows - left	WRNA-L	6/17/98	10:43			14
5.00		Willapa R at the Narrows - left	WRNA-L	6/17/98	13:50			11
5.00		Willapa R at the Narrows - right	WRNA-R	6/17/98	10:41			11
5.00		Willapa R at the Narrows - right	WRNA-R	6/17/98	13:45			23
5.00		Willapa R at the Narrows - right	WRNA-R	6/17/98	13:45			20
5.00		Willapa R at the Narrows - left	WRNA-L	7/15/98	10:32			15
5.00		Willapa R at the Narrows - left	WRNA-L	7/15/98	12:43			34
5.00		Willapa R at the Narrows - right	WRNA-R	7/15/98	10:27	28,300		19
5.00		Willapa R at the Narrows - right	WRNA-R	7/15/98	10:28			21
5.00		Willapa R at the Narrows - right	WRNA-R	7/15/98	12:40			29
5.00		Willapa R at the Narrows - left	WRNA-L	8/5/98	8:33			9.5
5.00		Willapa R at the Narrows - left	WRNA-L	8/5/98	12:54			8.0 J
5.00		Willapa R at the Narrows - left	WRNA-L	8/5/98	12:55			11 J
5.00		Willapa R at the Narrows - right	WRNA-R	8/5/98	8:31			13
5.00		Willapa R at the Narrows - right	WRNA-R	8/5/98	12:53			15
5.00		Willapa R at the Narrows - left	WRNA-L	9/2/98	8:40			3.0
5.00		Willapa R at the Narrows - left	WRNA-L	9/2/98	8:41			3.0
5.00		Willapa R at the Narrows - left	WRNA-L	9/2/98	12:52			1.0
5.00		Willapa R at the Narrows - right	WRNA-R	9/2/98	8:39			3.0
5.00		Willapa R at the Narrows - right	WRNA-R	9/2/98	12:50			5.0
5.00		Willapa R at the Narrows - right	WRNA-R	9/2/98	12:51			5.0
5.00		Willapa R at the Narrows - left	WRNA-L	9/23/98	9:01			3.0
5.00		Willapa R at the Narrows - left	WRNA-L	9/23/98	11:51			5.0
5.00		Willapa R at the Narrows - right	WRNA-R	9/23/98	8:58			7.0
5.00		Willapa R at the Narrows - right	WRNA-R	9/23/98	11:49			8.0
5.00		Willapa R at the Narrows - left	WRNA-L	10/7/98	9:26			17
5.00		Willapa R at the Narrows - left	WRNA-L	10/7/98	11:59			8.0
5.00		Willapa R at the Narrows - right	WRNA-R	10/7/98	9:25			30
5.00		Willapa R at the Narrows - right	WRNA-R	10/7/98	11:58			16
5.00		Willapa R at the Narrows - left	WRNA-L	11/4/98	8:55			16

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
5.00		Willapa R at the Narrows - left	WRNA-L	11/4/98	13:14			1.5
5.00		Willapa R at the Narrows - right	WRNA-R	11/4/98	8:53			18
5.00		Willapa R at the Narrows - right	WRNA-R	11/4/98	8:54			19
5.00		Willapa R at the Narrows - right	WRNA-R	11/4/98	13:13			11
5.00		Willapa R at the Narrows - left	WRNA-L	11/16/98	12:03			130 J
5.00		Willapa R at the Narrows - left	WRNA-L	11/16/98	15:25			160 J
5.00		Willapa R at the Narrows - left	WRNA-L	11/16/98	15:26			140
5.00		Willapa R at the Narrows - right	WRNA-R	11/16/98	12:00			170 J
5.00		Willapa R at the Narrows - right	WRNA-R	11/16/98	15:20			140
5.00		Willapa R at the Narrows - left	WRNA-L	12/1/98	12:09			35
5.00		Willapa R at the Narrows - left	WRNA-L	12/1/98	12:10			36
5.00		Willapa R at the Narrows - left	WRNA-L	12/1/98	16:10			49
5.00		Willapa R at the Narrows - right	WRNA-R	12/1/98	12:07			51
5.00		Willapa R at the Narrows - right	WRNA-R	12/1/98	16:06	4,250		35
4.30	0.10	S Bend SW Ditch near PHW	SBSW-6	11/4/98	10:35			1,100
4.30	0.10	S Bend SW Ditch near PHW	SBSW-6	11/16/98	15:09			3,800 J
4.30	0.10	S Bend SW Ditch near PHW	SBSW-6	11/16/98	15:09			3,900
4.10	0.00	East Point Seafood	EPTSF	4/22/98	10:20			1,100
4.10	0.00	East Point Seafood	EPTSF	4/22/98	15:00			930 J
4.10	0.00	East Point Seafood	EPTSF	5/5/98	9:40			110 J
4.10	0.00	East Point Seafood	EPTSF	5/6/98	13:55	635	710	220 J
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	4/22/98	16:30			110
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	5/5/98	14:55	157		260
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	5/27/98	9:50			1,800
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	6/17/98	13:05			310
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	6/17/98	13:05			320
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	7/15/98	13:50			970
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	8/5/98	8:42			10,000 J
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	9/2/98	7:10			230
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	9/2/98	6:40			2,100
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	9/23/98	9:05			250
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	9/23/98	9:05			210
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	10/7/98	9:00	1,720		380
3.75	0.00	S Bend SW Pipe at SB Packers	SBSW-3	12/1/98	15:27			880
3.70	0.00	South Bend Packing	SBPAK	4/22/98	14:30			1.0 U
3.70	0.00	South Bend Packing	SBPAK	5/5/98	7:30			1.0 U
3.70	0.00	South Bend Packing	SBPAK	8/5/98	9:15	97		1.0 UJ
3.50	0.00	South Bend WWTP	SBTP	4/22/98	8:40			3.0 U
3.50	0.00	South Bend WWTP	SBTP	4/22/98	8:40			3.0 U
3.50	0.00	South Bend WWTP	SBTP	4/22/98	13:55			3.0
3.50	0.00	South Bend WWTP	SBTP	5/5/98	11:05			280
3.50	0.00	South Bend WWTP	SBTP	5/6/98	11:40	518		
3.50	0.00	South Bend WWTP	SBTP	5/6/98	11:20	517	1.0	2.0
3.50	0.00	South Bend WWTP	SBTP	5/27/98	10:05			3.0 U
3.50	0.00	South Bend WWTP	SBTP	5/27/98	15:30			3.0 U
3.50	0.00	South Bend WWTP	SBTP	6/17/98	10:40	878		1.0
3.50	0.00	South Bend WWTP	SBTP	6/17/98	15:05			1.0

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
3.50	0.00	South Bend WWTP	SBTP	7/15/98	11:10			350
3.50	0.00	South Bend WWTP	SBTP	7/15/98	11:15			130
3.50	0.00	South Bend WWTP	SBTP	7/15/98	14:30			70
3.50	0.00	South Bend WWTP	SBTP	8/5/98	10:50			3.0 J
3.50	0.00	South Bend WWTP	SBTP	8/5/98	13:45	754		
3.50	0.00	South Bend WWTP	SBTP	8/5/98	13:55	760		
3.50	0.00	South Bend WWTP	SBTP	8/5/98	14:30			2.0 J
3.50	0.00	South Bend WWTP	SBTP	8/5/98	14:35			5.0 J
3.50	0.00	South Bend WWTP	SBTP	9/1/98	14:30			3.0 U
3.50	0.00	South Bend WWTP	SBTP	9/2/98	11:30			6.0
3.50	0.00	South Bend WWTP	SBTP	9/23/98	11:00			16
3.50	0.00	South Bend WWTP	SBTP	9/23/98	14:35			5.0
3.50	0.00	South Bend WWTP	SBTP	10/7/98	10:45	627		
3.50	0.00	South Bend WWTP	SBTP	10/7/98	10:40			1.0
3.50	0.00	South Bend WWTP	SBTP	10/7/98	10:42			1.0
3.50	0.00	South Bend WWTP	SBTP	11/3/98	9:00			1.0 U
3.50	0.00	South Bend WWTP	SBTP	11/4/98	9:50			3.0 U
3.50	0.00	South Bend WWTP	SBTP	11/16/98	14:30			29
3.50	0.00	South Bend WWTP	SBTP	11/16/98	10:20			1.0
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	5/5/98	15:40			28
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	5/27/98	9:35			87
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	6/17/98	12:45			300
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	7/15/98	13:36			330
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	7/15/98	13:36			360
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	8/5/98	8:24			31
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	9/2/98	7:00			51
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	9/23/98	8:55			65
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	10/7/98	8:50			380
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	10/7/98	8:50			400
3.40	0.00	S Bend SW Pipe near Gardner's	SBSW-1	12/1/98	13:57			320
3.15	0.00	Creek at Coast Seafoods	SBSW-2	4/22/98	16:45			150
3.15	0.00	Creek at Coast Seafoods	SBSW-2	5/5/98	15:20			88
3.15	0.00	Creek at Coast Seafoods	SBSW-2	5/27/98	9:30			1,300
3.15	0.00	Creek at Coast Seafoods	SBSW-2	5/27/98	9:30			1,300 J
3.15	0.00	Creek at Coast Seafoods	SBSW-2	6/17/98	12:30			2,600 J
3.15	0.00	Creek at Coast Seafoods	SBSW-2	7/15/98	13:22			1,600
3.15	0.00	Creek at Coast Seafoods	SBSW-2	8/5/98	8:09			1,100
3.15	0.00	Creek at Coast Seafoods	SBSW-2	9/2/98	6:40			2,300
3.15	0.00	Creek at Coast Seafoods	SBSW-2	9/23/98	8:40			250
3.15	0.00	Creek at Coast Seafoods	SBSW-2	10/7/98	8:35			1,600 J
3.15	0.00	Creek at Coast Seafoods	SBSW-2	12/1/98	14:10	479		3,800
3.10	0.00	Coast Seafoods	COASF	4/22/98	14:45			610 J
3.10	0.00	Coast Seafoods	COASF	4/22/98	14:45			200
3.10	0.00	Coast Seafoods	COASF	5/5/98	8:40			260
3.10	0.00	Coast Seafoods	COASF	5/5/98	8:55			140
3.10	0.00	Coast Seafoods	COASF	5/5/98	14:00			280
3.10	0.00	Coast Seafoods	COASF	5/6/98	10:00	18,400	630	1,200

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
3.10	0.00	Coast Seafoods	COASF	5/27/98	8:05			330
3.10	0.00	Coast Seafoods	COASF	5/27/98	13:30			80
3.10	0.00	Coast Seafoods	COASF	6/17/98	11:45			900
3.10	0.00	Coast Seafoods	COASF	6/17/98	15:50			960
3.10	0.00	Coast Seafoods	COASF	6/17/98	15:50			600 J
3.10	0.00	Coast Seafoods	COASF	7/15/98	12:00			200,000 J
3.10	0.00	Coast Seafoods	COASF	7/15/98	12:00			200,000 J
3.10	0.00	Coast Seafoods	COASF	7/15/98	15:30			300,000 J
3.10	0.00	Coast Seafoods	COASF	8/5/98	11:45			1,500 J
3.10	0.00	Coast Seafoods	COASF	8/5/98	12:15	1,370		
3.10	0.00	Coast Seafoods	COASF	8/5/98	12:15			6,400 J
3.10	0.00	Coast Seafoods	COASF	9/1/98	13:30			17 J
3.10	0.00	Coast Seafoods	COASF	9/2/98	8:30			490
3.10	0.00	Coast Seafoods	COASF	9/23/98	13:55			420
3.10	0.00	Coast Seafoods	COASF	9/23/98	9:50	28,100		830
3.10	0.00	Coast Seafoods	COASF	9/23/98	13:45			430
3.10	0.00	Coast Seafoods	COASF	10/7/98	9:45			370
3.10	0.00	Coast Seafoods	COASF	10/7/98	9:45			310
3.10	0.00	Coast Seafoods	COASF	10/7/98	13:30			110
3.10	0.00	Coast Seafoods	COASF	11/3/98	15:50	25,500		410 J
3.10	0.00	Coast Seafoods	COASF	11/4/98	11:45			530
3.10	0.00	Coast Seafoods	COASF	11/16/98	9:30			300
3.10	0.00	Coast Seafoods	COASF	11/16/98	13:50			220
3.10	0.00	Coast Seafoods	COASF	12/1/98	9:55			250
3.10	0.00	Coast Seafoods	COASF	12/1/98	9:55			280
3.10	0.00	Coast Seafoods	COASF	12/1/98	14:00			800
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:27	38,300		
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:50	39,000		
1.80	0.50	Potter Slough at Hwy 101	SBSW-4	4/22/98	17:10			24
1.80	0.50	Potter Slough at Hwy 101	SBSW-4	11/16/98	15:41			470
0.40		Willapa R at Johnson Sl - left	WRJS-L	4/22/98	12:15			1.0 U
0.40		Willapa R at Johnson Sl - left	WRJS-L	4/22/98	16:30			2.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	4/22/98	12:10			1.0 U
0.40		Willapa R at Johnson Sl - right	WRJS-R	4/22/98	16:22			1.0 U
0.40		Willapa R at Johnson Sl - right	WRJS-R	4/22/98	16:26			1.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	5/5/98	12:20			3.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	5/5/98	19:09			3.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	5/5/98	19:10			2.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	5/5/98	11:45			5.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	5/5/98	19:04			1.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	5/27/98	8:30			31
0.40		Willapa R at Johnson Sl - left	WRJS-L	5/27/98	10:19			45
0.40		Willapa R at Johnson Sl - right	WRJS-R	5/27/98	8:22			32 J
0.40		Willapa R at Johnson Sl - right	WRJS-R	5/27/98	10:10	21,500		430 J
0.40		Willapa R at Johnson Sl - right	WRJS-R	5/27/98	10:13			420 J
0.40		Willapa R at Johnson Sl - left	WRJS-L	6/17/98	11:05			3.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	6/17/98	14:08			5.0

Table C.3 Laboratory Results from Bacteria Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	SpCond uS/cm	Entero #/100ml	FC #/100ml
0.40		Willapa R at Johnson Sl - right	WRJS-R	6/17/98	11:04			5.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	6/17/98	11:05			6.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	6/17/98	14:06			3.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	7/15/98	10:50			9.0 J
0.40		Willapa R at Johnson Sl - left	WRJS-L	7/15/98	13:03			17
0.40		Willapa R at Johnson Sl - right	WRJS-R	7/15/98	10:47			14
0.40		Willapa R at Johnson Sl - right	WRJS-R	7/15/98	13:01			26
0.40		Willapa R at Johnson Sl - left	WRJS-L	8/5/98	9:12			2.0 J
0.40		Willapa R at Johnson Sl - left	WRJS-L	8/5/98	9:13			8.0 J
0.40		Willapa R at Johnson Sl - left	WRJS-L	8/5/98	13:46			1.0 UJ
0.40		Willapa R at Johnson Sl - right	WRJS-R	8/5/98	9:10			9.0 J
0.40		Willapa R at Johnson Sl - right	WRJS-R	8/5/98	13:44			4.0 J
0.40		Willapa R at Johnson Sl - left	WRJS-L	9/2/98	9:26			2.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	9/2/98	13:48			2.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	9/2/98	13:51			1.0 U
0.40		Willapa R at Johnson Sl - right	WRJS-R	9/2/98	9:25			1.0 U
0.40		Willapa R at Johnson Sl - right	WRJS-R	9/2/98	13:48			3.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	9/23/98	10:18			1.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	9/23/98	12:16			2.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	9/23/98	10:15			1.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	9/23/98	12:12			1.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	9/23/98	12:14			1.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	10/7/98	9:55	41,200		10
0.40		Willapa R at Johnson Sl - left	WRJS-L	10/7/98	12:51			2.0 U
0.40		Willapa R at Johnson Sl - right	WRJS-R	10/7/98	9:52			3.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	10/7/98	9:53			10
0.40		Willapa R at Johnson Sl - right	WRJS-R	10/7/98	12:49			4.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	11/4/98	9:38			3.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	11/4/98	9:39			5.0
0.40		Willapa R at Johnson Sl - left	WRJS-L	11/4/98	14:14			1.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	11/4/98	9:37			3.0
0.40		Willapa R at Johnson Sl - right	WRJS-R	11/4/98	14:13			1.0 U
0.40		Willapa R at Johnson Sl - left	WRJS-L	11/16/98	12:22			70
0.40		Willapa R at Johnson Sl - left	WRJS-L	11/16/98	15:42			120
0.40		Willapa R at Johnson Sl - right	WRJS-R	11/16/98	12:20			84
0.40		Willapa R at Johnson Sl - right	WRJS-R	11/16/98	15:40			110
0.40		Willapa R at Johnson Sl - left	WRJS-L	12/1/98	12:32			17
0.40		Willapa R at Johnson Sl - left	WRJS-L	12/1/98	16:29			84
0.40		Willapa R at Johnson Sl - right	WRJS-R	12/1/98	12:27			14
0.40		Willapa R at Johnson Sl - right	WRJS-R	12/1/98	12:28			17
0.40		Willapa R at Johnson Sl - right	WRJS-R	12/1/98	16:27			69

All samples are grabs from just below the surface.

Data Qualifiers

J The associated numerical result is an estimate. The “true” value may be greater than or equal to the reported results.

U The analyte was not detected at or above the reported result.

Table C.4

Table C.4. Laboratory Results from Dissolved Oxygen Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	Depth* m	TSS mg/L	Salin mg/L	Chlrd mg/L	BOD5 mg/L	NH3 mg/L	NO2/3 mg/L	TPN mg/L	Orth-P mg/L	TP mg/L	Chla ug/L
41.2		Willapa R below Patton Creek	WRPA	5/6/98	10:35		6.0		2.92	0.3	0.01	0.415	0.459	0.01	0.021	3.7
41.2		Willapa R below Patton Creek	WRPA	8/4/98	11:15		4.0 U		2.78	0.28 J	0.01 U	0.2995	0.355	0.01 U	0.033	0.5 U
41.2		Willapa R below Patton Creek	WRPA	9/1/98	11:15		1.0		2.90	0.1	0.01	0.266	0.3935	0.01	0.0355	0.5
41.2		Willapa R below Patton Creek	WRPA	11/3/98	11:50		1.0		3.13	0.71	0.012	0.163	0.2195	0.01	0.01	0.5
41.2		Willapa R below Patton Creek	WRPA	11/3/98	11:50		1.0		3.12	0.63	0.01	0.169	0.217	0.01	0.01	0.5
37.5	0.30	Falls Ck abv Retreat Center	FALLS	5/6/98	11:10		1.0		2.50	0.1	0.01	0.311	0.35	0.01	0.026	
37.5	0.30	Falls Ck abv Retreat Center	FALLS	8/4/98	11:58		4.0 U		2.57	0.19 J	0.01 U	0.192	0.266	0.01 U	0.02	
37.5	0.30	Falls Ck abv Retreat Center	FALLS	9/1/98	11:45		1.0		2.66	0.4	0.01	0.159	0.232	0.01	0.042	
37.5	0.30	Falls Ck abv Retreat Center	FALLS	11/3/98	10:47		1.0		2.73	0.43	0.01	0.189	0.256	0.01	0.01	
37.1		Willapa R at Swiss Picknik Rd	WRSW	5/6/98	10:54		1.0		2.83	0.1	0.01	0.376	0.399	0.01	0.027	1.1
37.1		Willapa R at Swiss Picknik Rd	WRSW	8/4/98	11:01		4.0 U		2.82	0.5 J	0.01 U	0.245	0.349	0.01 U	0.024	0.79
37.1		Willapa R at Swiss Picknik Rd	WRSW	9/1/98	10:53		1.0		3.06	0.3	0.01	0.311	0.411	0.01	0.039	0.62
37.1		Willapa R at Swiss Picknik Rd	WRSW	11/3/98	11:50		1.0		3.15	0.61	0.014	0.199	0.269	0.01	0.01	0.5
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	5/6/98	11:40		2.0		4.42	0.3	0.01	0.304	0.464	0.012	0.043	
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	5/6/98	11:40		2.0		4.45	0.3	0.01	0.307	0.413	0.012	0.04	
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	8/4/98	13:05		9.0		8.93	3.4	0.01 U	0.025	0.523	0.04	0.134	
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	9/1/98	12:10		2.5		11.0	1.7	0.01	0.01	0.413	0.03	0.082	
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	11/3/98	12:25		2.0		9.00	0.79	0.014	0.013	0.174	0.029	0.041	
33.2		Willapa R at Lebam	WRLE	5/6/98	11:25		1.0		3.27	0.2	0.01	0.34	0.419	0.01	0.029	1.3
33.2		Willapa R at Lebam	WRLE	5/6/98	11:40		1.0		3.26	0.2	0.01	0.339	0.422	0.01	0.03	2.1
33.2		Willapa R at Lebam	WRLE	8/4/98	11:32		4.0 U		3.38	0.77 J	0.047	0.275	0.456	0.017	0.038	0.87
33.2		Willapa R at Lebam	WRLE	8/4/98	13:32		4.0 U		3.69	0.77 J	0.01 U	0.244	0.441	0.01	0.038	1.6
33.2		Willapa R at Lebam	WRLE	9/1/98	11:16		1.0		3.54	0.6	0.035	0.36	0.524	0.01	0.011	1.27
33.2		Willapa R at Lebam	WRLE	9/1/98	11:28											1.25
33.2		Willapa R at Lebam	WRLE	11/3/98	12:05		1.0		4.37	0.72	0.01	0.135	0.247	0.01	0.021	0.59
30.5	2.90	Fork Ck at A-400 Bridge	TRBKG-6	9/1/98	12:46		1.0		3.04	0.3	0.01	0.201	0.266	0.01	0.038	
30.5	2.90	Fork Ck at A-400 Bridge	TRBKG-6	11/3/98	13:35		1.0		2.95	0.3	0.01	0.464	0.539	0.01	0.01	
30.5	0.25	Fork Creek at State Hatchery	FORK	5/6/98	13:00		1.0		3.0	0.0	0.01	0.394	0.418	0.01	0.027	
30.5	0.25	Fork Creek at State Hatchery	FORK	8/4/98	14:11		4.0 U		3.19	0.46 J	0.01 U	0.324	0.443	0.01 U	0.023	
30.5	0.25	Fork Creek at State Hatchery	FORK	9/1/98	13:15		1.0		3.56	0.7	0.018	0.263	0.417	0.01	0.035	
30.5	0.25	Fork Creek at State Hatchery	FORK	11/3/98	13:50		1.0		3.13	0.42	0.01	0.4335	0.447	0.01	0.01	
30.5	0.20	Forks Creek Fish Hatchery	WFISH	5/6/98	13:25		1.0		3.04	0.8	0.166	0.38	0.73	0.028	0.051	
30.5	0.20	Forks Creek Fish Hatchery	WFISH	8/4/98	14:50		4.0 U		3.17	0.96 J	0.143	0.318	0.64	0.027	0.047	
30.5	0.20	Forks Creek Fish Hatchery	WFISH	9/1/98	13:40		1.0		3.34	0.65	0.184	0.228	0.577	0.022	0.049	
30.5	0.20	Forks Creek Fish Hatchery	WFISH	9/1/98	13:40		1.0		3.33	0.9	0.183	0.235	0.563	0.021	0.037	
30.5	0.20	Forks Creek Fish Hatchery	WFISH	11/3/98	14:15		1.0		3.14	0.66	0.071	0.456	0.555	0.01	0.01	
30.0		Willapa R abv Trap Creek	WRTR	5/6/98	12:10		2.0		3.33	0.5	0.017	0.365	0.438	0.01	0.037	1.4
30.0		Willapa R abv Trap Creek	WRTR	9/1/98	11:47		1.0		3.49	1.1	0.044	0.223	0.467	0.013	0.046	1.26
30.0		Willapa R abv Trap Creek	WRTR	9/1/98	11:49		1.0		3.49	1.0	0.044	0.238	0.442	0.011	0.042	1.6
30.0		Willapa R abv Trap Creek	WRTR	11/3/98	12:50		1.0		3.72	0.76	0.089	0.291	0.393	0.01	0.018	1.26
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	9/1/98	13:04		1.0		3.8	0.4	0.01	0.086	0.139	0.01	0.038	
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	11/3/98	13:16		4.0		3.58	0.4	0.01	0.189	0.244	0.01	0.01	

C.4.1

Table C.4. Laboratory Results from Dissolved Oxygen Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	Depth* m	TSS mg/L	Salin mg/L	Chlrd mg/L	BOD5 mg/L	NH3 mg/L	NO2/3 mg/L	TPN mg/L	Orth-P mg/L	TP mg/L	Chla ug/L
29.9	0.15	Trap Creek above Hwy 6	TRAP	5/6/98	12:47		1.0		3.45	0.2	0.01	0.196	0.223	0.01	0.021	
29.9	0.15	Trap Creek above Hwy 6	TRAP	8/4/98	13:05		4.0 U		3.65	0.21 J	0.01 U	0.139	0.181	0.01 U	0.02	
29.9	0.15	Trap Creek above Hwy 6	TRAP	8/4/98	13:24		4.0 U		3.68	0.19 J	0.01 U	0.1205	0.1855	0.01 U	0.0175	
29.9	0.15	Trap Creek above Hwy 6	TRAP	9/1/98	13:20		1.0		3.82	0.4	0.01	0.092	0.1305	0.01	0.024	
29.9	0.15	Trap Creek above Hwy 6	TRAP	11/3/98	12:55		2.0		3.66	0.39	0.01	0.186	0.2425	0.01	0.01	
26.1	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	5/6/98	15:00		1.0		6.11	0.0	0.01	0.284	0.285	0.01	0.029	
26.1	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	8/4/98	14:33		4.0 U		3.73	0.4 J	0.01 U	0.165	0.248	0.01	0.023	
26.1	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	11/3/98	13:35		1.0		3.97	0.6	0.01	0.084	0.17	0.01	0.01	
25.2		Willapa R at Oxbow Road	WROX	5/6/98	13:20		1.0		3.31	0.4	0.01	0.306	0.369	0.01	0.02	1.6
25.2		Willapa R at Oxbow Road	WROX	8/4/98	13:52		4.0		4.25	0.34 J	0.01 U	0.189	0.252	0.01 U	0.019	0.5 U
25.2		Willapa R at Oxbow Road	WROX	8/4/98	14:05											0.78
25.2		Willapa R at Oxbow Road	WROX	9/1/98	13:57		2.0		3.65	0.9	0.01	0.062	0.228	0.01	0.028	1.45
25.2		Willapa R at Oxbow Road	WROX	11/3/98	14:24		2.0		3.71	0.56	0.01	0.245	0.288	0.01	0.01	0.85
24.8	1.60	Green Ck at Green Ck Rd Br	TRBKG-4	5/6/98	14:20		1.0		4.87	0.6	0.01	0.628	0.706	0.01	0.035	
24.8	1.60	Green Ck at Green Ck Rd Br	TRBKG-4	8/4/98	12:06		4.0 U		9.06	0.86 J	0.01 U	0.236	0.501	0.03	0.052	
24.2	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	5/6/98	13:57		3.0		4.31	0.0	0.01	0.379	0.384	0.01	0.024	
24.2	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	8/4/98	15:18		4.0 U		3.54	0.78 J	0.01 U	0.147	0.303	0.01 U	0.026	
24.2	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	9/1/98	13:43		4.0		4.49	0.6	0.01	0.157	0.212	0.01	0.02	
24.2	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	11/3/98	13:55		1.0		4.33	0.35	0.01	0.167	0.213	0.01	0.01	
24.2	0.50	Stringer Ck at Highland-Stringer Rd	STRINGER	11/3/98	14:05		1.0		4.29	0.51	0.082	0.17	0.223	0.01	0.01	
21.4		Willapa R at SR 6 nr Menlo	WRMN	5/6/98	14:00		1.0		3.5	0.8	0.01	0.318	0.405	0.01	0.022	2.7
21.4		Willapa R at SR 6 nr Menlo	WRMN	5/6/98	14:00											3.1
21.4		Willapa R at SR 6 nr Menlo	WRMN	8/4/98	15:25		4.0 U		3.92	1.0 J	0.01 U	0.178	0.388	0.01 U	0.034	0.74
21.4		Willapa R at SR 6 nr Menlo	WRMN	8/4/98	15:25		4.0 U		3.91	1.1 J	0.01 U	0.159	0.393	0.01 U	0.031	1.1
21.4		Willapa R at SR 6 nr Menlo	WRMN	9/1/98	14:25		3.0		3.97	1.2	0.01	0.107	0.265	0.01	0.025	1.44
21.4		Willapa R at SR 6 nr Menlo	WRMN	11/3/98	14:45		2.0		3.82	0.625	0.01	0.237	0.332	0.01	0.01	0.59
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	5/6/98	14:55		1.0		4.49	0.1	0.01	0.647	0.706	0.01		
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	8/4/98	16:24		4.0 U		4.84	0.92 J	0.01 U	0.171	0.35	0.01 U	0.033	
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	9/1/98	15:23		2.5		5.02	0.75	0.01	0.102	0.261	0.01	0.053	
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	11/3/98	15:35		2.0		5.58	0.75	0.01	0.088	0.202	0.01	0.01	
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	5/6/98	14:25		2.0		5.15	0.5	0.01	0.546	0.644	0.01	0.036	
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	8/4/98	16:10		4.0 U		6.62	1.2 J	0.01 U	0.157	0.375	0.01 U	0.035	
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	9/1/98	15:06		1.0		7.42	0.9	0.01	0.063	0.283	0.01	0.024	
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	11/3/98	15:15		2.0		7.23	1.1	0.01	0.04	0.299	0.01	0.01	
17.5		Willapa R at Camp One Rd	WRC1	5/5/98	11:10		2.0	0.04	4.11	0.6	0.01	0.33	0.437	0.01	0.029	2.9
17.5		Willapa R at Camp One Rd	WRC1	5/5/98	18:10		2.0	0.035	4.02	0.7	0.01	0.32	0.436			2.2
17.5		Willapa R at Camp One Rd	WRC1	5/6/98	15:35		2.0		4.23	0.8	0.01	0.353	0.461	0.01	0.02	3.2
17.5		Willapa R at Camp One Rd	WRC1	8/4/98	15:46		5.0		5.01	1.1 J	0.01 U	0.179	0.402	0.01 U	0.031	1.6 J
17.5		Willapa R at Camp One Rd	WRC1	8/5/98	9:40		4.0 U	0.043	4.96	0.93 J	0.019	0.1835	0.3895	0.01 U	0.035	1.6
17.5		Willapa R at Camp One Rd	WRC1	8/5/98	9:40			0.044						0.01 U	0.038	
17.5		Willapa R at Camp One Rd	WRC1	9/1/98	14:17		3.0		5.5	1.2	0.01	0.102	0.335	0.01	0.021	2.25
17.5		Willapa R at Camp One Rd	WRC1	9/2/98	9:25		5.0	0.2	5.56	1.3	0.01	0.085	0.345	0.01	0.016	2.17

C.4.2

Table C.4. Laboratory Results from Dissolved Oxygen Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	Depth* m	TSS mg/L	Salin mg/L	Chlrd mg/L	BOD5 mg/L	NH3 mg/L	NO2/3 mg/L	TPN mg/L	Orth-P mg/L	TP mg/L	Chla ug/L
17.5		Willapa R at Camp One Rd	WRC1	11/3/98	16:00		2.0		4.66	0.64	0.013	0.207	0.327	0.01	0.01	0.72
17.5		Willapa R at Camp One Rd	WRC1	11/3/98	16:00											1.14
17.5		Willapa R at Camp One Rd	WRC1	11/4/98	13:00		2.0	0.041	4.65	0.8	0.01	0.219	0.358	0.01	0.01	1.38
17.5		Willapa R at Camp One Rd	WRC1	11/4/98	13:00		3.0		4.61	0.9	0.01	0.212	0.333	0.01	0.01	1.04
13.7		Willapa R at Willapa Road	WRWI	5/5/98	11:45		2.0	0.037	4.39	0.5	0.01	0.309	0.437			3.5
13.7		Willapa R at Willapa Road	WRWI	5/5/98	17:05		2.0	0.037	4.38	0.4	0.01	0.307	0.428			3.3
13.7		Willapa R at Willapa Road	WRWI	5/5/98	17:05		2.0	0.036	4.4		0.01	0.32	0.42			2.3
13.7		Willapa R at Willapa Road	WRWI	8/5/98	6:38		33	0.258	123	2.5	0.01	0.049	0.419		0.055	32
13.7		Willapa R at Willapa Road	WRWI	8/5/98	12:10		25	3.85	2,020	1.4	0.01	0.018	0.276			
13.7		Willapa R at Willapa Road	WRWI	9/2/98	8:40		30	4.40	2,485	1.1	0.015	0.01	0.268			11
13.7		Willapa R at Willapa Road	WRWI	9/2/98	12:45		10		3,820	0.9	0.011	0.024	0.269	0.032		
13.7		Willapa R at Willapa Road	WRWI	11/4/98	12:20		16	2.72	1,400	0.38	0.033	0.211	0.434			1.39
13.7		Willapa R at Willapa Road	WRWI	11/4/98	6:55		13	0.069	20	0.43	0.023	0.207	0.489			0.96
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	9/2/98	11:35		1.5		6.4	0.9	0.01	0.01	0.237	0.011	0.04	
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	11/4/98	11:25		6.0		6.23	1.15	0.01	0.099	0.309	0.01	0.01	
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	9/2/98	12:00		3.0		6.51	0.7	0.01	0.01	0.271	0.01	0.037	
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	9/2/98	12:00		3.0		6.45	0.7	0.01	0.012	0.254	0.01	0.038	
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	11/4/98	11:55		2.0		6.61	0.96	0.01	0.06	0.319	0.01	0.016	
12.0	0.10	Wilson Creek near Willapa	WILSON	5/5/98	16:25		3.0		6.47	0.4	0.01	0.354	0.48	0.01	0.032	
12.0	0.10	Wilson Creek near Willapa	WILSON	8/5/98	8:05		42		285	1.2	0.012	0.081	0.395	0.01	0.051	
9.5		Willapa R near Ellis Slough	WREL-M	5/5/98	15:55		5.0	2.87	1,450		0.01	0.24	0.408			
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:02		8.0	10.0	5,060		0.01	0.033	0.228			
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:05		9.0	9.99	5,850		0.01	0.032	0.227			
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:07		17	16.1	9,560		0.01	0.032	0.189			
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:12	4.0	16	16.3	13,000		0.01	0.032	0.191			
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:16		12	15.2	8,350		0.01	0.026	0.298			
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:04	6.0	15	20.3	8,940		0.01	0.04	0.198			
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:00		12	20.0	11,200		0.01	0.039	0.26			
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:27		48	17.8	10,400		0.081	0.162	0.499			
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:30	5.0	55	18.2	15,400		0.075	0.168	0.491			
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:25		9.0	8.48	4,500		0.076	0.225	0.445			
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	5/5/98	16:30		5.0	6.38	3,200	0.5	0.015	0.197	0.326			2.4
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	8/5/98	7:30		9.0	14.6	7,970	0.865	0.01	0.026	0.23			2.8
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	8/5/98	11:32		15	19.6	11,900	1.1	0.01	0.02	0.217			5.7
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	8/5/98	11:35											7.1
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	8/5/98	11:40	5.0	17	20.2	11,200	0.94	0.01	0.015	0.212			6.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	9/2/98	7:38		10	19.4	10,800	1.3	0.01	0.031	0.235			7.31
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	9/2/98	7:43		8.0	19.7	11,300	1.3	0.01	0.04	0.254			5.97
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	9/2/98	11:15		8.0	21.6	12,000	0.9	0.01	0.042	0.237			10
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	9/2/98	11:28	6.0	15	23.3	13,400	1.2	0.023	0.0285	0.232			4.47
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	11/4/98	11:50		33	21.3	11,500	0.72	0.079	0.137	0.41			2.37
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	11/4/98	11:57	7.0	77	21.8	12,600	0.71	0.082	0.116	0.44			2.32

C.4.3

Table C.4. Laboratory Results from Dissolved Oxygen Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	Depth* m	TSS mg/L	Salin mg/L	Chlrd mg/L	BOD5 mg/L	NH3 mg/L	NO2/3 mg/L	TPN mg/L	Orth-P mg/L	TP mg/L	Chla ug/L
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	11/4/98	7:50		14	13.9	11,400	0.56	0.055	0.208	0.5285			2.17
7.5	0.10	Weyco SW Outfall W-9	WEY-SW9	11/4/98	9:10		1,240		134	92	0.067	0.01	0.062			
7.4	0.10	Weyco SW Outfall W-8	WEY-SW8	11/4/98	9:30		218		75	38	0.12	0.01	0.027			
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	5/5/98	13:00		2.0		4.89	0.2	0.01	0.526	0.571			
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	8/5/98	11:45		4.0 U		5.38	1.0 J	0.01 U	0.253	0.364			
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	9/2/98	14:58		10		5.81	0.7	0.01	0.1	0.241			
7.1	4.20	So Fk Willapa R at Golf Course Rd	SFRK-F	5/5/98	14:00		2.0		5.0	0.1	0.01	0.202	0.241	0.01	0.028	
7.1	4.20	So Fk Willapa R at Golf Course Rd	SFRK-F	5/5/98	14:00		1.0		4.96	0.0	0.01	0.207	0.242	0.01	0.028	
7.1	4.20	So Fk Willapa R at Golf Course Rd	SFRK-F	8/5/98	10:50		4.0 U		4.94	0.44 J	0.01 U	0.143	0.214	0.01 U	0.031	
7.1	4.20	So Fk Willapa R at Golf Course Rd	SFRK-F	9/2/98	10:40		2.0		5.02	0.5	0.01	0.082	0.177	0.01	0.03	
7.1	4.20	So Fk Willapa R at Golf Course Rd	SFRK-F	11/4/98	10:55		2.0		5.04	0.64	0.01	0.055	0.204	0.01	0.01	
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:04		4.0	4.55	2,400		0.019	0.152	0.275			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:43		7.0	11.4	6,180		0.01 U	0.048	0.249			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:05	5.0	21	18.6	10,000		0.01 U	0.022	0.1995			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:00		13	15.4	9,490		0.01 U	0.036	0.267			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	7:58		5.0	15.0	7,860		0.01	0.042	0.196			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:38		8.0	19.0	10,700		0.01	0.036	0.232			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:41	8.0	30	22.4	14,600		0.01	0.019	0.248			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:15		62	21.1	13,300		0.046	0.14	0.466			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:17	7.0	78	21.2	16,800		0.041	0.129	0.499			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:21	7.0	97	21.4	12,400		0.039	0.128	0.475			
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:05		10	5.01	6,450		0.047	0.141	0.36			
7.1	0.40	PHW/Raymond SW	PHW-SW1	11/4/98	8:00		900		180	242	0.249	0.01	0.084			
7.1	0.30	Raymond SW Drain north of PHW	RAYSW-6	11/4/98	8:10		19		340	1.6	0.477	0.107	0.838			
7.1	0.10	Weyco SW Outfall W-2	WEY-SW2	11/4/98	9:55		126		13	8.0	0.202	0.01	0.268			
7.0	0.00	Raymond WWTP	RAYTP	5/6/98	12:50		9.0		356	10	14	2.55	17			
7.0	0.00	Raymond WWTP	RAYTP	9/2/98	10:00		21		488	9.0	10	16	24			
7.0	0.00	Raymond WWTP	RAYTP	9/2/98	10:00		30		491	12	11	16	24			
7.0	0.00	Raymond WWTP	RAYTP	11/3/98	10:00		17		402	9.0	20	2.51	22			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	5/5/98	14:55		4.0	11.0	5,700		0.026	0.157	0.285			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	5/5/98	15:00	9.0	8.0	16.6	7,900		0.036	0.1	0.272			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	5/5/98	17:40		6.0	9.20	4,800		0.025	0.175	0.3			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	8/5/98	8:03		9.0	17.6	12,600		0.01 U	0.026	0.221			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	8/5/98	12:23		13	21.5	12,100		0.01 U	0.023	0.214			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	8/5/98	12:26	5.0	23	22.1	11,900		0.01 U	0.019	0.199			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	9/2/98	8:17		9.0	21.1	11,700		0.01	0.0455	0.245			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	9/2/98	12:04		19	22.8	13,600		0.01	0.034	0.628			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	9/2/98	12:07	8.0	15	24.4	18,200		0.01	0.038	0.228			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	9/2/98	12:15	8.0	11	24.5	16,700		0.01	0.035	0.205			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	11/4/98	12:41		17	23.0	14,000		0.039	0.114	0.377			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	11/4/98	12:45	7.0	49	23.6	44,500		0.034	0.103	0.343			
6.4		Willapa R at Raymond (nr Port)	WRRM-M	11/4/98	8:29		21	16.7	17,600		0.069	0.188	0.445			

C.4.4

Table C.4. Laboratory Results from Dissolved Oxygen Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	Depth* m	TSS mg/L	Salin mg/L	Chlrd mg/L	BOD5 mg/L	NH3 mg/L	NO2/3 mg/L	TPN mg/L	Orth-P mg/L	TP mg/L	Chla ug/L
5.3	0.50	Skidmore Slough above tide gate	RAYSW-7	5/5/98	16:05		7.0		254	0.5	0.01	0.165	0.352			
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	8/5/98	7:38		10		150	1.9 J	0.01 U	0.01 U	0.451			
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	8/5/98	7:38		8.0		161	1.9 J	0.01 U	0.01 U	0.444			
5.3	0.60	Skidmore Slough at 101 bridge	RAYSW-1	9/2/98	7:40		10		197	1.3	0.01	0.01	0.392			
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	13:56		4.0	14.2	6,400	0.4	0.034	0.107	0.267			1.9
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:02	10.0	24	20.1 1	10,000	0.5	0.028	0.073	0.254			
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:00		7.0	13.1	5,600	0.7	0.027	0.138	0.284			1.4
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:06		6.0	13.5	8,800		0.028	0.125	0.319			2.3
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:35		20	21.1	12,800	1.1 J	0.01 U	0.024	0.209			0.5 U
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	12:58		21	22.4	15,000	1.3 J	0.015	0.026	0.195			2.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:05	5.0	18	23.2 1	12,600	1.2 J	0.01 U	0.024	0.181			
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:44		11	23.7 1	13,400	1.1	0.01	0.045	0.217			6.21
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	12:55		10	23.7 1	13,600	3.0	0.01	0.043	0.257			18
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:01			23.6 1								14
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:05	8.0	15	25.2	13,100	0.7	0.01	0.037	0.171			
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:15		14	24.9	13,200	0.64	0.012	0.0805	0.31			2.83
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:18		14	24.7	13,200	0.51	0.013	0.08	0.252			
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:25	10.0	27	25.5	31,600	0.66	0.01	0.071	0.248			
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	8:57		26	21.0	25,600	0.51	0.049	0.152	0.46			2.61
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	8:58								2.65			
4.3	0.10	S Bend SW Ditch near PHW	SBSW-6	11/4/98	10:35		390		7.73	38	0.04	0.01	0.354			
4.1	0.00	East Point Seafood	EPTSF	5/6/98	13:55		583		7.46	1,830	2.0	0.697	0.544			
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	5/5/98	14:55		3.0		17	0.5	0.082	0.643	0.839			
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	8/5/98	8:42		4.0 U		41	1.1 J	0.122	0.352	0.624			
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	9/2/98	7:10		2.0		26	0.8	0.054	0.259	0.506			
3.7	0.00	South Bend Packing	SBPAK	8/5/98	9:15		4.0 U			0.12 J	0.01 U	0.366	0.356		0.0155	
3.5	0.00	South Bend WWTP	SBTP	5/5/98	11:05											
3.5	0.00	South Bend WWTP	SBTP	5/6/98	11:20		8.0		69	8.0	13	0.156	13			
3.5	0.00	South Bend WWTP	SBTP	5/6/98	11:40		8.0		69	9.0	13	0.212	14			
3.5	0.00	South Bend WWTP	SBTP	8/5/98	13:45		8.0			4.03	0.24	0.081	2.37		1.12	
3.5	0.00	South Bend WWTP	SBTP	8/5/98	13:55		11			3.8	0.246	0.084	2.29		1.13	
3.5	0.00	South Bend WWTP	SBTP	9/2/98	11:25		8.0		134	8.4	0.359	0.093	3.17			
3.5	0.00	South Bend WWTP	SBTP	11/3/98	9:00		65		170	17	5.16	0.452	11			
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	5/5/98	15:40		2.0		5.71	0.4	0.01	0.499	0.56			
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	8/5/98	8:24		4.0 U		5.85	1.3 J	0.042	0.307	0.5075			
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	9/2/98	7:00		3.0		6.15	1.4	0.034	0.21	0.47			
3.15	0.00	Creek at Coast Seafoods	SBSW-2	5/5/98	15:20		6.0		16	1.6	0.033	0.212	0.505			
3.15	0.00	Creek at Coast Seafoods	SBSW-2	8/5/98	8:09		12		447	1.7 J	0.19	0.151	1.01			
3.15	0.00	Creek at Coast Seafoods	SBSW-2	9/2/98	6:40		5.0		621	0.9	0.107	0.132	0.596			
3.15	0.00	Creek at Coast Seafoods	SBSW-2	9/2/98	6:40		7.0									
3.10	0.00	Coast Seafoods	COASF	5/6/98	10:00		318		20,000	66	0.591	0.26	8.63			
3.10	0.00	Coast Seafoods	COASF	8/5/98	12:15		96		338	109	0.845	0.371	13		0.84	

C.4.5

Table C.4. Laboratory Results from Dissolved Oxygen Surveys.

MS RM	Trib RM	Sampling Station	Site Code	Date	Time	Depth* m	TSS mg/L	Salin mg/L	Chlrd mg/L	BOD5 mg/L	NH3 mg/L	NO2/3 mg/L	TPN mg/L	Orth-P mg/L	TP mg/L	Chla ug/L
3.10	0.00	Coast Seafoods	COASF	9/2/98	7:30		290		7,880	161	3.29	0.109	12			
3.10	0.00	Coast Seafoods	COASF	9/2/98	8:30				7,780							
3.10	0.00	Coast Seafoods	COASF	11/3/98	11:50			15.5								
3.10	0.00	Coast Seafoods	COASF	11/4/98	11:45		261		4,500	38	1.61	0.338	7.76			
3.10	0.00	Coast Seafoods	COASF	11/4/98	11:45		556		4,250	37	1.57	0.308	13			
3.05		Willapa R below S Bend	WRSB-M	5/5/98	13:25		5.0	16.1	1	7,800		0.023	0.107	0.248		
3.05		Willapa R below S Bend	WRSB-M	5/5/98	13:30	6.0	9.0	19.1	1	16,000		0.017	0.078	0.224		
3.05		Willapa R below S Bend	WRSB-M	5/5/98	18:41		5.0	16.9	1	9,400		0.017	0.079	0.302		
3.05		Willapa R below S Bend	WRSB-M	8/5/98	8:56		23	22.8	1	15,100		0.01 U	0.013	0.218		
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:27		10	24.7	1	16,600		0.01 U	0.015	0.196		
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:30		13	24.4	1	16,100		0.01 U	0.022	0.325		
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:33	5.0	10	25.2		15,100		0.01 U	0.02	0.163		
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:07		13	25.3	1	14,200		0.01	0.033	0.261		
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:32		7.0	24.9	1	14,800		0.01	0.038	0.233		
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:35	6.0	8.0	26.8	2	15,500		0.01	0.04	0.215		
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:50		18	25.3		22,300		0.028	0.07	0.224		
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:53	10.0	26	26.4		21,400		0.01	0.063	0.195		
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:20		31	23.3		12,600		0.035	0.105	0.301		
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	11:50		6.0	18.5	@	11,000	1.4	0.01	0.079	0.22		4.3
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	11:50			18.2	1		0.8					4.5
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	12:30	7.0	7.0	23.2	1	11,000	0.5	0.01	0.046	0.165		
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:14		6.0	18.5	1	14,000	1.2	0.011	0.079	0.225		5.4
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:16		14	24.3		18,600	1.0 J	0.01 U	0.01 U	0.213		3.7
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:21						1.2 J					0.5 U
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:50		8.0	26.4		19,100	1.1 J	0.01 U	0.024	0.185		2.7
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:55	5.0	11	26.8	1	15,500	0.85 J	0.01 U	0.018	0.168		
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:30		8.0	27.0	1	15,400	1.2	0.01	0.039	0.256		4.79
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	13:53		7.0	26.5	1	15,500	1.2	0.01	0.0405	0.2205		5.3
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	14:01	6.0	7.0	27.9	1	15,700	0.9	0.01	0.041	0.174		
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:16			25.6								
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:16		19	25.6		19,200	0.6	0.011	0.075	0.205		2.68
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:26	7.0	23	26.4		17,900	0.54	0.01	0.065	0.185		
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:42		31	25.1		13,700	0.61	0.01	0.079	0.224		3.1

* Samples with no depth reported are grabs from just below the surface.

Data Qualifiers

- J The analyte was positively identified. The associated numerical result is an estimate.
- U The analyte was not detected at or above the reported result
- 1 Bottle was overfilled; agitated bottle, poured small amount of water out, agitated again, then measured
- 2 Salt crystals on neck of bottle. Carefully wiped off crystals with Kim-Wipe, agitated bottle, then measured
- @ Sample was contained in 0.5L bottle, opening too large for direct measurement; agitated bottle, pre-rinsed new bottle 3X with sample, filled new bottle, then measured.

C.4.6

Table C.5

Table C.5. Ultimate BOD Test Results.

MS RM	Trib RM	Sampling Station	Site Code	Sample Number	Date	Time	BOD5	UBOD	U:5 ratio	k
37.1		Willapa R at Swiss Picknik Rd	WRSW	199202	5/6/98	10:54	0.24	0.65	2.75	0.099
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	199204	5/6/98	11:40	0.57	1.37	2.42	0.106
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	199205	5/6/98	11:40	0.73	1.42	1.94	0.132
30.5	0.20	Forks Creek Fish Hatchery (WDFW)	WFISH	199208	5/6/98	13:25	1.55	2.71	1.74	0.196
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	199224	5/6/98	15:35	0.76	1.35	1.77	0.177
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	199260	5/5/98	14:00	0.22	1.33	6.13	0.036
5.0		Willapa R at the Narrows	WRNA-M	199294	5/5/98	18:00	0.58	1.28	2.19	0.039
4.1	0.00	East Point Seafood	EPTSF	199302	5/6/98	13:55	2048	2666	1.30	0.291
3.5	0.00	South Bend WWTP	SBTP	199271	5/6/98	11:40	5.60	21.92	3.92	0.047
3.5	0.00	South Bend WWTP	SBTP	199314	5/6/98	11:20	6.14	21.11	3.44	0.055
29.9	0.15	Trap Creek above Hwy 6	TRAP	329214	8/4/98	13:05	0.29	0.64	2.24	0.087
29.9	0.15	Trap Creek above Hwy 6	TRAP	329215	8/4/98	13:24	0.23	0.69	3.05	0.078
25.2		Willapa R at Oxbow Road	WROX	329216	8/4/98	13:52	0.38	0.74	1.96	0.113
21.4		Willapa R at SR 6 nr Menlo	WRMN	329220	8/4/98	15:25	1.04	1.80	1.74	0.154
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	329222	8/4/98	16:10	3.25	5.23	1.61	0.168
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	329260	8/5/98	10:50	0.42	0.96	2.25	0.096
5.0		Willapa R at the Narrows	WRNA-M	329294	8/5/98	8:35	1.16	2.24	1.93	0.125
3.5	0.00	South Bend WWTP	SBTP	329314	8/5/98	13:45	5.63	23.3	4.14	0.052
3.5	0.00	South Bend WWTP	SBTP	329271	8/5/98	13:55	5.33	24.2	4.53	0.051
3.1	0.00	Coast Seafoods	COASF	329318	8/5/98	12:15	388	523	1.35	0.223
41.2		Willapa R below Patton Creek	WRPA	369200	9/1/98	11:15	0.19	0.53	2.80	0.083
30.5	0.20	Forks Creek Fish Hatchery (WDFW)	WFISH	369208	9/1/98	13:40	0.0	0.7	-	0.039
30.0		Willapa R abv Trap Creek	WRTR	369212	9/1/98	11:47	0.80	1.60	2.00	0.128
30.0		Willapa R abv Trap Creek	WRTR	369213	9/1/98	11:49	0.95	1.63	1.73	0.151
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	369218	9/1/98	13:43	0.46	1.75	3.83	0.060
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	369234	9/2/98	12:00	1.13	2.37	2.09	0.088
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	369250	9/2/98	7:38	1.28	2.13	1.66	0.156
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	369251	9/2/98	7:43	1.22	1.98	1.63	0.148
7.0	0.00	Raymond WWTP	RAYTP	369270	9/2/98	10:00	10.30	36.3	3.52	0.074
3.1	0.00	Coast Seafoods	COASF	362318	9/2/98	7:30	173	274	1.58	0.129
37.5	0.30	Falls Ck abv Retreat Center	FALLS	449348	11/3/98	10:47	0.54	1.00	1.85	0.106
33.2		Willapa R at Lebam	WRLE	449206	11/3/98	12:05	0.81	1.70	2.10	0.104
30.5	0.25	Fork Creek at State Hatchery	FORK	449210	11/3/98	13:50	0.58	1.19	2.04	0.094
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	449224	11/3/98	16:00	0.67	1.33	2.00	0.117
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	449225	11/3/98	16:00	0.73	1.52	2.07	0.101
13.7		Willapa R at Willapa Road	WRWI	449232	11/4/98	12:20	0.24	1.24	5.08	0.054
7.0	0.00	Raymond WWTP	RAYTP	449270	11/3/98	10:00	6.88	40.4	5.87	0.039
3.1	0.00	Coast Seafoods	COASF	449310	11/4/98	11:45	193	262	1.36	0.226
0.4		Willapa R at Johnson Sl	WRJS-M	449336	11/4/98	14:16	0.46	0.92	1.99	0.067
0.4		Willapa R at Johnson Sl	WRJS-M	449337	11/4/98	14:16	0.49	0.97	1.99	0.117

Table C.6

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		pH units
							liquid	metal			%Sat	meter	
41.2		Willapa R below Patton Creek	WRPA	4/21/98	11:00			9.3	50				
41.2		Willapa R below Patton Creek	WRPA	5/6/98	10:39	0.1	10.5		56	0.0	96	10.6	7.5
41.2		Willapa R below Patton Creek	WRPA	5/26/98	11:50			8.6	51				
41.2		Willapa R below Patton Creek	WRPA	6/16/98	12:10			11.3	55				
41.2		Willapa R below Patton Creek	WRPA	7/14/98	12:00			13.4	58				
41.2		Willapa R below Patton Creek	WRPA	8/4/98	11:15	0.2	13.5		55	0.0	98	10.2	7.6
41.2		Willapa R below Patton Creek	WRPA	9/1/98	11:10	0.1	13.7		49	0.0	98	10.1	7.6
41.2		Willapa R below Patton Creek	WRPA	9/22/98	11:00			11.6	61				
41.2		Willapa R below Patton Creek	WRPA	10/6/98	11:25			10.6	32				
41.2		Willapa R below Patton Creek	WRPA	11/3/98	11:42	0.0	8.2		52	0.0	94	11.0	7.1
41.2		Willapa R below Patton Creek	WRPA	11/17/98	11:53			7.8	46				
41.2		Willapa R below Patton Creek	WRPA	12/2/98	11:05			8.5	47				
37.5	0.30	Falls Ck abv Retreat Center	FALLS	5/6/98	11:10	0.2	10.8		47	0.0	98	10.9	7.5
37.5	0.30	Falls Ck abv Retreat Center	FALLS	8/4/98	11:58	0.1	14.3		52	0.0	98	10.1	7.4
37.5	0.30	Falls Ck abv Retreat Center	FALLS	9/1/98	11:50	0.1	14.6		47	0.0	97	9.8	7.5
37.5	0.30	Falls Ck abv Retreat Center	FALLS	9/1/98	11:50	0.1	14.6		47	0.0	96	9.8	7.5
37.5	0.30	Falls Ck abv Retreat Center	FALLS	9/22/98	11:34			12.1	42				
37.5	0.30	Falls Ck abv Retreat Center	FALLS	10/6/98	13:47				41				
37.5	0.30	Falls Ck abv Retreat Center	FALLS	11/3/98	10:47								
37.5	0.30	Falls Ck abv Retreat Center	FALLS	11/3/98	11:02	0.0	8.1		56	0.0	91	10.7	7.2
37.5	0.30	Falls Ck abv Retreat Center	FALLS	11/17/98	11:40			7.9	44				
37.5	0.30	Falls Ck abv Retreat Center	FALLS	12/2/98	10:47			8.4	35				
37.1		Willapa R at Swiss Picknik Rd	WRSW	4/21/98	11:02		10.7	10.3	49				
37.1		Willapa R at Swiss Picknik Rd	WRSW	5/6/98	10:49	0.0	11.5		54	0.0	103	11.2	7.1
37.1		Willapa R at Swiss Picknik Rd	WRSW	5/6/98	10:54								10.8
37.1		Willapa R at Swiss Picknik Rd	WRSW	5/26/98	10:35		8.7	8.6	51				
37.1		Willapa R at Swiss Picknik Rd	WRSW	6/16/98	13:00		13.2	13.2	52				
37.1		Willapa R at Swiss Picknik Rd	WRSW	7/14/98	11:40		15.1	15.0	51				
37.1		Willapa R at Swiss Picknik Rd	WRSW	8/4/98	11:01		15.8		70	0.0	95	9.4	7.3
37.1		Willapa R at Swiss Picknik Rd	WRSW	9/1/98	10:58	0.0	15.5		62	0.0	95	9.0	7.2
37.1		Willapa R at Swiss Picknik Rd	WRSW	9/22/98	12:00		13.1	13.1	47				
37.1		Willapa R at Swiss Picknik Rd	WRSW	10/6/98	14:09		12.9		45				
37.1		Willapa R at Swiss Picknik Rd	WRSW	11/3/98	11:46	0.0	8.1		60	0.0	98	11.5	7.0
37.1		Willapa R at Swiss Picknik Rd	WRSW	11/3/98	11:47	0.1	8.2		61	0.0	96	11.3	7.0
37.1		Willapa R at Swiss Picknik Rd	WRSW	11/17/98	12:07		8.3		53				
37.1		Willapa R at Swiss Picknik Rd	WRSW	12/2/98	11:00		8.6		41				
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	4/21/98	11:40			11.0	81				
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	5/6/98	11:30	0.2	13.3		85	0.0	92	9.7	7.2
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	5/26/98	12:20			9.5	65				
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	6/16/98	12:35			13.7	102				
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	7/14/98	12:30			16.8	118				
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	8/4/98	13:07	0.0	18.4		123	0.1	77	7.3	7.1
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	9/1/98	12:15	0.0	16.0		122	0.1	51	5.1	7.0
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	9/22/98	11:30			12.9	163				
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	10/6/98	11:55			12.3	84				
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	11/3/98	12:25	0.1	8.6		141	0.1	76	8.9	6.8

C.6.1

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	11/17/98	12:10		8.2		87					
36.2	0.40	Fern Creek at Elk Prairie Rd	FERN	12/2/98	11:24		9.0		62					
33.2		Willapa R at Lebam	WRLE	4/21/98	11:45		11.9	11.1	58					
33.2		Willapa R at Lebam	WRLE	5/6/98	11:26	0.2	12.7		62	0.0	102	10.8		7.1
33.2		Willapa R at Lebam	WRLE	5/6/98	11:39	0.2	12.7		62	0.0	101	10.8		7.1
33.2		Willapa R at Lebam	WRLE	5/6/98	11:40	0.2	12.7		62	0.0	101	10.7		7.1
33.2		Willapa R at Lebam	WRLE	5/26/98	10:50		9.5	9.4	62					
33.2		Willapa R at Lebam	WRLE	6/16/98	13:20		13.9	13.9	64					
33.2		Willapa R at Lebam	WRLE	7/14/98	11:59		16.5	16.4	61					
33.2		Willapa R at Lebam	WRLE	8/4/98	11:32	1.2	17.9		80	0.0	96	9.1		7.2
33.2		Willapa R at Lebam	WRLE	9/1/98	11:16								8.2	
33.2		Willapa R at Lebam	WRLE	9/1/98	11:21	0.2	17.0		67	0.0	87	8.0		7.1
33.2		Willapa R at Lebam	WRLE	9/22/98	12:27		14.4		52					
33.2		Willapa R at Lebam	WRLE	10/6/98	14:20		12.8		57					
33.2		Willapa R at Lebam	WRLE	11/3/98	12:11	0.1	8.5		76	0.0	93	10.9		7.0
33.2		Willapa R at Lebam	WRLE	11/3/98	12:12	0.1	8.5		76	0.0	93	10.9		7.0
33.2		Willapa R at Lebam	WRLE	11/17/98	12:20		8.3		66					
33.2		Willapa R at Lebam	WRLE	12/2/98	11:13		8.9		47					
30.5	4.10	Fork Ck at A-400 Bridge	TRBKG-6	9/1/98	12:50	0.0	15.0		56	0.0	99	9.6		7.3
30.5	4.10	Fork Ck at A-400 Bridge	TRBKG-6	11/3/98	13:27	0.6	8.6		48	0.0	97	11.4		7.2
30.5	0.25	Fork Creek at State Hatchery	FORK	4/21/98	12:35			10.4	52					
30.5	0.25	Fork Creek at State Hatchery	FORK	5/6/98	13:03	0.3	11.7		53	0.0	101	10.9		7.3
30.5	0.25	Fork Creek at State Hatchery	FORK	5/26/98	13:30			9.4	54					
30.5	0.25	Fork Creek at State Hatchery	FORK	6/16/98	13:35			13.3	58					
30.5	0.25	Fork Creek at State Hatchery	FORK	7/14/98	13:30			15.2	63					
30.5	0.25	Fork Creek at State Hatchery	FORK	8/4/98	14:22	0.1							10.3	
30.5	0.25	Fork Creek at State Hatchery	FORK	8/4/98	14:26	0.1	18.8		62	0.0	108	10.0		7.3
30.5	0.25	Fork Creek at State Hatchery	FORK	9/1/98	13:21	0.1	16.8		60		107	10.4		6.4
30.5	0.25	Fork Creek at State Hatchery	FORK	9/22/98	12:10			13.7	71					
30.5	0.25	Fork Creek at State Hatchery	FORK	10/6/98	12:55			12.4	35					
30.5	0.25	Fork Creek at State Hatchery	FORK	11/3/98	13:51	0.4	8.6		53	0.0	97	11.3		7.1
30.5	0.25	Fork Creek at State Hatchery	FORK	11/17/98	13:13		8.4	8.4	46					
30.5	0.25	Fork Creek at State Hatchery	FORK	12/2/98	11:52		8.6		45					
30.5	0.20	Willapa Fish Hatchery	WFISH	5/6/98	13:22	0.1	11.6		54	0.0	85	9.3		7.1
30.5	0.20	Willapa Fish Hatchery	WFISH	8/4/98	14:44	0.3	18.1		61	0.0	95	9.0		7.2
30.5	0.20	Willapa Fish Hatchery	WFISH	9/1/98	13:35		16.6		57	0.0	93	9.1		7.3
30.5	0.20	Willapa Fish Hatchery	WFISH	11/3/98	14:10	0.2	8.5		53	0.0	93	10.9		6.9
30.0		Willapa R abv Trap Creek	WRTR	4/21/98	12:00		11.4	10.9	55					
30.0		Willapa R abv Trap Creek	WRTR	4/21/98	12:10		11.4	11.0	55					
30.0		Willapa R abv Trap Creek	WRTR	5/6/98	12:09	0.3	13.0		58	0.0	102	10.8		7.2
30.0		Willapa R abv Trap Creek	WRTR	5/26/98	11:10		10.1	10.0	57					
30.0		Willapa R abv Trap Creek	WRTR	6/16/98	13:40		14.4	14.4	60					
30.0		Willapa R abv Trap Creek	WRTR	7/14/98	12:10		16.3	16.3	57					
30.0		Willapa R abv Trap Creek	WRTR	8/4/98	12:39	1.4	17.3		77	0.0	101	9.8		7.2
30.0		Willapa R abv Trap Creek	WRTR	9/1/98	11:52		16.0		68			9.9		7.2
30.0		Willapa R abv Trap Creek	WRTR	9/22/98	12:40		13.8		52					

C.6.2

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) meter	liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
30.0		Willapa R abv Trap Creek	WRTR	10/6/98	14:36		13.1			51					
30.0		Willapa R abv Trap Creek	WRTR	11/3/98	12:34	0.3	8.7			69	0.0	100	11.6		7.1
30.0		Willapa R abv Trap Creek	WRTR	11/3/98	12:35	0.3	8.7			68	0.0	101	11.7		7.1
30.0		Willapa R abv Trap Creek	WRTR	11/3/98	12:36	0.3	8.7			68	0.0	100	11.6		7.1
30.0		Willapa R abv Trap Creek	WRTR	11/17/98	12:30		8.3			59					
30.0		Willapa R abv Trap Creek	WRTR	12/2/98	11:26		8.8			45					
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	8/4/98	12:06	0.9	14.6			103	0.0	88	9.0		7.0
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	8/4/98	12:39	1.4	17.3			77	0.0	102	9.9		7.2
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	9/1/98	13:09	0.0	15.6			59	0.0	109	10.5		7.4
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	11/3/98	13:16	0.0	8.9			60	0.0	104	12.1		7.2
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	11/3/98	13:17	0.0	8.9			59	0.0	103	11.9		7.2
29.9	1.00	Trap Creek at B-Line Bridge	TRBKG-5	11/3/98	13:18	0.0	8.9			59	0.0	101	11.7		7.2
29.9	0.15	Trap Creek above Hwy 6	TRAP	4/21/98	12:55			10.0		50					
29.9	0.15	Trap Creek above Hwy 6	TRAP	5/6/98	12:45	0.0	11.0			53	0.0	103	11.3		7.1
29.9	0.15	Trap Creek above Hwy 6	TRAP	5/26/98	11:20		8.7	8.6		51					
29.9	0.15	Trap Creek above Hwy 6	TRAP	6/16/98	13:50		12.8	12.8		52					
29.9	0.15	Trap Creek above Hwy 6	TRAP	7/14/98	12:25		14.1	13.9		50					
29.9	0.15	Trap Creek above Hwy 6	TRAP	8/4/98	13:06	1.0	15.1			68	0.0	99	10.0	9.8	7.0
29.9	0.15	Trap Creek above Hwy 6	TRAP	9/1/98	13:26	0.0	15.4			59	0.0	89	8.5		7.2
29.9	0.15	Trap Creek above Hwy 6	TRAP	9/22/98	12:53		12.7			45					
29.9	0.15	Trap Creek above Hwy 6	TRAP	10/6/98	14:44		11.8			44					
29.9	0.15	Trap Creek above Hwy 6	TRAP	11/3/98	12:55	0.0	8.4			64	0.0	89	10.4		6.9
29.9	0.15	Trap Creek above Hwy 6	TRAP	11/3/98	12:55	0.0	8.4			64	0.0	95	11.1		6.9
29.9	0.15	Trap Creek above Hwy 6	TRAP	11/17/98	12:41		8.6			48					
29.9	0.15	Trap Creek above Hwy 6	TRAP	12/2/98	11:34		8.9			40					
26.1	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	5/6/98	14:58	0.4	11.1			49	0.0	101	11.1		7.0
26.1	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	8/4/98	14:33	1.6	14.8			63	0.0	101	10.3		7.2
26.1	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	11/3/98	13:42	0.7	8.4			59	0.0	96	11.3		7.0
26.1	0.10	Oxbow Ck at Oxbow Rd Br	TRBKG-3	11/3/98	13:43	0.7	8.4			56	0.0	96	11.3		7.1
25.2		Willapa R at Oxbow Road	WROX	4/21/98	12:48		11.9	11.4		55					
25.2		Willapa R at Oxbow Road	WROX	5/6/98	13:20	0.2	13.2			58	0.0	109	11.5		7.5
25.2		Willapa R at Oxbow Road	WROX	5/26/98	11:50		10.7	10.6		56					
25.2		Willapa R at Oxbow Road	WROX	6/16/98	14:05		15.8	15.7		60					
25.2		Willapa R at Oxbow Road	WROX	7/14/98	12:35		17.1	17.1		57					
25.2		Willapa R at Oxbow Road	WROX	8/4/98	13:52	1.6	15.4			72	0.0	101	10.2		7.2
25.2		Willapa R at Oxbow Road	WROX	9/1/98	14:01	0.0	20.2			64	0.0	125	10.9		8.0
25.2		Willapa R at Oxbow Road	WROX	9/22/98	13:20		16.0			55					
25.2		Willapa R at Oxbow Road	WROX	10/6/98	14:55		11.9			46					
25.2		Willapa R at Oxbow Road	WROX	11/3/98	14:24										
25.2		Willapa R at Oxbow Road	WROX	11/3/98	14:24									11.8	
25.2		Willapa R at Oxbow Road	WROX	11/3/98	14:34	0.2	9.1			70	0.0	103	11.8		7.2
25.2		Willapa R at Oxbow Road	WROX	11/3/98	14:35	0.2	9.1			68	0.0	101	11.7		7.2
25.2		Willapa R at Oxbow Road	WROX	11/3/98	14:35	0.2	9.0			69	0.0	106	12.3		7.2
25.2		Willapa R at Oxbow Road	WROX	11/17/98	13:04		8.6			58					
25.2		Willapa R at Oxbow Road	WROX	12/2/98	11:53		8.9			45					
24.8	1.60	Green Ck at Green Ck Rd Br	TRBKG-4	5/6/98	14:25	0.0	12.9			62	0.0	97	10.3		6.6

C.6.3

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid meter	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	4/21/98	12:36		10.8	10.1		55				
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	5/6/98	13:55	0.3	10.9		57	0.0	102	11.3		7.2
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	5/26/98	11:40		9.0	8.9		58				
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	6/16/98	14:20		12.7	12.6		58				
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	7/14/98	12:45		13.8	13.8		54				
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	8/4/98	15:19	1.1	22.3		74	0.0	116	10.1		7.4
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	8/4/98	15:24	1.0	22.3		74	0.0	113	9.9		7.4
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	9/1/98	13:43								9.8	
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	9/1/98	13:48	0.0	15.2		62	0.0	101	9.8		7.1
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	9/22/98	13:04		12.9		46					
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	10/6/98	15:02		13.9		52					
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	11/3/98	14:04	0.3	9.1		66	0.0	99	11.4		7.0
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	11/17/98	12:56		8.8		59					
24.2	0.50	Stringer Creek at Highland-Stringer Rd	STRINGER	12/2/98	11:46		8.9		47					
21.4		Willapa R at SR 6 nr Menlo	WRMN	4/21/98	13:00			11.3	60					
21.4		Willapa R at SR 6 nr Menlo	WRMN	5/6/98	13:58	0.5	13.6		59	0.0	104	10.8		7.3
21.4		Willapa R at SR 6 nr Menlo	WRMN	5/26/98	13:50			11.1	60					
21.4		Willapa R at SR 6 nr Menlo	WRMN	6/16/98	14:00			15.7	65					
21.4		Willapa R at SR 6 nr Menlo	WRMN	7/14/98	14:05			18.4	70					
21.4		Willapa R at SR 6 nr Menlo	WRMN	8/4/98	15:17	0.0	23.3		69	0.0	114	9.7		7.7
21.4		Willapa R at SR 6 nr Menlo	WRMN	9/1/98	14:33	0.3	21.9		62	0.0	111	9.7		7.6
21.4		Willapa R at SR 6 nr Menlo	WRMN	9/22/98	12:45			16.5	79					
21.4		Willapa R at SR 6 nr Menlo	WRMN	10/6/98	13:20			13.9	38					
21.4		Willapa R at SR 6 nr Menlo	WRMN	11/3/98	14:50	0.9	9.1		62	0.0	97	11.2		7.2
21.4		Willapa R at SR 6 nr Menlo	WRMN	11/17/98	14:38		8.8		52					
21.4		Willapa R at SR 6 nr Menlo	WRMN	12/2/98	12:12		8.8		48					
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	5/6/98	14:50	0.1	12.2		61	0.0	100	10.7		7.1
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	5/6/98	14:55								10.6	
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	8/4/98	16:27	0.0	18.6		76	0.0	93	8.7		7.3
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	9/1/98	15:25	0.0	17.0		70	0.0	93	9.0		7.3
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	9/1/98	15:35								8.7	
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	9/1/98	15:39	0.1	17.0		70	0.0	92	8.9		7.3
17.9	3.80	Mill Ck at 3rd Mill Ck Rd Br	TRBKG-2	11/3/98	15:36	0.1	8.3		79	0.0	91	10.8		7.0
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	4/21/98	13:25			11.3	66					
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	5/6/98	14:25	0.2	12.6		65	0.0	99	10.5		7.2
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	5/26/98	14:03			9.9	70					
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	6/16/98	14:30			13.7	77					
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	7/14/98	14:27			15.8	84					
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	8/4/98	16:06	0.0	19.0		84	0.0	101	9.4		7.4
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	9/1/98	15:06	0.0	17.5		79	0.0	96	9.2		7.3
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	9/22/98	13:10			13.7	100					
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	10/6/98	13:40			12.1	49					
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	11/3/98	15:13	0.2	8.5		87	0.0	92	10.8		6.8
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	11/17/98	14:58		8.4	8.4	68					
17.9	0.30	Mill Creek at 1st Mill Ck Rd Br	MILLCK	12/2/98	12:32		9.0		55					
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	4/21/98	13:15		12.8	12.3	61					
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	4/22/98	13:20			12.6	64					

C.6.4

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		pH units
							liquid	metal			%Sat	meter	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	4/22/98	18:25			13.2					
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/5/98	10:49	0.9	13.3		62	0.0	99	10.3	7.5
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/5/98	11:20	0.0						10.5	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/5/98	17:59	0.6	16.1		60	0.0	110	10.9	7.5
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/5/98	18:00	0.0						11.1	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/6/98	15:35	0.0						10.7	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/6/98	15:38	0.0	14.3		64	0.0	103	10.6	7.2
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/26/98	12:10	0.0	11.8	11.7	61			11.1	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/27/98	7:45	0.0		10.0	64			10.2	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	5/27/98	14:20	0.0		11.9	63			11.4	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/16/98	14:40	0.0	17.2	17.2	66			10.6	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/17/98	10:32	0.0						9.2	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/17/98	10:35			15.3	70				
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	6/17/98	17:00	0.0			67	16.0		10.5	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/14/98	10:40	0.0						8.4	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/14/98	13:04	0.0	17.0	17.7	73			9.1	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/15/98	10:23	0.0		18.0	76			8.4	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/15/98	15:19	0.0		18.6	76			8.9	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	7/31/98	15:55	0.0						9.3	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	8/4/98	15:46	0.0						9.8	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	8/4/98	15:49	1.4	23.5		87	0.0	114	9.7	7.2
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	8/5/98	9:37	1.0	20.3		76	0.0	83	7.5	7.6
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	8/28/98	12:30							8.7	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/1/98	14:22	0.1	21.3		79	0.0	99	8.4	7.3
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/1/98	14:25	0.0						9.1	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/2/98	9:25	0.0						7.4	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/2/98	9:27	0.4	20.1		71	0.0	82	7.5	7.3
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/22/98	13:25			16.9	86				
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	9/23/98	12:25			16.6	87				
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/6/98	9:58	0.0						9.4	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/6/98	14:00	0.0		14.5	41			9.9	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/7/98	11:10		13.8		77				
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/7/98	11:30	0.0		13.9	81			9.1	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/7/98	14:05	0.0						9.7	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	10/7/98	10:25	0.0						10.6	
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/3/98	16:00	1.3	9.2		68	0.0	97	11.1	7.1
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/4/98	12:56	1.4	10.0		69	0.0	99	11.2	7.1
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/16/98	12:25			9.5					
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	11/17/98	15:06		8.7		55				
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	12/1/98	11:30		7.5		37				
17.5		Willapa R at Camp One Rd (Bullard Rd)	WRC1	12/2/98	12:51		8.9		49				
13.7		Willapa R at Willapa Road	WRWI	4/22/98	13:35			12.6	65				
13.7		Willapa R at Willapa Road	WRWI	4/22/98	13:35			12.6	65				
13.7		Willapa R at Willapa Road	WRWI	5/5/98	11:40	0.0	14.2		64	0.0	97	9.9	7.2
13.7		Willapa R at Willapa Road	WRWI	5/5/98	11:41	2.0	14.2		63	0.0	97	10.0	7.1
13.7		Willapa R at Willapa Road	WRWI	5/5/98	17:03	0.6	14.8		62	0.0	97	9.9	7.3
13.7		Willapa R at Willapa Road	WRWI	5/27/98	8:15			11.9	63				

C.6.5

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	%Sat	DO (mg/L)		pH units
							liquid	metal				meter	Wink	
13.7		Willapa R at Willapa Road	WRWI	5/27/98	13:40			12.4						
13.7		Willapa R at Willapa Road	WRWI	6/17/98	11:00			17.0						
13.7		Willapa R at Willapa Road	WRWI	6/17/98	16:35			17.1						
13.7		Willapa R at Willapa Road	WRWI	7/15/98	10:50			19.4						
13.7		Willapa R at Willapa Road	WRWI	7/15/98	15:00			19.5						
13.7		Willapa R at Willapa Road	WRWI	8/5/98	6:39	0.4	22.4		530	0.3	99	8.6		7.1
13.7		Willapa R at Willapa Road	WRWI	8/5/98	12:21	1.0	22.2		6848	3.8	208	7.9		7.0
13.7		Willapa R at Willapa Road	WRWI	9/2/98	8:32	1.2	21.2		6807	4.2	78	6.8		6.8
13.7		Willapa R at Willapa Road	WRWI	9/2/98	8:34	0.3	21.2		6814	4.2	79	6.9		6.8
13.7		Willapa R at Willapa Road	WRWI	9/2/98	8:37	0.0							6.7	
13.7		Willapa R at Willapa Road	WRWI	9/2/98	12:33	2.4	21.0		11425	7.2	73	6.3		6.9
13.7		Willapa R at Willapa Road	WRWI	9/2/98	12:35	1.5	21.1		10007	6.3	75	6.5		6.9
13.7		Willapa R at Willapa Road	WRWI	9/2/98	12:36	-0.1	21.3		8295	5.2	79	6.8		6.9
13.7		Willapa R at Willapa Road	WRWI	9/23/98	7:55			17.4	>1000					
13.7		Willapa R at Willapa Road	WRWI	10/7/98	8:10			14.3	1503					
13.7		Willapa R at Willapa Road	WRWI	10/7/98	12:15			14.7	>1000					
13.7		Willapa R at Willapa Road	WRWI	10/7/98	12:15			14.7	3515					
13.7		Willapa R at Willapa Road	WRWI	11/4/98	6:49	0.2	9.2		142	0.1	88	10.1		6.7
13.7		Willapa R at Willapa Road	WRWI	11/4/98	12:17	0.0	9.5		4499	2.5	84	9.4		6.9
13.7		Willapa R at Willapa Road	WRWI	11/4/98	12:19	1.0	9.5		5212	2.9	82	9.3		6.9
13.7		Willapa R at Willapa Road	WRWI	11/4/98	12:20	2.0	9.5		5286	2.9	82	9.2		6.9
13.7		Willapa R at Willapa Road	WRWI	11/4/98	12:20	3.0	9.5		5571	3.1	82	9.2		6.9
13.7		Willapa R at Willapa Road	WRWI	11/16/98	12:01			9.6						
13.7		Willapa R at Willapa Road	WRWI	11/16/98	16:48			9.7						
13.7		Willapa R at Willapa Road	WRWI	12/1/98	11:12			7.5	37					
13.7		Willapa R at Willapa Road	WRWI	12/1/98	15:03			7.6	57					
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	9/2/98	11:38	0.2	16.1		74	0.0	87	8.6		7.3
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	9/23/98	10:05			11.3	90					
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	10/7/98	12:30			12.0	90					
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	11/4/98	11:32	0.4	8.8		83	0.0	86	10.0		6.7
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	11/16/98	14:03			9.8						
12.0	0.9/1.2	Ward Creek blw Fairchild Ck	WARD	12/1/98	13:16		8.0		37					
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	9/2/98	12:05	0.1	16.6		78	0.0	84	8.2		7.1
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	9/23/98	10:30			12.0	95					
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	10/7/98	11:50			11.7	97					
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	11/4/98	11:54	0.7	8.8		88	0.0	89	10.3		7.2
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	11/16/98	14:19			9.8						
12.0	1.45	Wilson Creek at 1st Weyco Br	WILSUP	12/1/98	12:53		7.5	7.6	40					
12.0	0.10	Wilson Creek near Willapa	WILSON	4/22/98	17:50			12.3	72					
12.0	0.10	Wilson Creek near Willapa	WILSON	5/5/98	16:22	0.1	14.1		68	0.0	99	10.2		7.3
12.0	0.10	Wilson Creek near Willapa	WILSON	5/5/98	16:23	0.9	14.1		67	0.0	99	10.2		7.2
12.0	0.10	Wilson Creek near Willapa	WILSON	5/5/98	16:24	0.5	14.1		67	0.0	99	10.2		7.2
12.0	0.10	Wilson Creek near Willapa	WILSON	5/27/98	8:35			10.2	72					
12.0	0.10	Wilson Creek near Willapa	WILSON	6/17/98	13:35				79					
12.0	0.10	Wilson Creek near Willapa	WILSON	7/15/98	11:56			16.4	200					
12.0	0.10	Wilson Creek near Willapa	WILSON	7/15/98	12:55			16.4	185					
12.0	0.10	Wilson Creek near Willapa	WILSON	8/5/98	6:17	0.5	18.1		1122	0.6	75	7.0		6.9

C:6.6

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		Wink	pH units
							liquid	metal			%Sat	meter		
9.5		Willapa R near Ellis Slough	WREL-M	5/5/98	16:05	0.1	15.9		4806	2.6	95	9.2		7.2
9.5		Willapa R near Ellis Slough	WREL-M	5/5/98	16:06	1.0	15.9		4971	2.7	95	9.2		7.2
9.5		Willapa R near Ellis Slough	WREL-M	5/5/98	16:07	2.2	15.8		6316	3.5	93	9.0		7.2
9.5		Willapa R near Ellis Slough	WREL-M	5/5/98	16:08	3.0	15.8		7042	3.9	92	8.9		7.2
9.5		Willapa R near Ellis Slough	WREL-M	5/5/98	16:09	4.1	15.7		12067	6.9	87	8.2		7.2
9.5		Willapa R near Ellis Slough	WREL-M	5/5/98	16:11	5.0	15.5		19085	11.3	80	7.4		7.3
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:02	0.0							6.8	
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:05	0.0	22.2		16414	9.6	91	7.5		7.2
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:15	1.0	22.4		16965	9.9	81	6.6		7.1
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:16	2.0	22.4		17169	10.1	81	6.6		7.1
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:17	3.0	22.3		17378	8.7	80	6.6		7.1
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:19	4.0	22.3		18511	9.3	77	6.3		7.0
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:20	5.0	22.3		18548	9.3	76	6.3		7.0
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	7:20	5.3B								
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:10	0.1	22.0		25590	13.2	82	6.6		7.4
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:10	1.0	22.0		25764	13.3	80	6.5		7.4
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:10	2.0	22.0		25665	13.3	90	7.3		7.3
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:10	3.0	22.0		25690	13.3	79	6.4		7.3
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:13	4.0	21.9		25801	13.4	80	6.4		7.3
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:13	5.0	21.9		25888	13.4	79	6.4		7.3
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:16	6.0	21.9		26198	13.6	78	6.3		7.3
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:16	7.0	21.9		26210	13.6	78	6.3		7.3
9.5		Willapa R near Ellis Slough	WREL-M	8/5/98	11:16	7.2B								
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:21	0.0	21.1		21150	14.9	80	6.1		7.2
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:22	1.0	21.2		21346	15.0	77	5.9		7.2
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:23	1.9	21.2		21657	15.3	75	5.7		7.2
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:24	3.0	21.2		21700	15.3	77	5.9		7.2
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:25	4.1	21.2		21851	15.4	76	5.8		7.2
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:26	5.0	21.2		21743	15.3	77	5.9		7.2
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	7:27	5.6	21.2		21786	15.4	76	5.8		7.2
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:04	0.0	21.0		27096	19.5	83	6.2		7.6
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:05	0.9	21.0		27106	19.6	81	6.1		7.5
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:05	2.0	21.0		27138	19.6	80	6.0		7.5
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:06	3.0	20.9		27404	19.8	79	5.9		7.5
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:07	4.1	20.9		27511	19.9	79	5.9		7.5
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:07	5.0	20.9		27586	19.9	79	5.9		7.5
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:08	6.1	20.9		27586	19.9	78	5.8		7.5
9.5		Willapa R near Ellis Slough	WREL-M	9/2/98	11:08	6.9	20.9		27586	19.9	79	5.9		7.5
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:25	0.0							8.1	
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:39	1.0	10.2		14798	8.6	80	8.5		7.0
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:40	1.0	10.2		14836	8.6	79	8.4		7.0
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:40	1.0	10.2		14808	8.6	79	8.4		7.0
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:41	2.0	10.3		14904	8.7	78	8.3		7.0
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:41	3.0	10.3		15223	8.9	78	8.3		7.0
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:42	4.0	10.4		16310	9.5	80	8.4		7.0
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:43	5.1	10.4		16690	9.8	76	8.0		7.0
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	7:43	5.3	10.4		15984	9.3	77	8.1		7.0

C.6.7

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:35	0.1	11.3		28354	17.4	80	7.8		7.4
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:36	0.9	11.3		28290	17.4	79	7.8		7.4
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:38	2.0	11.3		28609	17.6	79	7.8		7.4
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:39	3.0	11.3		28743	17.7	79	7.7		7.4
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:40	3.9	11.3		29375	18.1	79	7.7		7.4
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:40	5.0	11.3		28417	17.5	79	7.8		7.4
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:41	5.9	11.3		29628	18.3	79	7.7		7.4
9.5		Willapa R near Ellis Slough	WREL-M	11/4/98	11:45	6.8	11.3		29817	18.4	79	7.7		7.4
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	4/22/98	11:00		14.2	14.0	17400					
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	4/22/98	11:10		13.9	13.8	17680					
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	4/22/98	11:20		14.5	14.1	17860					
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	4/22/98	15:15		13.6	13.6	9780					
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	4/22/98	15:21		13.5	13.5	10040					
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	5/5/98	16:42	0.0	16.5		9817	5.5	90	8.4		7.3
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	5/5/98	16:43	1.1	16.4		9976	5.6	90	8.5		7.3
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	5/5/98	16:44	2.0	16.2		10473	5.9	90	8.5		7.3
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	5/5/98	16:46	3.0	15.9		15280	8.9	86	8.1		7.3
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	5/5/98	16:47	4.1	15.5		21231	12.7	84	7.7		7.5
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	5/5/98	16:48	5.1	15.5		21837	13.1	83	7.6		7.5
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	5/5/98	16:50	6.2	15.4		22609	13.6	81	7.4		7.5
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	5/27/98	9:24		13.4		6200					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	5/27/98	9:26		13.4		6450					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	5/27/98	9:28		13.4		6260					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	5/27/98	12:22		13.8		11120					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	5/27/98	12:25		13.8		11260					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	6/17/98	10:12		17.7		15770					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	6/17/98	10:16		17.6		15723					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	6/17/98	12:50		17.6		8446					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	6/17/98	12:55		17.8		8431					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	7/15/98	10:02		19.3	19.3	18145					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	7/15/98	10:06		19.3	19.2	18715					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	7/15/98	12:15		19.4	19.4	13063					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	7/15/98	12:20		19.4	19.4	13158					
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:31	0.0	22.1		23281	11.9	84	6.9		7.3
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:32	1.0	22.2		23663	12.2	81	6.6		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:34	2.0	22.2		23724	12.2	80	6.5		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:35	3.0	22.2		23786	12.2	80	6.5		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:36	4.0	22.2		24307	12.5	80	6.5		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:37	5.0	22.2		24656	12.7	79	6.4		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:38	5.5	22.2		24718	12.7	79	6.4		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	7:38	5.8B								
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:32	0.1	21.5		30716	16.2	87	7.0	6.9	7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:32	1.0	21.5		31150	16.4	85	6.8		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:35	2.0	21.4		31322	16.5	84	6.7		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:35	3.0	21.4		31396	16.6	84	6.7		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:35	4.0	21.4		31396	16.6	83	6.7		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:38	5.0	21.4		31396	16.6	83	6.7		7.6

C.6.8

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	Temp metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:38	6.0	21.4		31768	16.8	82	6.6		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:44	7.0	21.4		31977	16.9	82	6.6		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	8/5/98	11:44	7.2B								
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:38	0.0							6.3	
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:40	0.0	20.9		26513	19.1	83	6.3		7.4
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:42	1.0	20.9		26996	19.5	80	6.0		7.4
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:42	2.2	20.9		27371	19.8	81	6.0		7.4
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:43	3.0	20.9		28280	20.5	82	6.1		7.4
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:44	4.1	20.9		28355	20.6	79	5.9		7.4
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:45	5.2	20.9		28398	20.6	76	5.7		7.5
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	7:48	6.0	20.9		28344	20.5	81	6.0		7.5
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:19	0.0	20.8		23906	17.0	88	6.8		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:19	1.0	20.5		30849	22.6	80	5.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:20	2.0	20.5		30902	22.6	80	5.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:21	3.0	20.5		30965	22.7	81	6.0		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:22	4.0	20.5		31062	22.8	81	6.0		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:23	5.0	20.5		31115	22.8	79	5.8		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:24	6.0	20.5		31115	22.8	80	5.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:25	7.0	20.5		31115	22.8	78	5.8		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	9/2/98	11:26	7.9	20.5		31115	22.8	72	5.3		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	9/23/98	8:24		18.4		26900					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	9/23/98	8:26		18.5		27200					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	9/23/98	11:14		18.4		26800					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	9/23/98	11:18		18.5		27200					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	10/7/98	8:39		16.0		23700					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	10/7/98	8:43		16.0		23600					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	10/7/98	12:15		16.3		28500					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	10/7/98	12:16		16.3		28900					
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	7:50	0.0							7.8	
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	7:54	-0.1	10.9		20166	12.0	77	7.9		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	7:55	1.0	10.9		22591	13.6	76	7.7		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	7:56	2.0	10.9		22917	13.8	77	7.8		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	7:57	3.1	10.9		23035	13.9	76	7.7		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	7:57	4.0	10.9		23161	14.0	76	7.7		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	8:01	5.0	10.9		23296	14.0	77	7.8		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	8:01	5.6	10.9		23288	14.0	77	7.8		7.2
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	11:56	0.0	11.4		33311	20.8	83	7.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	11:56	1.0	11.4		33438	20.9	83	8.0		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	11:59	2.0	11.4		33566	21.0	83	7.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:00	3.1	11.4		33949	21.3	83	7.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:00	4.0	11.4		33949	21.3	83	7.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:03	5.1	11.4		33896	21.3	83	7.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:04	6.1	11.4		33885	21.2	82	7.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:05	7.0	11.4		34076	21.4	82	7.9		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:06	8.1	11.4		34073	21.4	82	7.8		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:06	8.5	11.4		34073	21.4	82	7.8		7.6
7.7		Willapa R at Hwy 101 Bridge	WRHY-M	11/4/98	12:06	8.6	11.4		34073	21.4	82	7.8		7.6

C.6.9

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	11/16/98	11:26		10.6		6390					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	11/16/98	11:28		10.6		6780					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	11/16/98	14:55		10.6		1590					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	11/16/98	15:00		10.6		1633					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	12/1/98	11:45		8.3		14850					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	12/1/98	11:50		8.3		14980					
7.7		Willapa R at Hwy 101 Bridge	WRHY-R	12/1/98	15:45		7.6		1696					
7.7		Willapa R at Hwy 101 Bridge	WRHY-L	12/1/98	15:48		7.6		1806					
7.5	0.10	Weyco SW Outfall W-9	WEY-SW9	11/4/98	9:12	0.4	11.0		942	0.5	79	8.7		6.8
7.4	0.10	Weyco SW Outfall W-8	WEY-SW8	11/4/98	9:36	0.6	11.3		381	0.2	87	9.5		6.3
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	4/22/98	14:25		12.9		81					
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	5/5/98	12:55	0.1	13.5		73	0.0	97	10.1		7.1
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	6/17/98	16:10			14.1	91					
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	7/15/98	11:33			14.5	97					
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	8/5/98	11:43	0.2	16.1		82	0.0	200	9.3		7.3
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	9/2/98	14:13	0.1	19.6		75	0.0	93	8.5		7.3
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	9/23/98	13:05			14.8	101					
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	10/7/98	13:10			14.0	108					
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	11/16/98	13:48			10.9						
7.2	0.40	Riverdale Creek at Lions Club Park	RAYSW-3	12/1/98	16:10		9.1		62					
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	4/22/98	15:10			10.9	67					
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	5/5/98	13:49	0.1	12.0		63	0.0	100	10.8		7.3
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	5/5/98	14:00	0.0							11.1	
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	5/27/98	13:05			10.2	72					
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	6/17/98	11:35			12.2	70					
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	7/15/98	14:35			14.2	73					
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	8/5/98	10:55	0.3	15.6		69	0.0	95	9.5		7.4
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	9/2/98	10:38	0.3	15.3		63	0.0	96	9.6		7.4
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	9/23/98	9:40			11.7	78					
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	10/7/98	10:20			11.1	75					
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	11/4/98	10:57	1.2	9.0		67	0.0	91	10.5		6.9
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	11/16/98	14:45			9.7						
7.1	4.20	South Fork Willapa R at Golf Course Rd	SFRK-F	12/1/98	12:03		7.9		38					
7.1	2.00	SF Trib near Lee Johnson Rd	RAYSW-4	5/5/98	14:27	0.1	14.1		58	0.0	83	8.5		7.0
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:13	0.0	15.6		7085	3.9	93	9.0		7.3
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:14	1.0	15.6		7382	4.1	92	8.9		7.3
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:16	2.0	15.5		14569	8.4	86	8.1		7.3
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:16	2.0	15.5		15842	9.2	85	8.0		7.3
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:18	3.0	15.4		20134	12.0	83	7.6		7.4
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:19	4.1	15.4		22665	13.6	80	7.3		7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:20	5.0	15.4		23546	14.2	79	7.2		7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:24	6.0	15.4		23822	14.4	79	7.2		7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:24	6.8	15.4		23933	14.5	78	7.1		7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	5/5/98	17:25	9.1	15.4		24099	14.6	76	6.9		7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:43	0.0							6.5	
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:47	0.0	20.7		18332	9.2	75	6.4		7.2

C.6.10

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		pH units
							liquid	metal			%Sat	meter	
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:48	1.0	21.2		21925	11.2	74	6.1	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:49	2.0	21.3		22935	11.8	72	6.0	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:50	3.0	21.4		23710	12.2	72	5.9	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:51	4.0	21.4		23809	12.2	72	5.9	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:52	5.0	21.4		23972	12.3	71	5.9	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:52	6.0	21.4		24210	12.5	72	5.9	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:53	7.0	21.5		24310	12.5	71	5.8	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:53	8.0	21.5		24422	12.6	71	5.9	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:53	9.0	21.5		24422	12.6	70	5.8	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	7:53	9.1B							
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:01	0.1	21.6		24823	12.8	84	6.8	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:01	1.0	21.7		28201	14.7	82	6.6	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:01	2.0	21.6		28535	14.9	81	6.6	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:04	3.0	21.6		28919	15.1	80	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:04	4.0	21.6		29265	15.3	81	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:04	5.0	21.6		29439	15.4	81	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:04	6.0	21.6		29401	15.4	81	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:06	7.0	21.5		29810	15.7	79	6.4	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:06	8.0	21.5		29921	15.7	80	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:06	9.0	21.5		29921	15.7	81	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:08	10.0	21.5		29689	15.6	80	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:08	11.0	21.5		29677	15.6	79	6.4	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	8/5/98	12:08	11.5B							
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	8:03	0.0	20.3		20935	14.7	75	5.9	7.4
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	8:04	0.9	20.8		24581	17.5	76	5.7	7.3
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	8:05	1.9	20.9		26213	18.8	76	5.7	7.4
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	8:06	3.1	20.9		27123	19.6	75	5.6	7.4
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	8:07	4.0	20.9		27391	19.8	71	5.3	7.4
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:42	0.0	20.9		25742	18.5	85	6.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:43	1.0	20.8		28119	20.4	79	5.9	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:44	2.0	20.7		29228	21.3	79	5.9	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:45	2.9	20.7		29719	21.7	78	5.7	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:47	4.1	20.6		29815	21.7	77	5.7	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:48	5.0	20.6		29911	21.8	77	5.7	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:50	6.0	20.6		29889	21.8	77	5.7	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:51	7.0	20.6		29953	21.8	73	5.4	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:52	8.0	20.6		29985	21.9	75	5.5	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:53	9.0	20.6		30049	21.9	73	5.4	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:54	9.9	20.6		29985	21.9	74	5.4	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	9/2/98	11:55	10.9	20.6		30017	21.9	76	5.6	7.5
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:12	0.0	10.4		19316	11.4	77	8.0	7.3
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:13	1.0	10.5		19826	11.8	76	7.8	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:14	2.0	10.6		20333	12.1	75	7.7	7.2
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:15	3.0	10.6		20647	12.3	74	7.6	7.1
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:17	4.1	10.7		21410	12.8	74	7.6	7.1
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:17	5.0	10.7		21657	13.0	74	7.5	7.1
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:19	6.1	10.7		21907	13.1	74	7.5	7.1

C.6.11

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		pH units
							liquid	metal			%Sat	meter	
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:19	7.0	10.7		21845	13.1	73	7.5	7.1
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:21	8.1	10.7		22170	13.3	73	7.4	7.1
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:22	9.0	10.7		22161	13.3	73	7.4	7.1
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	8:23	10.0	10.7		22168	13.3	72	7.3	7.1
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:20	0.0	11.4		33250	20.8	83	7.9	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:21	1.1	11.4		33069	20.7	83	7.9	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:21	2.0	11.4		33058	20.7	82	7.9	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:22	3.0	11.4		33186	20.8	82	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:24	4.1	11.4		33186	20.8	82	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:24	5.0	11.4		33186	20.8	82	7.9	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:26	6.1	11.4		33321	20.9	82	7.9	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:27	7.1	11.4		33311	20.8	82	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:28	7.9	11.4		33385	20.9	81	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:31	9.1	11.4		33693	21.1	82	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:32	10.1	11.4		33502	21.0	82	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:33	11.1	11.4		33311	20.8	82	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:34	12.2	11.4		33311	20.8	81	7.8	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:34	12.1	11.4		33438	20.9	81	7.7	7.6
7.1	1.00	South Fork Willapa R at Hwy 101	SFRK-M	11/4/98	12:35	12.9	11.4		33502	21.0	81	7.7	7.6
7.1	0.80	Drain at Bruckenhaus	RAYSW-5	5/27/98	10:55		13.3		1330				
7.1	0.80	Drain at Bruckenhaus	RAYSW-5	6/17/98	14:00			15.7	>1000				
7.1	0.80	Drain at Bruckenhaus	RAYSW-5	7/15/98	12:37			17.7	960				
7.1	0.30	Raymond SW Drain north of PHW	RAYSW-6	11/4/98	8:21	0.1	12.7		1353	0.7	62	6.5	6.2
7.1	0.30	Raymond SW Drain north of PHW	RAYSW-6	11/16/98	15:56			12.7					
7.1	0.30	Raymond SW Drain north of PHW	RAYSW-6	12/1/98	15:53		8.7		OFL				
7.1	0.10	Weyco SW Outfall W-2	WEY-SW2	11/4/98	10:02	0.1	12.0		156	0.1	76	8.2	6.4
7.0	0.00	Raymond WWTP	RAYTP	4/22/98	8:00		15.0		115				
7.0	0.00	Raymond WWTP	RAYTP	4/22/98	15:20		18.0		1300				
7.0	0.00	Raymond WWTP	RAYTP	5/5/98	12:00		18.0		1300	0.7			
7.0	0.00	Raymond WWTP	RAYTP	5/5/98	12:00		17.2				7.2		
7.0	0.00	Raymond WWTP	RAYTP	5/5/98	12:00		17.1					7.5	
7.0	0.00	Raymond WWTP	RAYTP	5/6/98	12:30		17.0		1400	1.0			
7.0	0.00	Raymond WWTP	RAYTP	5/6/98	12:30		17.4				6.6		
7.0	0.00	Raymond WWTP	RAYTP	5/6/98	12:30		17.2					7.5	
7.0	0.00	Raymond WWTP	RAYTP	5/27/98	10:40		14.0		1500				
7.0	0.00	Raymond WWTP	RAYTP	5/27/98	15:00		16.0		1600				
7.0	0.00	Raymond WWTP	RAYTP	6/17/98	11:10		18.5		1700				
7.0	0.00	Raymond WWTP	RAYTP	6/17/98	14:45		19.5		1700				
7.0	0.00	Raymond WWTP	RAYTP	7/15/98	10:20		20.0		1900				
7.0	0.00	Raymond WWTP	RAYTP	7/15/98	15:05		21.0		1900				
7.0	0.00	Raymond WWTP	RAYTP	9/2/98	10:00		21.0		1800	1.0	5.2		
7.0	0.00	Raymond WWTP	RAYTP	9/2/98	10:00		21.0						7.1
7.0	0.00	Raymond WWTP	RAYTP	9/2/98	13:30		22.0		1800	1.0			
7.0	0.00	Raymond WWTP	RAYTP	9/2/98	13:30		22.0						7.1
7.0	0.00	Raymond WWTP	RAYTP	9/23/98	10:25		18.0		2100				
7.0	0.00	Raymond WWTP	RAYTP	9/23/98	14:10		19.0		2100				
7.0	0.00	Raymond WWTP	RAYTP	10/7/98	11:14		17.5		2200				

C.6.12

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
7.0	0.00	Raymond WWTP	RAYTP	10/7/98	14:30		17.5		2250					
7.0	0.00	Raymond WWTP	RAYTP	11/3/98	14:00		12.2					7.7		
7.0	0.00	Raymond WWTP	RAYTP	11/3/98	14:00		11.9							7.3
7.0	0.00	Raymond WWTP	RAYTP	11/3/98	14:00		12.1		1350	0.7				
7.0	0.00	Raymond WWTP	RAYTP	11/4/98	11:00		11.5		1320	0.7				
7.0	0.00	Raymond WWTP	RAYTP	11/4/98	11:00		12.2					7.2		
7.0	0.00	Raymond WWTP	RAYTP	11/4/98	11:00		12.1							7.2
7.0	0.00	Raymond WWTP	RAYTP	11/4/98	11:00		11.5		1320	0.7				
7.0	0.00	Raymond WWTP	RAYTP	11/4/98	11:00		12.2					6.9		
7.0	0.00	Raymond WWTP	RAYTP	11/4/98	11:00		12.0							7.3
7.0	0.00	Raymond WWTP	RAYTP	11/16/98	10:45		12.0		1060					
7.0	0.00	Raymond WWTP	RAYTP	11/16/98	15:10		12.0		1060					
7.0	0.00	Raymond WWTP	RAYTP	11/16/98	15:10		12.0		1050					
7.0	0.00	Raymond WWTP	RAYTP	12/1/98	8:45		8.0		380					
7.0	0.00	Raymond WWTP	RAYTP	12/1/98	14:25		7.0		470					
6.4		Willapa R at Raymond (nr Port)	WRRR-M	4/22/98	11:30		14.1	14.1	16860					
6.4		Willapa R at Raymond (nr Port)	WRRR-M	4/22/98	11:38		14.1	13.7	18000					
6.4		Willapa R at Raymond (nr Port)	WRRR-M	4/22/98	15:32		13.8	13.7	14800					
6.4		Willapa R at Raymond (nr Port)	WRRR-M	4/22/98	15:44		13.7	13.7	15250					
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	5/4/98	17:55	0.5							8.0	
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:09	0.0	16.3		15270			8.5		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:12	0.9	16.1		15932	9.3	87	8.1		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:13	2.0	16.0		16375	9.6	86	8.0		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:14	3.0	16.1		17031	10.0	87	8.0		7.5
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:15	4.2	15.6		20732	12.4	83	7.6		7.5
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:17	5.5	15.3		26028	15.9	82	7.4		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:18	6.0	15.3		25973	15.8	81	7.3		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:21	7.2	15.3		26690	16.3	82	7.4		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	15:22	8.0	15.2		27464	16.8	82	7.4		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	5/5/98	17:40	0.0							8.4	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	5/27/98	9:09		13.6		10350					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	5/27/98	9:11		13.7		10330					
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	5/27/98	9:11	0.5	13.7		10330				7.6	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	5/27/98	10:51		13.8		9760					
6.4		Willapa R at Raymond (nr Port)	WRRR-R	5/27/98	10:54		13.8		9890					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	5/27/98	10:55	0.0	13.8		10250				7.6	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	6/17/98	10:22		17.5		19238					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	6/17/98	10:24	0.0	17.6		19238				7.9	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	6/17/98	13:00		17.8		12018					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	6/17/98	13:03		17.7		11780					
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	6/17/98	13:05	0.0							8.1	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	7/15/98	10:13		19.2	19.1	22373					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	7/15/98	10:16	0.0	19.2	19.1	22278				6.3	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	7/15/98	12:26		19.4	19.3	17100					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	7/15/98	12:28	0.0	19.4	19.3	16863				6.2	
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	7/31/98	13:17	0.5							7.2	
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:03	0.0							6.7	

C.6.13

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	Temp metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:05	0.0	21.6		27885	14.5	84	6.8		7.5
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:06	1.0	21.6		27985	14.6	82	6.7		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:07	2.0	21.7		28615	15.0	81	6.5		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:08	3.0	21.7		28979	15.2	81	6.5		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:09	4.0	21.7		29357	15.4	81	6.5		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:10	5.0	21.7		29669	15.6	81	6.5		7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:11	6.0	21.6		30089	15.8	81	6.5		7.5
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:12	6.5	21.6		30176	15.9	81	6.5		7.5
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	8:12	6.6B								
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:23	0.1							7.1	
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:26	0.1	21.4		33148	17.6	91	7.3		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:26	1.0	21.4		33195	17.6	88	7.0		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:26	2.0	21.3		33416	17.8	88	7.0		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:26	3.0	21.3		33540	17.8	87	6.9		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:26	4.0	21.2		34131	18.2	86	6.9		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:32	5.0	21.2		34256	18.3	86	6.8		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:34	6.0	21.2		34391	18.3	84	6.7		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:34	7.0	21.2		34527	18.4	84	6.7		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:36	8.0	21.2		34588	18.4	84	6.7		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	8/5/98	12:36	8.4B								
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	8/28/98	16:12	0.5							8.2	
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:20	0.0	20.5		28556	20.7	85	6.4		7.5
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:20	1.0	20.5		29403	21.4	82	6.1		7.5
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:21	2.0	20.5		29993	21.9	82	6.1		7.6
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:22	3.1	20.5		30346	22.2	82	6.1		7.6
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:23	4.0	20.5		30475	22.3	82	6.1		7.6
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:24	5.1	20.5		30785	22.5	80	5.9		7.6
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:24	6.0	20.5		31042	22.7	79	5.8		7.6
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:25	6.9	20.5		31149	22.8	78	5.8		7.6
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	8:27	7.4	20.5		31106	22.8	73	5.4		7.6
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	9/2/98	8:29	0.5							6.2	
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:04	0.0							6.9	
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:09	0.0	20.7		30781	22.5	102	7.6		7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:11	1.0	20.6		30971	22.7	90	6.7		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:11	2.0	20.5		31321	23.0	89	6.6		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:13	3.1	20.5		31618	23.2	84	6.2		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:14	3.9	20.4		31767	23.3	84	6.2		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:16	5.0	20.4		32236	23.7	84	6.2		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:18	8.0	20.3		32663	24.1	81	6.0		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:21	9.9	20.3		32673	24.1	81	5.9		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:27	6.0	20.4		32257	23.7	82	6.1		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	9/2/98	12:27	5.1	20.4		31895	23.4	81	6.0		7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	9/2/98	12:35								7.4	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	9/23/98	8:40		18.4		29400					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	9/23/98	8:43		18.3		29200					
6.4		Willapa R at Raymond (nr Port)	WRRR-L	9/23/98	11:40		18.4		30400					
6.4		Willapa R at Raymond (nr Port)	WRRR-R	9/23/98	11:41		18.4		30200					

C.6.14

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)			SpCond uS/cm	Salin ppt	DO (mg/L)		pH units
							liquid	metal	meter			%Sat	meter	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	10/6/98	9:00					25800			6.1	
6.4		Willapa R at Raymond (nr Port)	WRRR-L	10/6/98	9:03					25800				
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	10/6/98	11:25								6.7	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	10/6/98	12:23				16.4	30500				
6.4		Willapa R at Raymond (nr Port)	WRRR-L	10/6/98	12:24				16.7	29500				
6.4		Willapa R at Raymond (nr Port)	WRRR-L	10/6/98	12:25								6.6	
6.4		Willapa R at Raymond (nr Port)	WRRR-L	10/7/98	13:35								6.7	
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	11/2/98	15:15	0.5							7.9	
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	11/4/98	8:29	0.5							7.8	
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:33	0.0	11.1			26521	16.2	80	7.9	7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:34	1.1	11.2			27664	17.0	78	7.7	7.3
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:35	2.1	11.2			27789	17.1	78	7.7	7.3
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:36	3.0	11.2			28118	17.3	78	7.7	7.3
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:37	4.0	11.2			28614	17.6	78	7.7	7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:40	5.0	11.3			29503	18.2	78	7.7	7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:41	6.1	11.3			29817	18.4	79	7.7	7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	8:42	7.0	11.3			30902	19.2	78	7.6	7.4
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:46	0.0	11.6			35509	22.4	86	8.1	7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:46	0.9	11.4			36364	23.0	85	8.0	7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:49	1.9	11.4			36109	22.8	85	8.0	7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:49	3.0	11.4			36236	22.9	85	8.0	7.7
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:50	3.9	11.4			36367	23.0	85	8.0	7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:50	5.0	11.4			36428	23.0	85	8.0	7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:52	6.0	11.4			36555	23.1	81	7.6	7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:53	7.0	11.4			36826	23.3	82	7.8	7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:54	8.0	11.4			36877	23.3	84	8.0	7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-M	11/4/98	12:54	9.0	11.4			36877	23.3	84	7.9	7.8
6.4		Willapa R at Raymond (nr Port)	WRRR-DS	11/4/98	13:00	0.5							8.1	
6.4		Willapa R at Raymond (nr Port)	WRRR-R	11/16/98	11:46		10.7			5980				
6.4		Willapa R at Raymond (nr Port)	WRRR-L	11/16/98	11:50		10.6			6190				
6.4		Willapa R at Raymond (nr Port)	WRRR-R	11/16/98	15:10		10.7			4900				
6.4		Willapa R at Raymond (nr Port)	WRRR-L	11/16/98	15:12		10.7			4640				
6.4		Willapa R at Raymond (nr Port)	WRRR-R	12/1/98	11:58		8.2			13400				
6.4		Willapa R at Raymond (nr Port)	WRRR-L	12/1/98	12:01		8.3			14730				
6.4		Willapa R at Raymond (nr Port)	WRRR-R	12/1/98	15:55		7.6			2300				
6.4		Willapa R at Raymond (nr Port)	WRRR-L	12/1/98	15:57		7.6			2270				
5.9	0.10	Raymond SW at Delaware St.	RAYSW-2	4/22/98	15:50			14.6		126				
5.9	0.10	Raymond SW at Delaware St.	RAYSW-2	5/27/98	11:15			12.2		230				
5.9	0.10	Raymond SW at Delaware St.	RAYSW-2	11/16/98	15:20			11.8						
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	5/27/98	10:20			12.8		308				
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	6/17/98	12:00			17.2		295				
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	7/15/98	14:12			19.2		308				
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	8/5/98	7:37	0.5	21.2			675	0.3	81	7.2	6.9
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	9/2/98	7:39	0.1	20.5			698	0.4	79	7.1	7.0
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	9/23/98	8:25			15.7		1100				
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	10/7/98	9:35		15.0			800				
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	11/16/98	16:19			10.6						

C.6.15

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
5.3	0.60	Skidmore Slough above tide gate	RAYSW-1	12/1/98	15:40		7.7		190					
5.3	0.50	Skidmore Slough at 101 bridge	RAYSW-7	4/22/98	16:15		14.8		730					
5.3	0.50	Skidmore Slough at 101 bridge	RAYSW-7	5/5/98	15:54	0.5	16.3		839	0.4	100	9.7		7.1
5.3	0.50	Skidmore Slough at 101 bridge	RAYSW-7	5/5/98	15:56	0.7	16.3		979	0.5	100	9.7		7.0
5.3	0.50	Skidmore Slough at 101 bridge	RAYSW-7	5/5/98	15:57	0.0	16.3		788	0.4	99	9.7		7.1
5.3	0.50	Skidmore Slough at 101 bridge	RAYSW-7	5/5/98	15:57	0.0	16.2		756	0.4	99	9.7		7.1
5.0		Willapa R at the Narrows	WRNA-M	4/22/98	11:43		14.2	13.9	21100					
5.0		Willapa R at the Narrows	WRNA-M	4/22/98	11:50		14.0	13.9	21600					
5.0		Willapa R at the Narrows	WRNA-M	4/22/98	15:59		13.7	13.7	18820					
5.0		Willapa R at the Narrows	WRNA-M	4/22/98	16:05		13.7	13.7	19390					
5.0		Willapa R at the Narrows	WRNA-M	4/22/98	16:08		13.7	13.7	19660					
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:20	0.1	16.1		19726	11.7	89	8.1		7.6
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:22	1.1	15.9		20776	12.4	86	7.9		7.6
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:24	2.0	15.9		21046	12.6	86	7.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:25	3.0	15.7		22101	13.3	85	7.7		7.6
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:26	4.0	15.5		24471	14.8	84	7.6		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:26	4.9	15.4		24919	15.1	84	7.6		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:31	6.1	15.3		26412	16.1	84	7.6		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:32	7.0	15.2		27187	16.6	83	7.5		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:32	7.9	15.2		27519	16.9	83	7.5		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	14:33	9.7	15.1		29234	18.0	83	7.4		7.8
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	17:51	0.0							8.2	
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:18	0.0	16.6		19326	11.5	91	8.2		7.6
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:18	2.1	16.1		21373	12.8	90	8.1		7.6
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:20	4.0	15.8		23748	14.3	88	8.0		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:21	5.7	15.3		26905	16.5	86	7.7		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:26	8.4	15.2		27792	17.1	85	7.6		7.7
5.0		Willapa R at the Narrows	WRNA-M	5/5/98	18:27	9.5	15.2		28014	17.2	84	7.5		7.8
5.0		Willapa R at the Narrows	WRNA-L	5/27/98	8:58		13.9		15200					
5.0		Willapa R at the Narrows	WRNA-R	5/27/98	9:00		13.9		14630					
5.0		Willapa R at the Narrows	WRNA-L	5/27/98	10:41		14.0		13670					
5.0		Willapa R at the Narrows	WRNA-R	5/27/98	10:42		14.0		13590					
5.0		Willapa R at the Narrows	WRNA-R	6/17/98	10:41		17.4		21850					
5.0		Willapa R at the Narrows	WRNA-L	6/17/98	10:43		17.4		21233					
5.0		Willapa R at the Narrows	WRNA-R	6/17/98	13:45		17.8		16150					
5.0		Willapa R at the Narrows	WRNA-L	6/17/98	13:50		17.8		16388					
5.0		Willapa R at the Narrows	WRNA-R	7/15/98	10:27		19.1	19.0	25555					
5.0		Willapa R at the Narrows	WRNA-L	7/15/98	10:32		19.0	19.0	25840					
5.0		Willapa R at the Narrows	WRNA-R	7/15/98	12:40		19.4	19.3	21660					
5.0		Willapa R at the Narrows	WRNA-L	7/15/98	12:43		19.3	19.3	22610					
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:36	0.0	21.3		32679	17.3	84	6.8		7.7
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:36	1.0	21.3		32717	17.3	84	6.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:36	3.0	21.3		32954	17.5	85	6.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:36	5.0	21.3		33027	17.5	85	6.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:40	7.0	21.3		33227	17.6	84	6.7		7.6
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:40	9.0	21.3		33364	17.7	84	6.7		7.6
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:45	9.8	21.3		33416	17.8	83	6.7		7.6

C.6.16

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	8:45	9.9B								
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:00	0.1	21.3		34871	18.6	90	7.2		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:00	1.0	21.2		35561	19.0	89	7.1		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:00	3.0	21.2		35634	19.1	87	6.9		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:00	5.0	21.2		35647	19.1	87	6.9		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:03	7.0	21.2		35785	19.2	87	6.9		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:03	9.0	21.2		36081	19.3	87	6.9		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:03	11.0	21.2		36094	19.3	86	6.9		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:08	12.1	21.2		36106	19.3	87	6.9		7.8
5.0		Willapa R at the Narrows	WRNA-M	8/5/98	13:08	12.8B								
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:46	0.0	20.3		31484	23.1	86	6.4		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:47	1.0	20.4		31539	23.1	82	6.1		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:48	3.0	20.3		31859	23.4	84	6.2		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:51	4.9	20.4		32128	23.6	85	6.3		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:53	7.2	20.4		32717	24.1	85	6.2		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:55	9.2	20.4		32792	24.2	80	5.9		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:55	10.6	20.4		32803	24.2	81	5.9		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	8:56	10.6	20.4		32771	24.2	81	6.0		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:01	0.0	20.9		31403	23.0	98	7.3		7.8
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:05	1.1	20.6		32095	23.6	89	6.6		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:06	3.0	20.4		32568	24.0	83	6.2		7.7
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:07	5.0	20.3		33281	24.6	82	6.0		7.8
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:08	7.0	20.2		33581	24.8	79	5.8		7.8
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:09	9.1	20.2		33355	24.6	84	6.2		7.8
5.0		Willapa R at the Narrows	WRNA-M	9/2/98	13:11	10.3	20.2		33569	24.8	77	5.6		7.8
5.0		Willapa R at the Narrows	WRNA-R	9/23/98	8:58		18.3		32200					
5.0		Willapa R at the Narrows	WRNA-L	9/23/98	9:01		18.3		32400					
5.0		Willapa R at the Narrows	WRNA-R	9/23/98	11:49		18.2		33900					
5.0		Willapa R at the Narrows	WRNA-L	9/23/98	11:51		18.3		33900					
5.0		Willapa R at the Narrows	WRNA-R	10/7/98	9:25		16.1		28500					
5.0		Willapa R at the Narrows	WRNA-L	10/7/98	9:26		16.1		28700					
5.0		Willapa R at the Narrows	WRNA-R	10/7/98	11:58		16.1		32400					
5.0		Willapa R at the Narrows	WRNA-L	10/7/98	11:59		16.3		32000					
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	9:01	0.1	11.3		33131	20.7	83	7.9		7.6
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	9:02	1.0	11.3		32301	20.1	82	7.9		7.6
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	9:03	3.0	11.3		33766	21.2	82	7.9		7.6
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	9:04	5.1	11.3		32426	20.2	81	7.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	9:05	7.1	11.3		34022	21.3	81	7.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	9:06	8.9	11.3		32681	20.4	81	7.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	9:07	10.8	11.3		33447	20.9	82	7.8		7.6
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:20	0.0	11.5		38261	24.3	87	8.2		7.9
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:21	1.0	11.5		38455	24.5	84	7.8		7.9
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:22	3.0	11.5		38586	24.6	84	7.9		7.9
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:23	4.9	11.5		38714	24.6	86	8.1		7.9
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:24	7.1	11.5		38969	24.8	86	8.0		7.9
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:25	9.0	11.5		39096	24.9	85	7.9		7.9
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:25	10.0							8.1	

C.6.17

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:26	11.1	11.5		39029	24.9	87	8.1		7.9
5.0		Willapa R at the Narrows	WRNA-M	11/4/98	13:27	13.0	11.5		39348	25.1	86	8.0		7.9
5.0		Willapa R at the Narrows	WRNA-R	11/16/98	12:00		10.8		8400					
5.0		Willapa R at the Narrows	WRNA-L	11/16/98	12:03		10.8		8710					
5.0		Willapa R at the Narrows	WRNA-R	11/16/98	15:20		10.7		9880					
5.0		Willapa R at the Narrows	WRNA-L	11/16/98	15:25		10.7		9770					
5.0		Willapa R at the Narrows	WRNA-R	12/1/98	12:07		8.2		13520					
5.0		Willapa R at the Narrows	WRNA-L	12/1/98	12:09		8.3		15520					
5.0		Willapa R at the Narrows	WRNA-R	12/1/98	16:06		7.7		4280					
5.0		Willapa R at the Narrows	WRNA-L	12/1/98	16:10		7.8		4870					
4.3	0.10	S Bend SW Ditch near PHW	SBSW-6	11/4/98	10:36	0.0	11.7		375	0.2	67	7.3		7.0
4.3	0.10	S Bend SW Ditch near PHW	SBSW-6	11/16/98	15:09		12.4							
4.1	0.00	East Point Seafood	EPTSF	4/22/98	10:20		12.0		410					
4.1	0.00	East Point Seafood	EPTSF	4/22/98	15:00		12.0		225					
4.1	0.00	East Point Seafood	EPTSF	5/5/98	9:35		11.5		440	0.0				
4.1	0.00	East Point Seafood	EPTSF	5/5/98	9:35		11.7					10.3		
4.1	0.00	East Point Seafood	EPTSF	5/5/98	9:35		11.6							8.4
4.1	0.00	East Point Seafood	EPTSF	5/6/98	13:55		12.5		397	0.0				
4.1	0.00	East Point Seafood	EPTSF	5/6/98	13:55		12.8					10.3		
4.1	0.00	East Point Seafood	EPTSF	5/6/98	13:55		12.8							8.4
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	4/22/98	16:30		12.3		152					
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	5/5/98	14:54	0.1	12.7		160	0.1	87	9.2		6.7
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	5/27/98	9:50		10.7		600					
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	6/17/98	13:05			11.8	148					
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	7/15/98	13:50		14.5		233					
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	8/5/98	8:42	0.1	14.6		256	0.1	84	8.6		7.2
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	9/2/98	7:13	0.1	14.9		169	0.1	87	8.8		7.1
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	9/23/98	9:05		12.7		390					
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	10/7/98	9:00		12.3	12.4	1780					
3.8	0.00	S Bend SW Pipe at SB Packers	SBSW-3	12/1/98	15:27		8.5		151					
3.7	0.00	South Bend Packing	SBPAK	4/22/98	14:30		15.0		75					
3.7	0.00	South Bend Packing	SBPAK	5/5/98	6:15		10.4		110	0.0				7.7
3.7	0.00	South Bend Packing	SBPAK	8/5/98	8:30		11.0		108	0.0				
3.7	0.00	South Bend Packing	SBPAK	8/5/98	8:30		16.2							7.6
3.5	0.00	South Bend WWTP	SBTP	4/22/98	8:40		15.0		410					
3.5	0.00	South Bend WWTP	SBTP	4/22/98	13:55		17.5		430					
3.5	0.00	South Bend WWTP	SBTP	5/5/98	10:55		15.2		420	0.2				
3.5	0.00	South Bend WWTP	SBTP	5/5/98	10:55		15.4					2.9		
3.5	0.00	South Bend WWTP	SBTP	5/5/98	10:55		15.3							7.5
3.5	0.00	South Bend WWTP	SBTP	5/6/98	10:55		16.0		440	0.2				
3.5	0.00	South Bend WWTP	SBTP	5/6/98	10:55		16.4					2.4		
3.5	0.00	South Bend WWTP	SBTP	5/6/98	10:55		16.2							7.3
3.5	0.00	South Bend WWTP	SBTP	5/27/98	10:00		13.5		450					
3.5	0.00	South Bend WWTP	SBTP	5/27/98	15:30		16.0		460					
3.5	0.00	South Bend WWTP	SBTP	6/17/98	10:40		17.0		700					
3.5	0.00	South Bend WWTP	SBTP	6/17/98	15:05		17.5		750					

C.6.18

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
3.5	0.00	South Bend WWTP	SBTP	7/15/98	11:05		19.0		700					
3.5	0.00	South Bend WWTP	SBTP	7/15/98	14:30		19.0		650					
3.5	0.00	South Bend WWTP	SBTP	8/5/98	10:40		20.5					3.8		
3.5	0.00	South Bend WWTP	SBTP	8/5/98	10:40		20.0		1006	0.5				
3.5	0.00	South Bend WWTP	SBTP	8/5/98	10:40		21.1							6.4
3.5	0.00	South Bend WWTP	SBTP	8/5/98	24-hr				774	0.4				9.4
3.5	0.00	South Bend WWTP	SBTP	8/5/98	13:30		20.0		1053	0.6				
3.5	0.00	South Bend WWTP	SBTP	8/5/98	13:30		20.3							9.3
3.5	0.00	South Bend WWTP	SBTP	8/5/98	13:30		20.4					3.6		
3.5	0.00	South Bend WWTP	SBTP	9/1/98	14:20		19.0		620	0.3		2.4		
3.5	0.00	South Bend WWTP	SBTP	9/1/98	14:20		19.3							7.6
3.5	0.00	South Bend WWTP	SBTP	9/2/98	11:25		20.0		640	0.3				
3.5	0.00	South Bend WWTP	SBTP	9/2/98	11:25		19.9							7.6
3.5	0.00	South Bend WWTP	SBTP	9/2/98	24-hr				475	0.2				7.8
3.5	0.00	South Bend WWTP	SBTP	9/23/98	11:00		18.0		500					
3.5	0.00	South Bend WWTP	SBTP	9/23/98	14:35		17.5		500					
3.5	0.00	South Bend WWTP	SBTP	10/7/98	10:30		16.0		500					
3.5	0.00	South Bend WWTP	SBTP	11/3/98	15:00		10.4					14.0		
3.5	0.00	South Bend WWTP	SBTP	11/3/98	15:00		10.2							9.0
3.5	0.00	South Bend WWTP	SBTP	11/3/98	15:00		10.2		520	0.3				
3.5	0.00	South Bend WWTP	SBTP	11/4/98	9:30		10.1		550	0.3				
3.5	0.00	South Bend WWTP	SBTP	11/4/98	9:30		10.6					10.4		
3.5	0.00	South Bend WWTP	SBTP	11/4/98	9:30		11.4							9.2
3.5	0.00	South Bend WWTP	SBTP	11/4/98	24-hr				500	0.3				8.7
3.5	0.00	South Bend WWTP	SBTP	11/16/98	10:15		11.0		700					
3.5	0.00	South Bend WWTP	SBTP	11/16/98	14:30		12.0		700					
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	5/5/98	15:38	0.2	14.3		56	0.0	96	9.8		7.2
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	5/27/98	9:35			10.9	60					
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	6/17/98	12:45			14.3	64					
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	7/15/98	13:36			15.6	69					
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	8/5/98	8:26	0.2	18.2		64	0.0	96	9.1		7.2
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	9/2/98	6:56	0.1	17.9		61	0.0	95	9.0		7.4
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	9/23/98	8:55			15.3	77					
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	10/7/98	8:50		13.8	13.8	75					
3.4	0.00	S Bend SW Pipe near Gardner's	SBSW-1	12/1/98	13:57		8.9		31					
3.15	0.00	Creek at Coast Seafoods	SBSW-2	4/22/98	16:45			11.6	82					
3.15	0.00	Creek at Coast Seafoods	SBSW-2	5/5/98	15:15	0.0	12.8		161	0.1	95	10.0		7.0
3.15	0.00	Creek at Coast Seafoods	SBSW-2	5/27/98	9:30			10.2	133					
3.15	0.00	Creek at Coast Seafoods	SBSW-2	6/17/98	12:30			12.8	210					
3.15	0.00	Creek at Coast Seafoods	SBSW-2	7/15/98	13:22			14.5	101					
3.15	0.00	Creek at Coast Seafoods	SBSW-2	8/5/98	8:11	0.1	15.5		1685	0.9	86	8.5		7.1
3.15	0.00	Creek at Coast Seafoods	SBSW-2	9/2/98	6:40	0.2	15.8		2030	1.2	78	7.7		7.1
3.15	0.00	Creek at Coast Seafoods	SBSW-2	9/23/98	8:40			13.0	>1000					
3.15	0.00	Creek at Coast Seafoods	SBSW-2	10/7/98	8:35		12.6		6030					
3.15	0.00	Creek at Coast Seafoods	SBSW-2	12/1/98	14:05		8.3		OFL					
3.10	0.00	Coast Seafoods	COASF	4/22/98	14:45		12.0		700					
3.10	0.00	Coast Seafoods	COASF	5/5/98	8:15		14.1							7.7

C.6.19

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		pH units	
							liquid	metal			%Sat	meter		Wink
3.10	0.00	Coast Seafoods	COASF	5/5/98	8:15	14.2					6.4			
3.10	0.00	Coast Seafoods	COASF	5/5/98	8:15	14.0				13.0				
3.10	0.00	Coast Seafoods	COASF	5/5/98	13:50	15.0					8.6			
3.10	0.00	Coast Seafoods	COASF	5/5/98	13:50	15.0				13.0				
3.10	0.00	Coast Seafoods	COASF	5/6/98	9:15	13.6					9.1			
3.10	0.00	Coast Seafoods	COASF	5/6/98	9:15	13.1				13.1				
3.10	0.00	Coast Seafoods	COASF	5/27/98	8:05	12.5			13000	10.0				
3.10	0.00	Coast Seafoods	COASF	5/27/98	13:30	14.0			17000	14.0				
3.10	0.00	Coast Seafoods	COASF	6/17/98	11:45	15.5			14000	11.0				
3.10	0.00	Coast Seafoods	COASF	6/17/98	15:45	18.5			17200	13.0				
3.10	0.00	Coast Seafoods	COASF	7/15/98	11:55	17.5				12.5				
3.10	0.00	Coast Seafoods	COASF	7/15/98	15:25	19.0			12000	9.0				
3.10	0.00	Coast Seafoods	COASF	8/5/98	11:40	16.1					8.9			
3.10	0.00	Coast Seafoods	COASF	8/5/98	11:40	16.2							7.4	
3.10	0.00	Coast Seafoods	COASF	8/5/98	11:40	16.0			929	0.5				
3.10	0.00	Coast Seafoods	COASF	8/5/98	24-hr				1347	0.7			7.8	
3.10	0.00	Coast Seafoods	COASF	8/5/98	15:20	18.0			1084	0.6				
3.10	0.00	Coast Seafoods	COASF	8/5/98	15:20	18.1					7.9			
3.10	0.00	Coast Seafoods	COASF	8/5/98	15:20	18.1							8.1	
3.10	0.00	Coast Seafoods	COASF	9/1/98	13:30	19.0				15.0	8.6			
3.10	0.00	Coast Seafoods	COASF	9/1/98	13:30	19.1							7.8	
3.10	0.00	Coast Seafoods	COASF	9/2/98	8:00	18.5				17.5	7.2			
3.10	0.00	Coast Seafoods	COASF	9/2/98	8:00	18.4							7.8	
3.10	0.00	Coast Seafoods	COASF	9/2/98	24-hr					15.0			7.1	
3.10	0.00	Coast Seafoods	COASF	9/23/98	9:40		16.0			18.0				
3.10	0.00	Coast Seafoods	COASF	9/23/98	13:45	16.5				20.0				
3.10	0.00	Coast Seafoods	COASF	10/7/98	9:30	14.5				18.0				
3.10	0.00	Coast Seafoods	COASF	10/7/98	13:30	16.5				20.0				
3.10	0.00	Coast Seafoods	COASF	11/3/98	15:45	12.0				16.0				
3.10	0.00	Coast Seafoods	COASF	11/3/98	15:45	12.2					8.5			
3.10	0.00	Coast Seafoods	COASF	11/4/98	11:45	12.0				16.0				
3.10	0.00	Coast Seafoods	COASF	11/4/98	11:45	12.4					8.1			
3.10	0.00	Coast Seafoods	COASF	11/4/98	24-hr					8.3			7.8	
3.10	0.00	Coast Seafoods	COASF	11/16/98	9:30	12.0				7.0				
3.10	0.00	Coast Seafoods	COASF	11/16/98	13:45	12.0								
3.10	0.00	Coast Seafoods	COASF	12/1/98	9:50	9.0				16.5				
3.10	0.00	Coast Seafoods	COASF	12/1/98	14:00	9.0				11.0				
3.05		Willapa R below S Bend	WRSB-M	5/5/98	18:52	-0.1	16.4			23394	14.1	96	8.5	7.8
3.05		Willapa R below S Bend	WRSB-M	5/5/98	18:54	2.1	15.3			27291	16.7	88	7.9	7.8
3.05		Willapa R below S Bend	WRSB-M	5/5/98	18:54	4.1	15.1			29067	17.9	86	7.7	7.8
3.05		Willapa R below S Bend	WRSB-M	5/5/98	18:56	4.8	15.1			29511	18.2	86	7.7	7.8
3.05		Willapa R below S Bend	WRSB-DS	6/17/98	10:52	0.5							8.4	
3.05		Willapa R below S Bend	WRSB-DS	6/17/98	13:56	0.5							8.2	
3.05		Willapa R below S Bend	WRSB-DS	7/31/98	12:48	0.1							7.6	
3.05		Willapa R below S Bend	WRSB-M	8/5/98	8:56	0.1							7.0	
3.05		Willapa R below S Bend	WRSB-M	8/5/98	8:57	0.0	21.2			35160	18.8	88	7.0	7.7
3.05		Willapa R below S Bend	WRSB-M	8/5/98	9:00	1.0	21.2			35251	18.8	87	6.9	7.7

C.6.0

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		pH units
							liquid	metal			%Sat	meter	
3.05		Willapa R below S Bend	WRSB-M	8/5/98	9:00	2.0	21.1		35331	18.9	88	7.0	7.8
3.05		Willapa R below S Bend	WRSB-M	8/5/98	9:01	3.0	21.1		35281	18.9	87	7.0	7.8
3.05		Willapa R below S Bend	WRSB-M	8/5/98	9:02	4.0	21.1		35330	18.9	87	7.0	7.7
3.05		Willapa R below S Bend	WRSB-M	8/5/98	9:03	5.0	21.1		35432	18.9	87	6.9	7.7
3.05		Willapa R below S Bend	WRSB-M	8/5/98	9:04	6.0	21.2		35483	19.0	87	6.9	7.7
3.05		Willapa R below S Bend	WRSB-M	8/5/98	9:04	6.1B							
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:30	0.2	21.4		37501	20.2	93	7.4	7.3
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:30	1.0	21.3		37689	20.3	92	7.2	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:30	2.0	21.1		37866	20.4	92	7.2	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:34	3.0	21.0		38196	20.6	57	7.1	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:34	4.0	21.0		38390	20.7	89	7.0	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:34	5.0	21.0		38403	20.7	89	7.0	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:36	6.0	21.0		38477	20.8	88	7.0	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:36	7.0	21.0		38540	20.8	88	7.0	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:37	7.9	21.0		38527	20.8	87	6.9	7.9
3.05		Willapa R below S Bend	WRSB-M	8/5/98	13:37	8.0B							
3.05		Willapa R below S Bend	WRSB-DS	8/28/98	16:55	0.1							7.1
3.05		Willapa R below S Bend	WRSB-DS	9/2/98	9:02	0.1							6.3
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:07	0.1							6.9
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:11	0.0	20.1		33405	24.7	93	6.9	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:12	1.0	20.1		33534	24.8	91	6.8	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:13	2.0	20.1		33651	24.9	88	6.5	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:13	3.0	20.1		34037	25.2	87	6.4	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:14	3.9	20.1		34272	25.4	85	6.2	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:15	5.1	20.1		34538	25.6	86	6.3	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:19	6.0	20.1		33489	24.7	81	6.0	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	9:18	6.6	20.1		33339	24.6			7.8
3.05		Willapa R below S Bend	WRSB-DS	9/2/98	13:24	0.1							6.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:36	0.0	20.8		33048	24.4	94	6.9	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:37	0.9	20.3		33830	25.0	88	6.5	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:38	2.0	20.3		34031	25.2	89	6.5	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:39	3.0	20.2		34274	25.4	84	6.2	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:40	3.9	20.0		35007	26.0	85	6.3	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:41	4.9	20.0		35060	26.0	85	6.3	7.8
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:42	6.0	19.9		35358	26.3	86	6.3	7.9
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:43	7.0	19.9		35379	26.3	87	6.4	7.9
3.05		Willapa R below S Bend	WRSB-M	9/2/98	13:44	7.3	19.9		35199	26.2			7.8
3.05		Willapa R below S Bend	WRSB-DS	11/2/98	14:10	0.5							8.3
3.05		Willapa R below S Bend	WRSB-DS	11/4/98	9:15	0.5							8.1
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:28	0.0	11.4		36379	23.0	87	8.2	7.7
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:29	0.9	11.4		36562	23.1	87	8.2	7.8
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:29	2.0	11.4		35984	22.7	86	8.1	7.8
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:30	3.0	11.4		35863	22.6	85	8.1	7.8
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:31	3.9	11.4		35927	22.7	85	8.1	7.8
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:32	4.7	11.4		36444	23.0	85	8.0	7.8
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:32	6.0	11.3		35809	22.6	85	8.0	7.8
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:33	7.0	11.4		37082	23.5	85	8.0	7.8

C.6.2

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	DO (mg/L)		pH units
							meter	liquid			metal	%Sat	
3.05		Willapa R below S Bend	WRSB-M	11/4/98	9:34	7.5	11.3		36511	23.1	85	8.0	7.8
3.05		Willapa R below S Bend	WRSB-DS	11/4/98	13:50	0.5							
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:54	0.0	11.9		38629	24.6	91	8.4	7.9
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:55	1.0	11.7		39938	25.5	91	8.4	7.9
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:56	2.0	11.7		39961	25.5	90	8.3	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:56	3.0	11.7		39948	25.5	90	8.3	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:57	4.0	11.7		40075	25.6	90	8.3	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:58	5.0	11.7		40143	25.7	90	8.3	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:58	6.0	11.7		40132	25.7	90	8.3	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:59	7.0	11.7		40266	25.8	89	8.2	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	13:59	7.9	11.7		40139	25.7	87	8.0	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	14:00	9.1	11.7		40394	25.8	87	8.0	8.0
3.05		Willapa R below S Bend	WRSB-M	11/4/98	14:00	9.3	11.7		40266	25.8	88	8.1	8.0
1.8	0.50	Potter Slough at Hwy 101	SBSW-4	4/22/98	17:10			16.8	>1000				
1.8	0.50	Potter Slough at Hwy 101	SBSW-4	11/16/98	15:41			9.5					
0.4		Willapa R at Johnson Sl	WRJS-M	4/22/98	12:10		15.1	15.1	27100				
0.4		Willapa R at Johnson Sl	WRJS-M	4/22/98	12:15		15.5	15.0	26600				
0.4		Willapa R at Johnson Sl	WRJS-M	4/22/98	16:20		14.3	13.3	23800				
0.4		Willapa R at Johnson Sl	WRJS-M	4/22/98	16:22		14.3	13.2	23800				
0.4		Willapa R at Johnson Sl	WRJS-M	4/22/98	16:30		14.1	14.0	24100				
0.4		Willapa R at Johnson Sl	WRJS-DS	5/5/98	12:20	2.0						8.3	
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	12:54	0.0	15.7		24082	14.6	90	8.1	7.7
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	12:56	1.0	15.6		24526	14.9	88	8.0	7.8
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	12:58	2.0	15.4		25414	15.5	88	7.9	7.8
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	12:59	2.9	15.2		27576	16.9	88	7.9	7.8
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	13:01	4.0	14.9		29684			7.8	7.9
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	13:04	5.0	14.8		31070	19.3	86	7.7	7.9
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:10	0.1						8.7	
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:26	0.1	16.2		26534	16.2	99	8.8	7.9
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:31	0.0	16.3		26420	16.1	98	8.7	7.9
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:32	0.9	16.1		26865	16.4	98	8.7	7.9
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:34	1.8	15.7		27928	17.1	93	8.3	7.9
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:35	2.9	15.0		30453	18.9	90	8.1	7.9
0.4		Willapa R at Johnson Sl	WRJS-M	5/5/98	19:36	3.8	14.9		30677	19.0	88	7.9	7.9
0.4		Willapa R at Johnson Sl	WRJS-R	5/27/98	8:22		14.4		28100				7.4
0.4		Willapa R at Johnson Sl	WRJS-L	5/27/98	8:30		14.5		28200				
0.4		Willapa R at Johnson Sl	WRJS-R	5/27/98	10:10		14.2		21800				7.6
0.4		Willapa R at Johnson Sl	WRJS-R	5/27/98	10:13		14.2		21300				
0.4		Willapa R at Johnson Sl	WRJS-L	5/27/98	10:19		14.4		26100				
0.4		Willapa R at Johnson Sl	WRJS-R	6/17/98	11:04		17.0		27455				8.3
0.4		Willapa R at Johnson Sl	WRJS-L	6/17/98	11:10		17.1		27170				
0.4		Willapa R at Johnson Sl	WRJS-R	6/17/98	14:06		17.5		22895				
0.4		Willapa R at Johnson Sl	WRJS-L	6/17/98	14:08		17.6		22753				
0.4		Willapa R at Johnson Sl	WRJS-R	7/15/98	10:47		18.6	18.5	29830				
0.4		Willapa R at Johnson Sl	WRJS-L	7/15/98	10:50		18.6	18.5	29925				
0.4		Willapa R at Johnson Sl	WRJS-R	7/15/98	13:01		18.7	18.6	28880				
0.4		Willapa R at Johnson Sl	WRJS-L	7/15/98	13:03		18.9	18.8	29213				

C.6.2

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC)		SpCond uS/cm	Salin ppt	%Sat	DO (mg/L)		pH units
							liquid	metal				meter	Wink	
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:16	0.0							7.1	
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:19	0.0	21.0		37225	20.0	89	7.0		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:19	1.0	21.1		37428	20.1	87	6.9		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:19	2.0	21.0		37651	20.3	87	6.9		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:22	3.0	21.0		37762	20.3	87	6.9		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:22	4.0	21.0		37774	20.3	88	6.9		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:23	5.0	21.0		37774	20.3	87	6.9		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:25	6.0	21.0		37774	20.3	88	7.0		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	9:25	6.2B								
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:49	0.1	20.9		39719	21.5	93	7.4		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:50	1.0	20.9		40090	21.7	93	7.3	7.3	8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:51	2.0	20.9		40186	21.8	92	7.3		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:52	3.0	20.8		40326	21.9	91	7.2		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:53	4.0	20.5		40614	22.1	85	6.7		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:54	5.0	20.5		40662	22.1	88	7.0		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:55	6.0	20.5		40662	22.1	88	6.9		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:56	7.0	20.5		40687	22.1	87	6.9		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:57	8.0	20.4		40723	22.1	88	7.0		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:58	8.4	20.4		40723	22.1	87	6.9		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	8/5/98	13:58	8.7B								
0.4		Willapa R at Johnson Sl	WRJS-DS	8/5/98	14:45	0.1							8.4	
0.4		Willapa R at Johnson Sl	WRJS-DS	8/28/98	15:00	0.1							7.4	
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:30	0.1							7.0	
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:32	0.0	19.8		35493	26.4	94	7.0		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:33	0.9	19.8		35781	26.6	90	6.7		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:34	2.0	19.8		35920	26.8	88	6.5		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:35	3.1	19.7		36314	27.1	88	6.5		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:36	4.0	19.7		36346	27.1	87	6.4		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:37	4.9	19.7		36399	27.2	87	6.4		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:38	6.0	19.7		36580	27.3	87	6.4		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:39	7.0	19.7		36506	27.2	79	5.8		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:40	7.1	19.7		36538	27.3	90	6.6		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	9:42	2.0								7.5
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	13:53	0.1							7.2	
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	13:56	0.0	20.8		25313	18.1	97	7.5		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	13:57	1.0	20.6		35017	26.0	98	7.2		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	13:58	1.9	20.2		35345	26.3	98	7.2		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	13:59	3.0	20.1		35578	26.5	95	7.0		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	14:02	4.2	19.7		36357	27.1	91	6.7		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	14:02	5.0	19.6		36526	27.3	91	6.7		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	14:03	6.0	19.4		36928	27.6	90	6.7		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	14:04	7.1	19.3		37065	27.7	92	6.8		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	9/2/98	14:05	7.6	19.3		37097	27.7	91	6.7		8.0
0.4		Willapa R at Johnson Sl	WRJS-DS	9/2/98	14:10	3.0							7.5	
0.4		Willapa R at Johnson Sl	WRJS-R	9/23/98	10:15		17.9		35800					
0.4		Willapa R at Johnson Sl	WRJS-L	9/23/98	10:18		18.0		35900					
0.4		Willapa R at Johnson Sl	WRJS-R	9/23/98	12:12		17.7		37100					

C.6.3

Table C.6. Field Measurements.

MS RM	Trib RM	Station Name	Site Code	Date	Time	Depth meters	Temp (degC) liquid	metal	SpCond uS/cm	Salin ppt	%Sat	DO (mg/L) meter	Wink	pH units
0.4		Willapa R at Johnson Sl	WRJS-L	9/23/98	12:16		17.6		37000					
0.4		Willapa R at Johnson Sl	WRJS-R	10/6/98	9:52		15.7		33800				6.7	
0.4		Willapa R at Johnson Sl	WRJS-L	10/6/98	9:55		15.9		33900					
0.4		Willapa R at Johnson Sl	WRJS-L	10/6/98	12:00								7.3	
0.4		Willapa R at Johnson Sl	WRJS-R	10/6/98	12:49		15.1		35900					
0.4		Willapa R at Johnson Sl	WRJS-L	10/6/98	12:51		15.1		35900					
0.4		Willapa R at Johnson Sl	WRJS-DS	11/2/98	13:45	0.5							8.5	
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:48	0.0	11.4		38603	24.6	88	8.2		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:48	1.0	11.4		38859	24.8	87	8.1		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:49	2.0	11.4		39046	24.9	87	8.1		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:50	3.0	11.4		39174	25.0	87	8.1		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:51	3.9	11.4		39171	25.0	87	8.1		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:51	4.9	11.4		39120	24.9	88	8.2		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:52	5.9	11.4		38788	24.7	88	8.2		7.9
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	9:53	6.5	11.4		39298	25.1	88	8.2		7.9
0.4		Willapa R at Johnson Sl	WRJS-DS	11/4/98	9:58	0.5							8.2	
0.4		Willapa R at Johnson Sl	WRJS-DS	11/4/98	14:26	0.5							8.6	
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:21	0.0	12.0		39192	25.0	92	8.5		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:22	1.0	11.9		39911	25.5	91	8.4		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:23	2.0	11.9		40042	25.6	91	8.4		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:23	3.0	11.8		40303	25.8	91	8.4		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:24	4.1	11.8		40316	25.8	92	8.4		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:25	5.1	11.8		40498	25.9	91	8.4		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:25	6.0	11.8		40370	25.8	91	8.3		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:26	7.1	11.8		40370	25.8	91	8.3		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:27	8.0	11.8		40625	26.0	91	8.4		8.0
0.4		Willapa R at Johnson Sl	WRJS-M	11/4/98	14:31	9.1	11.8		40243	25.7	91	8.3		8.0
0.4		Willapa R at Johnson Sl	WRJS-R	11/16/98	12:20		10.8		17250					
0.4		Willapa R at Johnson Sl	WRJS-L	11/16/98	12:22		10.8		19800					
0.4		Willapa R at Johnson Sl	WRJS-R	11/16/98	15:40		10.8		13620					
0.4		Willapa R at Johnson Sl	WRJS-L	11/16/98	15:42		10.8		13890					
0.4		Willapa R at Johnson Sl	WRJS-R	12/1/98	12:27		8.5		27300					
0.4		Willapa R at Johnson Sl	WRJS-L	12/1/98	12:32		8.6		27600					
0.4		Willapa R at Johnson Sl	WRJS-R	12/1/98	16:27		8.4		17050					
0.4		Willapa R at Johnson Sl	WRJS-L	12/1/98	16:29		8.4		17220					

C.6.2

Appendix D

Datalogger Results

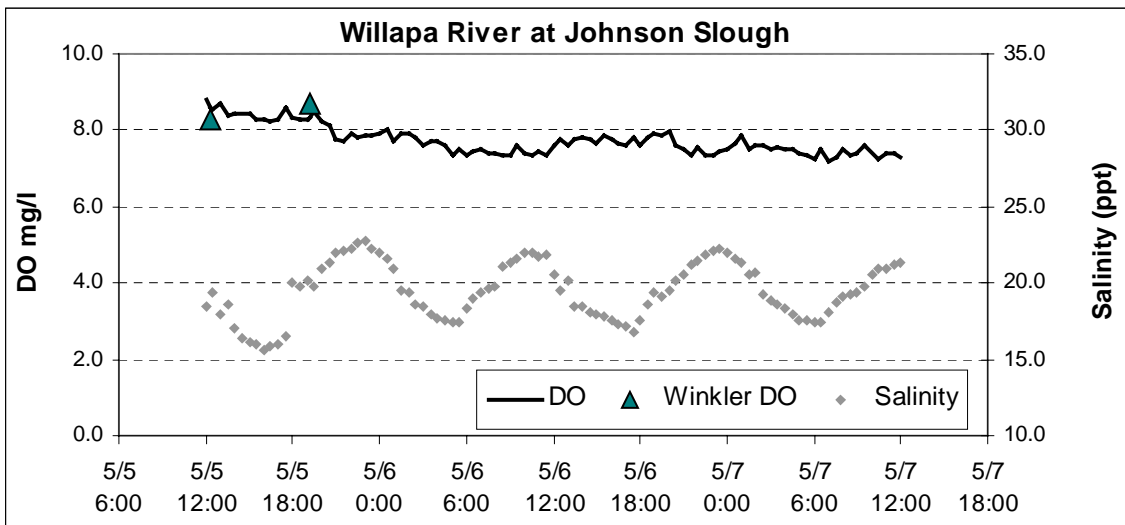
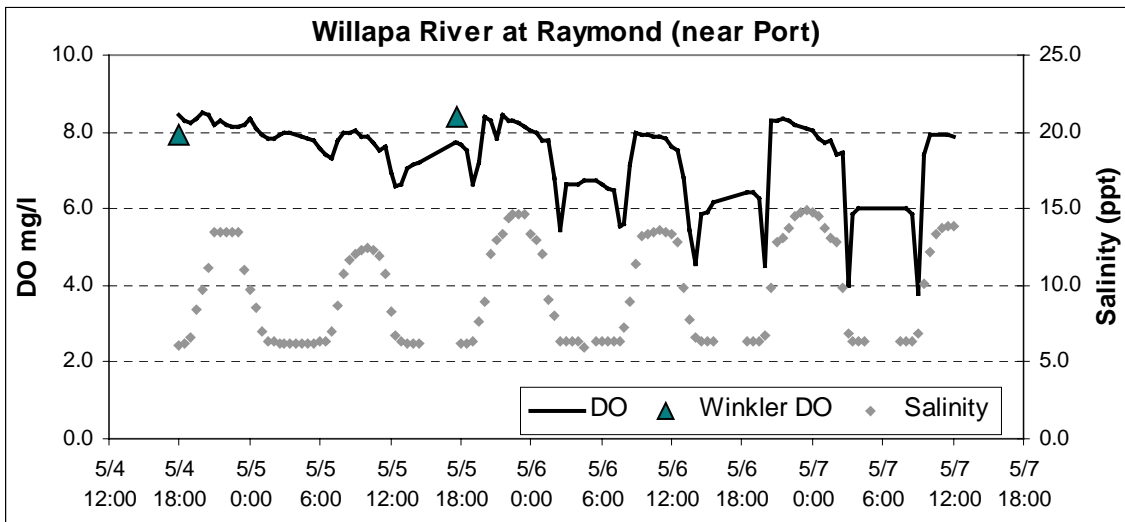
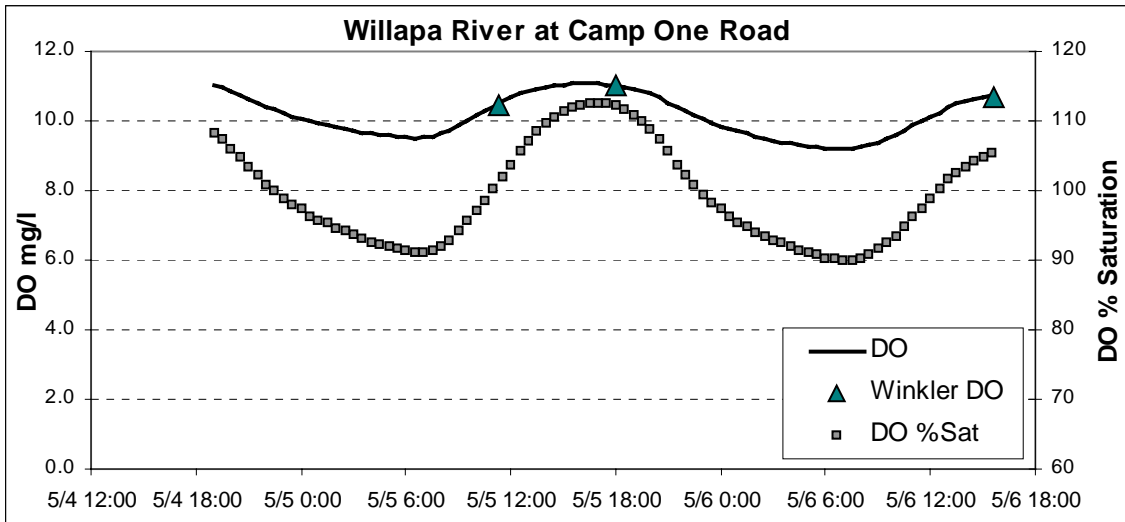


Figure D.1. Datasonde Dissolved Oxygen Measurements – May 4-6, 1998.

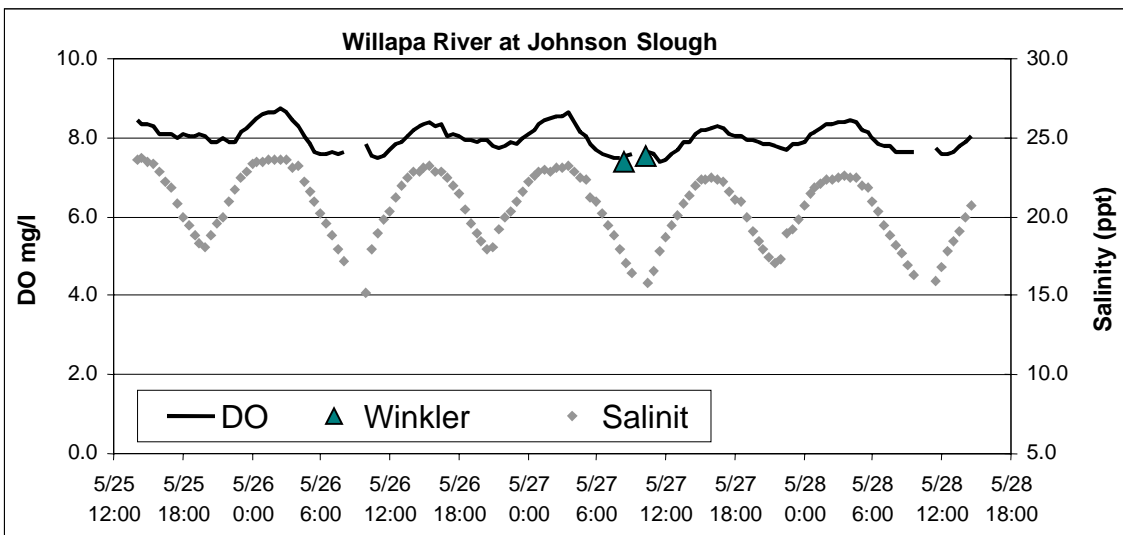
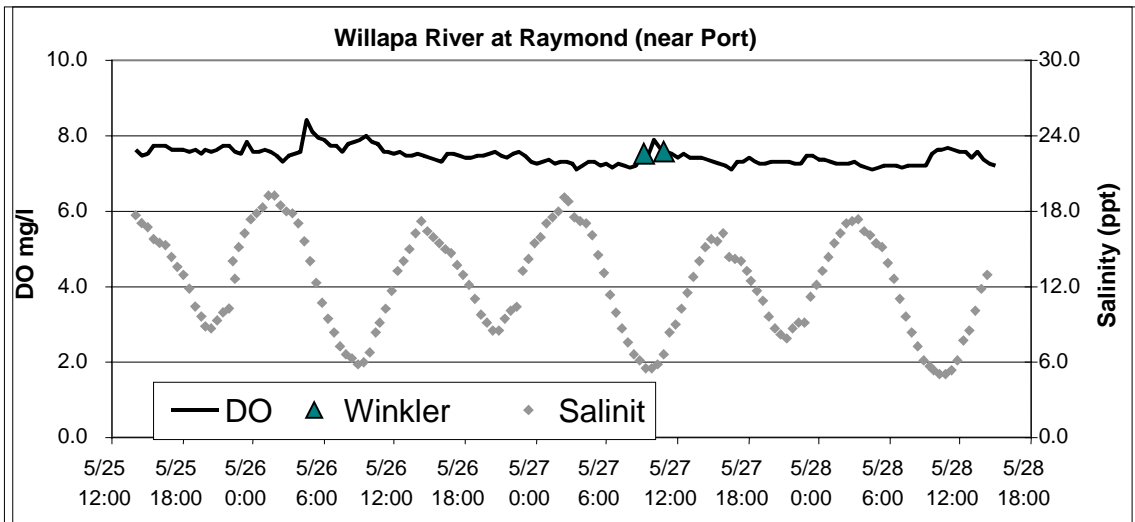
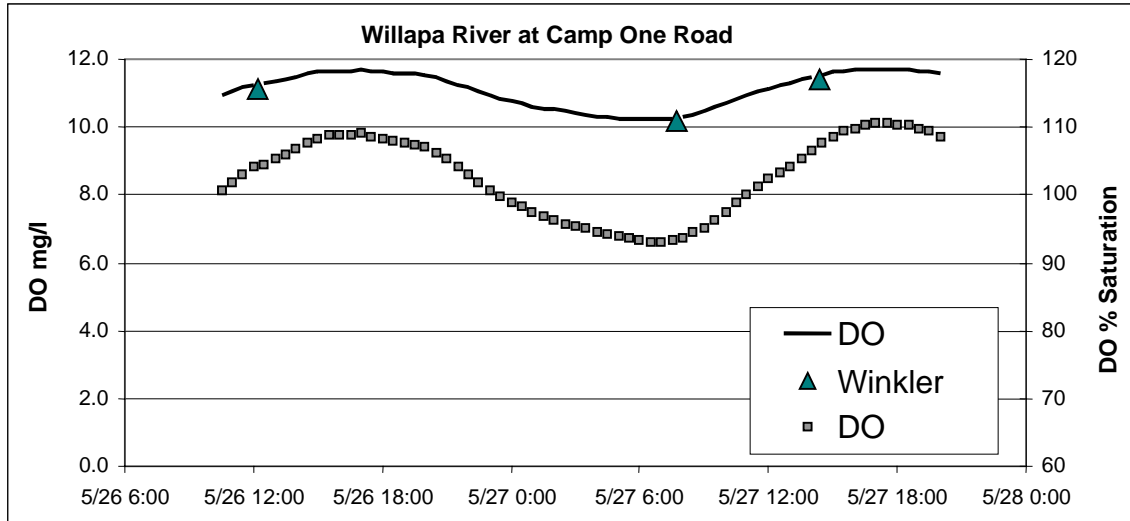


Figure D.2. .Datasonde Dissolved Oxygen Measurements – May 25-28, 1998.

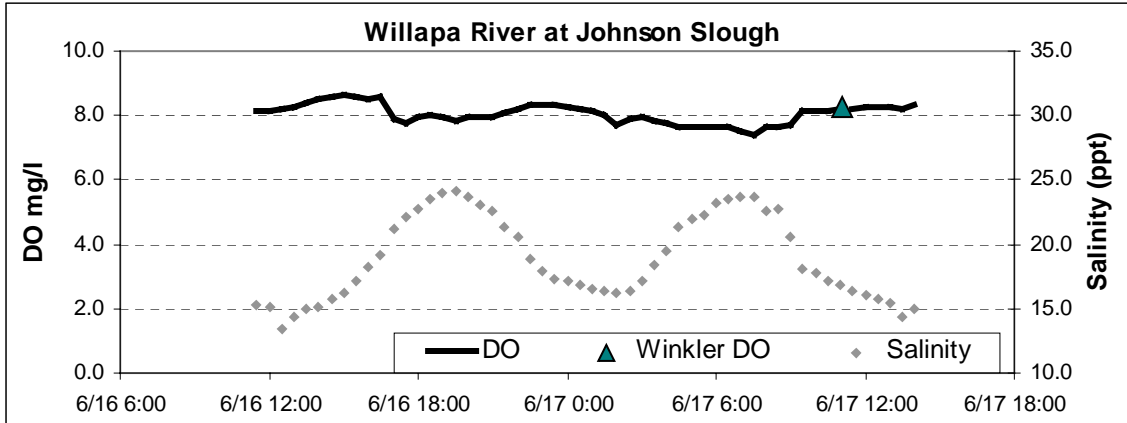
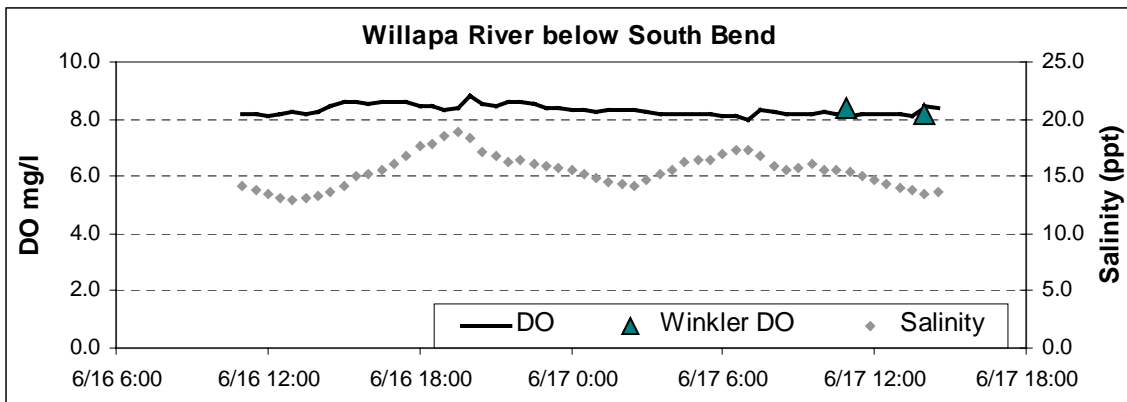
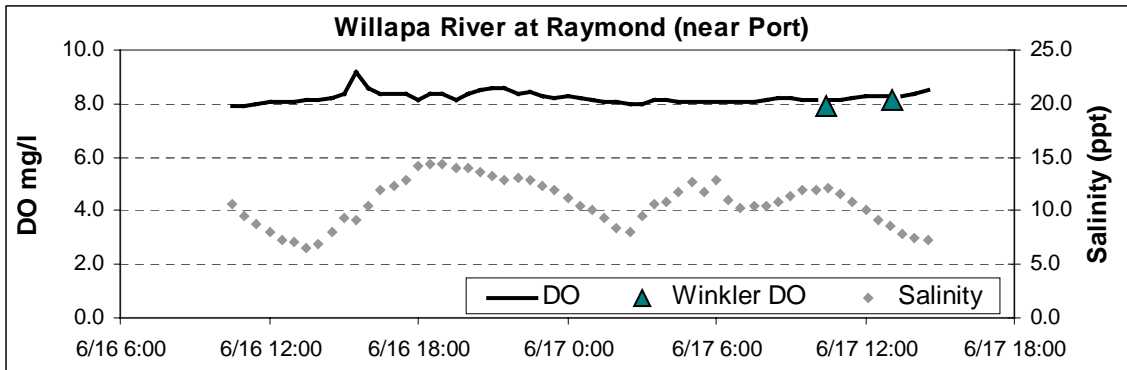
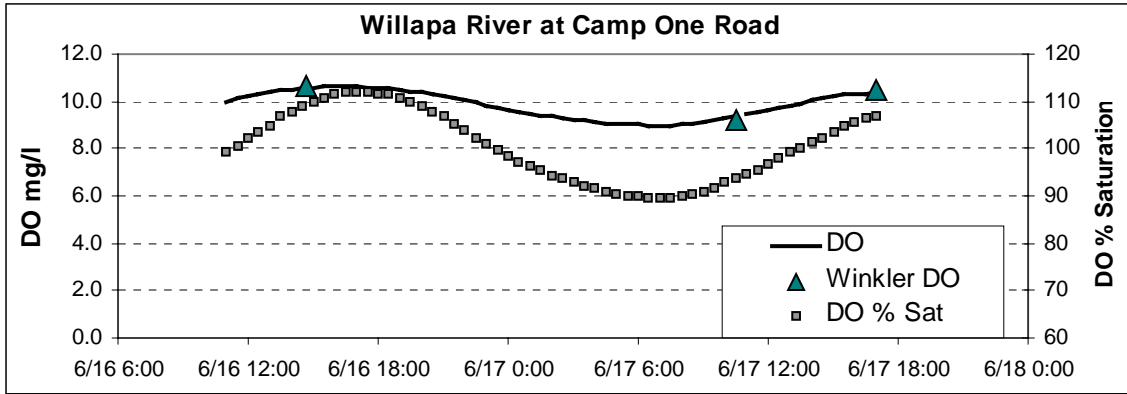


Figure D.3. Datasonde Dissolved Oxygen Measurements – June 16-17, 1998.

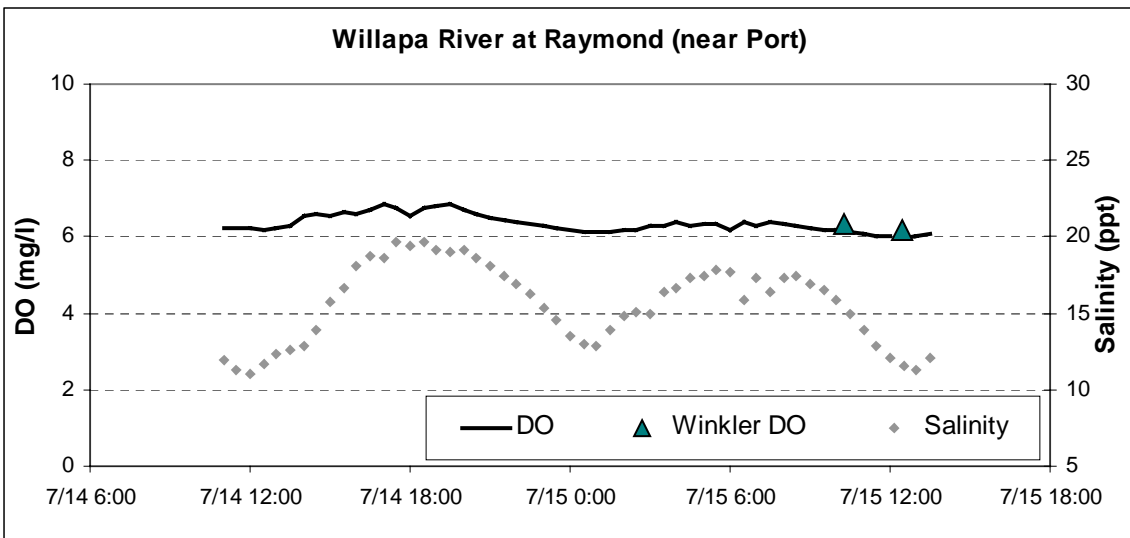
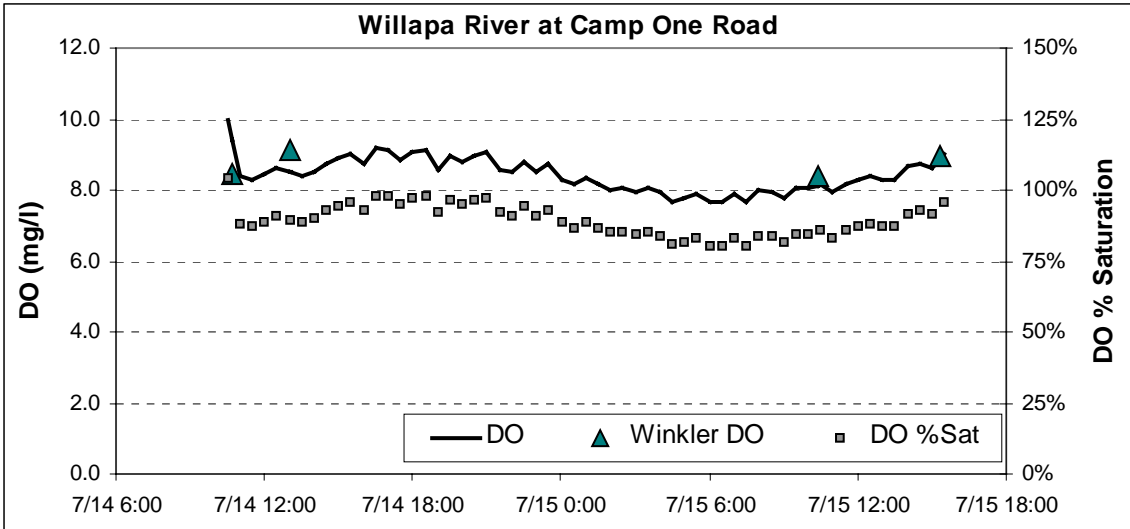


Figure D.4. Datasonde Dissolved Oxygen Measurements – July 14-15, 1998.

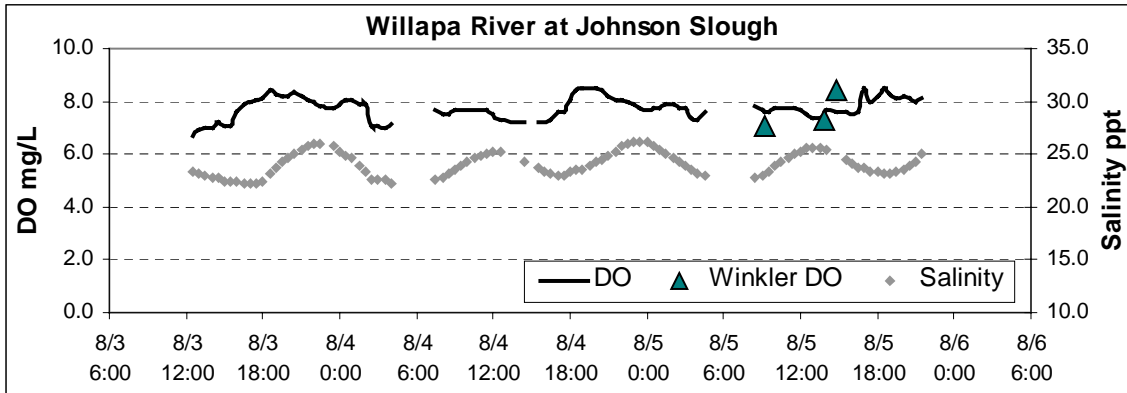
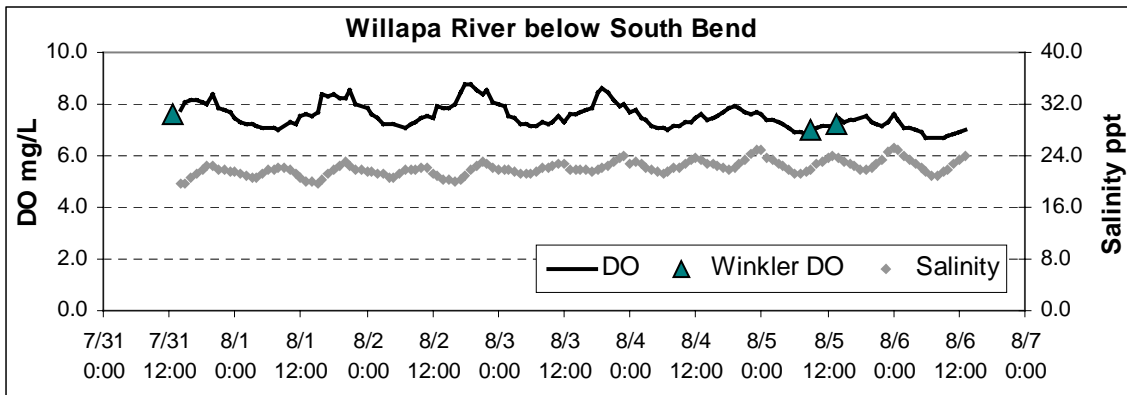
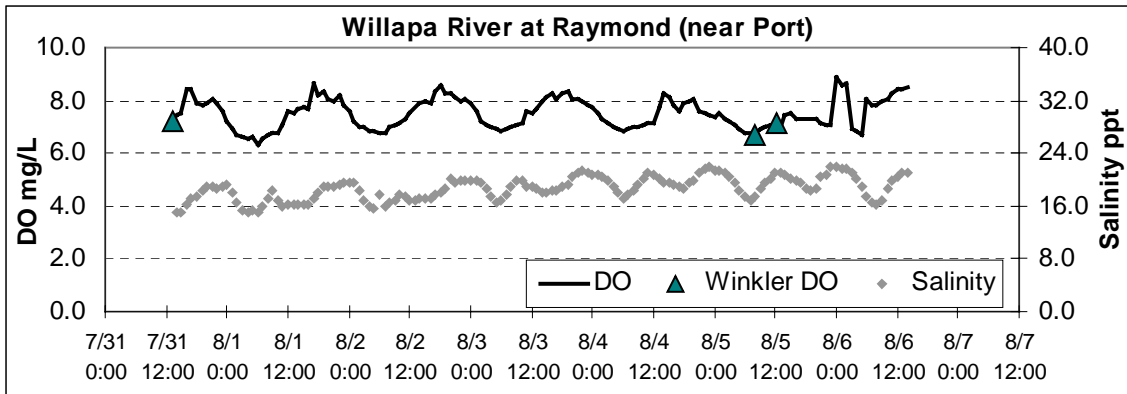
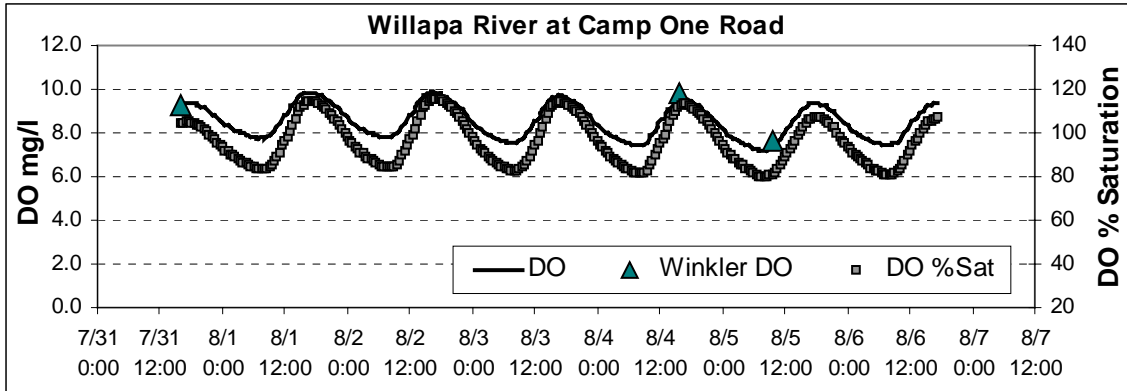


Figure D.5. Datasonde Dissolved Oxygen Measurements – July 31-August 7, 1998.

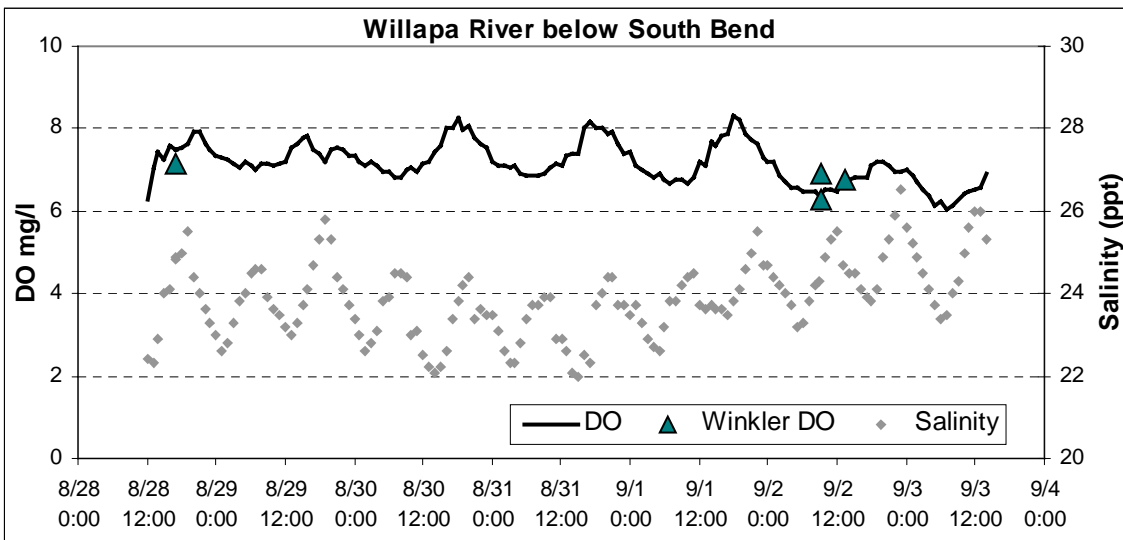
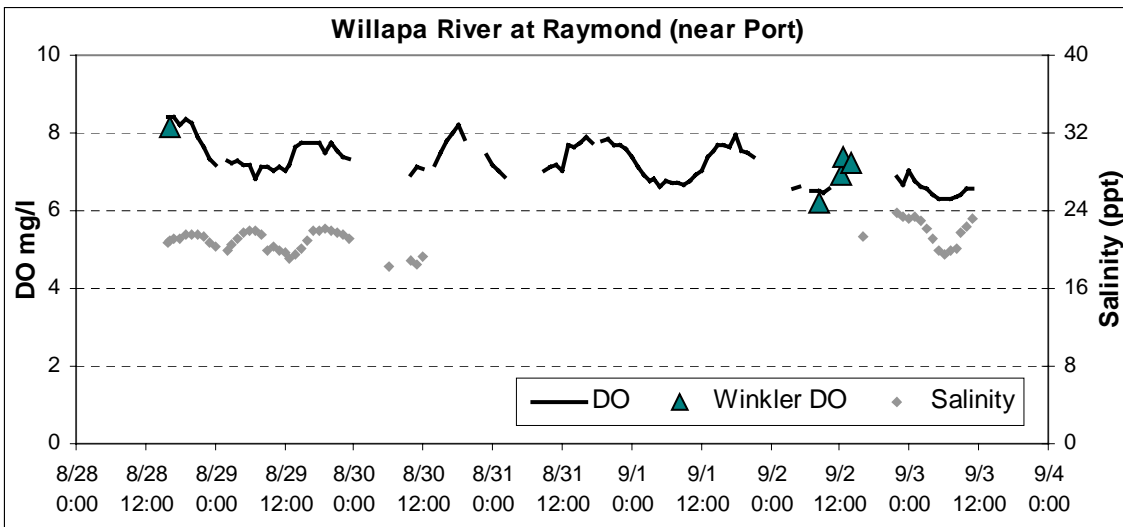
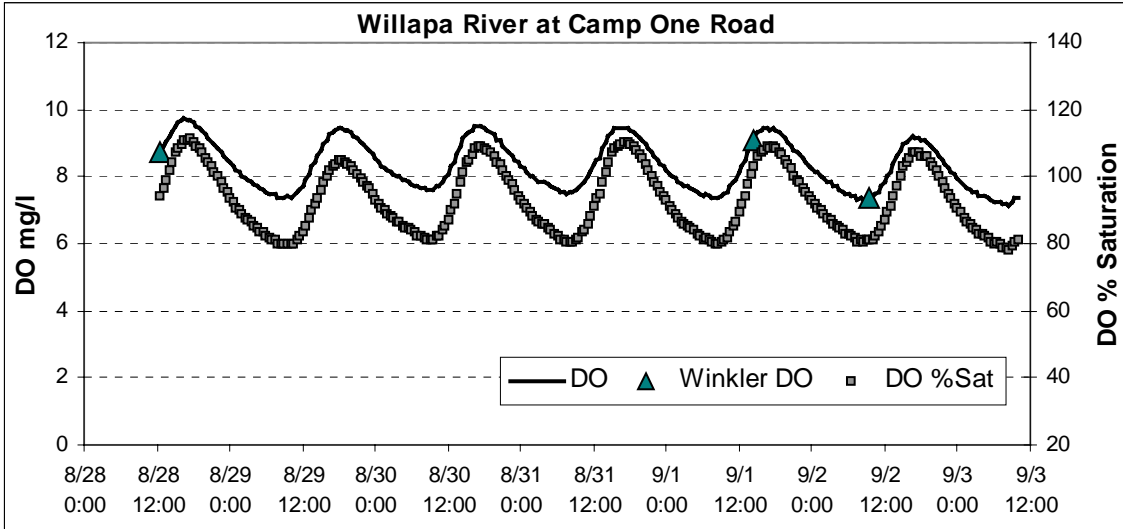


Figure D.6. Datasonde Dissolved Oxygen Measurements – Aug 28-Sept 4, 1998.

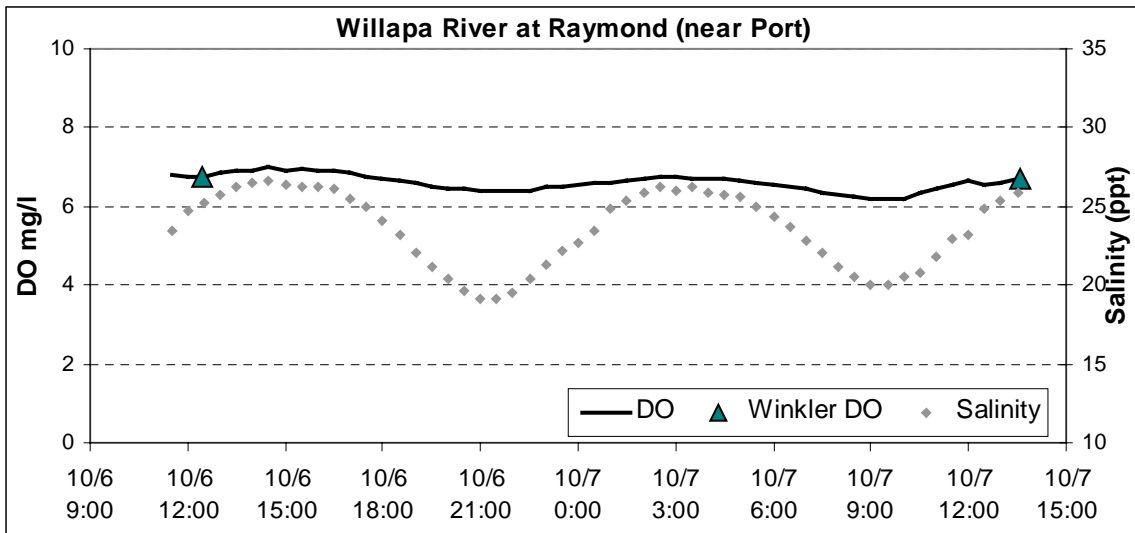
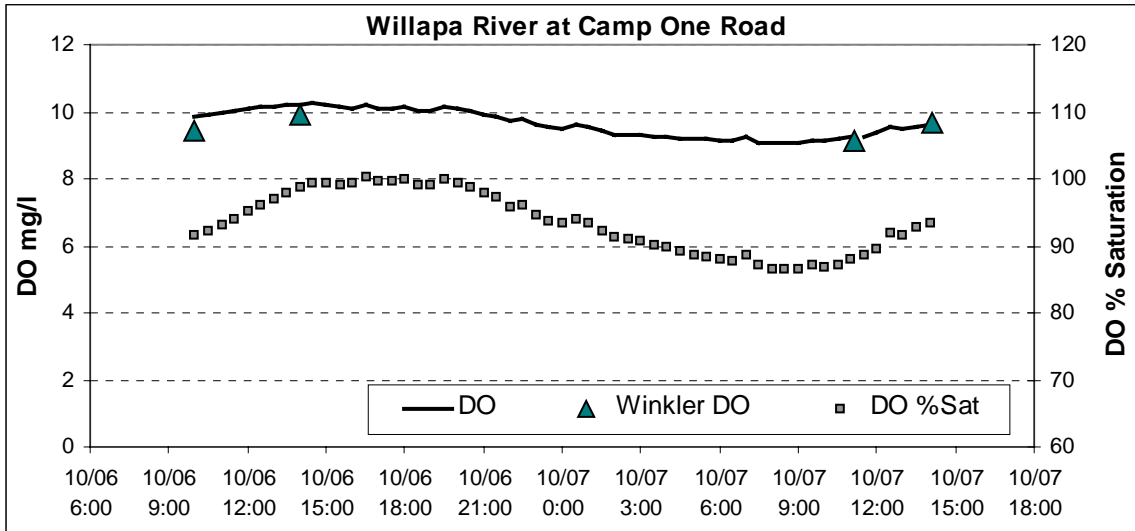


Figure D.7. Datasonde Dissolved Oxygen Measurements – October 6-7, 1998

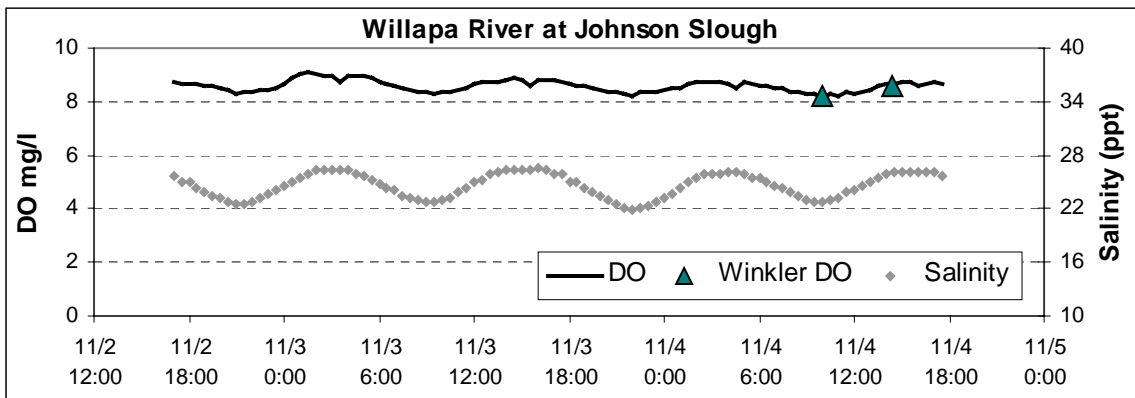
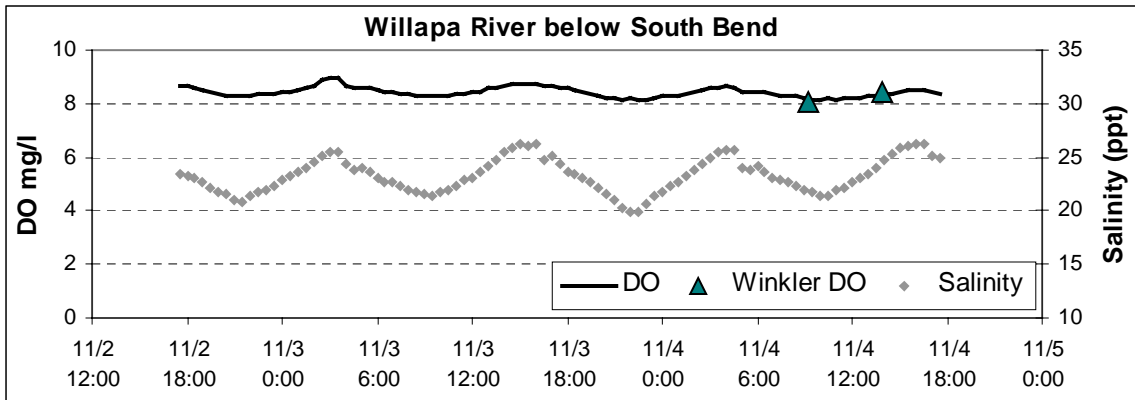
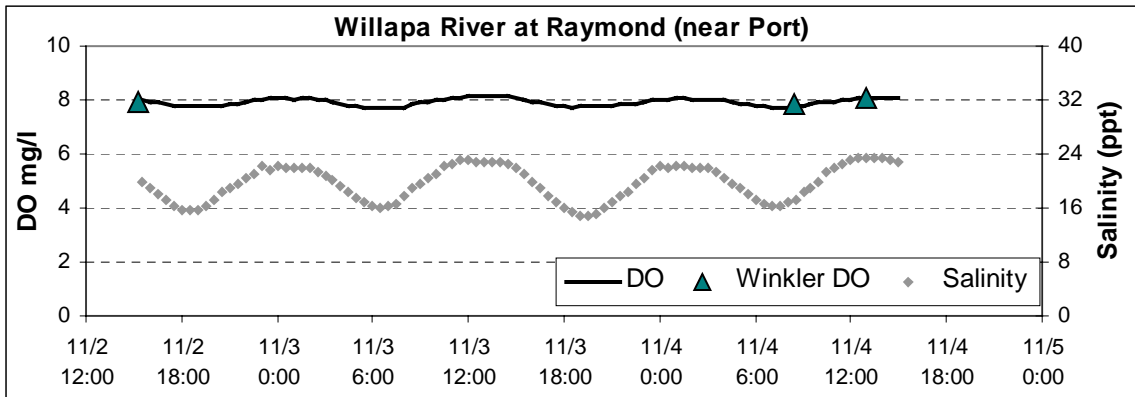
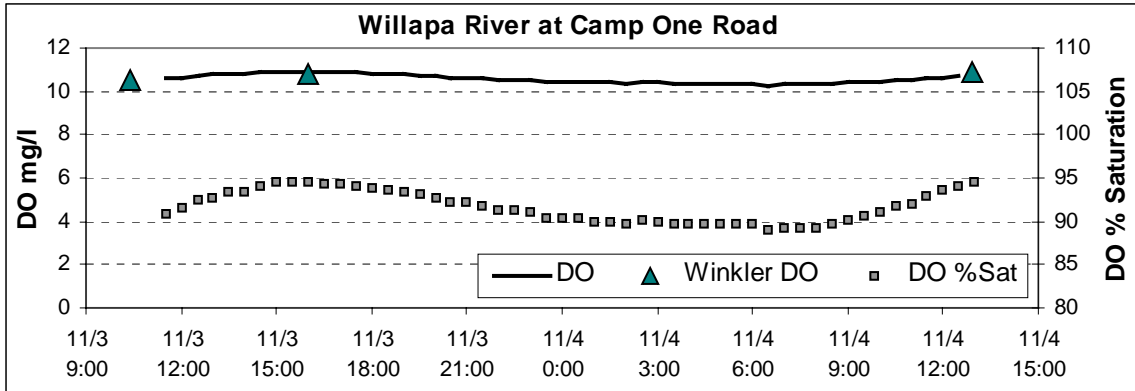


Figure D.8. Datasonde Dissolved Oxygen Measurements – November 2-4, 1998.