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PORT OF WILLAPA PRETREATMENT FACILITY
CITY OF RAYMOND WASTEWATER TREATMENT PLANT
SEPTEMBER AND DECEMBER 1992 CLASS II INSPECTION

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ABSTRACT

Class II Inspections were conducted at the City of Raymond (Raymond) wastewater treatment plant (WTP) in September (dry weather) and December 1992 (wet weather). Each inspection included the Port of Willapa Harbor (Port) pretreatment facility (PTF) which is a significant contributor to the WTP. For the PTF, effluent BOD_5 was 360 mg/L during the dry weather inspection, higher than the permitted daily average of 300 mg/L. TSS was 1640 mg/L, over five times the permitted daily average. Nitrification was not taking place and effluent ammonia concentrations were high. During the wet weather inspection, PTF discharge flow was 66,290 gpd, 23% above the 54,000 gpd permitted daily average. The 24-hour composite BOD_5 was 900 mg/L, three times the permitted daily average of 300 mg/L. Oil and grease concentrations were more than ten times the design limits but within permit limits. Chromium was found in the PTF sludge at a high concentration (4480 mg/Kg-dw). Chloroform and 1,1,1-trichloroethane were volatile organic compounds found in the PTF effluent.

The Raymond WTP performed well during the dry weather inspection. The effluent was well within NPDES permit limits for BOD_5, TSS, and pH. BOD_5 removal was 94%. Substantial nitrification was occurring. The WTP removed over 95% TSS during both dry weather and wet weather. During dry weather conditions, the Port PTF contributes up to one fifth of the flow of the Raymond WTP. During wet weather, the PTF was contributing only 5% of the Raymond WTP flow. The PTF effluent BOD_5 concentration was 900 mg/L, three times the permit limit. The PTF effluent was responsible for 41 mg/L BOD_5 of the Raymond influent BOD_5. The WTP did not provide effective removal of organics during the wet weather inspection. Only 30% of BOD_5 was removed; 85% removal is required by permit. The wet weather effluent BOD_5 concentration of 50 mg/L exceeded the permitted weekly average of 45 mg/L. The effluent BOD_5 load of 530 lb/day was approximately double the 270 lbs/day permitted weekly average. Nitrification did not take place during the wet weather inspection. Chromium was found in high concentrations in the WTP influent, but was undetected in the effluent. Due to discrepancies in laboratory results, acceleration of Raymond's lab accreditation process is recommended.

INTRODUCTION

Class II Inspections were conducted at the City of Raymond (Raymond) wastewater treatment plant (WTP) in September (dry weather) and December 1992 (wet weather). Each inspection included the Port of Willapa Harbor (Port) pretreatment facility (PTF) which is a significant contributor to the WTP. Conducting the inspection were Rebecca Inman and Steven Golding of the Department of Ecology Environmental Investigations and Laboratory Services Program (EILS). Joe Crafton (PTF Supervisor) and Steve Porter (Plant Operator) represented the Port. Ron Hebish (Plant Operator) and Mike Freeman (Backup Operator) represented Raymond. Gordon Sargent (Plant Manager) represented Protan. All assisted during the inspection.

The inspection had the following objectives:

Port of Willapa Harbor

1. Measure flows and determine influent concentrations to the PTF.

2. Determine effluent concentrations and efficiency of the PTF.

3. Evaluate the effect of the PTF discharge on the efficiency of the Raymond WTP during dry weather and wet weather conditions.

City of Raymond

1. Verify NPDES permit self monitoring.

2. Assess wastewater treatment plant loading and capacity during dry weather and wet weather conditions.

3. Evaluate the effect of the PTF discharge on the efficiency of the Raymond WTP.

4. Assess wastewater toxicity with priority pollutant scans and effluent bioassays.

SETTING

Port of Willapa Harbor Pretreatment Facility

The Port operates an industrial pretreatment facility located south of the Willapa River along US Highway 101 near the City of Raymond (Figure 1). The facility was constructed in 1990-91 to reduce BOD and solids contributed to the Raymond sewer system from industries at the Port. The PTF consists of a dissolved air flotation unit (DAF) with polymer addition to remove solids, followed by an activated sludge sequencing batch reactor (SBR - Figure 2).

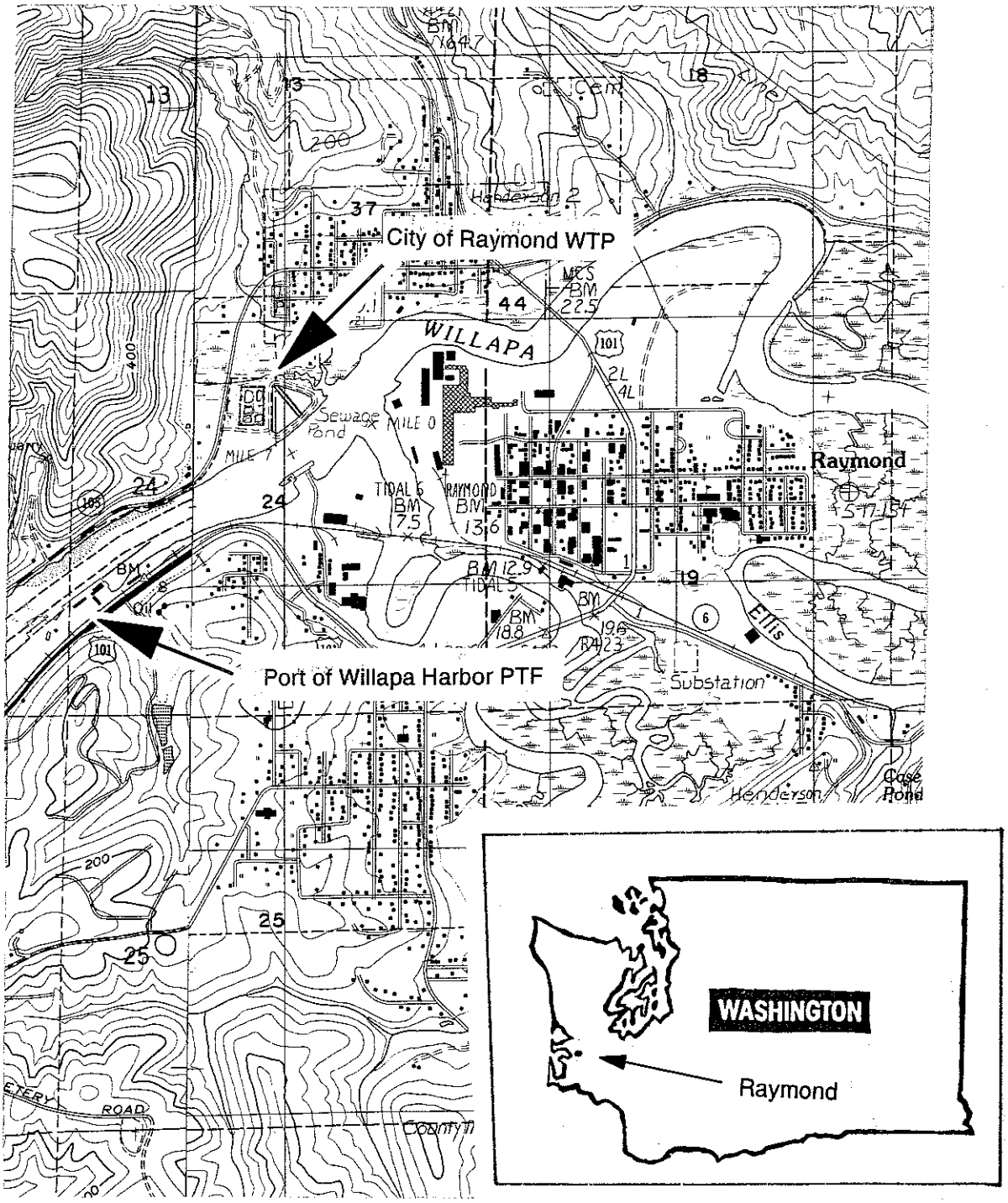

Figure 1 – Location Map – City of Raymond WTP, Port of Willapa Harbor PTF
September, December 1992.

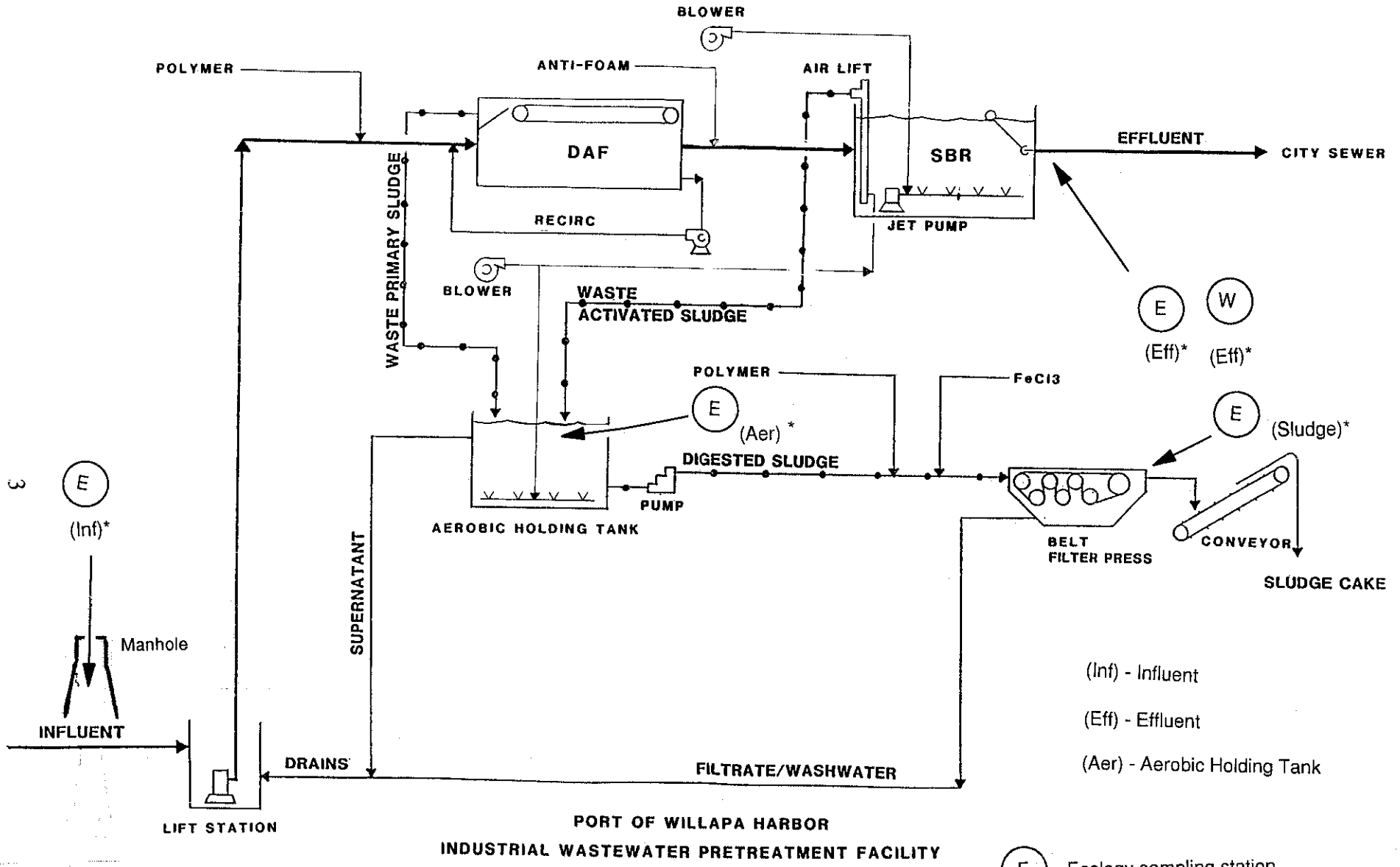

Figure 2 – Flow Scheme – Port of Willapa Harbor
(Diagram from Gray and Osborne Inc.)

Sludge is dried on a belt filter press and used by dairy farmers, mixing the sludge with manure and spreading it on pastures.

The Port applied for a state waste discharge permit December 3, 1990, for industrial discharges to a POTW. The Port's application was in effect during the inspections and until the June 14, 1993, effective date of the permit.

At the time of the September Ecology inspection, the PTF treated a high BOD, high TSS waste from a shellfish processing operation (Protan) and an eel-skinning operation (Oh Yang). Oh Yang, which was a relatively small contributor of BOD_5 and flow, has since shut down operations and vacated the site (Porter, 1993). As reflected in the permit application, a maximum of 54,000 gallons/day of wastewater can be treated and discharged to the City's wastewater treatment plant.

Prior to construction of the Port PTF, Protan's wastewater was discharged directly to Raymond. Raymond treatment plant operators had reported that at times slug loads from the Port had impacted dissolved oxygen levels at the WTP. Solids from the Port influent had also reportedly created problems by settling out in the City sewer system. The PTF was constructed to reduce the impacts of Port industrial loadings to the Raymond WTP.

City of Raymond WTP

The Raymond WTP, located on the North side of the Willapa River (Figure 1), serves the City and the Port PTF. The WTP also receives leachate from the Rainbow Valley landfill by tank truck. The WTP was constructed in 1983-84 to replace an existing stabilization pond. An upgrade of the WTP to increase organic capacity was completed in July, 1990. Surface aerators were replaced with fine-bubble diffusers suspended from floating air laterals in each of the aerated lagoons (Figure 3).

All influent to the WTP is pumped and discharged intermittently through two force mains. The remainder of the headworks consists of a bar screen, a Parshall flume, and an influent splitter box. Wastewater flows through two parallel trains of three aerated lagoons each, then through polishing ponds (west and east lagoons) and a dechlorination basin. Raymond plans to remove sludge from the polishing ponds on an intermittent basis. No sludge has been removed since the lagoons were constructed. To meet permit requirements for dechlorination, there are plans to add SO_2 injection equipment to provide for dechlorination.

After completion of the upgrade there remain concerns about actual hydraulic loading compared with the design capacity of the facility. Infiltration and inflow have been major problems for the operation of the WTP. The City has successfully eliminated a large portion of I & I into the collection system in accordance with a permit condition (Ragsdale and Bollinger, 1991). Ecology Order No. DE 93WQ-S328 issued February 4, 1993, includes an amended schedule for side sewer replacement.

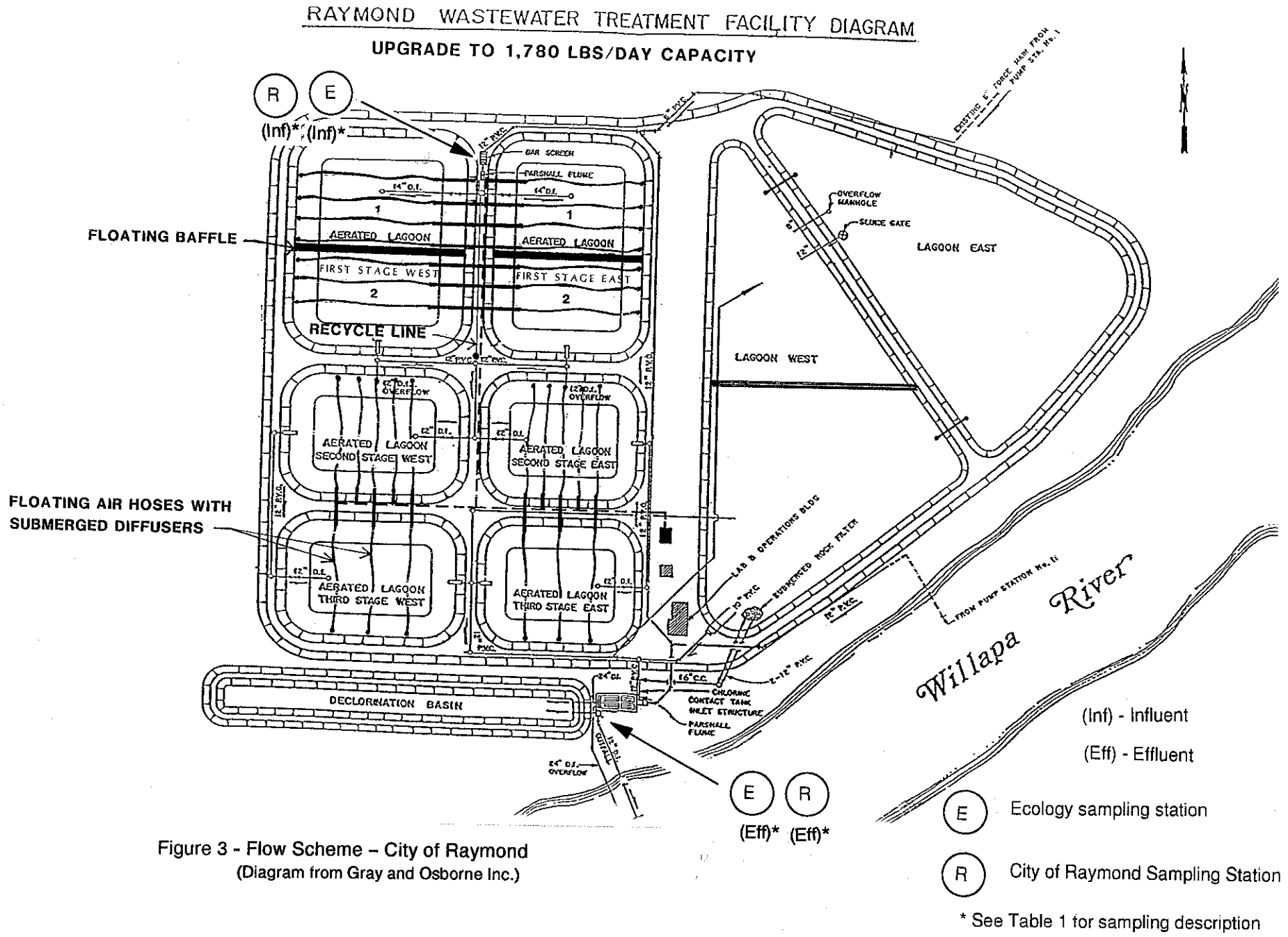

Figure 3 - Flow Scheme – City of Raymond
(Diagram from Gray and Osborne Inc.)

Because I & I have historically resulted in large flows to the WTP during the wet season, the inspections were conducted during periods of both dry weather and wet weather. The dry weather study was conducted September 28-30, 1992. The 7-day and 30-day rainfalls prior to September 28 were 2.00 inches and 2.98 inches. The wet weather study was conducted December 14-16. The 7-day and 30-day rainfalls prior to December 14 were 2.87 inches and 9.17 inches. This compares with a historical average November and December rainfall for the Raymond NOAA station of 12.1 inches (1980-91).

The City of Raymond's discharge is regulated under NPDES permit No. WA-002332-9, modified in February 1993. The permit expires in December 1993. The provisional permit, with a term of 18 months, was issued in accordance with the Washington State Criteria for Sewage Works Design. Provisional permits are issued for new technologies for a 12 to 18 month period, during which the actual capacity and performance are established. Full-term permit limits and conditions are then established accordingly.

PART I

CLASS II INSPECTION
PORT OF WILLAPA HARBOR PRETREATMENT FACILITY

PROCEDURES

Class II Inspection sampling included Ecology grab and composite samples. Ecology Isco compositors were set up to collect effluent samples during the dry weather inspection and influent and effluent samples during the wet weather inspection. Sampler configurations and locations are summarized in Figure 2 and Table 1. The influent sampler collected equal volumes of sample every 30 minutes for 24 hours. The effluent samplers collected a sample during each decant cycle of the PTF. The compositor bottles were iced to keep samples cooled.

Dry weather inspection

The Protan and Oh Yang effluents formed the PTF influent during the September dry weather inspection. Ecology collected two grab samples of Oh Yang effluent and one grab sample of Protan effluent. Effluent grabs from the SBR were collected from a tap in the discharge line. An Isco sampler was set up to be actuated by a float switch installed two feet from the bottom of the SBR surge tank. The sampler collected one gallon of sample for each decant cycle of the SBR for the 24 hour period from 1300, September 29 to 1300, September 30. During this time there were three decants cycles on September 29 at 1700, on the night of September 29, and on September 30 at 1200.

The PTF was not in operation from September 27, prior to the investigation, until 1300 September 29. A sludge pump belt had broken and the plant was unable to waste solids. A decant cycle was automatically actuated by a high float on September 29 at 0700 but an effluent sample was not collected because the sludge pump was out of operation and sludge had built up in the aerobic holding tank.

The Port collected a composite sample of SBR effluent, sampling continuously during the decant at 1200 on September 30. The sample was kept refrigerated. Protan collected a composite sample of equal volumes of sample every 30 minutes from 1530, September 29 to 0850, September 30. The compositor was iced during the inspection.

The Ecology composite effluent sample was split for analysis by the Ecology and PTF laboratories. Results from samples collected by Port personnel were compared with samples collected by Ecology. Samples collected, sampling times, and parameters analyzed are summarized in Appendix A. Ecology analytical methods and laboratories performing the analyses are summarized in Appendix B.

Table 1 - Sampling Station Descriptions - Port of Willapa Harbor PTF, September and December 1992.

Port of Willapa Harbor Pretreatment Facility

Ecology Influent Samples (InfW-1, InfW-2)

Grab samples of all influent to the pretreatment facility from manhole upstream of wetwell. Wastewater from the western-most Oh Yang facility bypasses the manhole, but the facility was not in operation. (September sampling only)

Ecology and Protan Samples (InfW-P1, InfW-P2, InfW-PE, InfW-PP)

Grab and composite samples of Protan wastewater from tap into outflow line outside of Protan building. (For December sampling when Protan was the only contributor, InfW-P represents all influent to the pretreatment facility.)

InfW-0

Grab samples of Oh Yang wastewater from mixing tank in front of Oh Yang building. (September sampling only. Oh Yang contributed no flow in December.)

Aeration (Aer)

Samples were collected from the SBR walkway with the sample container on a long pole to permit sampling in a well-mixed zone.

Ecology effluent composite samples (EffW-E)

Composite samples were collected from the decant tank. The intake was positioned two feet above the bottom. A float switch was positioned two feet above the decant tank bottom to trigger one sample with each decant.

Ecology effluent grab samples (EffW-G, EffW-1, EffW-2)

Grab samples were collected from a tap into the effluent line from the decant tank.

Port of Willapa Harbor effluent composite samples (EffW-W)

Continuous samples were collected from the effluent line. The sampler was operating throughout each decant cycle sampled.

Sludge

Sludge from the PTF belt filter press was collected as sludge was extruded from the press.

Wet weather inspection

The Protan effluent was the PTF influent during the December wet weather inspection. The Oh Yang plant was not operating. Effluent grabs from the Port SBR were collected from a tap in the discharge line. An Isco compositor was set up to be triggered by a float switch in the SBR effluent surge tank, as in the dry weather inspection. Three one gallon samples were composited from the float-switched Isco: from December 15 at 1200, December 15 at 2100, and December 16 at 0600.

The Port also collected a composite sample of SBR effluent, sampling continuously during the three decants that Ecology sampled. The sample was kept refrigerated.

Protan personnel indicated that the effluent stream is highly variable from process to process, making grab samples of the Protan effluent not representative of the whole effluent. To better characterize the effluent, an Isco compositor was set up by Ecology for the wet weather inspection, to sample Protan effluent every 30 minutes from a tap into the discharge line. The composite sampler collected sample from December 15 at 0800 to December 16 at 0800. Two grab samples of Protan effluent were also taken. Protan collected a composite sample during the inspection. The compositor bottle was iced during the inspection.

The Ecology composite effluent sample was split for analysis by the Ecology and PTF laboratories. Results from samples collected by Port personnel were compared with samples collected by Ecology. Samples collected, sampling times, and parameters analyzed during the wet weather inspection are summarized in Appendix C. Ecology analytical methods and laboratories performing the analyses are summarized in Appendix B.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Ecology quality assurance procedures for sampling included special cleaning of the sampling equipment prior to the inspection to prevent sample contamination by the equipment (Appendix D). Chain-of-custody procedures were followed to assure the security of the samples (Huntamer and Hyre, 1991).

Dry Weather Data

Most Ecology laboratory data for samples collected in September dry weather conditions met Ecology QA/QC guidelines and are considered to be reliable. Those data that did not meet the guidelines are appropriately qualified on the data tables.

Priority pollutant organics surrogate recoveries and matrix spike data are reasonable and acceptable within quality control limits. Di-n-butylphthalate was detected in the method blank; results for this analyte were changed to qualifier U to indicate these analytes were not detected at a level above the contamination. The data generated for metals analysis of water samples can be used without qualification. For the sludge sample, chromium, lead, and

silver failed the serial dilution test and are qualified with an E - reported result is an estimate because of the presence of interference. Antimony is qualified with an N because of low recovery in the corresponding quality control standard.

Wet Weather Data

Most Ecology laboratory data for samples collected in December wet weather conditions met Ecology QA/QC guidelines and are considered to be reliable. Those data that did not meet the guidelines are appropriately qualified on the data tables.

Surrogate recoveries and matrix spike data for priority pollutant organics are reasonable and acceptable within quality control limits. Methylene chloride was detected in the method blank; results for this analyte were changed to qualifier U to indicate these analytes were not detected at a level above the contamination.

Metals holding times were met. Instrument calibration, procedural blanks, and spiked sample analyses were acceptable. Viscosity problems were noted in the analysis of the influent sample. In addition, due to a laboratory accident, the duplicate spike was lost for the graphite furnace analysis. Graphite furnace and mercury data are flagged with N or J depending on the severity of the interference or problem.

RESULTS AND DISCUSSION

Flow Measurements

Influent flow to the PTF was measured by an ultrasonic in line meter which did not lend itself to verification by Ecology. Effluent flow from Protan was also measured with an in line meter. Oh Yang did not have an effluent flow meter. Meter readings for water use were used to represent Oh Yang flow.

A flow comparison for the month of March 1993 was made by Port personnel between the PTF influent meter and Protan effluent meter. To arrive at Protan's flow contribution, both the belt filter press wash water (which was included in the PTF flow meter reading) and the Oh Yang contribution to the PTF are subtracted from the PTF monthly flow. This is then compared with flow measured by the Protan effluent meter for the month of March:

1,089,700	PTF influent meter total
- 431,000	belt filter press wash water
- 10,900	Oh Yang influent (water meter reading)
647,800	Contribution from Protan for March 1993
676,700	Protan meter reading for March 1993

Both determinations of Protan's flow agreed closely. The PTF influent meter reading for Protan's flow for the month was within 4% of that measured by Protan.

Before May 1, 1993, the influent meter read the sum of influent and belt filter press wash water. As of May 1, the influent meter no longer includes belt filter press wash water (Porter, 1993). Meter readings for PTF water use should be added to the influent meter readings to obtain a representation of effluent flow. The Port expects to install an effluent flow meter during the summer of 1993.

State Waste Discharge Permit Compliance/General Chemistry

Dry Weather Inspection

During the dry weather inspection Protan, the principle contributor to the PTF, was operating in limited production. Flow for the 24-hour period of the dry weather inspection was 24,300 gpd, less than half the permitted 54,000 gpd.

The Oh Yang effluent to the PTF was a high strength waste (approx. 1800 mg/L TSS; approx. 2200 mg/L COD). Flow, based on Oh Yang water meter readings, was 6,500 gpd, less than one third of Protan's flow.

The influent to the PTF varied considerably in strength during both dry weather and wet weather inspections. Dry weather grabs for influent TSS ranged from 440 mg/L to 4100 mg/L (est.). COD ranged from 1000 mg/L to 6260 mg/L (Table 2).

At the time of the inspections, no permit had been issued for the Port PTF, but a December 3, 1990, application for a permit was in effect. The limits in the application remained in effect until the permit became effective June 14, 1993. Both the application and the permit require that the effluent meet an average BOD_5 of 300 mg/L, 300 mg/L TSS, 200 mg/L NO_3-N, and 10 mg/L NH_3-N. A 5 mg/L limit for oil and grease was requested in the application. The oil and grease limit was set at 100 mg/L by the permit. The temperature limit was set at 0-70°F, as requested in the permit application (Table 3).

From the Ecology 24-hour effluent composite sample during dry weather, BOD_5 was 360 mg/L, in excess of the limit established in the permit. TSS was 1640 mg/L, over five times the limit. The NO_2 + NO_3 - N concentration was 1.19 mg/L, well below the limit. The NH_3-N concentration was 219 mg/L, over twenty times the limit. Oil and grease concentrations approximated permit application limits, and were well below the limits of the permit during the dry weather survey. Effluent temperature exceeded permit application and permit limits during the dry weather inspection.

Table 2 – General Chemistry Results – Port of Willapa Harbor, September 1992.

Parameter	Location:	InfW-1	InfW-2	InfW-PE	InfW-O1	InfW-O2	InfW-PP
	Type:	grab	grab	grab	grab	grab	comp
	Date:	9/29	9/30	9/29	9/29	9/30	9/29-9/30
	Time:	1500	1210	1335	1405	1150	1530-0850
	Lab Log #:	408230	408231	408233	408235	408236	408237
GENERAL CHEMISTRY							
Conductivity (umhos/cm)		9640	5990	8940	9260	5700	11900
pH (SU)							
Alkalinity (mg/L CaCO3)		1520	329	840	540	1060	1110
Hardness (mg/L CaCO3)		2943	2542	2418	4520	3561	2829
TS (mg/L)				12070	9160	6190	9870
TNVS (mg/L)				6360	4420	3240	6720
TSS (mg/L)		4100J	440	3660J	1650J	1900	1660
TNVSS (mg/L)				1320J	325J	850	660
% Solids							
% Volatile Solids							
BOD5 (mg/L)							1980
COD (mg/L)		6260	1000	7320	2600	1770	3480
TOC (water mg/L)		2220	754	1930	1450	739	1290
TOC (soil mg/L)							
NH3-N(mg/L)							
NO2+NO3-N(mg/L)							
Total-P(mg/L)							
Oil and Grease (mg/L)		46	28J	117	56	93	
FIELD OBSERVATIONS							
Temp(C)		23.5	15.0	23.6	15.3	15.3	6.7
pH(S.U.)		7.69	8.27	6.49	6.9	8.5	7.04
Conductivity(umhos/cm)				>1000	>1000		

InfW – Ecology sample of PTF effluent (influent to the PTF).
InfW-O – Ecology sample of Oh Yang effluent (influent to the PTF).
InfW-PE – Ecology sample of Protan effluent
grab – grab sample
comp – composite sample
PP – Protan sample
E – Ecology sample

J – The analyte was positively identified. The associated numerical result is an estimate.

Table 2 – (cont'd) – Port of Willapa Harbor, September 1992.

Parameter II	Locatn:	AerW-1	AerW-2	EffW-1	EffW-2	EffW-E	EffW-W	EffW-G	EffW-GD	Sludge
	Type:	grab	grab	grab	grab	E-comp	W-comp	grab	grab	grab
	Date:	9/30	9/30	9/29	9/30	9/29-9/30	9/29-9/30	9/30	9/30	9/30
	Time:	0715	1350	7A	1240	1300-1300	1100-1300	1235	1235	0700
	Lab Log #:	408238	408239	408240	408241	408242	408243	408245	408246	408244
GENERAL CHEMISTRY										
Conductivity (umhos/cm)				12400	10500	11800	10600	11500		
pH (SU)										7.2
Alkalinity (mg/L CaCO3)				766	700	1200	674	739		
Hardness (mg/L CaCO3)				2740	2226	3155	2324	2473		
TS (mg/L)		20190	18370			8290	6170	6990	7100	
TNVS (mg/L)		11660	10690			6530	5110	5690	5720	
TSS (mg/L)				67	119	1640	84	93	68J	
TNVSS (mg/L)						800	53	47	11J	
% Solids										16.6
% Volatile Solids										8.8
BOD5 (mg/L)						360		310		
COD (mg/L)				856	259	1130	248	624		
TOC (water mg/L)				547	235	590	246	354	361	
TOC (soil mg/L)										44800
NH3-N(mg/L)						219	199	202	200	
NO2+NO3-N(mg/L)						1.19	1.15	2.60	2.53	
Total-P(mg/L)						78.6	4.77	5.84	6.33	
Oil and Grease (mg/L)				4	6J					
FIELD OBSERVATIONS										
Temp(C)		27.6			25.1	10.3	20.0			
pH(S.U.)		7.64			7.89	8.1	7.91			
Conductivity(umhos/cm)										

grab – grab sample
comp – composite sample
E – Ecology sample

InfW-P– Protan effluent composite sample
AerW – Ecology aeration basin sample
EffW-1,2,E – Ecology sample of Port of Willapa effluent
EffW-W – Port sample of Port effluent
G – grab composite sample
GD – duplicate grab composite sample
Sludge – sludge from the Port belt filter press

J – The analyte was positively identified. The associated numerical result is an estimate.

Table 3 – State Waste Discharge Permit Limits and Inspection Results – Port of Willapa Harbor, 1992.

Dry Weather – September 1992

	State Waste Discharge Limits*		Inspection Results	
Parameter	Monthly Average	Daily Average**	Composite Samples	Grab Samples
Flow (gpd)		54,000	24,300	
BOD5 (mg/L)		300	360	
TSS (mg/L)		300	1640	
Oil and Grease (mg/L)		100		4; 6 (est.)
NH3-N (mg/L)		10	219	
NO3-N (mg/L)		200	1.19***	
Temperature(C)		(70F)21.1		25.1
pH		6.0 - 9.0		7.9

Wet Weather – December 1992

	State Waste Discharge Limits*			Inspection Results	
Parameter	Monthly Average	Daily Average**	Permit Application Limits+	Composite Samples	Grab Samples
Flow (gpd)		54,000	54,000	66,290	
BOD5 (mg/L)		300	300	900	
TSS (mg/L)		300	300	-	
Oil and Grease (mg/L)		100	5		65 (est.), 60 (est.)
NH3-N (mg/L)		10	10	150	
NO3-N (mg/L)		200	200	0.16***	
Temperature (C)		(70F)21.1	(70F)21.1		22.2; 19.8
pH		6.0 - 9.0			7.4; 7.2

* These permit limits are effective June 14 1993

\+ The limits of the permit application were effective at the time of the inspections

** maximum of allowable range

*** NO2 + NO3

Wet Weather Inspection

Protan was operating in full production during the wet weather inspection. Influent and effluent parameters are shown in Table 4. Flow during the inspection was 66,290 gpd, 23% above the 54,000 gpd established in the permit (Table 3). From the Ecology 24-hour effluent composite sample, BOD_5 was 900 mg/L, three times the permitted daily average. The Manchester laboratory was unable to determine effluent TSS because the effluent sample was viscous, possibly the result of flocculent addition by the Port. The concentration of NO_2 + NO_3-N was 0.16 mg/L, less than one hundredth of the permitted NO_3-N concentration (200 mg/L). NH_3-N was 150 mg/L, 15 times the permitted daily average. Oil and grease concentrations (65 mg/L est., 60 mg/L est.) were considerably greater than the limits of the permit application but were within the limits of the permit issued June 14, 1993. Effluent temperature approximated permit limits during the wet weather inspection.

Discussion

The data indicate that the PTF is capable of removing suspended solids at removal efficiencies of 95% or better (approximately 2000 mg/L influent, 100 mg/L effluent). The PTF showed a capability of removing 88% BOD_5 (for wet weather 24-hour influent and effluent data), although effluent BOD_5 concentrations (900 mg/L) exceeded permit limits by a factor of three. It is likely that much of the removal of BOD_5 accompanied solids removal.

The plant relies on the addition of polymers for solids removal. Because this process dominates the removal mechanisms of the PTF, the degree of effectiveness of the plant's biological removal mechanisms can be obscured. Beyond the BOD_5 that can be removed with the settling of solids by flocculent addition, much of the BOD_5 appears to be soluble and depends for any further removal on biological treatment within the PTF. The plant is designed for biological treatment including nitrification.

An estimate of the percentage of BOD_5 removal other than by solids removal can be made by comparing influent with effluent total volatile dissolved solids (TVDS). Wet weather suspended solids data are not available because it was determined that the samples could not be analyzed. Comparing Protan dry weather influent TVDS with effluent TVDS results in a PTF removal efficiency of 55% to 71% for dissolved organics.

The Port PTF consists of a single sequential batch reactor (SBR). During the decant cycle, effluent is draining from one end of the aeration basin as influent continues to enter the other end. Port personnel assert that there is little interchange between influent and effluent, but the configuration may at times be a limiting factor to effluent quality.

PTF loadings have at times been intermittent because of interruptions in raw material supplies to Protan. There have been periods with little or no organic loading to the PTF. A viable culture of microorganisms should be maintained in order to provide biological

Table 4 – General Chemistry Results – Port of Willapa Harbor, December 1992.

Parameter / Location:	InfW-P1	InfW-P2	InfW-PE	InfW-PP	EffW-1	EffW-2	EffW-E	EffW-ED	EffW-W	Sludge
Type:	grab	grab	comp	comp	grab	grab	comp	comp	comp	grab
Date:	12/15	12/15	12/15–16	12/15–16	12/15	12/16	12/15–16	12/15–16	12/15–16	12/15
Time:	1320	1550	0800–0800	0930–1100	1220	0610	0800–0800	0800–0800	0800–0800	1300
Lab Log #:	518230	518231	518232	518233	518249	518250	518251	518252	518253	518254
GENERAL CHEMISTRY										
Conductivity (umhos/cm)	42700	7200	19500	25300	14900	16700	16000		16400	
pH (SU)										7.0
Alkalinity (mg/L CaCO3)	606	999	1320	1820	875	899	901		959	
Hardness (mg/L CaCO3)	12300	1490	6970	9370	4220	5190			4980	
TS (mg/L)	32000	15700	20700	25400			10900	10900	11400	
TNVS (mg/L)	27300	3630	12100	16500			8620	8740	9090	
TSS (mg/L)	720	x	x		x	375	x		x	
TNVSS (mg/L)	370	x	x				x		x	
% Solids										15.2
% Volatile Solids										66.5 dry
BOD5 (mg/L)			7370	7990			900		1110	
COD (mg/L)	4700	26000	12000	12000	2200	3000	3500		2500	
TOC (water mg/L)	866	4830	2530	2720	476	619	702	658	654	
TOC (soil mg/L)										32 dry
NH3-N(mg/L)			64	67			150	150	170	
NO2+NO3-N(mg/L)			0.67	0.41			0.16	0.05	0.14	
Total-P(mg/L)			1.8	26			13	14	22	
Oil and Grease (mg/L)	34J	172J			65J	60J				
FIELD OBSERVATIONS										
Temp (C)	12.0	10.2			22.2	19.8				
Temp-cooled (C)			1.9	3.6			3.7		9.1	
pH (S.U.)	9.0	7.8	8.5	8.8	7.4	7.2	7.8		7.7	
Conductivity (umhos/cm)	>20000	9640	17190	>20000	13600	14850	14730		14940	
Chlorine (total – mg/L)										

InfW-P – influent from Protan
EffW – Port of Willapa effluent
grab – grab sample
comp – composite sample

E – Ecology sample
PP – Protan sample
D – duplicate sample
Sludge – sludge from the Port belt filter press

X – lab unable to complete analyses

treatment when loading occurs. Protan reports that production is expected to be almost continuous in the future (Sargent, 1992).

Effluent NH_3-N concentrations were high (219 mg/L; 150 mg/L) while NO_2 + NO_3 - N concentrations were low (1.19 mg/L; 0.16 mg/L) during both inspections. This indicates that nitrification was not occurring in the PTF.

High BOD_5 concentrations in the Port effluent and the resulting high BOD_5/TKN (total Kjeldahl nitrogen) ratio suggest the nitrifier population level is generally low (WPCF, 1983). The SBR size and sludge wasting rates suggest a short sludge retention time (SRT - data to calculate the SRT were not collected during the inspection). A short SRT would prevent the buildup of an adequate population of nitrifying bacteria. Metals concentrations, alkalinity, and pH as measured in the PTF effluent should not be limiting to nitrification (EPA, 1975).

Split Sample Results

Dry Weather Inspection

Ecology and the Port split samples from the Port effluent compositor (Table 5). The temperature of the Port composite sample was 20.0°C, compared with 4°C required for sample preservation. Because the Port's compositor had only sampled one decant during the dry weather inspection and the SBR's decant cycle had just ended when samples were split, the sample had little time to cool in the Port's sample refrigerator.

The Port effluent TSS concentration (150 mg/L) was almost twice the Ecology analysis (84 mg/L). Attention should be paid to TSS testing during the Port's laboratory performance evaluation. The Port COD analysis yielded 51 mg/L, one fifth of the Ecology analysis (248 mg/L). The Port performs its own COD analysis. It was found after the dry weather inspection that the Port COD analyzer had been malfunctioning. Samples were also split from the Ecology effluent compositor but written records containing the results were not kept by the Port.

Protan's composite effluent sample was also split. Protan TSS result (1162 mg/L) was considerably lower than Ecology's analysis of the same sample (1660 mg/L). Protan and Ecology analyses of BOD_5 were close, within 7%.

Protan does not ordinarily control temperature on effluent samples. In September and December they iced their samples only at the recommendation of Ecology personnel. It is recommended that Protan ice all composite samples being collected.

Wet Weather Inspection

Ecology and the Port split samples from the Port effluent compositor (Table 5). Ecology analyses showed the Port effluent COD sample (2500 mg/L) 29% lower than the Ecology

Table 5 – Split Sample Results Comparison – Port of Willapa Harbor, 1992.

Dry Weather – September 1992

Parameter	Analysis by:				
Location:		InfW–PP	EffW–E	EffW–W	EffW–G
Type:		comp	E–comp	W–comp	grab–comp
Date:		9/29–9/30	9/29–9/30	9/30–9/30	9/30
Time:		1530–0850	1300–1300	1100–0100	1235
Lab Log #:		408237	408242	408243	408245
Sampled by:			Ecology	Port	Ecology
TSS (mg/L)					
	Ecology	1660	1640	84	93
	Port			150	
	Protan	1162			
COD (mg/L)					
	Ecology	3480	1130	248	624
	Port			51	
BOD5 (mg/L)					
	Ecology	1980	360		310
	Protan	1840			

Wet Weather – December 1992

Parameter	Analysis by:				
Location:		InfW–PE	InfW–PP	EffW–E	EffW–W
Type:		comp	comp	E–comp	W–comp
Date:		12/15–16	12/15–16	12/15–16	12/15–16
Time:		0800–0800	0930–1100	0800–0800	0800–0800
Lab Log #:		518233	518233	518251	518253
Sampled by:		Ecology	Protan	Ecology	Port
TSS (mg/L)					
	Ecology	x	x	x	x
	Port				800
	Protan	2900	7500		
COD (mg/L)					
	Ecology	12000	12000	3500	2500
	Port				3130
BOD5 (mg/L)					
	Ecology	7370	7990		
	Protan	4000	5700		

InfW – influent to the Willapa Harbor PTF
EffW – effluent from the Willapa Harbor PTF
P – influent to the PTF from Protan
X – lab unable to complete analyses

E – Ecology sample
W – Port of Willapa Harbor sample
PP – Protan sample of influent from Protan

G – grab sample

effluent COD sample (3500 mg/L). The Port effluent BOD_5 sample (1100 mg/L) was 22% higher than the Ecology effluent BOD_5 sample. The Port composite sampler employs a peristaltic pump which delivers a continuous sample throughout each decant. The low velocity of fluid in the intake hose can allow solids to settle out of the sample instead of being collected. It is recommended that a composite sampler with higher uptake velocities be used.

The Port COD results (3130 mg/L) were within 25% of Ecology's analysis (2500 mg/L). Wet weather TSS results could not be compared because the Manchester Lab was unable to perform TSS analyses. Samples were also split from the Ecology effluent compositor but written records of the results were not kept by the Port.

Splits were also made of the Ecology and Protan composite samples of Protan effluent. The Ecology analyses found the BOD_5 results for the sample collected by Protan to be within 8% of the sample collected by Ecology sample. Protan analyses were consistently lower than Ecology analyses, however. The Protan analysis of the Ecology effluent was 46% lower and the Protan analysis of the Protan effluent was 29% lower than Ecology's analysis. It is recommended that Protan review its sampling, preservation, and shipping procedures, as well as any other possible causes of low laboratory results.

Laboratory Procedures\Accreditation

Laboratory record keeping and calculations were in need of improvement. Difficulties were encountered in obtaining records. Care is needed in assuring the operating condition of laboratory instruments and in delineating units of analysis.

The Port's laboratory did not analyze for all permit parameters. The lab was not accredited by the Department of Ecology. The lab must be accredited or an accredited lab must be used to analyze permit limited parameters by July 1, 1994.

PTF Operation

The flow rate of influent to the PTF varied widely within the course of one day. This is evident in the circular flow chart for the wet weather inspection, a time of high production by Protan (Figure 4). Large variations in flow are often experienced by the PTF.

Plant performance varied considerably throughout the day during the dry weather inspection, with effluent TSS varying from 67 mg/L and 119 mg/L for two daytime grabs to 1640 mg/L for a 24-hour composite that included a nighttime decant. Effluent COD's ranged from 259 mg/L for the grabs to 1130 mg/L for the composite sample. The high TSS concentration in the composite sample and BOD_5 (360 mg/L) higher than the effluent limit, indicate that the nighttime decant was a slug of poorly treated wastewater.

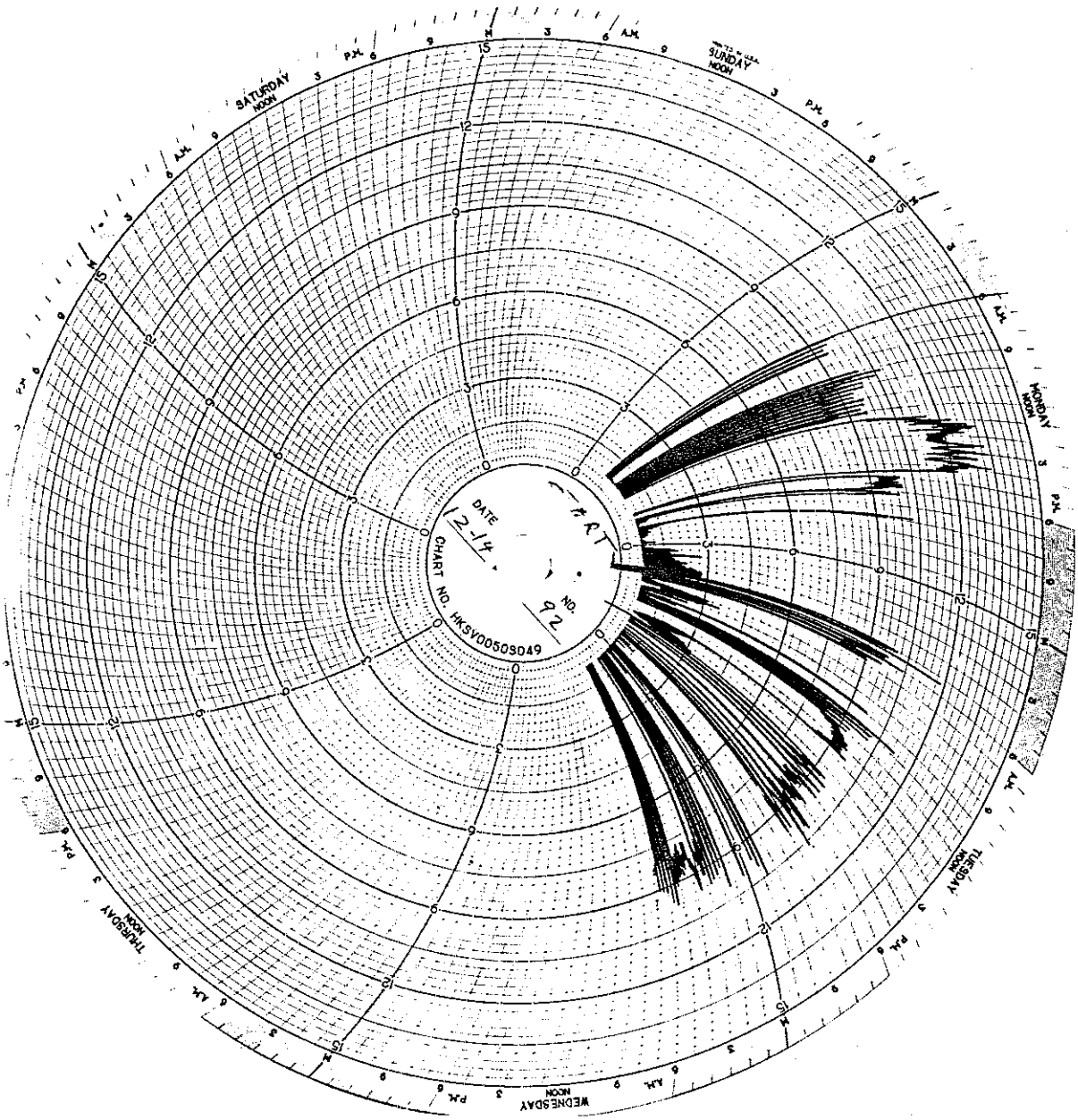

Figure 4 – Circular Flow Chart, Wet weather – Port of Willapa Harbor, December 1992.

It has been reported that the PTF operates less efficiently at night when it is left unattended (Crafton, 1992; Hebish, 1992). Protan operates around the clock, and large slugs of wastewater from Protan to the Port PTF have been reported at night (Crafton, 1992). Also, flocculent addition and SBR operation are not adjusted to changing conditions when the plant is unattended.

The Port reports that since the inspection Protan has been regulating their discharge for more steady releases and that the two PTF operators are available to work an extended work schedule to operate the plant from 5 AM to 11:30 PM during periods when solids are high and belt filter press operation is required to waste solids. (Porter, 1993)

Although large variations in influent flow and strength contribute to difficulties in operation of the PTF, a means is available for leveling the influent load. Protan has 40,000 gallons of wastewater storage capacity and is therefore able to reduce variations in flow. Also, Protan should ensure that it does not discharge at a rate to cause the PTF to exceed the 54,000 gpd permitted. Cooperative efforts to control the discharge of wastewater from Protan to the Port PTF are important in maintaining efficient PTF performance.

During the wet weather inspection, with Protan in full production, influent BOD_5 was much higher (7370 mg/L) than the Protan influent during the dry weather inspection (1980 mg/L BOD_5). Even so, the PTF reduced TSS at removal efficiencies of 95% or better during both the dry weather and wet weather inspections, and BOD_5 at efficiencies of 88% or better during the wet weather inspection. (Overall BOD_5 removal efficiency was only 82% during the dry weather inspection, but this was when a slug load of high-BOD effluent was released from the PTF at night.)

However, even with these removal efficiencies, the 24-hour composite BOD_5 was 900 mg/L, three times the permitted daily average of 300 mg/L. For the conditions of the wet weather inspection, a BOD_5 removal efficiency of approximately 97% would have been needed in order to meet the effluent limit of 300 mg/L BOD_5. It is uncertain from the limited data of the wet and dry weather inspections whether this degree of removal can be obtained. It is clear that the PTF would need to be operated within its design hydraulic loading. The PTF was hydraulically overloaded during the wet weather inspection, discharging a flow of 66,290 gpd, 23% above the 54,000 gpd design flow and permitted discharge. Optimal use of flocculent and attention to biological treatment processes of the PTF could also be expected to bring about improved removal efficiencies. If these measures do not result in effluent BOD_5 concentrations within the 300 mg/L limit, reduced influent loadings or plant expansion would be necessary to meet existing permit limits.

Priority Pollutant Scans

Dry Weather Inspection

A number of priority pollutants were detected in the samples of PTF influent and effluent collected (Table 6). Methylene chloride and acetone were found in small quantities in the influent and acetone was found in the effluent. As both compounds are used for laboratory cleaning of sampling apparatus, their concentration is not likely representative.

Of the seven other VOA compounds found in the PTF influent or effluent, all were found at low concentrations with the exception of 1,1,1 - Trichloroethane. It was found in concentrations of 15 μg/L and 2.5 μg/L in two influent grab samples and in concentrations of 790 μg/L and 1200 μg/L in two effluent grabs. These concentrations are well below EPA water quality criteria (Table 6). Although the PTF provides pretreatment, discharging to a municipal sewage treatment plant, effluent concentrations from the PTF were compared with EPA water quality criteria as an indicator of potential impact.

Five BNA compounds were found in the PTF effluent. Phenol, 2-nitrophenol, and 4-Nitrophenol were found in concentrations well below EPA water quality criteria. 4-methylphenol and benzoic acid were found in concentrations well below all LC_{50}'s for a number of fish species (Verschueren, 1983). No pesticide/PCB compounds were found in the PTF effluent.

Four metals were detected in the PTF effluent. Arsenic and zinc were found in concentrations below EPA water quality criteria. Chromium was found in concentrations lower than fresh water criteria for the trivalent form but higher than criteria for the hexavalent form. Copper was found in concentrations lower than fresh water criteria but higher than acute marine criteria.

Complete priority pollutant scan results for the Port PTF, dry weather inspection, with detection limits, are included in Appendix E.

Tentatively Identified Compounds (TICs) in the PTF influent during the dry weather inspection included methanethiol, thiobismethane, and several unknowns, at or below concentrations of 1027 μg/L (est.). Thiobismethane, dimethyldisulfide, and a number of unknowns were tentatively identified in the PTF effluent in concentrations up to 1190 μg/L (est.). Carboxylic acid, butanoic acid, benzenepropanoic acid, sterol isomer, and a number of unknowns were tentatively identified in the composite effluent sample. TICs are summarized in Appendix F.

Wet Weather Inspection

Priority pollutant organics scans yielded similar results for the PTF during the wet weather inspection as compared with the dry weather inspection. Somewhat fewer VOAs and BNAs

Table 6 – Comparison of Detected Compounds and Metals to Toxicity Criteria – Port of Willapa Harbor, September 1992.

	Location:	InfW-1	InfW-2	EffW-1	EffW-2	Sludge	EPA Water Quality Criteria Summary			
	Type:	grab	grab	grab	grab	grab				
	Date:	9/29	9/30	9/29	9/30	9/30	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
	Time:	1500	1210	1700	1240	0700				
	Lab Log#:	408230	408231	408240	408241	408244				
(Group)[1]	VOA Compounds	ug/L	ug/L	ug/L	ug/L	ug/Kg-dw	(ug/L)	(ug/L)	(ug/L)	(ug/L)
a	Methylene Chloride	2.2	2.0 U	2.0 U	20 U	15	11,000 *(a)		12,000 *(a)	6,400 *(a)
	Acetone	33	12 UJ	17 UJ	57	910				
	1,1-Dichloroethane	1.0 U	1.0 U	0.8 J	10 U	6.4 U				
a	Chloroform	37	36	8.5	8.1 J	55	28,900 *	1,240 *	12,000 *(a)	6,400 *(a)
	1,2-Dichloroethane	1.0 U	1.0 U	1.5	10 U	6.4 U	118,000 *	20,000 *	113,000 *	
	2-Butanone (MEK)	38	5.0 U	8.6	50 U	160				
c	1,1,1-Trichloroethane	15	2.5	790	1200	6.4 U	18,000 *(c)		31,200 *	
a	Bromodichloromethane	2.3	3.9	1.0 U	10 U	6.4 U	11,000 *(a)		12,000 *(a)	6,400 *(a)
	Toluene	40	1.0 U	6.5	10 U	6.4 U	17,500 *		6,300 *	5,000 *

	Location:	EffW-G	Sludge	EPA Water Quality Criteria Summary			
	Type:	grab	grab				
	Date:	9/30	9/30	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
	Time:	1235	0700				
	Lab Log#:	408245	408244				
(Group)[1]	BNA Compounds	ug/L	ug/Kg-dw	(ug/L)	(ug/L)	(ug/L)	(ug/L)
	Phenol	79	350 U	10,200 *	2,560 *	5,800 *	
	4-Methylphenol	66	180 U				
	Isophorone	2 U	120 J	117,000 *		12,900 *	
l	2-Nitrophenol	5.6 J	880 U	230 *(l)	150 *(l)	4,850 *(l)	
	Benzoic Acid	130 J	1800 UJ				
l	4-Nitrophenol	5.7 J	880 U	230 *(l)	150 *(l)	4,850 *(l)	
n	Phenanthrene	2 U	90 J			300 *(n)	
n	Fluoranthene	2 U	71 J	3,980 *		40 *	16 *
n	Pyrene	2 U	97 J			300 *(n)	
i	Bis(2-Ethylhexyl)Phthalate	2 U	2700	940 *(i)	3 *(i)	2,944 *(i)	3.4 *(i)
i	Di-n-Octyl Phthalate	2 U	76 J	940 *(i)	3 *(i)	2,944 *(i)	3.4 *(i)
(Group)[1]	Pesticide/PCB Compounds	ug/L	ug/Kg-dw	(ug/L)	(ug/L)	(ug/L)	(ug/L)
u	4,4'-DDE	0.10 U	16	1,050 *	0.001 (u)	14 *	0.001 (u)

InfW-1,2, – Ecology grab samples of Port influent
EffW-1,2,G – Ecology grab sample of Port effluent
Sludge – Sludge from the Port belt filter press

a Total Halomethanes
c Total Trichloroethanes
l Total Nitrophenols
n Total Polynuclear Aromatic Hydrocarbons
i Total Phthalate Esters
u DDT plus metabolites

[ ] – detected analyte

Table 6 – (cont'd) – Port of Willapa Harbor, September 1992.

Location:	EffW–1	Sludge	EPA Water Quality Criteria Summary			
Type:	grab	grab				
Date:	9/29	9/30	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
Time:	1700	0700				
Lab Log#:	408240	408244				
Metals	ug/L	mg/Kg–dr	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Antimony	30 U	35 P	9,000 *	1,600 *		
Arsenic	9.3 N	23 P				
Pentavalent			850 *	48 *	2,319 *	13 *
Trivalent			360	190	69	36
Cadmium	2.0 U	1.9 P	31.8 +	4.9 +	43	9.3
Chromium	146	4480				
Hexavalent			16	11	1,100	50
Trivalent			7,942 +	947 +	10,300 *	
Copper	22	99.8 E	102 +	58 +	2.9	
Lead	1.0 U	5.57 E	867 +	33.8 +	140	5.6
Mercury	0.050 UN	0.039 PN	2.4	0.012	2.1	0.025
Nickel	10 U	12 P	6,820 +	758 +	75	8.3
Selenium	2 UJ	1.4	260	35	410	54
Zinc	11 P	173	564 +	511 +	95	86

[1]NOTE: SOME INDIVIDUAL COMPOUND CRITERIA OR LOELS MAY NOT AGREE WITH GROUP CRITERIA OR LOELS. REFER TO APPROPRIATE EPA DOCUMENT ON AMBIENT WATER QUALITY CRITERIA FOR FULL DISCUSSION.

[ ] – detected analyte

U The analyte was not detected at or above the reported result.
J The analyte was positively identified. The associated numerical result is an estimate.
UJ The analyte was not detected at or above the reported estimated result.
N The spike sample recovery is not within control limits.
P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
E Reported result is an estimate because of the presence of interference.
* Insufficient data to develop criteria. Value presented is the LOEL – Lowest Observed Effect Level.
+ Hardness dependent criteria (640 mg/L used).

were detected during the wet weather inspection and some concentrations were lower (Table 7). The VOA found in the highest concentration, 4-methylphenol increased in effluent concentrations from 66 μg/L during the dry weather inspection to 300 μg/L during the wet weather inspection, still well below the LC_{50}'s for all species of fish reported by Verschueren (1983).

While no pesticide/PCB compounds were found during the dry weather inspection, four were found in the effluent during the wet weather inspection. Alpha-BHC and beta-BHC were found in concentrations below EPA water quality criteria. 4,4'-DDE and Endrin were found in concentrations higher than EPA chronic freshwater and chronic marine criteria.

More priority pollutant metals were found during the wet weather inspection, and in higher concentrations than during the dry weather inspection. Arsenic, cadmium, copper, mercury, silver, and zinc were above at least some of the EPA water quality criteria. Lead and selenium were found in concentrations below all criteria. Chromium was not found during the wet weather inspection, suggesting that Oh Yang was the source of the chromium. Oh Yang was not operating during the wet-weather inspection and has since shut down operations and vacated the site.

The appearance of pesticides and increased metals in the PTF effluent in December may be due to Protan's having switched sources of shell between the two inspections, from shrimp during the dry weather inspection in September, to crab during the wet weather inspection.

Complete priority pollutant scan results for the Port PTF, wet weather inspection, with detection limits, are included in Appendix G.

Several TICs, in concentrations below 200 μg/L, were found in the two volatile organics effluent grab samples. Forms of butanoic acid, pentanoic acid, decanoic acid, and unknown compounds were found in the semivolatile fraction at concentrations of up to 40,000 μg/L (est.) in the influent to the PTF. Forms of butanoic acid, pentanoic acid, and propanoic acid were found in the PTF effluent in concentrations up to 2500 μg/L (est.). TICs found are summarized in Appendix H.

Sludge

Priority Pollutant Organics

Priority pollutant scans of the sludge samples were performed for the dry weather inspection only (Table 6). Effluent pesticides/PCBs and metals data indicate higher concentrations during the wet weather inspection than during the dry weather inspection, suggesting that the sludge produced during the wet weather inspection may have had higher concentrations of these than from the sludge samples collected.

Table 7 – Comparison of Detected Compounds and Metals to Toxicity Criteria – Port of Willapa/Raymond, December 1992.

	Location:	EffW-1	EffW-2	EffR-1	EffR-2	EPA Water Quality Criteria Summary			
	Type:	grab	grab	grab	grab				
	Date:	12/15	12/16	12/15	12/15	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
	Time:	1220	0610	0920	1415				
	Lab Log#:	518249	518250	518242	518243				
(Group)[1]	VOA Compounds	ug/L	ug/L	ug/L	ug/L	(ug/L)	(ug/L)	(ug/L)	(ug/L)
	Acetone	10 U	61	9 J	26				
a	Chloroform	3 J	4 J	10 U	10 U	28,900 *	1,240 *	12,000 *(a)	6,400 *(a)
	2-Butanone (MEK)	10 U	4 NJ	10 U	10 U				
	Toluene	1 J	1 J	10 U	10 U	17,500 *		6,300 *	5,000 *

	Location:	EffW-E	EffR-E	EPA Water Quality Criteria Summary			
	Type:	comp	comp				
	Date:	12/15-16	12/15-16	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
	Time:	0800-0800	0800-0800				
	Lab Log#:	518251	518244				
	BNA Compounds	ug/L	ug/L	(ug/L)	(ug/L)	(ug/L)	(ug/L)
	Phenol	22	1 U	10,200 *	2,560 *	5,800 *	
	4-Methylphenol	300	1 U				
	Benzoic Acid	110 J	25 U				
	Pesticide/PCB Compounds	ug/L	ug/L	(ug/L)	(ug/L)	(ug/L)	(ug/L)
q	alpha-BHC	0.037 NJ	0.006 N	100 *(q)		0.34 *(q)	
q	beta-BHC	0.16 D	0.006 U	100 *(q)		0.34 *(q)	
q	gamma-BHC (Lindane)	0.004 U	0.006	2.0	0.08	0.16	
u	4,4'-DDE	0.086 D	0.004 U	1,050 *	0.001 (u)	14 *	0.001 (u)
†	Endrin	0.007 J	0.01 U	0.18 (t)	0.0023 (t)	0.037 (t)	0.0023 (t)
	Metals Hardness = 335	ug/L	ug/L				
	Arsenic	162 N	5.8 J				
	Pentavalent			850 *	48 *	2,319 *	13 *
	Trivalent			360	190	69	36
	Cadmium	6.45	0.13 P	15.3 +	2.9 +	43	9.3
	Copper	140	7.7 P	55 +	33 +	2.9	
	Lead	1.4 J	8.6 J	380 +	14.8 +	140	5.6
	Mercury	0.16 J	0.050 UJ	2.4	0.012	2.1	0.025
	Selenium	5.1 N	2.0 UN	260	35	410	54
	Silver	2.4	0.50 U	32.5 +	0.12	2.3	
	Zinc	160	32	326 +	295 +	95	86

[1]NOTE: SOME INDIVIDUAL COMPOUND CRITERIA OR LOELS MAY NOT AGREE WITH GROUP CRITERIA OR LOELS. REFER TO APPROPRIATE EPA DOCUMENT ON AMBIENT WATER QUALITY CRITERIA FOR FULL DISCUSSION.

U The analyte was not detected at or above the reported result.
J The analyte was positively identified. The associated numerical result is an estimate.
N The spike sample recovery is not within control limits.
P The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
* Insufficient data to develop criteria. Value presented is the LOEL – Lowest Observed Effect Level.
D The result is obtained from a dilution of the original extract.

[ ] – detected analyte

\+ Hardness dependent criteria (335 mg/L used).

a Total Halomethanes
q Total BHCs
† Endrin
u DDT plus metabolites

Besides methylene chloride and acetone, compounds used in cleaning sampling apparatus, eight priority pollutant organic compounds were detected. Bis(2-ethylhexyl)phthalate (2700 μg/Kg-dw) was found in the sludge in the highest concentration. It was not found in the PTF effluent. The other priority pollutant organic compounds found in the sludge were found in concentrations of less than 100 μg/Kg-dw.

A single pesticide/PCB compound was found in the sludge: 4,4'-DDE (16 μg/Kg).

TICs in the sludge were methanethiol, thiobismethane, dimethyldisulfide, at concentrations up to 2200 μg/Kg-dw (est.). Several unknowns were detected at lower concentrations. TICs are summarized in Appendix F.

Metals

Ten priority pollutant metals were detected in the sludge sample. Chromium was found in the highest concentration (4480 mg/Kg-dw). Besides zinc (173 mg/Kg-dw) and copper (99.8 mg/Kg-dw), the other metals were detected at concentrations of 35 mg/Kg-dw or less. Although the sludge produced by the PTF is not sewage sludge, as a point of comparison, the chromium concentration from the Port PTF (4480 mg/Kg-dw) was 49% higher than the ceiling concentration for land application from Standards for the Use or Disposal of Sewage Sludge; Final Rules (EPA, 1993).

Complete priority pollutant scan results for Port PTF sludge are included in Appendix E.

Conclusions and recommendations for this facility are addressed at the end of the next section.

PART II

CLASS II INSPECTION
CITY OF RAYMOND WASTEWATER TREATMENT PLANT

PROCEDURES

Dry Weather and Wet Weather Inspections

Sampling procedures were the same for the Raymond WTP dry weather and wet weather inspections. Class II Inspection sampling included Ecology grab and composite samples. An effluent grab composite sample consisting of two subsamples was collected by Ecology for bioassay testing. An Ecology Isco compositor actuated by a Sigma bubbler flow meter was set up to take flow-proportioned influent samples. Another Ecology Isco compositor was set up to collect effluent samples with equal volumes of sample collected every 30 minutes for 24 hours (0900 to 0900). The compositors were iced to keep samples cooled. Sample configurations and locations are summarized in Table 8 and Figure 3 (p. 5).

Raymond WTP personnel collected influent and effluent composite samples. The Raymond influent composite sample was flow-proportioned to the flow of pump station 11, which pumps most of Raymond's influent including that from the Port PTF. The sampler intake was positioned where all influent can be sampled. The Raymond effluent composite sampler was set up to collect samples at the outflow box just downstream of the dechlorination basin above the bottom of the basin.

All composite samples were split for analysis by both the Ecology and WTP laboratories. Samples collected, sampling times, and parameters analyzed for the dry weather inspection are summarized in Appendix I, and for the wet weather inspection, in Appendix J. Ecology analytical methods and laboratories performing the analyses are summarized in Appendix B.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC considerations for the Raymond wet weather and dry weather are the same as those for the Port PTF, described previously.

RESULTS AND DISCUSSION

Flow Measurements

Raymond effluent flow measurements were used to calculate permitted parameters in lbs/day. The Parshall flume was inspected and flume configuration was verified to be acceptable. Ecology made an instantaneous measurement for comparison with the flow meter measurement. Ecology and plant flow meter measurements agreed within 3%, within the measurement accuracy of the Ecology flow measurement.

Table 8 - Sampling Station Descriptions - City of Raymond WTP, September and December 1992.

City of Raymond

Ecology influent samples (InfR)

The grab and composite samples were collected downstream of the Parshall flume, upstream of plant return flow. The composite sample intake was kept one half inch above the channel.

City of Raymond Composite influent sample (InfR-R)

The composite samples were collected in the channel just upstream of the Parshall flume. The sample intake was located in an open vertical pipe several inches off the bottom of the channel.

Ecology effluent samples (EffR-1, EffR-2, EffR-E, EffR-ED, EffR-GC)

The grab, grab-composite, and composite samples were collected at the outflow box just downstream of the dechlorination basin. The sample intake was weighted so as to maintain a position several inches below the surface of the effluent.

City of Raymond effluent samples (EffR-R)

The grab and composite samples were collected at the outflow box just downstream of the dechlorination basin above the bottom.

The Raymond influent Parshall flume was not checked by Ecology. The varying flow resulting from influent delivered by the pump stations did not lend itself to verification.

NPDES Permit Compliance/General Chemistry

Dry Weather Inspection

The WTP was performing well during the dry weather inspection. The conventional parameters of BOD_5, TSS and pH indicate an adequately treated effluent (Table 9). The effluent was well within National Pollutant Discharge Elimination System (NPDES) permit limits for 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS) and pH (Table 10).

The dry weather inspection TSS influent (820 mg/L; 2,544 lb/day) to the WTP is in excess of the 220 mg/L typical of domestic wastewaters (Metcalf and Eddy, 1991) and of the maximum design criteria included in the permit (1,780 lbs/day; Table 10). The high influent TSS concentration is likely the result of contributions from the Port PTF. The 24-hour composite PTF effluent sample during the dry weather inspection found 1640 mg/L TSS.

The warm, sunny weather appears to have stimulated photosynthesis. The presence of algae was evidenced by the green color of the aerated lagoons and dechlorination basin as well as the moderately high pH of the effluent. While algae may be responsible for a portion of the BOD_5 and TSS in the WTP effluent, effluent BOD_5 and TSS remained low.

A comparison of influent and effluent ammonia and nitrate-nitrite concentrations indicate that the WTP was achieving substantial nitrification of the relatively high levels of ammonia in the influent. Ammonia concentrations of approximately 58 mg/L in the influent were reduced to approximately 5.5 mg/L in the effluent, while NO_2 + NO_3 - N concentrations increased from approximately 0.04 mg/L in the influent to 30 mg/L in the effluent. Alkalinity was present in sufficient concentration in the effluent (81.1 mg/L) so as not to limit nitrification. Total-P decreased from approximately 28 mg/L in the influent to approximately 10 mg/L in the effluent. All field conductivity measurements were off-scale, greater than 1000 umhos/cm. A new conductivity meter with a higher measurement range was used for the wet weather inspection.

Wet Weather Inspection

Flow rate as measured from the Raymond effluent flow meter during the wet weather inspection was 1.27 MGD, as compared with 0.37 MGD during the dry weather inspection. An increase in I & I in the Raymond sewer system accounts for the increased flow. The dilution resulting from I & I also accounts, at least in part, for the lower influent BOD_5 and TSS concentrations during the wet weather inspection. The influent BOD_5 concentration during wet weather was 148 mg/L as compared with 280 mg/L during dry weather. The

Table 9 – General Chemistry Results – City of Raymond WTP, September 1992.

Parameter / Location:	InfR-1	InfR-2	InfR-E	InfR-R	Leach	EffR-1	EffR-2	EffR-E	EffR-ED	EffR-GC	EffR-R
Type:	grab	grab	comp	comp	grab	grab	grab	comp	comp	grab-comp	comp
Date:	9/29	9/29	9/29-30	9/29-30	9/29	9/29	9/29	9/29-30	9/29-30	9/29	9/29-30
Time:	1000	1540	0900-0900	0900-0900	1010	1045	1600	0900-0900	0900-0900	*	0900-0900
Lab Log #:	408260	408261	408262	408263	408270	408264	408265	408266	408269	408268	408267
GENERAL CHEMISTRY											
Conductivity (umhos/cm)	3580	4180	8070	7130		3100	3100	3120		3110	2950
Alkalinity (mg/L CaCO3)			503	372				81.1		82.8	82.4
Hardness (mg/L CaCO3)			1731	1325				633		653	648
TS (mg/L)			5830	4940				2150	2150		2280
TNVS (mg/L)			4380	3860				1620	1570		1670
TSS (mg/L)	560J	500J	820	1420	17	22	26	33	32	28	36
TNVSS (mg/L)			440	560				10	14		12
BOD5 (mg/L)			280	147	72			17			15
COD (mg/L)	603	582	705	621		64	82.8	81.2			86.8
TOC (water mg/L)	249	145	226	184		41.1	38.7	36.4	33.9		34.5
TOC (soil/sed)											
NH3-N (mg/L)			58.0	47.6				5.51	5.32		5.39
NO2+NO3-N (mg/L)			0.043	0.048				29.5	28.6		32.0
Total-P (mg/L)			28.2	33.5				10.2	9.42		9.06
Oil and Grease (mg/L)	36	39J				2	2				
F-Coliform MF (#/100mL)						1100	390				
FIELD OBSERVATIONS											
Temperature (C)	18.1	19.6				15.6	17.4				
Temp-cooled (C)*+			7.3	4.4	10.4			3.6			3.8
pH	7.8	7.8	7.8	7.6	7.7	8.1	8.5	8.3			8.1
Conductivity (umhos/cm)	>1000	>1000			>1000	>1000					
Chlorine (mg/L)						<0.1					
Sulfide (mg/L)											

* grab composite sample collected as two equal volumes at 1130 and 1545 on 9/29.

InfR – City of Raymond influent
E – Ecology sample
ED – Ecology duplicate sample
Leach – Landfill leachate influent
R – City of Raymond sample
EffR – City of Raymond effluent

J – The associated numerical result is an estimated quantity.

grab – grab sample
comp – composite sample
G – grab-composite sample

Table 10 - NPDES Permit Limits and Inspection Results - City of Raymond, 1992

Dry Weather - September 1992

Parameter	NPDES Limits: Monthly Average	NPDES Limits: Weekly Average	Inspection Results: Composite Samples	Inspection Results: Grab Samples
BOD5				
mg/L	30	45	17	
lbs/day	180	270	53	
TSS				
mg/L	75	110	33	
lbs/day	450	660	102	
Fecal coliform				
/100mL	200	400		1100; 390
pH				
S U	6.0 – 9 0			8 1; 8 5
Chlorine				
mg/L	0 06	0 15 (daily max)		<0.1
lb/day	0 36	0.90 (daily max)		
Flow*				
gpd	1,500,000		372 000	
Influent BOD5*				
lbs/day	1 780		869	
Influent TSS*				
lbs/day	1,780		2,544	

Wet Weather - December 1992

Parameter	NPDES Limits: Monthly Average	NPDES Limits: Weekly Average	Inspection Results: Composite Samples	Inspection Results: Grab Samples
BOD5				
mg/L	30	45	50	
lbs/day	180	270	530	
TSS				
mg/L	75	110	3	
lbs/day	450	660	32	
Fecal coliform				
/100mL	200	400		280; 260
pH				
S.U	6 0 – 9.0			7 7; 7 8
Chlorine				
mg/L	0 06	0.15 (daily max)		<0 1
lb/day	0 36	0 90 (daily max)		
Flow*				
gpd	1,500 000		1,270 000	
Influent BOD5*				
lbs/day	1,780		1,568	
Influent TSS*				
lbs/day	1 780		1,642	

*Design Criteria: Average for the maximum month

influent TSS concentration during wet weather was 155 mg/L as compared with 820 mg/L during the dry weather inspection (Table 11).

The WTP was not providing effective removal of organics during the wet weather inspection. During wet weather, only 30% of BOD_5 was removed as compared with 94% removal during the dry weather inspection and 85% removal required by permit. The wet weather effluent BOD_5 concentration of 50 mg/L compares with a permitted monthly average of 30 mg/L and a permitted weekly average of 45 mg/L (Table 10). The effluent BOD_5 of 530 lb/day is approximately double the 270 lbs/day permitted weekly average.

While during both dry and wet weather inspections TSS was removed at 96% or higher efficiency, TSS concentrations were lower during wet weather conditions (3 mg/L) than during dry weather conditions (33 mg/L). Lower TSS influent concentrations during the wet weather inspection (155 mg/L) than during the dry weather inspection (820 mg/L) and a reduction in algae growth in the aerobic lagoons in December appear to account for the low TSS levels.

The high effluent BOD_5 (50 mg/L) relative to the TSS (3 mg/L) in the WTP effluent suggests that much of the BOD_5 was in a soluble form. The PTF, with only 55% to 71% dry weather removal efficiency for dissolved solids, appears to have been a significant source of dissolved organics to the WTP.

A comparison of influent and effluent ammonia and nitrate + nitrite concentrations during the wet weather inspection indicate that the WTP was not achieving much nitrification. This is likely the result of lower temperatures and shorter detention times in the aerated lagoons. Ammonia concentrations of approximately 17 mg/L in the influent compare with concentrations of approximately 15 mg/L in the effluent. NO_2 + NO_3 - N concentrations increased only a small amount from approximately 0.4 mg/L in the influent to 3.2 mg/L in the effluent. Alkalinity in the effluent (157 mg/L) was not limiting to nitrification. Total-P decreased from approximately 6.6 mg/L in the influent to approximately 3.0 mg/L in the effluent.

Fecal Coliform Counts/Chlorination

Fecal coliform counts were made both for dry weather and wet weather inspections. A fecal coliform count for dry weather (1100/100mL) was in excess of weekly and monthly permit limits. The other dry weather (390/100mL) and wet weather (280/100mL; 260/100mL) counts were greater than the monthly permit limit (Table 10).

Ecology field tests for chlorine were made during the dry weather and wet weather inspections. All tests showed less than the 0.1 mg/L detection limit of the test for both final effluent and effluent from the chlorine contact basin. Raymond tests grab samples for 7 AM September 30, 1992, indicated a chlorine residual of 0.0 mg/L in the final effluent and a chlorine residual of 0.10 mg/L for the chlorine contact basin effluent as the effluent enters

Table 11 – General Chemistry Results – City of Raymond WTP, December 1992.

Parameter / Location:	InfR-1	InfR-2	InfR-E	InfR-R	EffR-1	EffR-2	EffR-E	EffR-ED	EffR-GC	EffR-R
Type:	grab	grab	comp	comp	grab	grab	comp	comp	grab-comp	comp
Date:	12/15	12/15	12/15-16	12/15-16	12/15	12/15	12/15-16	12/15-16	12/15	12/15-16
Time:	830	1350	0820-0820	0800-0800	0920	1415	0800-0800	0800-0800	0920	0800-0800
Lab Log #:	518238	518239	518240	518241	518242	518243	518244	518245	518247	518246
GENERAL CHEMISTRY										
Conductivity (umhos/cm)	820	4190	1860	1380	2090	2130	2140		2110	2120
Alkalinity (mg/L CaCO3)			178	156			157		156	155
Hardness (mg/L CaCO3)			420	327			337		332	336
TS (mg/L)			1220	1300			1230	1260		1250
TNVS (mg/L)			781	657			1040	1020		1030
TSS (mg/L)	89	360	155	340	8	5	3	3	11	12
TNVSS (mg/L)			27	40			3	1U		3
BOD5 (mg/L)			148	254			50			45
COD (mg/L)			460	580			110			75
TOC (water mg/L)	36.5	186	68.4	89.5	20.6	21.9	23.9	24.0		22.4
TOC (soil/sed)										
NH3-N (mg/L)			17	12			15	15		15
NO2+NO3-N (mg/L)			0.43	0.34			3.2	3.3		3.2
Total-P (mg/L)			6.6	10			3.0	3.0		3.1
Oil and Grease (mg/L)	10J	29J			2J	3J				
F-Coliform MF (#/100mL)					280	260				
FIELD OBSERVATIONS										
Temperature (C)	11.6	12.7			5.9	6.7				
Temp-cooled (C)*+			2.4	2.8			1.5			2.3
pH	7.4	7.4	7.3	8.8	7.7	7.8	8.2			8.9
Conductivity (umhos/cm)	741	4070	1845	1396	2170	2140	2210			2200
Chlorine (mg/L)					<0.1					
Sulfide (mg/L)										

* grab composite sample collected as two equal volumes at 0920 12/15 and 1010 12/16.

InfR – City of Raymond influent
E – Ecology sample
ED – Ecology duplicate sample
R – City of Raymond sample
EffR – City of Raymond effluent

grab – grab sample
comp – composite sample
GC – grab composite sample

the dechlorination basin. Raymond tests for December 16, 1992, indicated a chlorine residual of 0.04 mg/L in the final effluent and 0.06 mg/L in the chlorine contact basin. All chlorine concentrations measured were less than the permit limit of 0.06 mg/L maximum monthly average. The monthly average of 0.36 lb/day (0.034 mg/L at 1.27 MGD) was slightly exceeded during the wet weather inspection, but the daily maximum of 0.90 lb/day was not approached.

Adequate chlorine should be added to maintain fecal coliform counts below permitted limits. The narrow margin to which fecal coliform counts can be maintained while not exceeding chlorine concentration, and the limited effectiveness of the existing dechlorination basin limits support the need for the installation of dechlorination equipment, as specified in the permit.

Split Sample Results

Dry Weather Inspection

For influent TSS and BOD_5, there was a considerable but inconsistent variability both in sampling and analyses of dry weather Ecology and Raymond samples (Table 12). Less variability was found in effluent samples than in influent samples, indicating that the source of variability may have been the uneven distribution of large particles in the influent.

Ecology and Raymond sampling and analyses all resulted in similar results for effluent TSS, NH_3/NH_4, and total P: within 5 mg/L for TSS, within 0.5 mg/L for NH_3/NH_4, and within 1.2 mg/L for total P. BOD_5 analyses for effluent were more variable. Samples collected by Ecology and Raymond were in close agreement for $NO_2 + NO_3$ (within 17%). However $NO_2 + NO_3$ analyses by Ecology and Raymond varied considerably, with Raymond reporting results consistently more than double the Ecology results.

Wet Weather Inspection

During the wet weather inspection, Ecology and Raymond analyses of all influent BOD_5 and TSS samples resulted in differences of up to 32%. This was likely due to the presence of large particles of solids in the influent (Table 12).

Results from influent samples collected by Raymond resulted in TSS and BOD_5 concentrations consistently from 50% to 100% higher than results from Ecology samples. The difference is likely the result of differences in intake location, accounting for different concentrations of solid collected.

During both inspections, Raymond BOD_5 analyses for eight of eight samples were significantly greater than Ecology analyses of the same samples at the 95% confidence level. It is recommended that Raymond evaluate its BOD_5 test procedures.

Table 12 – Split Sample Results Comparison – City of Raymond, 1992.

Dry Weather – September 1992

	Location:	InfR–E	InfR–R	EffR–E	EffR–R
	Type:	comp	comp	comp	comp
	Date:	9/29–30	9/29–30	9/29–30	9/29–30
	Time:	0900–0900	0900–0900	0900–0900	0900–0900
	Lab Log #:	408262	408263	408266	408267
	Sampled by:	Ecology	Raymond	Ecology	Raymond
Parameter	Analysis by:				
TSS (mg/L)					
	Ecology	820	1420	33	36
	Raymond	1571	397	33	31
BOD5 (mg/L)					
	Ecology	280	147	17	15
	Raymond	465	300	26	23
NH3–N (mg/L)	Ecology	58.0	47.6	5.51	5.39
NH4–N (mg/L)	Raymond	68.1 (87.5)*	30.3 (39)*	5.83 (7.5)*	5.83 (7.5)*
NO2 + NO3–N (mg/L)	Ecology	0.043		29.5	32.0
NO2–N (mg/L)	Raymond	0.24 (0.8)*	0.07 (0.24)*	69 (228)*	57 (187)*
NO3–N (mg/L)	Raymond	0	0	18 (80)*	19 (85)*
Total-P (mg/L)					
	Ecology	28.2		10.2	9.06
	Raymond	85	62	10	9

Wet Weather – December 1992

	Location:	InfR–E	InfR–R	EffR–E	EffR–R
	Type:	comp	comp	comp	comp
	Date:	12/15–16	12/15–16	12/15–16	12/15–16
	Time:	0820–0820	0800–0800	0800–0800	0800–0800
	Lab Log #:	518240	518241	518244	518246
	Sampled by:	Ecology	Raymond	Ecology	Raymond
Parameter	Analysis by:				
TSS (mg/L)					
	Ecology	155	340	3	12
	Raymond	157	401	8	13
BOD5 (mg/L)					
	Ecology	148	254	50	45
	Raymond	195	298	72	76

InfR–E – Ecology sample of Raymond influent
InfR–R – Raymond sample of Raymond influent
EffR–E – Raymond sample of Raymond effluent
EffR–R – Raymond sample of Raymond effluent

comp – composite sample

* Numbers in parenthesis are the values reported by the City of Raymond in terms of compound molecular weight.

Laboratory Accreditation

The City of Raymond WTP laboratory is not accredited. Accreditation will be required by the Department of Ecology, or an accredited lab must be used for permit limited parameters by July 1, 1994. Accreditation is dependent on results of a laboratory audit conducted by Ecology. In light of discrepancies revealed through split sample analyses, it is recommended that accreditation efforts be accelerated.

WTP Operation, Loading, and Capacity

The WTP was performing well during dry weather conditions although influent TSS (2,544 lb/day) exceeded the TSS design capacity of 1,780 lb/day (Table 10). All aerated lagoons were in operation but the third stage lagoons were not being aerated.

During the wet weather inspection the plant exceeded permitted weekly effluent concentration limits for BOD_5 slightly. On a weight basis, however, effluent BOD_5 (530 lb/day) exceeded the permitted monthly average (180 lb/day) by 194% and the permitted weekly average (270 lb/day) by 96%.

Ecology samples indicate that during the wet weather inspection the plant was within design loading criteria. Ecology influent samples for TSS (155 mg/L) and BOD_5 (148 mg/L) correspond to a WTP loading of 1,642 lb/day TSS and 1,568 lb/day BOD_5 at a flow rate of 1.27 MGD. WTP design loadings are 1,780 lb/day for both TSS and BOD_5 at a maximum flow rate of 1.50 MGD. Design performance was for 87% BOD_5 reduction across the aerated lagoons based on influent loading of 1780 lb/day BOD_5 (Gray and Osborne, 1990). Therefore, it appears that the WTP was operating within its design limits but was not meeting its design performance.

Samples collected by Raymond samplers resulted in higher TSS and BOD_5 concentrations than did Ecology's. Influent TSS of 340 mg/L and BOD_5 of 254 mg/L corresponded to a WTP loading of 3,601 lb/day and 2,690 lb/day, which would indicate that the WTP was operating considerably above design loading. The Ecology influent sampler intake was located so that it was in still water when influent was not being pumped to the WTP. However, the sampler was set up with flow-proportioned actuation so that samples would be taken only when there was flow on influent. The Raymond influent sampler may have been located too close to the channel bottom, where solids settle. This could explain Raymond's high influent concentrations.

Several factors support the assessment that the Raymond wet weather inspection influent sample was not representative. Medium concentration untreated domestic wastewater is typically 220 mg/L (Metcalf and Eddy, 1991). With the large amounts of I & I, Raymond influent would be expected to be lower. Raymond self reporting data for 1991 and 1992 consistently show BOD_5 concentrations below 200 mg/L, often below 100 mg/L for similar

WTP flows. Also, the Raymond wet weather influent sample BOD_5 is higher than the Raymond dry weather influent sample, contrary to what would be expected.

While the Port PTF can contribute as much as one fifth of the Raymond WTP influent flow during dry weather, wet weather impacts of the PTF on Raymond WTP influent is not as large. A mass balance shows that for a WTP influent BOD_5 concentration of 254 mg/L at 1.27 MGD, with the Port PTF effluent at 66,290 gpd and 900 mg/L BOD_5, the PTF's contribution of BOD_5 to the Raymond WTP influent would be 36 mg/L. This leaves the concentration of the Raymond WTP influent, other than the portion contributed by the Port PTF, as 218 mg/L, higher than can be reasonably accounted for by the City's contribution of domestic waste diluted by I & I. By contrast, a mass balance on the Ecology sample, with a BOD_5 of 148, results in a contribution to the Raymond influent by the PTF of 41 mg/L BOD_5, with the remaining portion of influent contributing 107 mg/L BOD_5, a more expected result during wet weather when I & I is high.

In summary, it appears that while loading was below design loading during the wet weather inspection, the Raymond WTP did not perform according to design. For these calculations influent conditions during the inspection were assumed to be representative although the aerated lagoons had a longer than one day hydraulic detention time (approximately nine days) during the wet weather inspection. Because the loadings determined by Ecology were close to the design loading of the WTP, within 12%, it is possible that the WTP received higher than design loading. In either case, measures should be continued to reduce I &I, as required by permit, and to improve plant performance so that permit limitations can be met.

There are indications of possible problems in plant design and operation. WTP design was based on a completely mixed initial cell followed by partially mixed cells (Gray and Osborne, 1990). Observations of plant operation indicate that the "Biolac" surface aeration system does not provide completely suspended conditions as were intended. The WTP operator reports solids settling throughout the cells except for the fraction of the lagoon area directly beneath the air diffusers (Hebish, 1992). The assumption of a completely mixed initial cell may not be realistic.

Hydraulic detention time through the six aerated lagoons was approximately 31 days during the dry weather inspection and nine days during the wet weather inspection. Nine days is a relatively short detention time so that mixing and aeration should be evaluated to provide for adequate treatment with design loading conditions.

Priority Pollutant Scans

Dry Weather Inspection

A number of organic priority pollutants were detected in the Raymond WTP samples collected (Table 13). With the exception of acetone and benzoic acid, the ten priority pollutant organics collected in influent samples during the dry weather inspection found at

Table 13 – Comparison of Detected Compounds and Metals to Toxicity Criteria – City of Raymond, September 1992.

	Location:	InfR-1	InfR-2	EffR-1	EffR-2	EPA Water Quality Criteria Summary**			
	Type:	grab	grab	grab	grab				
	Date:	9/29	9/29	9/29	9/29				
	Time:	1000	1540	1045	1600				
	Lab Log#:	408260	408261	408264	408265	Acute Fresh	Chronic Fresh	Acute Marine	Chronic Marine
(Group)[1]	VOA Compounds	ug/L	ug/L	ug/L	ug/L	(ug/L)	(ug/L)	(ug/L)	(ug/L)
a	Methylene Chloride	2.0 U	2.0 U	5.2	2.0 U	11,000 *(a)		12,000 *(a)	6,400 *(a)
	Acetone	49	17	11	7.7				
a	Chloroform	5.2	8.6	0.9 J	0.9 J	28,900 *	1,240 *	12,000 *(a)	6,400 *(a)
	2-Butanone (MEK)	8.5	5.0 U	5.0 U	5.0 U				
	Benzene	1.8	0.9 J	1.0 U	1.0 U	5,300 *		5,100 *	700 *
	Toluene	6.0	3.5	1.0 U	1.0 U	17,500 *		6,300 *	5,000 *
	Total Xylenes	3.3	1.3 J	2.0 U	2.0 U				

	Location:	InfR-E	EffR-E				
	Type:	comp	comp				
	Date:	9/29-30	9/29-30				
	Time:	900-900	0900-0900				
	Lab Log#:	408262	408266				
	BNA Compounds	ug/L	ug/L	(ug/L)	(ug/L)	(ug/L)	(ug/L)
	Phenol	4.6	2 U	10,200 *	2,560 *	5,800 *	
	Benzyl Alcohol	5.1	5 U				
	4-Methylphenol	21	1 U				
	Benzoic Acid	110 J	10 UJ				

Pesticide/PCB Compounds
none detected in City of Raymond influent or effluent

Metals	Hardness = 640					
Arsenic	2.6 PN	1.6 PN				
Pentavalent			850 *	48 *	2,319 *	13 *
Trivalent			360	190	69	36
Chromium	3230	5.0 U				
Hexavalent			16	11	1,100	50
Trivalent			7,942 +	947 +	10,300 *	
Copper	158	7.2 P	102 +	58 +	2.9	
Lead	36.2	5.5	867 +	33.8 +	140	5.6
Mercury	0.18 PN	0.050 UN	2.4	0.012	2.1	0.025
Silver	0.77 P	0.50 U	98.9 +	0.12	2.3	
Zinc	269	21	564 +	511 +	95	86

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.
N – The spike sample recovery is not within control limits.
P – The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

[1]NOTE: SOME INDIVIDUAL COMPOUND CRITERIA OR LOELS MAY NOT AGREE WITH GROUP CRITERIA OR LOELS. REFER TO APPROPRIATE EPA DOCUMENT ON AMBIENT WATER QUALITY CRITERIA FOR FULL DISCUSSION.

[ ] – analyte detected

* – insufficient data to develop criteria. Value shown is the LOEL – Lowest Observed Effect Level
+ – Hardness dependent criteria (640 used).
a – Total Halomethanes
** – EPA, 1986.
Inf – influent sample
Eff – effluent sample

low concentrations (less than 21 μg/L). Benzoic acid was found in the influent at concentrations of 110 μg/L (est.).

Three priority pollutant organics were found in the Raymond effluent. Methylene chloride and acetone are used for laboratory cleaning of sampling apparatus and are not likely representative of the effluent. Chloroform (0.9 μg/L est.) was found in concentrations three orders of magnitude below EPA water quality criteria.

No pesticide/PCB compounds were detected in the Raymond effluent during the dry weather inspection.

Seven priority pollutant metals were detected in the Raymond influent during the dry weather inspection. Of these, four were detected in the Port PTF effluent, but generally at lower concentrations than in the Raymond influent. Chromium (3,230 μg/L) was found in high concentrations in the Raymond influent, and in considerably lower concentrations in the Port PTF influent and effluent. Chromium was found in the Port PTF sludge at a high concentration (4,480 mg/kg-dw) during the dry-weather inspection.

Four priority pollutant metals were detected in the Raymond effluent. All were below EPA water quality criteria with the exception of copper (7.2 μg/L est.) which exceeded EPA acute marine criteria (2.9 μg/L).

Complete priority pollutant scan results for the Raymond WTP, dry weather inspection, with detection limits, are included in Appendix K.

The TICs in the Raymond WTP influent are mostly those in the Port PTF effluent. Thiobismethane and methanethiol were tentatively identified in concentrations of less than 10 μg/L. Alkyl benzene isomer was also found (6 μg/L est.). Hexanoic acid, carboxylic acid, benzenepropanoic acid, hexadecanoic acid, and octadecanoic acid, and sterol isomer were found at concentrations of up to 830 μg/L (est.). Unknowns were also found at concentrations up to 2100 μg/L (est.). TICs in the effluent included siloxan isomer, known and unknown alcohols, hexadeconoic acid, and sterol isomer, all at concentrations of less than 45 μg/L. TICs are summarized in Appendix F.

Wet Weather Inspection

With the exception of acetone, no organic priority pollutants were detected in the samples from the Raymond WTP collected during the wet weather inspection (Table 7, p. 26).

Two pesticide/PCB compounds were detected in the Raymond effluent during the wet weather inspection. Alpha-BHC (0.006 μg/L est.) and gamma-BHC (0.006 μg/L) were both detected at concentrations well below EPA water quality criteria. Alpha-BHC was also found in the Port PTF effluent (0.037 μg/L est.) at approximately six times the Raymond effluent concentration.

Five priority pollutant metals were detected in the Raymond effluent during the wet weather inspection. Arsenic, cadmium, and zinc were found in concentrations below EPA water quality criteria. Copper (7.7 μg/L est.) was above acute marine water quality criteria (2.9 μg/L). Lead (8.6 μg/L est.) was above chronic marine water quality criteria (5.6 μg/L). Of these metals, all were detected in the Port PTF wet weather effluent. Arsenic, cadmium and copper were found in the PTF effluent in concentrations of over ten times the Raymond WTP effluent, while zinc was found at five times and lead at six times the concentration found in the Raymond effluent.

Complete priority pollutant scan results for the Raymond WTP, wet weather inspection, with detection limits, are included in Appendix L.

The TICs found in the Raymond WTP effluent during the wet weather inspection were benzo(g)pteridine-2,4(1H,3H) and a number of unknown hydrocarbons and unknowns, all at estimated concentrations below 10 μg/L. TICs are summarized in Appendix H.

Bioassays

Dry Weather Inspection

Bioassay organism sensitivity to dry weather Raymond effluent was variable (Table 14). The effluent showed no toxicity to Microtox or rainbow Trout. Fathead minnow larvae showed no acute toxicity. There was impairment of growth, with a no observable effect concentration (NOEC) of 50% effluent. *Ceriodaphnia dubia* showed both acute and chronic toxicity with 0% survival at 100% effluent and an NOEC of 6.25% effluent.

Chlorine residual may have been responsible for the toxic effects observed. The effluent for bioassay testing was not dechlorinated. Chlorine residual was found to be 0.02 mg/L when the effluent arrived in the laboratory. It is uncertain whether this concentration would have been maintained until the test organisms were exposed. Sample preparation for testing (dilutions, warming, equilibration) combined with the components of the sample which may react with chlorine could tend to reduce residual chlorine. A concentration of 0.02 mg/L is known to have negative effects on biota (Stinson, 1992).

Wet Weather Inspection

There was little toxicity shown in the wet weather bioassays (Table 15). The effluent showed no toxicity to Microtox, no acute or chronic toxicity to *Ceriodaphnia dubia*, no toxicity to rainbow trout, and no acute toxicity to fathead minnow larvae. There was some chronic toxicity to fathead minnow larvae, with an NOEC of 50%. The effluent was dechlorinated for the wet weather bioassay tests.

Table 14 – Effluent Bioassay Results, Dry Weather – City of Raymond, September 1992.

Microtox — EC50 (% Effluent)

Sample	Sample No.	5 minutes	15 minutes
Control		a	a
EffR-GC	408268	a	a

a – Statistical analysis resulted in a large number of negative gammas. Negative gammas are interpreted as a lack of toxicity.

Ceriodaphnia dubia – survival/reproduction test
(Ceriodaphnia dubia)
Sample N 408268

Sample Conc.	# Tested	# Young Produced	Percent Survival
Control	10	171	90
6.25 %	10	168	100
12.5 %	10	121	80
25 %	10	117	80
50 %	10	32	90
100 %	10	0	0

NOEC for Reproduction = 6.25% Effluent
NOEC for Survival = 50% Effluent
LC50 = 51.6% effluent

Fathead Minnow larval – survival and growth test
(Pimephales promelas)
Sample No. 408268

Sample Conc.	# Tested*	Percent Survival	Average Dry Weight (mg)
Control	30	90.0	0.32
6.25 % Effluent	30	96.7	0.40
12.5 % Effluent	30	93.3	0.36
25 % Effluent	30	96.7	0.33
50 % Effluent	30	100.0	0.31
100 % Effluent	30	63.3	0.33

NOEC for Weight = 100%
NOEC for Survival = 100 % effluent
LC50 > 100 % effluent

* five replicates per concentration, seven organisms per replicate

Rainbow Trout – 96 hour survival test
(Oncorhynchus mykiss)
Sample No. 408268

Sample Conc.	Number Tested*	Percent Survival
Control	30	100
100 % Effluent	30	100

NOEC for Survival = 100 % effluent
LC50 > 100 % effluent

* three replicates per concentration, ten organisms per replicate

Table 15 – Effluent Bioassay Results, Wet Weather – City of Raymond, December 1992

Microtox — EC50 (% Effluent)

Sample	Sample No.	5 minutes	15 minutes
Control		a	a
EffR-GC	518247	a	a

a - Statistical analysis resulted in a large number of negative gammas. Negative gammas are interpreted as a lack of toxicity.

Ceriodaphnia dubia - survival/reproduction test
(Ceriodaphnia dubia)
Sample No. 518247

Sample Conc.	# Tested	# Young Produced	Percent Survival
Control	10	2.7	90
6.25 %	10	26.0	100
12.5 %	10	25.3	90
25 %	10	24.5	100
50 %	10	27.9	100
100 %	10	23.7	100

NOEC for Reproduction = 100 % Effluent
NOEC for Survival = 100 % Effluent
LC50 > 100 %

Fathead Minnow larval - survival and growth test
(Pimephales promelas)
Sample No. 518247

Sample Conc.	# Tested*	Percent Survival	Mean Individual Biomass (mg)
Control	35	97.1	0.64
6.25 % Effluent	35	97.1	0.66
12.5 % Effluent	35	100.0	0.66
25 % Effluent	35	100.0	0.63
50 % Effluent	35	97.1	0.58
100 % Effluent	35	91.4	0.50

NOEC for Biomass = 50 %
NOEC for Survival = 100 % effluent
LC50 > 100 % effluent

* five replicates per concentration, seven organisms per replicate

Rainbow Trout - 96 hour survival test
(Oncorhynchus mykiss)
Sample No. 518247

Sample Conc.	Number Tested*	Percent Survival
Control	30	100
100 % Effluent	30	100

NOEC for Survival = 100 % effluent
LC50 > 100 % effluent

* three replicates per concentration, ten organisms per replicate

Sludge

Sludge was not sampled, as no sludge has been disposed since the lagoons were constructed. Sludge accumulation and sludge quality monitoring requirements are included in the permit.

RECOMMENDATIONS AND CONCLUSIONS

Port of Willapa Harbor Pretreatment Facility

Flow

The PTF in line meter did not lend itself to verification by Ecology. A flow comparison with Protan by Port personnel for the month of March 1993 indicated agreement within 4%.

State Waste Discharge Permit Application/PTF Operation

The PTF effluent exceeded both the permit application BOD_5 concentration and state waste discharge permit limits during both inspections. Dry weather inspection TSS and wet weather inspection BOD_5 exceeded limits by several times.

During the wet weather inspection, PTF discharge flow was 66,290 gpd, 23% above the 54,000 gpd daily average of the permit application while effluent BOD_5 was three times the concentration of the permit application.

- Contributors to the PTF should be required to limit their flow so that the PTF can operate within all permit limits or the PTF expanded and limits appropriately adjusted.

With a high BOD_5 influent such as that during the wet weather inspection, it is uncertain whether the treatment efficiency required to attain permit limits can be reached. Proper plant operation, with operators on duty during peak periods, attention to biological treatment processes, leveling of influent flows, and adherence to design hydraulic detention time all would contribute to treatment efficiency.

- If high strength influent at the permitted discharge rate continues to cause the PTF to exceed permit limits, influent loadings should be decreased so that permit limits will be met.

Because the plant relies on the addition of polymers for solids removal, there has been a tendency to overlook the efficiency of biological removal processes in the PTF.

- Methods of improving the effectiveness of the PTF's biological processes through plant operations should be explored and instituted.

- Influent loading to the PTF should be managed, with coordination between Port personnel and contributors to the PTF waste stream.

During nighttime hours, the plant is left unattended while fluctuating influent loading continues. It has been reported that large slugs of influent from Protan occur at night and that the PTF operates less efficiently at night when it is left unattended. The high TSS concentration in the dry weather inspection composite sample and BOD_5 concentration higher than the effluent limit, indicate that the nighttime decant during the dry weather inspection consisted of a slug of poorly treated wastewater.

- The PTF should be staffed adequately so as to respond to varying influent loadings in order to remain in compliance with its state waste discharge permit.

Effluent NH_3-N concentrations were high and NO_2 + NO_3 - N concentrations were low during both inspections, indicating that nitrification was not taking place.

- NH_3-N removal mechanisms should be considered and measures should be taken to meet NH_3-N effluent limits.

Large variations in influent flow and strength throughout the day contribute to difficulties in operation of the PTF.

PTF loading has at times been intermittent because of interruptions in raw materials supplies to Protan. There have been with little or no organic loading to the PTF. It is reported that loading will be nearly continuous in the future.

- A viable culture of microorganisms should be maintained during low load periods in order to provide biological treatment when loading occurs.

<u>Split Samples</u>

The Port effluent TSS concentration (150 mg/L) was almost twice the Ecology analysis (84 mg/L).

- Attention should be paid to TSS testing during the Port's laboratory performance evaluation.

Protan's analysis of BOD_5 consistently yielded lower results than did Ecology's analyses.

- It is recommended that Protan review its sampling, preservation, and shipping procedures, as well as any other possible causes of low laboratory results.

Protan does not ordinarily control temperature on effluent samples.

- To preserve samples, it is recommended that Protan ice all samples as they are being composited and shipped.

Laboratory Procedures

- Laboratory record keeping should be improved. Care is needed in assuring the operating condition of laboratory instruments and in delineating units of analysis.

Priority Pollutant Scans

Dry Weather Inspection

All VOA and BNA compounds found were in low concentrations. No pesticide/PCB compounds were found during the dry weather inspection.

Four metals were detected in the PTF effluent. Chromium was found in concentrations lower than criteria for the trivalent form but higher than criteria for the hexavalent form. Copper was found in concentrations lower than acute fresh water criteria but higher than chronic fresh and acute marine criteria.

Wet Weather Inspection

Priority pollutant organics scans yielded similar results for the PTF during the wet weather inspection as compared with the dry weather inspection. All priority pollutants found were in low concentrations.

Four pesticide/PCB compounds were found in the effluent during the wet weather inspection. 4,4'-DDE and endrin were found in concentrations higher than EPA chronic freshwater and chronic marine criteria.

More priority pollutant metals were found during the wet weather inspection, and in higher concentrations than during the dry weather inspection. Arsenic, cadmium, copper, mercury, silver, and zinc were above at least some of the EPA water quality criteria. Lead and selenium were found in concentrations below all criteria. No chromium was found in the PTF wet weather sample, suggesting that the source of chromium was Oh Yang. Oh Yang was not operating in December and has since shut down and vacated the site.

Sludge

Priority pollutant scans of sludge samples were performed for the dry weather inspection only.

Eight priority pollutant organic compounds were detected. Bis(2-ethylhexyl)phthalate (2700 μg/Kg) was found in the sludge in the highest concentration. It was not found in the

PTF effluent. Methylene chloride and acetone, which are used for sampling apparatus cleaning and in the laboratory, often causing low level contamination, were also found. The single pesticide found in the sludge was 4,4'-DDE (16 μg/Kg).

Ten priority pollutant metals were detected in the sludge sample. Chromium was found in the highest concentration (4480 mg/Kg-dw), 49% higher than the ceiling concentration from the EPA Standards for the Use or Disposal of Sewage Sludge.

- The sludge should be monitored for chromium.

City of Raymond Wastewater Treatment Plant

Flow Measurements

The effluent Parshall flume was inspected and flume configuration was verified to be acceptable. An Ecology instantaneous measurement agreed with the plant flow meter within 3%.

NPDES Permit Compliance/General Chemistry

Dry Weather Inspection

The WTP was performing well during the dry weather inspection. The effluent was well within NPDES permit limits for BOD_5, TSS and pH.

The dry weather inspection high influent TSS (820 mg/L) is likely the result of contributions from the Port PTF. The 24-hour composite PTF effluent sample during the dry weather inspection found 1640 mg/L TSS.

The WTP was achieving substantial nitrification of the relatively high levels of ammonia in the influent. Total-P decreased from approximately 28 mg/L in the influent to approximately 10 mg/L in the effluent.

Wet Weather Inspection

The Raymond effluent flow meter measured 1.27 MGD, as compared with 0.37 MGD during the dry weather inspection. An increase in I & I in the Raymond sewer system is responsible for the increased flow.

The WTP was not providing effective removal of organics during the wet weather inspection. During wet weather, only 30% of BOD_5 was removed as compared with 94% removal during the dry weather inspection and 85% removal required by permit. Consistent influent loading during the nine day or longer detention time of the aerated lagoons is assumed in calculating % removal. The wet weather effluent BOD_5 exceeded monthly (by 20 mg/L) and

weekly (by 5 mg/L) limits. The effluent BOD_5 was approximately double the 270 lbs/day permitted weekly average.

TSS removal efficiencies were 96% or higher during both inspections. TSS concentrations in the effluent were low during the wet weather inspection.

The WTP was not achieving nitrification during the wet weather inspection. Alkalinity in the effluent was not limiting to nitrification. Total-P decreased from approximately 6.6 mg/L in the influent to approximately 3.0 mg/L in the effluent.

Fecal Coliform Counts/Chlorination

Fecal coliform counts were generally high (1100/100mL; 390/100mL; 280/100mL; 260/100mL). Chlorine residuals in the effluent were low (<0.01 mg/L and 0.04 mg/L). The narrow margin between adequate chlorine dosage to kill pathogens as indicated by fecal coliform count and the dosage to maintain a chlorine residual below the permit limit supports the need for improved dechlorination.

- Adequate chlorine should be added to maintain a chlorine residual from the chlorine tank and to maintain fecal coliform counts below permitted limits.

- Dechlorination equipment should be installed as specified in the permit.

Split Sample Results

There was large variability both in sampling and analyses for dry weather influent TSS and BOD_5 collected and analyzed by Ecology and Raymond samples. One source of variability may have been the uneven distribution of large particles in the influent.

Ecology and Raymond sampling and analyses all resulted in similar results for effluent TSS, NH_3/NH_4-N, and Total P. $NO_2 + NO_3$ - N analyses differed considerably.

During the wet weather inspection, Ecology and Raymond analyses of all influent BOD_5 and TSS samples resulted in differences of up to 32%.

Results from wet weather influent samples collected by Raymond resulted in TSS and BOD_5 concentrations consistently from 50% to 100% higher than results from Ecology samples. The difference is likely the result of differences in intake location.

During both inspections, Raymond BOD_5 analyses for eight of eight samples were significantly greater than Ecology analyses of the same samples at the 95% confidence level.

- It is recommended that Raymond evaluate its BOD_5 test procedures.

- In light of the discrepancies revealed through split sample analyses, it is recommended that laboratory accreditation efforts be accelerated.

WTP Operation, Loading, and Capacity

The WTP was performing well during dry weather conditions, with effluent meeting all permit limits.

During the wet weather inspection, the plant exceeded monthly and weekly limits for effluent BOD_5 concentration. On an effluent loading basis, effluent BOD_5 (530 lb/day) exceeded the permitted monthly average by 194% and the permitted weekly average by 96%.

Ecology samples indicate that during the wet weather inspection the plant was slightly below design loading criteria for TSS, BOD_5, and flow but was performing inadequately. Raymond samples resulted in higher TSS and BOD_5 concentrations than did Ecology's, which would indicate that the plant was receiving higher than design loads of TSS and BOD_5. There are indications that the Ecology sample is more representative than the Raymond sample. Based on the Ecology influent composite sample, it appears that the Raymond WTP was below design loading during the wet weather inspection.

Wet weather impacts of the PTF on Raymond WTP influent concentrations were calculated. A mass balance shows that for the conditions of the wet weather inspection, the contribution of the PTF to the Raymond WTP influent was 28% of the total BOD_5 load, or 41 mg/L.

- Measures should be continued to reduce I & I so that permit limitations can be met.

- Measures should be taken to reduce PTF effluent BOD_5 loadings to those within permit limits.

There are indications of possible problems in plant design and operation. WTP design was based on a completely mixed initial cell followed by partially mixed cells (Gray and Osborne, 1990). If poor wet weather performance continues, the WTP may need to be modified. Observations of plant operation indicate that the "Biolac" surface aeration system does not provide completely suspended conditions as it was intended.

Hydraulic detention time through the six aerated lagoons was approximately 31 days during the dry weather inspection and nine days during the wet weather inspection. Nine days is a relatively short detention time.

- Mixing and aeration should be evaluated, as well as verification of plant capacity as required by the permit.

Priority Pollutant Scans

Dry Weather Inspection

A number of organic priority pollutants were detected in the Raymond WTP samples collected. Other than benzoic acid (110 μg/L est.), the ten priority pollutant organics collected in influent samples during the dry weather inspection were found at low concentrations. Acetone was also found, but is used for sampling apparatus cleaning and in the laboratory, often causing low level contamination.

Of organic priority pollutants detected in the effluent, only chloroform was unequivocally not an artifact of sampling or laboratory contamination. It was present at a concentration three orders of magnitude below EPA water quality criteria (0.9 μg/L est.). No pesticide/PCB compounds were detected in the Raymond effluent during the dry weather inspection.

Seven priority pollutant metals were detected in the Raymond influent during the dry weather inspection. Of these, four were detected in the Port PTF effluent, but generally at lower concentrations than in the Raymond influent.

Four priority pollutant metals were detected in the Raymond effluent. All were below EPA water quality criteria with the exception of copper (7.2 μg/L est.) exceeded EPA acute marine criteria (2.9 μg/L).

Wet Weather Inspection

With the exception of acetone, no organic priority pollutants were detected in the samples from the Raymond WTP collected during the wet weather inspection.

Two pesticides were detected in the Raymond effluent during the wet weather inspection, alpha-BHC and gamma-BHC, both at concentrations well below EPA water quality criteria.

Five priority pollutant metals were detected in the Raymond effluent during the wet weather inspection. Arsenic, cadmium, and zinc were found in concentrations below EPA water quality criteria. Copper (7.7 μg/L est.) was above acute marine water quality criteria (2.9 μg/L). Lead (8.6 μg/L est.) was above chronic marine water quality criteria (5.6 μg/L). Of these metals, all were detected in the Port PTF wet weather effluent.

<u>Bioassays</u>

Dry Weather Inspection

Bioassay organism sensitivity to dry weather Raymond effluent was variable (Table 14). The effluent showed no toxicity to Microtox or rainbow trout. Fathead minnow larvae showed no acute toxicity. There was impairment of growth, with a no observable effect concentration (NOEC) of 50% effluent. *Ceriodaphnia dubia* showed both acute and chronic toxicity with 0% survival at 100% effluent and an NOEC of 6.25% effluent.

Chlorine residual may have contributed to the toxic effects observed. The effluent for bioassay testing was not dechlorinated. Chlorine residual was found to be 0.02 mg/L when the effluent arrived in the laboratory.

Wet Weather Inspection

There was little toxicity shown in the wet weather bioassays (Table 15). The effluent showed no toxicity to Microtox, no acute or chronic toxicity to *Ceriodaphnia dubia*, no toxicity to rainbow trout, and no acute toxicity to fathead minnow larvae. There was some chronic toxicity in fathead minnow larvae, with an NOEC of 50%. The effluent was dechlorinated for the wet weather bioassay tests.

Sludge

Sludge was not sampled as no sludge has been disposed since the lagoons were constructed. Chromium found in the WTP influent and the high concentrations of chromium found in the Port PTF sludge suggest the possibility of high chromium concentrations in the Raymond WTP sludge.

- Sludge accumulation and sludge quality monitoring requirements specified in the permit should be followed. Particular attention should be paid to chromium results.

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APPENDICES

Appendix A – Sampling Schedule – Port of Willapa Harbor, September 1992.

Parameter	Location:	InfW-1	InfW-2	InfW-PE	InfW-O1	InfW-O2	InfW-PP
	Type:	grab	grab	grab	grab	grab	comp
	Date:	9/29	9/30	9/29	9/29	9/30	9/29-9/30
	Time:	1500	1210	1335	1405	1150	1530-0850
	Lab Log #:	408230	408231	408233	408235	408236	408237
GENERAL CHEMISTRY							
Conductivity		E	E	E	E	E	E
pH							
Alkalinity		E	E	E	E	E	E
Hardness		E	E	E	E	E	E
TS				E	E	E	E
TNVS				E	E	E	E
TSS		E	E	E	E	E	EP
TNVSS				E	E	E	E
% Solids							
% Volatile Solids							
BOD5							EP
COD		E	E	E	E	E	E
TOC (water)		E	E	E	E	E	E
TOC (soil)							
NH3-N							
NO2+NO3-N							
Total-P							
Oil and Grease		E	E	E	E	E	
FIELD OBSERVATIONS							
Temp		E	E	E	E	E	E
pH		E	E	E	E	E	E
Conductivity				E	E		
D.O							
Chlorine							

InfW – Ecology sample of Port influent
InfW-O – Ecology sample of Oh Yang effluent
InfW-PE – Ecology sample of Protan effluent
grab – grab sample
comp – composite sample
PP – Protan sample
PE – Ecology sample of Protan effluent

E – Ecology analysis
W – Port analysis
P – Protan analysis

Appendix A – (cont'd) – Port of Willapa Harbor, September 1992.

Parameter II	Locatn:	AerW-1	AerW-2	EffW-1	EffW-2	EffW-E	EffW-W	EffW-G	EffW-GD	Sludge
	Type:	grab	grab	grab	grab	E-comp	W-comp	grab	grab	grab
	Date:	9/30	9/30	9/29	9/30	9/29-9/30	9/29-9/30	9/30	9/30	9/30
	Time:	0715	1350	7A	1240	1300-1300	1100-1300	1235	1235	0700
	Lab Log #:	408238	408239	408240	408241	408242	408243	408245	408246	408244
GENERAL CHEMISTRY										
Conductivity				E	E	E	E	E		
pH										E
Alkalinity				E	E	E	E	E		
Hardness				E	E	E	E	E		
TS		E	E			E	E	E	E	
TNVS		E	E			E	E	E	E	
TSS				E	E	EW	EW	E	E	
TNVSS						E	E	E	E	
% Solids										E
% Volatile Solids										E
BOD5						E		E		
COD				E	E	EW	EW	E		
TOC (water)				E	E	E	E	E	E	
TOC (soil)										E
NH3-N						E	E	E	E	
NO2+NO3-N						E	E	E	E	
Total-P						E	E	E	E	
Oil and Grease				E	E					
FIELD OBSERVATIONS										
Temp		E			E	E	E			
pH		E			E	E	E			
Conductivity										
D.O										
Chlorine										

InfW-P- Protan effluent composite sample
AerW - Ecology aeration basin sample
EffW-1,2,E - Ecology sample of Port effluent
EffW-W - Port sample of Port effluent
GC - grab composite sample
GCD - duplicate grab composite sample
Sludge - sludge from the Port belt filter press

E - Ecology analysis
W - Port of Willapa Harbor analysis
P - Protan analysis

Appendix B – Ecology Analytical Methods – Port of Willapa/Raymond, 1992.

Laboratory Analysis	Method used for Ecology Analysis	Laboratory Performing Analysis: September Inspection	Laboratory Performing Analysis: December Inspection
Conductivity	EPA, Revised 1983: 120.1	Ecology Machester Laboratory	Ecology Manchester Laboratory
pH	EPA, Revised 1983: 150.1	Ecology Machester Laboratory	Ecology Manchester Laboratory
Alkalinity	EPA, Revised 1983: 310.1	Ecology Machester Laboratory	Ecology Manchester Laboratory
Hardness	EPA, Revised 1983: 130.2	Ecology Machester Laboratory	Ecology Manchester Laboratory
TS	EPA, Revised 1983: 160.3	Ecology Machester Laboratory	Ecology Manchester Laboratory
TNVS	EPA, Revised 1983: 106.3	Ecology Machester Laboratory	Ecology Manchester Laboratory
TSS	EPA, Revised 1983: 160.2	Ecology Machester Laboratory	Ecology Manchester Laboratory
TNVSS	EPA, Revised 1983: 106.2	Ecology Machester Laboratory	Ecology Manchester Laboratory
% Solids	APHA, 1989: 2540G.	Water Management Laboratories	Laucks Testing Laboratories
% Volatile Solids	EPA, Revised 1983: 160.4	Water Management Laboratories	Laucks Testing Laboratories
BOD5	EPA, Revised 1983: 405.1	Water Management Laboratories	Ecology Manchester Laboratory
COD	EPA, Revised 1983: 410.1	Water Management Laboratories	Laucks Testing Laboratories
TOC (water)	EPA, Revised 1983: 415.1	Water Management Laboratories	Ecology Manchester Laboratory
TOC (soil/sed)	EPA, Revised 1983: 415.1	Water Management Laboratories	Laucks Testing Laboratories
NH3-N	EPA, Revised 1983: 350.1	Ecology Machester Laboratory	Laucks Testing Laboratories
NO2+NO3-N	EPA, Revised 1983: 353.2	Ecology Machester Laboratory	Laucks Testing Laboratories
Total-P	EPA, Revised 1983: 365.3	Ecology Machester Laboratory	Laucks Testing Laboratories
Oil and Grease (water)	EPA, Revised 1983: 413.1	Ecology Manchester Laboratory	Ecology Manchester Laboratory
F-Coliform MF	APHA, 1989: 9222D.	Ecology Machester Laboratory	Ecology Manchester Laboratory
VOC (water)	EPA, 1988: 8260	Analytical Resources Inc.	Laucks Testing Laboratories
VOC (soil/sed)	EPA, 1986: 8240	Analytical Resources Inc.	Laucks Testing Laboratories
BNAs (water)	EPA, 1986: 8270	Analytical Resources Inc.	Laucks Testing Laboratories
BNAs (soil/sed)	EPA, 1986: 8270	Analytical Resources Inc.	Laucks Testing Laboratories
Pest/PCB (water)	EPA, 1986: 8080	Analytical Resources Inc.	Laucks Testing Laboratories
Pest/PCB (soil/sed)	EPA, 1986: 8080	Analytical Resources Inc.	Laucks Testing Laboratories
PP Metals	EPA, Revised 1983: 200-299	Ecology Machester Laboratory	Ecology Manchester Laboratory
Salmonid (acute 100%)	Ecology, 1981.	Parametrix	Ecology Manchester Laboratory
Microtox (acute)	Beckman, 1982	Parametrix	Ecology Manchester Laboratory
Ceriodaphnia (chronic)	EPA 1989: 1002.0	Parametrix	Ecology Manchester Laboratory
Fathead Minnow (chronic)	EPA 1989b	Parametrix	Ecology Manchester Laboratory

APHA-AWWA-WPCF, 1989. Standard Methods for the Examination of Water and Wastewater, 17th Edition.
Beckman Instruments, Inc., 1982. Microtox System Operating Manual.
Ecology, 1981. Static Acute Fish Toxicity Test, WDOE 80-12, revised July 1981.
EPA, Revised 1983. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020 (Rev. March, 1983).
EPA, 1986: SW846. Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, 3rd. ed.,November, 1986.
EPA, 1988. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving waters to Marine and Estuarine
EPA, 1989. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving waters to Freshwater Organisms. Second edition. EPA/600/4-89/100.
EPA, 1989b. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms. Second edition. EPA/600/4-79-020

Appendix C – Sampling Schedule – Port of Willapa Harbor, December 1992.

Parameter	Location:	InfW-P1	InfW-P2	InfW-PE	InfW-PP	EffW-1	EffW-2	EffW-E	EffW-ED	EffW-W	Sludge
	Type:	grab	grab	comp	comp	grab	grab	comp	comp	comp	grab
	Date:	12/15	12/15	12/15–16	12/15–16	12/15	12/16	12/15–16	12/15–16	12/15–16	12/15
	Time:	1320	1550	0800–0800	0930–1100	1220	0610	0800–0800	0800–0800	0800–0800	1300
	Lab Log #:	518230	518231	518232	518233	518249	518250	518251	518252	518253	518254
GENERAL CHEMISTRY											
Conductivity		E	E	E	E	E	E	E		E	
pH											E
Alkalinity		E	E	E	E	E	E	E		E	
Hardness		E	E	E	E	E	E	E		E	
TS		E	E	E	E			E	E	E	
TNVS		E	E	E	E			E	E	E	
TSS		E	E	EP		E	E	EW		EW	E
TNVSS		E	E	E				E		E	E
% Solids											E
% Volatile Solids											E
BOD5				EP	EP			E		E	
COD		E	E	E	E	E	E	EW		EW	
TOC		E	E	E	E	E	E	E	E	E	
TOC											E
NH3-N				E	E			E	E	E	
NO2+NO3-N				E	E			E	E	E	
Total-P				E	E			E	E	E	
Oil and Grease		E	E			E	E				
FIELD OBSERVATIONS											
Temp (C)		E	E			E	E				
Temp-cooled (C)				E	E			E		E	
pH (S.U.)		E	E	E	E	E	E	E		E	
Conductivity (umhos/cm)		E	E	E	E	E	E	E		E	
Chlorine (total – mg/L)											

InfW-P – influent from Protan
EffW – Port of Willapa effluent
grab – grab sample
comp – composite sample

E – Ecology sample
PP – Protan sample
D – duplicate sample
Sludge – sludge from the Port belt filter press

E – Ecology analysis
W – Port of Willapa Harbor analysis
P – Protan analysis

Appendix D

Priority Pollutant Cleaning Procedures
Port of Willapa Harbor PTF, City of Raymond WTP
September, December 1992.

PRIORITY POLLUTANT SAMPLING EQUIPMENT CLEANING PROCEDURES

1. Wash with laboratory detergent
2. Rinse several times with tap water
3. Rinse with 10% HNO_3 solution
4. Rinse three (3) times with distilled/deionized water
5. Rinse with high purity methylene chloride
6. Rinse with high purity acetone
7. Allow to dry and seal with aluminum foil

Appendix E – VOA, BNA, Pesticide/PCB and Metals Scan Results – Port of Willapa Harbor, September 1992.

(Group)[1]	Location:	InfW-1	InfW-2	EffW-1	EffW-2	Sludge
	Type:	grab	grab	grab	grab	grab
	Date:	9/29	9/30	9/29	9/30	9/30
	Time:	1500	1210	1700	1240	0700
	Lab Log#:	408230	408231	408240	408241	408244
	VOA Compounds	ug/L	ug/L	ug/L	ug/L	ug/Kg-dr
a	Chloromethane	2.0 U	2.0 U	2.0 U	20 U	13 U
a	Bromomethane	2.0 U	2.0 U	2.0 U	20 U	13 U
	Vinyl Chloride	2.0 U	2.0 U	2.0 U	20 U	13 U
	Chloroethane	2.0 U	2.0 U	2.0 U	20 U	13 U
a	Methylene Chloride	2.2	2.0 U	2.0 U	20 U	15
	Acetone	33	12 UJ	17 UJ	57	910
	Carbon Disulfide	1.0 U	1.0 U	1.0 U	10 U	6.4 U
b	1,1-Dichloroethene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	1,1-Dichloroethane	1.0 U	1.0 U	0.8 J	10 U	6.4 U
b	1,2-Dichloroethene (total)	1.0 U	1.0 U	1.0 U	10 U	6.4 U
a	Chloroform	37	36	8.5	8.1 J	55
	1,2-Dichloroethane	1.0 U	1.0 U	1.5	10 U	6.4 U
	2-Butanone (MEK)	38	5.0 U	8.6	50 U	160
c	1,1,1-Trichloroethane	15	2.5	790	1200	6.4 U
a	Carbon Tetrachloride	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	Vinyl Acetate	1.0 U	1.0 U	1.0 U	10 U	6.4 U
a	Bromodichloromethane	2.3	3.9	1.0 U	10 U	6.4 U
d	1,2-Dichloropropane	1.0 U	1.0 U	1.0 U	10 U	6.4 U
e	cis-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	Trichloroethene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
a	Dibromochloromethane	1.0 U	1.0 U	1.0 U	10 U	6.4 U
c	1,1,2-Trichloroethane	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	Benzene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
e	trans-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
i	2-Chloroethylvinyl Ether	1.0 U	1.0 U	1.0 U	10 U	6.4 U
a	Bromoform	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	50 U	32 U
	2-Hexanone	5.0 U	5.0 U	5.0 U	50 U	32 U
	Tetrachloroethene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
f	1,1,2,2-Tetrachloroethane	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	Toluene	40	1.0 U	6.5	10 U	6.4 U
g	Chlorobenzene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	Ethylbenzene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	Styrene	1.0 U	1.0 U	1.0 U	10 U	6.4 U
	Total Xylenes	2.0 U	2.0 U	2.0 U	20 U	13 U
a	Trichlorofluoromethane	2.0 U	2.0 U	2.0 U	20 U	13 U
	1,1,2-Trichloro-1,2,2-Trifluoroethane (Fre	2.0 U	2.0 U	2.0 U	20 U	13 U

a Total Halomethanes
b Total Dichloroethenes
c Total Trichloroethanes
d Total Dichloropropanes
e Total Dichloropropenes
f Total Tetrachloroethanes
g Total Chlorinated Benzenes (excluding Dichlorobenzenes)
i Total Chloroalkyl Ethers

InfW-1,2 – Ecology sample of Port influent
EffW-1,2 – Ecology sample of Port effluent
Sludge – sludge from the Port belt filter press

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.

Appendix E – (cont'd) – Port of Willapa Harbor, September 1992.

(Group)[1]	BNA Compounds	EffW-G grab-comp 9/30 1235 408245 ug/L	Sludge grab 9/30 0700 408244 ug/Kg-dr
	Phenol	79	350 U
i	Bis(2-Chloroethyl)Ether	2 U	180 U
	2-Chlorophenol	2 U	180 U
h	1,3-Dichlorobenzene	2 U	180 U
h	1,4-Dichlorobenzene	2 U	180 U
	Benzyl Alcohol	10 U	880 U
h	1,2-Dichlorobenzene	2 U	180 U
	2-Methylphenol	2 U	180 U
i	2,2'-Oxybis(1-Chloropropane)	2 U	180 U
	4-Methylphenol	66	180 U
k	N-Nitroso-di-n-Propylamine	2 U	180 U
	Hexachloroethane	4 U	350 U
	Nitrobenzene	2 U	180 U
	Isophorone	2 U	120 J
l	2-Nitrophenol	5.6 J	880 U
	2,4-Dimethylphenol	4 U	350 U
	Benzoic Acid	130 J	1800 UJ
i	Bis(2-Chloroethoxy)Methane	2 U	180 U
	2,4-Dichlorophenol	6 U	530 U
g	1,2,4-Trichlorobenzene	2 U	180 U
n	Naphthalene	2 U	180 U
	4-Chloroaniline	6 U	530 U
	Hexachlorobutadiene	4 U	350 U
	4-Chloro-3-Methylphenol	4 U	350 U
	2-Methylnaphthalene	2 U	180 U
	Hexachlorocyclopentadiene	10 UJ	880 U
	2,4,6-Trichlorophenol	10 U	880 U
	2,4,5-Trichlorophenol	10 U	880 U
m	2-Chloronaphthalene	2 U	180 U
	2-Nitroaniline	10 U	880 U
i	Dimethyl Phthalate	2 U	180 U
n	Acenaphthylene	2 U	180 U
	3-Nitroaniline	10 U	880 U
n	Acenaphthene	2 U	180 U
l	2,4-Dinitrophenol	20 U	1800 U
l	4-Nitrophenol	5.7 J	880 U

g Total Chlorinated Benzenes (excluding Dichlorobenzenes)
h Total Dichlorobenzenes
i Total Phthalate Esters
j Total Chloroalkyl Ethers
k Total Nitrosamines
l Total Nitrophenols
m Total Chlorinated Naphthalenes
n Total Polynuclear Aromatic Hydrocarbons

EffWG – Ecology grab sample of Port effluent
Sludge – Sludge from the Port belt filter press

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.

Appendix E – (cont'd) – Port of Willapa Harbor, September 1992.

	Location:	EffW-GC	Sludge
	Type:	grab	grab
	Date:	9/30	9/30
	Time:	1235	0700
l	Lab Log#:	408245	408244
	BNA Compounds	ug/L	ug/Kg-dr
	Dibenzofuran	2 U	180 U
o	2,4-Dinitrotoluene	10 UJ	880 U
o	2,6-Dinitrotoluene	10 U	880 U
i	Diethyl Phthalate	2 U	180 U
p	4-Chlorophenyl Phenylether	2 U	180 U
n	Fluorene	2 U	180 U
	4-Nitroaniline	10 U	880 U
l	4,6-Dinitro-2-Methylphenol	20 U	1800 U
k	N-Nitrosodiphenylamine	2 U	180 U
p	4-Bromophenyl Phenylether	2 U	180 U
g	Hexachlorobenzene	2 U	180 U
	Pentachlorophenol	10 U	880 U
n	Phenanthrene	2 U	90 J
	Carbazole	2 U	180 U
n	Anthracene	2 U	180 U
i	Di-n-Butyl Phthalate	2 U	140 U
n	Fluoranthene	2 U	71 J
n	Pyrene	2 U	97 J
i	Butylbenzyl Phthalate	2 U	180 U
	3,3'-Dichlorobenzidine	10 U	880 U
n	Benzo(a)Anthracene	2 U	180 U
i	Bis(2-Ethylhexyl)Phthalate	2 U	2700
n	Chrysene	2 U	180 U
i	Di-n-Octyl Phthalate	2 U	76 J
n	Benzo(b)Fluoranthene	2 U	180 U
n	Benzo(k)Fluoranthene	2 U	180 U
n	Benzo(a)Pyrene	2 U	180 U
n	Indeno(1,2,3-cd)Pyrene	2 UJ	180 UJ
n	Dibenzo(a,h)Anthracene	2 U	180 U
n	Benzo(g,h,i)Perylene	2 UJ	180 UJ

g Total Chlorinated Benzenes (excluding Dichlorobenzenes)
i Total Phthalate Esters
k Total Nitrosamines
l Total Nitrophenols
n Total Polynuclear Aromatic Hydrocarbons
o Total Dinitrotoluenes
p Total Haloethers

EffWG – Ecology grab sample of Port effluent
Sludge – Sludge from the Port belt filter press

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.

Appendix E –Port of Willapa Harbor, September 1992.

	Location:	EffW–G		Sludge	
	Type:	grab		grab	
	Date:	9/30		9/30	
	Time:	1235		0700	
	Lab Log#:	408245		408244	
(Group)[1]	Pesticide/PCB Compounds	ug/L		ug/Kg–dr	
q	alpha–BHC	0.05	U	9.0	U
q	beta–BHC	0.05	U	18	U
q	delta–BHC	0.05	U	6.0	U
q	gamma–BHC (Lindane)	0.05	U	5.6	U
r	Heptachlor	0.05	U	5.6	U
	Aldrin	0.05	U		R
r	Heptachlor Epoxide	0.05	U	5.6	U
s	Endosulfan I	0.05	U	5.6	U
	Dieldrin	0.10	U	12	U
u	4,4'–DDE	0.10	U	16	
t	Endrin	0.10	U	12	U
s	Endosulfan II	0.10	U	12	U
u	4,4'–DDD	0.10	U	12	U
s	Endosulfan Sulfate	0.10	U	12	U
u	4,4'–DDT	0.10	U	12	U
	Methoxychlor	0.50	U	56	U
t	Endrin Ketone	0.10	U	12	U
v	alpha–Chlordane	0.05	U	5.6	U
v	gamma–Chlordane	0.05	U	5.6	U
	Toxaphene	5.0	U	560	U
w	Aroclor–1016	1.0	U	120	U
w	Aroclor–1221	2.0	U	480	U
	Aroclor–1248	1.0	U	120	U
	Aroclor–1254	1.0	U	120	U
	Aroclor–1260	1.0	U	120	U
w	Aroclor–1232	1.0	U	360	U
t	Endrin Aldehyde	0.10	U	12	U

q Total BHCs
r Heptachlor
s Endosulfan
t Endrin
u DDT plus metabolites
v Total Chlordane
w Total Aroclors (PCBs)

EffWG – Ecology grab sample of Port effluent
Sludge – Sludge from the Port belt filter press

U – The analyte was not detected at or above the reported result.
R – The data are unusable for all purposes.

Appendix E – Port of Willapa Harbor, September 1992.

Metals	EffW-G grab 9/30 1235 408245 ug/L	Sludge grab 9/30 0700 408244 mg/Kg-dr
Antimony	30 U	35 P
Arsenic	9.3 N	23 P
Pentavalent		
Trivalent		
Beryllium	1.0 U	0.50 U
Cadmium	2.0 U	1.9 P
Chromium	146	4480
Hexavalent		
Trivalent		
Copper	22	99.8 E
Lead	1.0 U	5.57 E
Mercury	0.050 UN	0.039 PN
Nickel	10 U	12 P
Selenium	2 UJ	1.4
Silver	0.50 U	1.5 UN
Thallium	2.5 UN	0.25 U
Zinc	11 P	173

U – The analyte was not detected at or above the reported result.
N – The spike sample recovery is not within control limits.
UJ – The analyte was not detected at or above the reported estimated result.
P – The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.
E – Reported result is an estimate because of the presence of interference.

EffW-G – Ecology grab sample of Port effluent
Sludge – Sludge from the Port belt filter press

Appendix F – VOA and BNA Scan Tentatively Identified Compounds (TICs) – Port of Willapa Harbor PTF and City of Raymond WTP, September 1992.

TIC data are presented on the laboratory report sheets that follow. Fractions are identified as VOA or ABN (BNA). Locations corresponding to the Lab Log# (called Sample No. on the laboratory report sheet) and data qualifiers are summarized on this page. If sheets are not included for a station, no TICs were detected.

Port of Willapa Harbor Pretreatment Facility

Location:	InfW–1	InfW–2	EffW–1	EffW–2	Sludge	EffW–G
Type:	grab	grab	grab	grab	grab	grab–comp
Date:	9/29	9/30	9/29	9/30	9/30	9/30
Time:	1500	1210	1700	1240	0700	1235
Lab Log #:	408230	408231	408240	408241	408244	408245

City of Raymond Wastewater Treatment Plant

Location:	InfR–1	InfR–2	InfR–E	EffR–1	EffR–2	EffR–E
Type:	grab	grab	comp	grab	grab	comp
Date:	9/29	9/29	9/29–30	9/29	9/29	9/29–30
Time:	1000	1540	0900–0900	1045	1600	0900–0900
Lab Log #:	408260	408261	408262	408264	408265	408266

NJ – indicates there is evidence the analyte is present
The associated numerical value is an estimate.

Inf – influent
Eff – effluent
grab – grab sample
comp – composite sample
G – grab composite sample
Sludge – sludge sample
W – Ecology sample from Port PTF
R – Ecology sample from Raymond WTP

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

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(206) 621-7523 (FAX)

ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408230

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879AR
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/26/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	-	UNKNOWN (bp m/e 44)	VOA	205	11 NJ KF
2	74-93-1	METHANETHIOL (bp m/e 47)	VOA	231	62
3	-	UNKNOWN (bp m/e 45)	VOA	249	77
4	75-18-3	THIOBISMETHANE (bp m/e 62)	VOA	323	98
5	-	UNKNOWN (bp m/e 126)	VOA	1027	60
6					
7					
8					
9					
10					
11					
12					
13					
14					
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ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408231

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879B
Matrix: Water

VTSR: 10/02/92

Data Release Authorized: Dm B. Otto
Report Prepared: 10/20/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	-	UNKNOWN (bp m/e 58)	VOA	302	16 J NJ KF
2	75-18-3	THIOBISMETHANE (bp m/e 62)	VOA	325	52 J
3	-	UNKNOWN (bp m/e 44)	VOA	735	12 J
4					
5					
6					
7					
8					
9					
10					
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408240

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879C
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/20/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	75-18-3	THIOBISMETHANE (bp m/e 62)	VOA	326	28 J NJ KF
2	624-92-0	DIMETHYLDISULFIDE (bp m/e 94)	VOA	682	230 J
3	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1057	32 J
4	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1071	12 J
5	-	UNKNOWN HYDROCARBON (bp m/e 43)	VOA	1114	38 J
6	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1123	33 J
7	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1144	56 J
8	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1152	69 J
9	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1180	19 J
10	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1190	63 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: **408240 Dilution**

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879CR
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/26/92 MAC:E bda

CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1 -	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1056	86 J NJ KF
2 -	UNKNOWN HYDROCARBON (bp m/e 43)	VOA	1113	110 J
3 -	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1121	78 J
4 -	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1142	150 J
5 -	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1150	200 J
6 -	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1177	57 J
7 -	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1187	250 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408241

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879D
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/26/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1056	50 J NJ KF
2	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1142	59 J
3	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1150	62 J
4	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1189	98 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408245

Lab ID: B879IDL
Matrix: Waters

QC Report No: B879 - WDOE
Project No: Port Raymond

Data Release Authorized:
Report: 10/28/92-MAC:ctr

Date Received: 10/02/92

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Conc (µg/L)
1	-	Unknown Carboxylic Acid (bp m/e 43)	ABN	251	240 J NJ KF
2	-	Unknown Carboxylic Acid (bp m/e 43)	ABN	305	230 J
3	-	Unknown Carboxylic Acid/coelute (bp m/e 60)	ABN	365	650 J
4	-	C6.H8.N2 Isomer (bp m/e 108)	ABN	384	90 J
5	-	Butanoic Acid Isomer (bp m/e 60)	ABN	451	450 J
6	-	Unknown Butanoic Acid (bp m/e 74)	ABN	470	610 J
7	-	Unknown Carboxylic Acid (bp m/e 60)	ABN	500	360 J
8	-	C7.H16.O3 isomer (bp m/e 59)	ABN	525	470 J
9	20324-32-7	2-Propanol, 1-(2-Methoxy-1-Methylethoxy)- (bp m/e 59)	ABN	532	790 J
10	-	Unknown Alcohol (bp m/e 59)	ABN	550	1310 J
11	-	Unknown (bp m/e 41)	ABN	560	270 J
12	-	Unknown (bp m/e 75)	ABN	572	80 J
13	-	Unknown Hydrocarbon (bp m/e 55)	ABN	745	30 J
14	-	Unknown Hydrocarbon (bp m/e 57)	ABN	764	72 J
15	-	C13.H28 isomer (bp m/e 57)	ABN	781	32 J
16	-	Unknown Hydrocarbon (bp m/e 57)	ABN	847	29 J
17	-	Unknown (bp m/e 91)	ABN	876	300 J
18	501-52-0	Benzenepropanoic Acid (bp m/e 91)	ABN	964	490 J
19	-	Unknown (bp m/e 79)	ABN	1094	56 J
20	-	Sterol isomer (bp m/e 43)	ABN	2171	59 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: **408244**

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879L
Matrix: Soils/Sediments

VTSR: 10/02/92

Data Release Authorized: _____
Prepared: 10/27/92 MAC E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/Kg)
1	74-93-1	METHANETHIOL (bp m/e 47)	VOA	282	340 J NJ KF
2	75-18-3	THIOBISMETHANE (bp m/e 47)	VOA	375	140 J
3	624-92-0	DIMETHYLDISULFIDE (bp m/e 94)	VOA	743	2200 J
4	-	UNKNOWN HYDROCARBON (bp m/e 43)	VOA	1215	45 J
5	-	UNKNOWN (bp m/e 55)	VOA	1232	45 J
6	-	UNKNOWN (bp m/e 41)	VOA	1239	34 J
7	-	UNKNOWN HYDROCARBON (bp m/e 43)	VOA	1249	68 J
8	-	UNKNOWN HYDROCARBON (bp m/e 43)	VOA	1259	130 J
9	-	UNKNOWN HYDROCARBON (bp m/e 57)	VOA	1270	200 J
10	-	UNKNOWN (bp m/e 41)	VOA	1281	70 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408244

Lab ID: B879L
Matrix: Soil/Sediments

QC Report No: B879 - WDOE
Project No: Port Raymond
Date Received: 10/02/92

Data Release Authorized:
Report: 10/29/92 MAC:ctr

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/Kg)
1	-	Unknown Hydrocarbon (bp m/e 57)	ABN	847	6600 J
2	-	Unknown Hydrocarbon (bp m/e 57)	ABN	1259	5300 J
3	-	Alkyl Decanoic Acid isomer (bp m/e 43)	ABN	1330	17000 J
4	-	Alkyl Decanoic Acid isomer (bp m/e 43)	ABN	1383	24000 J
5	-	Alkyl Decanoic Acid isomer (bp m/e 43)	ABN	1405	8400 J
6	-	Alkyl Decanoic Acid isomer (bp m/e 55)	ABN	1470	10000 J
7	-	Alkyl Decanoic Acid isomer (bp m/e 73)	ABN	1510	95000 J
8	-	Alkyl Decanoic Acid isomer (bp m/e 43)	ABN	1533	3400 J
9	-	Unknown (bp m/e 55)	ABN	1548	3700 J
10	-	Alkyl Decanoic Acid isomer (bp m/e 43)	ABN	1556	4700 J
11	-	Alkyl Decanoic Acid isomer (bp m/e 43)	ABN	1644	130000 J
12	-	Unknown (bp m/e 55)	ABN	1744	58000 J
13	-	Unknown Carboxylic Acid (bp m/e 55)	ABN	1757	25000 J
14	112-85-6	Docosanoic Acid (bp m/e 43)	ABN	1875	12000 J
15	-	Unknown (bp m/e 55)	ABN	1980	5800 J
16	-	Unknown Hydrocarbon (bp m/e 69)	ABN	2020	16000 J
17	-	Sterol isomer (bp m/e 215)	ABN	2158	37000 J
18	-	Sterol isomer (bp m/e 43)	ABN	2193	140000 J
19	-	Sterol isomer (bp m/e 69)	ABN	2202	7400 J
20	-	Sterol isomer (bp m/e 124)	ABN	2239	6100 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408260

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879ER
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/20/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	-	UNKNOWN (bp m/e 45)	VOA	251	11 J NJ KF
2	-	UNKNOWN (bp m/e 45)	VOA	288	7 J
3	75-18-3	THIOBISMETHANE (bp m/e 62)	VOA	324	6 J
4	-	UNKNOWN (bp m/e 68)	VOA	1029	12 J
5	-	ALKYL BENZENE ISOMER (bp m/e 119)	VOA	1036	6 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: **408261**

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879F
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/20/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	74-93-1	METHANETHIOL (bp m/e 47)	VOA	233	9 NJ KF
2	-	UNKNOWN (bp m/e 45)	VOA	252	12
3	75-18-3	THIOBISMETHANE (bp m/e 62)	VOA	326	6
4	-	ALKYL CYCLOHEXENE ISOMER (bp m/e 68)	VOA	1030	5
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408264

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879G
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/26/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	-	SILOXANE ISOMER (bp m/e 73)	VOA	181	32 NJ KF
2	-	UNKNOWN (bp m/e 60)	VOA	231	6
3	-	SILOXANE ISOMER (bp m/e 89)	VOA	337	13
4	1066-40-6	TRIMETHYLSILANOL (bp m/e 75)	VOA	353	6
5	-	UNKNOWN (bp m/e 46)	VOA	385	28
6	-	SILOXANE ISOMER (bp m/e 207)	VOA	671	67
7	-	SILOXANE ISOMER (bp m/e 281)	VOA	879	88
8	-	SILOXANE ISOMER (bp m/e 73)	VOA	1052	60
9	-	SILOXANE ISOMER (bp m/e 73)	VOA	1182	16
10	-	UNKNOWN (bp m/e 60)	VOA	273	18
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408265

QC Report No: B879 - WDOE
Project No: Port Raymond

Lab ID: B879H
Matrix: Water

VTSR: 10/02/92

Data Release Authorized:
Report Prepared: 10/20/92 MAC:E bda

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Concentration (µg/L)
1	-	UNKNOWN (bp m/e 61)	VOA	184	41 J NJ KF
2	-	UNKNOWN (bp m/e 60)	VOA	236	5 J
3	-	SILOXANE ISOMER (bp m/e 89)	VOA	339	22 J
4	1066-40-6	TRIMETHYLSILANOL (bp m/e 75)	VOA	356	8 J
5	-	UNKNOWN (bp m/e 46)	VOA	388	34 J
6	-	UNKNOWN (bp m/e 93)	VOA	278	19 J
7	-	SILOXANE ISOMER (bp m/e 207)	VOA	674	250 J
8	-	SILOXANE ISOMER (bp m/e 281)	VOA	882	310 J
9	-	SILOXANE ISOMER (bp m/e 73)	VOA	1055	200 J
10	-	SILOXANE ISOMER (bp m/e 73)	VOA	1184	53 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408262

Lab ID: B879JDL
Matrix: Waters

QC Report No: B879 - WDOE
Project No: Port Raymond

Data Release Authorized:
Report: 10/28/92-MAC:ctr

Date Received: 10/02/92

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Conc (µg/L)
1	142-62-1	Hexanoic Acid (bp m/e 60)	ABN	298	65 J NJ KC
2	-	Unknown (bp m/e 60)	ABN	390	48 J
3	-	Unknown Carboxylic Acid (bp m/e 74)	ABN	416	90 J
4	-	Unknown Carboxylic Acid (bp m/e 60)	ABN	433	37 J
5	-	Unknown Alcohol (bp m/e 59)	ABN	510	45 J
6	-	Unknown Alcohol (bp m/e 59)	ABN	515	45 J
7	-	Unknown Alcohol (bp m/e 59)	ABN	532	73 J
8	-	C10.H18.O isomer (bp m/e 59)	ABN	750	76 J
9	-	Unknown Acid (bp m/e 91)	ABN	860	170 J
10	501-52-0	Benzenepropanoic Acid (bp m/e 91)	ABN	935	180 J
11	-	Unknown (bp m/e 107)	ABN	1140	77 J
12	2091-29-4	9-Hexadecanoic Acid (bp m/e 55)	ABN	1454	16 J
13	57-10-3	Hexadecanoic Acid (bp m/e 73)	ABN	1488	350 J
14	506-12-7	Heptadecanoic Acid (bp m/e 43)	ABN	1544	12 J
15	-	Unknown Hydrocarbon (bp m/e 55)	ABN	1617	2100 J
16	57-11-4	Octadecanoic Acid (bp m/e 60)	ABN	1632	830 J
17	-	Unknown (bp m/e 55)	ABN	1732	71 J
18	-	Unknown Carboxylic Acid/coelute (bp m/e 43)	ABN	1746	50 J
19	-	Sterol isomer (bp m/e 43)	ABN	2152	190 J
20	-	Sterol isomer (bp m/e 43)	ABN	2174	480 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408266

Lab ID: B879K
Matrix: Waters

QC Report No: B879 - WDOE
Project No: Port Raymond

Data Release Authorized:
Report: 10/28/92-MAC:ctr

Date Received: 10/02/92

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Conc. (µg/L)
1	-	Siloxane isomer (bp m/e 113)	ABN	357	44 J NJ KF
2	-	Unknown Alcohol (bp m/e 59)	ABN	511	14 J
3	-	Unknown (bp m/e 45)	ABN	515	4 J
4	-	Unknown Alcohol (bp m/e 59)	ABN	525	26 J
5	-	Unknown (bp m/e 45)	ABN	531	5 J
6	-	Unknown (bp m/e 43)	ABN	551	5 J
7	-	Unknown (bp m/e 143)	ABN	668	20 J
8	-	Unknown (bp m/e 157)	ABN	694	12 J
9	-	(2-Butoxyethoxy)-Ethanol isomer (bp m/e 45)	ABN	749	35 J
10	-	Unknown (bp m/e 66)	ABN	894	9 J
11	-	Unknown (bp m/e 157)	ABN	910	11 J
12	124-17-4	Ethanol, 2-(2-Butoxyethoxy)-, Acetate (bp m/e 43)	ABN	945	6 J
13	-	Unknown (bp m/e 176)	ABN	1012	7 J
14	-	Unknown (bp m/e 45)	ABN	1073	6 J
15	-	Unknown (bp m/e 69)	ABN	1109	13 J
16	-	Unknown (bp m/e 59)	ABN	1326	16 J
17	57-10-3	Hexadecanoic Acid/coelute (bp m/e 43)	ABN	1467	5 J
18	-	Unknown (bp m/e 41)	ABN	1595	11 J
19	78-51-3	Ethanol, 2-Butoxy-, Phosphate (3:1) (bp m/e 45)	ABN	1778	5 J
20	-	Sterol isomer (bp m/e 43)	ABN	2171	6 J
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ORGANIC ANALYSIS DATA SHEET - Tentatively Identified Compounds

Sample No: 408266 Re-extraction

Lab ID: B879KRE
Matrix: Waters

QC Report No: B879 - WDOE
Project No: Port Raymond

Data Release Authorized:
Report: 10/28/92-MAC:ctr

Date Received: 10/02/92

	CAS Number	Compound Name	Fraction	Scan Number	Estimated Conc (µg/L)
1	-	Unknown (bp m/e 78)	ABN	358	29 J NJ KF
2	-	Unknown (bp m/e 78)	ABN	362	13 J
3	20324-32-7	2-Propanol, 1-(2-Methoxy-1-Methylethoxy)- (bp m/e 59)	ABN	510	11 J
4	13429-07-7	2-Propanol, 1-(2-Methoxypropoxy)- (bp m/e 59)	ABN	525	23 J
5	-	Unknown (bp m/e 45)	ABN	550	5 J
6	-	Unknown (bp m/e 143)	ABN	668	17 J
7	-	Unknown (bp m/e 157)	ABN	693	9 J
8	112-34-5	Ethanol, 2-(2-Butoxyethoxy)- (bp m/e 45)	ABN	749	33 J
9	-	Unknown (bp m/e 66)	ABN	894	6 J
10	-	Unknown (bp m/e 157)	ABN	915	11 J
11	124-17-4	Ethanol, 2-(2-Butoxyethoxy)-, Acetate (bp m/e 43)	ABN	944	5 J
12	-	Unknown (bp m/e 57)	ABN	960	5 J
13	-	Unknown (bp m/e 176)	ABN	1016	6 J
14	-	Unknown (bp m/e 69)	ABN	1113	15 J
15	-	Unknown (bp m/e 59)	ABN	1327	17 J
16	-	Alkyl Decanoic Acid isomer (bp m/e 43)	ABN	1466	7 J
17	-	Unknown (bp m/e 45)	ABN	1542	6 J
18	-	Unknown (bp m/e 41)	ABN	1595	7 J
19	-	Sterol isomer (bp m/e 43)	ABN	2170	10 J
20	-	Sterol isomer (bp m/e 55)	ABN	2238	9 J
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Appendix G – VOA, BNA, Pesticide/PCB and Metals Scan Results – Port of Willapa Harbor, December 1992.

	Location:	EffW-1	EffW-2
	Type:	grab	grab
	Date:	12/15	12/16
	Time:	1220	0610
	Lab Log#:	518249	518250
(Group)[1]	VOA Compounds	ug/L	ug/L
a	Chloromethane	10 U	10 U
a	Bromomethane	10 U	10 U
	Vinyl Chloride	10 U	10 U
	Chloroethane	10 U	10 U
a	Methylene Chloride	10 U	10 U
	Acetone	10 U	61
	Carbon Disulfide	10 U	10 U
b	1,1-Dichloroethene	10 U	10 U
	1,1-Dichloroethane	10 U	10 U
b	1,2-Dichloroethene (total)	10 U	10 U
a	Chloroform	3 J	4 J
	1,2-Dichloroethane	10 U	10 U
	2-Butanone (MEK)	10 U	4 NJ
c	1,1,1-Trichloroethane	10 U	10 U
a	Carbon Tetrachloride	10 U	10 U
a	Bromodichloromethane	10 U	10 U
d	1,2-Dichloropropane	10 U	10 U
e	cis-1,3-Dichloropropene	10 U	10 U
	Trichloroethene	10 U	10 U
a	Dibromochloromethane	10 U	10 U
c	1,1,2-Trichloroethane	10 U	10 U
	Benzene	10 U	10 U
e	trans-1,3-Dichloropropene	10 U	10 U
a	Bromoform	10 U	10 U
	4-Methyl-2-Pentanone (MIBK)	10 U	10 U
	2-Hexanone	10 U	10 U
	Tetrachloroethene	10 U	10 U
f	1,1,2,2-Tetrachloroethane	10 U	10 U
	Toluene	1 J	1 J
g	Chlorobenzene	10 U	10 U
	Ethylbenzene	10 U	10 U
	Styrene	10 U	10 U
	Total Xylenes	10 U	10 U

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
N – The spike sample recovery is not within control limits.

Appendix G – (cont'd) – Port of Willapa Harbor, December 1992.

(Group)[1]	BNA Compounds	InfW-PE	EffW-E
	Location:	InfW-PE	EffW-E
	Type:	comp	comp
	Date:	12/15-16	12/15-16
	Time:	0800-0800	0800-0800
	Lab Log#:	518232	518251
		ug/L	ug/L
	Phenol	180	22
	Aniline	120 U	50 UJ
i	Bis(2-Chloroethyl)Ether	25 U	10 U
	2-Chlorophenol	25 U	10 U
h	1,3-Dichlorobenzene	25 U	10 U
h	1,4-Dichlorobenzene	25 U	10 U
	Benzyl Alcohol	25 U	10 U
h	1,2-Dichlorobenzene	25 U	10 U
	2-Methylphenol	25 U	10 U
i	Bis(2-Chloroisopropyl)Ether	25 U	10 U
	4-Methylphenol	280	300
k	N-Nitroso-di-n-Propylamine	25 U	10 U
	Hexachloroethane	50 U	20 U
	Nitrobenzene	25 U	10 U
	Isophorone	25 U	10 U
l	2-Nitrophenol	50 U	20 U
	2,4-Dimethylphenol	25 U	10 U
	Benzoic Acid	92 J	110 J
i	Bis(2-Chloroethoxy)Methane	25 U	10 U
	2,4-Dichlorophenol	50 U	20 U
g	1,2,4-Trichlorobenzene	25 U	10 U
n	Naphthalene	25 U	10 U
	4-Chloroaniline	25 U	10 UJ
	Hexachlorobutadiene	25 U	10. U
	4-Chloro-3-Methylphenol	50 U	20 U
	2-Methylnaphthalene	25 U	10 U
	Hexachlorocyclopentadiene	50 U	20 U
	2,4,6-Trichlorophenol	50 U	20 U
	2,4,5-Trichlorophenol	50 U	20 U
m	2-Chloronaphthalene	25 U	10 U
	2-Nitroaniline	50 U	20 U
i	Dimethyl Phthalate	25 U	10 U
n	Acenaphthylene	25 U	10 U
o	2,6-Dinitrotoluene	50 U	20 U
	3-Nitroaniline	120 U	50 U
n	Acenaphthene	25 U	10 U
f	2,4-Dinitrophenol	250 U	100 U
l	4-Nitrophenol	250 U	100 U
	Dibenzofuran	25 U	10 U

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.

Appendix G – (cont'd) – Port of Willapa Harbor, December 1992.

	Location:	InfW–PE		EffW–E	
	Type:	comp		comp	
	Date:	12/15–16		12/15–16	
	Time:	0800–0800		0800–0800	
	Lab Log#:	518232		518251	
	BNA Compounds	ug/L		ug/L	
o	2,4–Dinitrotoluene	50	U	20	U
i	Diethyl Phthalate	25	U	10	U
p	4–Chlorophenyl Phenylether	25	U	10	U
n	Fluorene	25	U	10	U
	4–Nitroaniline	50	U	20	U
l	4,6–Dinitro–2–Methylphenol	250	U	100	U
k	N–Nitrosodiphenylamine	25	U	10	U
	1,2–Diphenylhydrazine	50	U	20	U
p	4–Bromophenyl Phenylether	50	U	20	U
g	Hexachlorobenzene	50	U	20	U
	Pentachlorophenol	250	U	100	U
n	Phenanthrene	25	U	10	U
n	Anthracene	25	U	10	U
	Carbazole	25	U	10	U
i	Di–n–Butyl Phthalate	25	U	10	U
n	Fluoranthene	25	U	10	U
n	Pyrene	25	U	10	U
i	Butylbenzyl Phthalate	25	U	10	U
	3,3'–Dichlorobenzidine	250	U	100	U
n	Benzo(a)Anthracene	25	U	10	U
n	Chrysene	25	U	10	U
i	Bis(2–Ethylhexyl)Phthalate	48	U	10	U
i	Di–n–Octyl Phthalate	25	U	10	U
n	Benzo(b)Fluoranthene	25	U	10	U
n	Benzo(k)Fluoranthene	25	U	10	U
n	Benzo(a)Pyrene	25	U	10	U
n	Indeno(1,2,3–cd)Pyrene	25	U	10	U
n	Dibenzo(a,h)Anthracene	25	U	10	U
n	Benzo(g,h,i)Perylene	25	U	10	U

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

Appendix G – (cont'd) – Port of Willapa Harbor, December 1992.

	Location:	InfW-PE	EffW-E
	Type:	comp	comp
	Date:	12/15-16	12/15-16
	Time:	0800-0800	0800-0800
	Lab Log#:	518232	518251
(Group)[1]	Pesticide/PCB Compounds	ug/L	ug/L
q	alpha-BHC	0.033 N	0.037 NJ
q	beta-BHC	0.099 DN	0.16 D
q	delta-BHC	0.009 U	0.009 U
q	gamma-BHC (Lindane)	0.004 U	0.004 U
r	Heptachlor	0.003 U	0.003 U
	Aldrin	0.004 U	0.004 U
r	Heptachlor Epoxide	0.083 U	0.083 U
s	Endosulfan I	0.014 U	0.014 U
	Dieldrin	0.007 J	0.01 U
u	4,4'-DDE	0.51 D	0.086 D
t	Endrin	0.008 NJ	0.007 J
s	Endosulfan II	0.031	0.004 U
u	4,4'-DDD	0.011	0.011 U
s	Endosulfan Sulfate	0.066 U	0.066 U
u	4,4'-DDT	0.012 UJ	0.012 UJ
i	Endrin Aldehyde	0.023 U	0.023 U
v	Chlordane	0.014 U	0.014 U
	Toxaphene	0.24 U	0.24 U
w	Aroclor-1016	0.065 U	0.065 U
w	Aroclor-1221	0.13 U	0.13 U
w	Aroclor-1232	0.65 U	0.65 U
w	Aroclor-1242	0.65 U	0.65 U
w	Aroclor-1248	0.65 U	0.65 U
w	Aroclor-1254	0.65 U	0.65 U
w	Aroclor-1260	0.65 U	0.65 U

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.
N – There is evidence the analyte is present in this sample.
D – The result is obtained from a dilution of the original extract.

Appendix G – (cont'd) – Port of Willapa Harbor, December 1992.

Location:	InfW–PE	EffW–E
Type:	comp	comp
Date:	12/15–16	12/15–16
Time:	0800–0800	0800–0800
Lab Log#:	518232	518251
Metals	ug/L	ug/L
Antimony	300 U	150 U
Arsenic	198 N	162 N
Pentavalent		
Trivalent		
Beryllium	10 U	5.0 U
Cadmium	48.5	6.45
Chromium	130 P	30 U
Hexavalent		
Trivalent		
Copper	847	140
Lead	12 J	1.4 J
Mercury	1.06 N	0.16 J
Nickel	100 U	50 U
Selenium	21.70 N	5.1 N
Silver	13.9	2.4
Thallium	5.0 UN	2.5 UN
Zinc	2120	160

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
N – The spike sample recovery is not within control limits.
P – The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

a Total Halomethanes
b Total Dichloroethenes
c Total Trichloroethanes
d Total Dichloropropanes
e Total Dichloropropenes
f Total Tetrachloroethanes
g Total Chlorinated Benzenes (excluding Dichlorobenzenes)
h Total Dichlorobenzenes
i Total Phthalate Esters
j Total Chloroalkyl Ethers
k Total Nitrosamines
l Total Nitrophenols
m Total Chlorinated Naphthalenes
n Total Polynuclear Aromatic Hydrocarbons
o Total Dinitrotoluenes
p Total Haloethers
q Total BHCs
r Heptachlor
s Endosulfan
t Endrin
u DDT plus metabolites
v Total Chlordane
w Total Aroclors (PCBs)

Appendix H – VOA and BNA Scan Tentatively Identified Compounds (TICs) – Port of Willapa Harbor PTF and City of Raymond WTP, December 1992.

TIC data are presented on the laboratory report sheets that follow. Fractions are identified as VOA or ABN (BNA). Locations corresponding to the Lab Log# (called Sample No. on the laboratory report sheet) and data qualifiers are summarized on this page. If sheets are not included for a station, no TICs were detected.

Port of Willapa Harbor Pretreatment Facility

Location:	InfW–PE	EffW–1	EffW–2	EffW–E
Type:	comp	grab	grab	comp
Date:	12/15–16	12/15	12/16	12/15–16
Time:	0800–0800	1220	0610	0800–0800
Lab Log #:	518232	518249	518250	518251

City of Raymond Wastewater Treatment Plant

Location:	EffR–E
Type:	comp
Date:	12/15–16
Time:	0800–0800
Lab Log #:	518244

NJ – indicates there is evidence the analyte is present. The associated numerical value is an estimate.

Inf – influent
Eff – effluent
grab – grab sample
comp – Ecology sample
W – Ecology sample from Port PTF
P – Ecology sample from Protan
R – Ecology sample from Raymond WTP

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

DOE SAMPLE NO.
518249

Lab Name: LAUCKS TESTING LABS Contract:

Lab Code: LAUCKS Case No.: SAS No.: SDG No.: 18230

Matrix: (soil/water) WATER Lab Sample ID: 12795-02

Sample wt/vol: 5.00 (g/ml) ML Lab File ID: >OL21K

Level: (low/med) LOW Date Received: 12/17/92

% Moisture: not dec. Date Analyzed: 12/21/92

GC Column: DB-624 ID: 0.53(mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

Number TICs found: 7

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.74931	METHANETHIOL	1.20	61	~~JN~~ NJ
2.115106	METHANE, OXYBIS-	1.50	7	~~JN~~
3.75183	METHANE, THIOBIS-	1.71	65	~~JN~~
4.624920	DISULFIDE, DIMETHYL-	8.41	140	~~JN~~
5.1618264	2,4-DITHIAPENTANE	14.95	10	~~JN~~
6.3658808	TRISULFIDE, DIMETHYL-	18.37	47	~~JN~~
7.1120214	UNDECANE	22.68	7	~~JN~~
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FORM I VOA-TIC 3/90

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

518232

Lab Name: LAUCKS TESTING LABS Contract:

Matrix: (soil/water) WATER Lab Sample ID: 9212795-04

Sample wt/vol: 200 (g/mL) ML Lab File ID: >LL286::D2

Level: (low/med) LOW Date Received: 12/17/92

% Moisture: decanted: (Y/N) N Date Extracted: 12/21/92

Concentrated Extract Volume:) 1000 (ul) Date Analyzed: 12/28/92

Injection Volume: 2.0 (uL) Dilution Factor: 5

GPC Cleanup: (Y/N) N pH:

Number TICs found: 28

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	6.80	3000	J ~~JN~~
2.107926	BUTANOIC ACID	9.59	13000	NJ ~~JN~~
4.	UNKNOWN	10.62	5100	J ~~JN~~
5.116530	BUTANOIC ACID, 2-METHYL-	11.00	3600	NJ JN
6.109524	PENTANOIC ACID	11.28	1700	JN
7.646071	PENTANOIC ACID, 4-METHYL-	13.06	11000	JN
8.142621	HEXANOIC ACID	13.19	870	JN
9.501520	BENZENEPROPANOIC ACID	19.91	25000	JN
10.334485	DECANOIC ACID	20.01	1900	JN
11.5393817	DECANOIC ACID, 2-HYDROXY-	22.39	500	JN
12.	UNKNOWN HYDROCARBON	22.56	380	J JN
13.14199156	BENZENEACETIC ACID, 4-HYDROX	24.40	690	NJ JN
14.	UNKNOWN HYDROCARBON	25.21	740	J JN
15.	UNKNOWN	25.47	1000	J JN
16.544638	TETRADECANOIC ACID	25.80	2500	NJ JN
17.1002842	PENTADECANOIC ACID	27.06	840	JN
20.57103	HEXADECANOIC ACID	28.75	40000	JN
21.506127	HEPTADECANOIC ACID	29.23	2500	JN
22.	UNKNOWN	29.67	990	J JN
23.	UNKNOWN	30.91	31000	J JN
24.57114	OCTADECANOIC ACID	31.08	7200	NJ JN
25.	UNKNOWN	32.81	18000	J JN
26.	UNKNOWN	33.06	18000	JN
27.	UNKNOWN	40.87	4400	JN
28.	UNKNOWN	40.96	3100	JN

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

518244

Lab Name: LAUCKS TESTING LABS Case No:

Matrix: (soil/water) WATER Lab Sample ID: 9212795-11

Sample wt/vol: 1000 (g/mL) ML Lab File ID: >LL284::D2

Level: (low/med) LOW Date Received: 12/17/92

% Moisture: decanted: (Y/N) N Date Extracted: 12/21/92

Concentrated Extract Volume: 1000 (ul) Date Analyzed: 12/28/92

Injection Volume: 2.0 (uL) Dilution Factor: 1

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 10

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	6.00	9	J ~~JN~~
2.	UNKNOWN	16.91	2	J ~~JN~~
3.	UNKNOWN HYDROCARBON	27.60	3	J ~~JN~~
4.	UNKNOWN	33.15	3	J ~~JN~~
5.	UNKNOWN	33.38	6	J ~~JN~~
6.2962892	BENZO[G]PTERIDINE-2,4(1H,3H)	36.95	3	NJ ~~JN~~
7.	UNKNOWN	37.48	5	J ~~JN~~
8.	UNKNOWN HYDROCARBON	40.78	3	J ~~JN~~
9.	UNKNOWN	43.22	5	J ~~JN~~
10.	UNKNOWN HYDROCARBON	43.73	3	J ~~JN~~

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

DOE SAMPLE NO.

518250

Lab Name: LAUCKS TESTING LABS Contract:

Lab Code: LAUCKS Case No.: SAS No.: SDG No.: 18230

Matrix: (soil/water) WATER Lab Sample ID: 12795-06

Sample wt/vol: 5.00 (g/ml) ML Lab File ID: >OL18M

Level: (low/med) LOW Date Received: 12/17/92

% Moisture: not dec. Date Analyzed: 12/18/92

GC Column: DB-624 ID: 0.53(mm) Dilution Factor: 1.0

Soil Extract Volume: (uL) Soil Aliquot Volume: (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 6

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.115106	METHANE, OXYBIS-	1.50	11	~~JN~~ NJ
2.75183	METHANE, THIOBIS-	1.70	71	~~JN~~
3.624920	DISULFIDE, DIMETHYL-	8.36	170	~~JN~~
4.1618264	2,4-DITHIAPENTANE	14.95	13	~~JN~~
5.3658808	TRISULFIDE, DIMETHYL-	18.37	21	~~JN~~
6.1120214	UNDECANE	22.66	26	~~JN~~
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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

SAMPLE NO.

518251

Lab Name: LAUCKS TESTING LABS Case No:

Matrix: (soil/water) WATER Lab Sample ID: 9212795-07

Sample wt/vol: 500 (g/mL) ML Lab File ID: >HA054::A4

Level: (low/med) LOW Date Received: 12/17/92

% Moisture: decanted: (Y/N) N Date Extracted: 12/29/92

Concentrated Extract Volume: 1000 (ul) Date Analyzed: 01/05/93

Injection Volume: 2.0 (uL) Dilution Factor: 5

GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

Number TICs found: 22

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.107926	BUTANOIC ACID	8.31	150	NJ ~~JN~~
2.503742	BUTANOIC ACID, 3-METHYL-	9.97	580	~~JN~~
3.116530	BUTANOIC ACID, 2-METHYL-	10.32	550	~~JN~~
4.109524	PENTANOIC ACID	11.20	1500	~~JN~~
5.646071	PENTANOIC ACID, 4-METHYL	12.56	1100	~~JN~~
6.646015	PROPANOIC ACID, 3-(METHYLTHI	14.88	120	~~JN~~
7.112345	ETHANOL, 2-(2-BUTOXYETHOXY)-	16.17	270	~~JN~~
8.13532188	PROPANOIC ACID, 3-(METHYLTHI	16.78	420	~~JN~~
9.103822	BENZENEACETIC ACID	17.65	78	~~JN~~
10.2613890	PROPANEDIOIC ACID, PHENYL-	17.89	200	~~JN~~
11.	UNKNOWN	18.30	67	J ~~JN~~
12.501520	BENZENEPROPANOIC ACID	19.63	2500	NJ JN
13.	UNKNOWN	19.96	78	J ~~JN~~
14.	UNKNOWN	25.18	62	J ~~JN~~
15.57103	HEXADECANOIC ACID	28.41	65	NJ ~~JN~~
16.	UNKNOWN	30.86	80	J ~~JN~~
17.	UNKNOWN	30.96	77	~~JN~~
18.	UNKNOWN	34.00	88	~~JN~~
19.	UNKNOWN	34.93	76	~~JN~~
20.	UNKNOWN	36.68	92	~~JN~~
21.	UNKNOWN	37.78	88	~~JN~~
22.	UNKNOWN	41.33	79	~~JN~~

Sm

Appendix I – Sampling Schedule – City of Raymond WTP, September 1992.

Parameter / Location:	InfR-1	InfR-2	InfR-E	InfR-R	Leach	EffR-1	EffR-2	EffR-E	EffR-ED
Type:	grab	grab	comp	comp	grab	grab	grab	comp	comp
Date:	9/29	9/29	9/29-30	9/29-30	9/29	9/29	9/29	9/29-30	9/29-30
Time:	1000	1540	0900-0900	0900-0900	1010	1045	1600	0900-0900	0900-0900
Lab Log #:	408260	408261	408262	408263	408270	408264	408265	408266	408269
GENERAL CHEMISTRY									
Conductivity	E	E	E	E		E	E	E	
Alkalinity			E	E				E	
Hardness				E				E	
TS			E	E				E	E
TNVS			E	E				E	E
TSS	E	E	ER	ER	E	E	E	ER	E
TNVSS			E	E				E	E
BOD5			ER	ER	E			ER	
COD	E	E	E	E		E	E	E	
TOC (water)	E	E	E	E		E	E	E	E
TOC (soil)									
NH3-N			ER	ER				ER	E
NO2+NO3-N			ER	ER				ER	E
Total-P			ER	ER				ER	E
Oil and Grease	E	E				E	E		
F-Coliform MF						E	E		
FIELD OBSERVATIONS									
Temperature (C)	E	E				E	E		
Temp-cooled (C)*+			E	E	E			E	
pH	E	E	E	E	E	E	E	E	
Conductivity (umhos/cm)	E	E			E	E			
Chlorine (mg/L)						E			
Sulfide (mg/L)						E			

InfR – City of Raymond influent
E – Ecology sample
ED – Ecology duplicate sample
Leach – Landfill leachate influent
R – City of Raymond sample
EffR – City of Raymond effluent

grab – grab sample
comp – composite sample
GC – grab-composite sample

Appendix I – Sampling Appendix I – (cont'd) – City of Raymond WTP, September 1992.

Parameter	Location:	EffR–GC	EffR–R
	Type:	grab–comp	comp
	Date:	9/29	9/29–30
	Time:	*	0900–0900
	Lab Log #:	408268	408267
GENERAL CHEMISTRY			
Conductivity		E	E
Alkalinity		E	E
Hardness		E	E
TS			E
TNVS			E
TSS		E	ER
TNVSS			E
BOD5			ER
COD			E
TOC (water)			E
TOC (soil)			
NH3–N			ER
NO2+NO3–N			ER
Total–P			ER
Oil and Grease			
F–Coliform MF			
FIELD OBSERVATIONS			
Temperature (C)			
Temp–cooled (C)*+			E
pH			E
Conductivity (umhos/cm)			
Chlorine (mg/L)			
Sulfide (mg/L)			

* grab composite sample collected as two equal volumes at 0920 12/15 and 1010 12/16.

Appendix J – Sampling Schedule – City of Raymond, December 1992.

Parameter	Location:	InfR-1	InfR-2	InfR-E	InfR-R	EffR-1	EffR-2	EffR-E	EffR-ED
	Type:	grab	grab	comp	comp	grab	grab	comp	comp
	Date:	12/15	12/15	12/15-16	12/15-16	12/15	12/15	12/15-16	12/15-16
	Time:	830	1350	0820-0820	0800-0800	0920	1415	0800-0800	0800-0800
	Lab Log #:	518238	518239	518240	518241	518242	518243	518244	518245
GENERAL CHEMISTRY									
Conductivity		E	E	E	E	E	E	E	
Alkalinity				E	E			E	
Hardness				E	E			E	
TS				E	E			E	E
TNVS				E	E			E	E
TSS		E	E	ER	ER	E	E	ER	E
TNVSS				E	E			E	E
BOD5				ER	ER			ER	
COD				E	E			E	
TOC (water)		E	E	E	E	E	E	E	E
TOC (soil/sed)									
NH3-N				E	E			E	E
NO2+NO3-N				E	E			E	E
Total-P				E	E			E	E
Oil and Grease		E	E			E	E		
F-Coliform MF (#/100mL)						E	E		
FIELD OBSERVATIONS									
Temperature		E	E			E	E		
Temp-cooled				E	E			E	
pH		E	E	E	E	E	E	E	
Conductivity (umhos/cm)		E	E	E	E	E	E	E	
Chlorine (mg/L)						E			
Sulfide (mg/L)						E			

InfR – City of Raymond influent
E – Ecology sample
ED – Ecology duplicate sample
R – City of Raymond sample
EffR – City of Raymond effluent

grab – grab sample
comp – composite sample
GC – grab composite sample

Appendix J – (cont'd) – City of Raymond, December 1992.

Parameter	Location:	EffR–GC	EffR–R
	Type:	grab–comp	comp
	Date:	12/15	12/15–16
	Time:	*	0800–0800
	Lab Log #:	518247	518246
GENERAL CHEMISTRY			
Conductivity		E	E
Alkalinity		E	E
Hardness		E	E
TS			E
TNVS			E
TSS		E	ER
TNVSS			E
BOD5			ER
COD			E
TOC (water)			E
TOC (soil/sed)			
NH3–N			E
NO2+NO3–N			E
Total–P			E
Oil and Grease			
F–Coliform MF (#/100mL)			
FIELD OBSERVATIONS			
Temperature			
Temp–cooled			E
pH			E
Conductivity (umhos/cm)			E
Chlorine (mg/L)			
Sulfide (mg/L)			

* grab composite sample collected as two equal volumes at 0920 12/15 and 1010 12/16.

Appendix K – VOA, BNA, Pesticide/PCB and Metals Scan Results – City of Raymond, September 1992.

(Group)[1]	VOA Compounds	InfR-1 grab 9/29 1000 408260 ug/L	InfR-2 grab 9/29 1540 408261 ug/L	EffR-1 grab 9/29 1045 408264	EffR-2 grab 9/29 1600 408265
a	Chloromethane	2.0 U	2.0 U	2.0 U	2.0 U
a	Bromomethane	2.0 U	2.0 U	2.0 U	2.0 U
	Vinyl Chloride	2.0 U	2.0 U	2.0 U	2.0 U
	Chloroethane	2.0 U	2.0 U	2.0 U	2.0 U
a	Methylene Chloride	2.0 U	2.0 U	5.2	2.0 U
	Acetone	49	17	11	7.7
	Carbon Disulfide	1.0 U	1.0 U	1.0 U	2.0 UJ
b	1,1-Dichloroethene	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane	1.0 U	1.0 U	1.0 U	1.0 U
b	1,2-Dichloroethene (total)	1.0 U	1.0 U	1.0 U	1.0 U
a	Chloroform	5.2	8.6	0.9 J	0.9 J
	1,2-Dichloroethane	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone (MEK)	8.5	5.0 U	5.0 U	5.0 U
c	1,1,1-Trichloroethane	1.0 U	1.0 U	1.0 U	1.0 U
a	Carbon Tetrachloride	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl Acetate	1.0 U	1.0 U	1.0 U	1.0 U
a	Bromodichloromethane	1.0 U	1.0 U	1.0 U	1.0 U
d	1,2-Dichloropropane	1.0 U	1.0 U	1.0 U	1.0 U
e	cis-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene	1.0 U	1.0 U	1.0 U	1.0 U
a	Dibromochloromethane	1.0 U	1.0 U	1.0 U	1.0 U
c	1,1,2-Trichloroethane	1.0 U	1.0 U	1.0 U	1.0 U
	Benzene	1.8	0.9 J	1.0 U	1.0 U
e	trans-1,3-Dichloropropene	1.0 U	1.0 U	1.0 U	1.0 U
i	2-Chloroethylvinyl Ether	1.0 U	1.0 U	1.0 U	1.0 U
a	Bromoform	1.0 U	1.0 U	1.0 U	1.0 U
	4-Methyl-2-Pentanone (MIBK)	5.0 U	5.0 U	5.0 U	5.0 U
	2-Hexanone	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene	1.0 U	1.0 U	1.0 U	1.0 U
f	1,1,2,2-Tetrachloroethane	1.0 U	1.0 U	1.0 U	1.0 U
	Toluene	6.0	3.5	1.0 U	1.0 U
g	Chlorobenzene	1.0 U	1.0 U	1.0 U	1.0 U
	Ethylbenzene	1.0 U	1.0 U	1.0 U	1.0 U
	Styrene	1.0 U	1.0 U	1.0 U	1.0 U
	Total Xylenes	3.3	1.3 J	2.0 U	2.0 U
a	Trichlorofluoromethane	2.0 U	2.0 U	2.0 U	2.0 U
	1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	2.0 U	2.0 U	2.0 U	2.0 U

InfR – City of Raymond influent
EffR – City of Raymond effluent
grab – grab sample

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.

Appendix K (cont'd) – City of Raymond, September 1992.

(Group)[1]	BNA Compounds	InfR-E comp 9/29-30 0900-0900 408262 ug/L	EffR-E comp 9/29-30 0900-0900 408266 ug/L
	Phenol	4.6	2 U
l	Bis(2-Chloroethyl)Ether	2 U	1 U
	2-Chlorophenol	2 U	1 U
h	1,3-Dichlorobenzene	2 U	1 U
h	1,4-Dichlorobenzene	2 U	1 U
	Benzyl Alcohol	5.1	5 U
h	1,2-Dichlorobenzene	2 U	1 U
	2-Methylphenol	2 U	1 U
l	2,2'-Oxybis(1-Chloropropane)	2 U	1 U
	4-Methylphenol	21	1 U
k	N-Nitroso-di-n-Propylamine	2 U	1 U
	Hexachloroethane	4 U	2 U
	Nitrobenzene	2 U	1 U
	Isophorone	2 U	1 U
l	2-Nitrophenol	10 U	5 U
	2,4-Dimethylphenol	4 U	2 U
	Benzoic Acid	110 J	10 UJ
l	Bis(2-Chloroethoxy)Methane	2 U	1 U
	2,4-Dichlorophenol	6 U	3 U
g	1,2,4-Trichlorobenzene	2 U	1 U
n	Naphthalene	2 U	1 U
	4-Chloroaniline	6 U	3 U
	Hexachlorobutadiene	4 U	2 U
	4-Chloro-3-Methylphenol	4 U	2 U
	2-Methylnaphthalene	2 U	1 U
	Hexachlorocyclopentadiene	10 U	5 U
	2,4,6-Trichlorophenol	10 U	5 U
	2,4,5-Trichlorophenol	10 U	5 U
m	2-Chloronaphthalene	2 U	1 U
	2-Nitroaniline	10 U	5 U
l	Dimethyl Phthalate	2 U	1 U
n	Acenaphthylene	2 U	1 U
	3-Nitroaniline	10 U	5 U
n	Acenaphthene	2 U	1 U
l	2,4-Dinitrophenol	20 U	10 U
l	4-Nitrophenol	10 U	5 U

InfR – City of Raymond influent
EffR – City of Raymond effluent
comp – composite sample

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.

Appendix K – (cont'd) – City of Raymond, September 1992.

(Group)[1]	BNA Compounds	InfR–E comp 9/29–30 0900–0900 408262 ug/L	EffR–E comp 9/29–30 0900–0900 408266 ug/L
	Dibenzofuran	2 U	1 U
o	2,4–Dinitrotoluene	10 UJ	5 U
o	2,6–Dinitrotoluene	10 U	5 U
i	Diethyl Phthalate	4.1	1 U
p	4–Chlorophenyl Phenylether	2 U	i U
n	Fluorene	2 U	i U
	4–Nitroaniline	10 U	5 U
l	4,6–Dinitro–2–Methylphenol	20 U	10 U
k	N–Nitrosodiphenylamine	2 U	1 U
p	4–Bromophenyl Phenylether	2 U	1 U
g	Hexachlorobenzene	2 U	1 U
	Pentachlorophenol	10 U	5 U
n	Phenanthrene	2 U	1 U
	Carbazole	2 U	1 U
n	Anthracene	2 U	1 U
i	Di–n–Butyl Phthalate	2 U	1 U
n	Fluoranthene	2 U	1 U
n	Pyrene	2 U	1 U
i	Butylbenzyl Phthalate	2 U	1 U
	3,3'–Dichlorobenzidine	10 U	5 U
n	Benzo(a)Anthracene	2 U	1 U
i	Bis(2–Ethylhexyl)Phthalate	2.7	0.6 J
n	Chrysene	2 U	1 U
i	Di–n–Octyl Phthalate	2 U	1 U
n	Benzo(b)Fluoranthene	2 U	1 U
n	Benzo(k)Fluoranthene	2 U	1 UJ
n	Benzo(a)Pyrene	2 U	1 U
n	Indeno(1,2,3–cd)Pyrene	2 UJ	1 UJ
n	Dibenzo(a,h)Anthracene	2 U	1 U
n	Benzo(g,h,i)Perylene	2 UJ	i UJ

InfR – City of Raymond influent
EffR – City of Raymond effluent
comp – composite sample

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.

Appendix K – (cont'd) – City of Raymond, September 1992.

(Group)[1]	Pesticide/PCB Compounds	InfR–E comp 9/29–30 0900–0900 408262 ug/L		EffR–E comp 9/29–30 0900–0900 408266 ug/L	
q	alpha–BHC	0.05	U	0.05	U
q	beta–BHC	0.05	U	0.05	U
q	delta–BHC	0.05	U	0.05	U
q	gamma–BHC (Lindane)	0.05	U	0.05	U
r	Heptachlor	0.05	U	0.05	U
	Aldrin	0.05	U	0.05	U
r	Heptachlor Epoxide	0.05	U	0.05	U
s	Endosulfan I	0.05	U	0.05	U
	Dieldrin	0.10	U	0.10	U
u	4,4'–DDE	0.10	U	0.10	U
t	Endrin	0.10	U	0.10	U
s	Endosulfan II	0.10	U	0.10	U
u	4,4'–DDD	0.10	U	0.10	U
s	Endosulfan Sulfate	0.10	U	0.10	U
u	4,4'–DDT	0.10	U	0.10	U
	Methoxychlor	0.50	U	0.50	U
t	Endrin Ketone	0.10	U	0.10	U
v	alpha–Chlordane	0.05	U	0.05	U
v	gamma–Chlordane	0.05	U	0.05	U
	Toxaphene	5.0	U	5.0	U
w	Aroclor–1016	1.0	U	1.0	U
w	Aroclor–1221	2.0	U	2.0	U
	Aroclor–1248	1.0	U	1.0	U
	Aroclor–1254	1.0	U	1.0	U
	Aroclor–1260	1.0	U	1.0	U
w	Aroclor–1232	1.0	U	1.0	U
t	Endrin Aldehyde	0.10	U	0.10	U

InfR – City of Raymond influent
EffR – City of Raymond effluent
comp – composite sample

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

Appendix K – (cont'd) – City of Raymond, September 1992.

Metals		InfR-E comp 9/29-30 0900-0900 408262	EffR-E comp 9/29-30 0900-0900 408266 ug/L
Antimony		30 U	30 U
Arsenic		2.6 PN	1.6 PN
	Pentavalent		
	Trivalent		
Beryllium		1.0 U	1.0 U
Cadmium		2.0 U	2.0 U
Chromium		3230	5.0 U
	Hexavalent		
	Trivalent		
Copper		158	7.2 P
Lead		36.2	5.5
Mercury		0.18 PN	0.050 UN
Nickel		10 U	10 U
Selenium		2.0 UJ	2.0 UJ
Silver		0.77 P	0.50 U
Thallium		2.5 UN	2.5 UN
Zinc		269	21

InfR – City of Raymond influent
EffR – City of Raymond effluent
comp – composite sample

U – The analyte was not detected at or above the reported result.
N – The spike sample recovery is not within control limits.
UJ – The analyte was not detected at or above the reported estimated result.
P – The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

a Total Halomethanes
b Total Dichloroethenes
c Total Trichloroethanes
d Total Dichloropropanes
e Total Dichloropropenes
f Total Tetrachloroethanes
g Total Chlorinated Benzenes (excluding Dichlorobenzenes)
h Total Dichlorobenzenes
i Total Phthalate Esters
l Total Chloroalkyl Ethers
k Total Nitrosamines
i Total Nitrophenols
m Total Chlorinated Naphthalenes
n Total Polynuclear Aromatic Hydrocarbons
o Total Dinitrotoluenes
p Total Haloethers
q Total BHCs
r Heptachlor
s Endosulfan
i Endrin
u DDT plus metabolites
v Total Chlordane
w Total Aroclors (PCBs)

Appendix L – VOA, BNA, Pesticide/PCB and Metals Scan Results – City of Raymond, December 1992.

(Group)[1]	VOA Compounds				
	Location:	EffR-1		EffR-2	
	Type:	grab		grab	
	Date:	12/15		12/15	
	Time:	0920		1415	
	Lab Log#:	518242		518243	
		ug/L		ug/L	
a	Chloromethane	10	U	10	U
a	Bromomethane	10	U	10	U
	Vinyl Chloride	10	U	10	U
	Chloroethane	10	U	10	U
a	Methylene Chloride	10	U	10	U
	Acetone	9	J	26	
	Carbon Disulfide	10	U	10	U
b	1,1-Dichloroethene	10	U	10	U
	1,1-Dichloroethane	10	U	10	U
b	1,2-Dichloroethene (total)	10	U	10	U
a	Chloroform	10	U	10	U
	1,2-Dichloroethane	10	U	10	U
	2-Butanone (MEK)	10	U	10	U
c	1,1,1-Trichloroethane	10	U	10	U
a	Carbon Tetrachloride	10	U	10	U
a	Bromodichloromethane	10	U	10	U
d	1,2-Dichloropropane	10	U	10	U
e	cis-1,3-Dichloropropene	10	U	10	U
	Trichloroethene	10	U	10	U
a	Dibromochloromethane	10	U	10	U
c	1,1,2-Trichloroethane	10	U	10	U
	Benzene	10	U	10	U
e	trans-1,3-Dichloropropene	10	U	10	U
a	Bromoform	10	U	10	U
	4-Methyl-2-Pentanone (MIBK)	10	U	10	U
	2-Hexanone	10	U	10	U
	Tetrachloroethene	10	U	10	U
f	1,1,2,2-Tetrachloroethane	10	U	10	U
	Toluene	10	U	10	U
g	Chlorobenzene	10	U	10	U
	Ethylbenzene	10	U	10	U
	Styrene	10	U	10	U
	Total Xylenes	10	U	10	U

EffR – City of Raymond effluent
grab – grab sample

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.

Appendix L – (cont'd) – City of Raymond, December 1992.

	Location:	EffR–E
	Type:	comp
	Date:	12/15–16
	Time:	0800–0800
	Lab Log#:	518244
(Group)[1]	BNA Compounds	ug/L
	Phenol	1 U
	Aniline	5 U
j	Bis(2–Chloroethyl)Ether	1 U
	2–Chlorophenol	1 U
h	1,3–Dichlorobenzene	1 U
h	1,4–Dichlorobenzene	1 U
	Benzyl Alcohol	1 U
h	1,2–Dichlorobenzene	1 U
	2–Methylphenol	1 U
l	Bis(2–Chloroisopropyl)Ether	1 U
	4–Methylphenol	1 U
k	N–Nitroso–di–n–Propylamine	1 U
	Hexachloroethane	2 U
	Nitrobenzene	1 U
	Isophorone	1 U
l	2–Nitrophenol	2 U
	2,4–Dimethylphenol	1 U
	Benzoic Acid	25 U
j	Bis(2–Chloroethoxy)Methane	1 U
	2,4–Dichlorophenol	2 U
g	1,2,4–Trichlorobenzene	1 U
n	Naphthalene	1 U
	4–Chloroaniline	1 U
	Hexachlorobutadiene	1 U
	4–Chloro–3–Methylphenol	2 U
	2–Methylnaphthalene	1 U
	Hexachlorocyclopentadiene	2 U
	2,4,6–Trichlorophenol	2 U
	2,4,5–Trichlorophenol	2 U
m	2–Chloronaphthalene	1 U
	2–Nitroaniline	2 U
i	Dimethyl Phthalate	1 U
n	Acenaphthylene	1 U
o	2,6–Dinitrotoluene	2 U
	3–Nitroaniline	5 U
n	Acenaphthene	1 U
j	2,4–Dinitrophenol	10 U
i	4–Nitrophenol	10 U
	Dibenzofuran	1 U

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

EffR– City of Raymond effluent
comp – composite sample

Appendix L – (cont'd) – City of Raymond, December 1992.

	Location:	EffR–E
	Type:	comp
	Date:	12/15–16
	Time:	0800–0800
	Lab Log#:	518244
(Group)[1]	BNA Compounds	ug/L
o	2,4–Dinitrotoluene	2 U
i	Diethyl Phthalate	1 U
p	4–Chlorophenyl Phenylether	1 U
n	Fluorene	1 U
	4–Nitroaniline	2 U
l	4,6–Dinitro–2–Methylphenol	10 U
k	N–Nitrosodiphenylamine	1 U
	1,2–Diphenylhydrazine	2 U
p	4–Bromophenyl Phenylether	2 U
g	Hexachlorobenzene	2 U
	Pentachlorophenol	10 U
n	Phenanthrene	1 U
n	Anthracene	1 U
	Carbazole	1 U
i	Di–n–Butyl Phthalate	1 U
n	Fluoranthene	1 U
n	Pyrene	1 U
i	Butylbenzyl Phthalate	1 U
	3,3'–Dichlorobenzidine	10 U
n	Benzo(a)Anthracene	1 U
n	Chrysene	1 U
i	Bis(2–Ethylhexyl)Phthalate	1 U
i	Di–n–Octyl Phthalate	1 U
n	Benzo(b)Fluoranthene	1 U
n	Benzo(k)Fluoranthene	1 U
n	Benzo(a)Pyrene	1 U
n	Indeno(1,2,3–cd)Pyrene	1 U
n	Dibenzo(a,h)Anthracene	1 U
n	Benzo(g,h,i)Perylene	1 U

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

EffR– City of Raymond effluent
comp – composite sample

Appendix L – (cont'd) – City of Raymond, December 1992.

	Location:	EffR–E
	Type:	comp
	Date:	12/15–16
	Time:	0800–0800
	Lab Log#:	518244
(Group)[1]	Pesticide/PCB Compounds	ug/L
q	alpha–BHC	0.006 N
q	beta–BHC	0.006 U
q	delta–BHC	0.009 U
q	gamma–BHC (Lindane)	0.006
r	Heptachlor	0.003 U
	Aldrin	0.006 U
r	Heptachlor Epoxide	0.083 U
s	Endosulfan I	0.014 U
	Dieldrin	0.01 U
u	4,4'–DDE	0.004 U
t	Endrin	0.01 U
s	Endosulfan II	0.004 U
u	4,4'–DDD	0.011 U
s	Endosulfan Sulfate	0.066 U
u	4,4'–DDT	0.012 U
i	Endrin Aldehyde	0.023 U
v	Chlordane	0.014 U
	Toxaphene	0.24 U
w	Aroclor–1016	0.065 U
w	Aroclor–1221	0.13 U
w	Aroclor–1232	0.65 U
w	Aroclor–1242	0.65 U
w	Aroclor–1248	0.65 U
w	Aroclor–1254	0.65 U
w	Aroclor–1260	0.65 U

EffR– City of Raymond effluent
comp – composite sample

U – The analyte was not detected at or above the reported result.
N – There is evidence the analyte is present in this sample.

Appendix L – (cont'd) – City of Raymond, December 1992.

Location:	EffR–E
Type:	comp
Date:	12/15–16
Time:	0800–0800
Lab Log#:	518244

Metals	ug/L
Antimony	30 U
Arsenic	5.8 J
Pentavalent	
Trivalent	
Beryllium	1.0 U
Cadmium	0.13 P
Chromium	5.0 U
Hexavalent	
Trivalent	
Copper	7.7 P
Lead	8.6 J
Mercury	0.050 UJ
Nickel	10 U
Selenium	2.0 UN
Silver	0.50 U
Thallium	2.5 UN
Zinc	32

U – The analyte was not detected at or above the reported result.
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The analyte was not detected at or above the reported estimated result.
N – The spike sample recovery is not within control limits.
P – The analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

a Total Halomethanes
b Total Dichloroethenes
c Total Trichloroethanes
d Total Dichloropropanes
e Total Dichloropropenes
f Total Tetrachloroethanes
g Total Chlorinated Benzenes (excluding Dichlorobenzenes)
h Total Dichlorobenzenes
i Total Phthalate Esters
j Total Chloroalkyl Ethers
k Total Nitrosamines
l Total Nitrophenols
m Total Chlorinated Naphthalenes
n Total Polynuclear Aromatic Hydrocarbons
o Total Dinitrotoluenes
p Total Haloethers
q Total BHCs
r Heptachlor
s Endosulfan
i Endrin
u DDT plus metabolites
v Total Chlordane
w Total Aroclors (PCBs)