OLYMPUS TERRACE SEWER DISTRICT
WASTEWATER TREATMENT PLANT
MARCH 16-19, 1992 CLASS II INSPECTION

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by
Steven Golding

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Toxics, Compliance and Ground Water Investigations Section
Olympia, WA 98504-7710

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ABSTRACT

A Class II inspection was conducted at the Olympus Terrace Sewer District Wastewater Treatment Plant (WTP) on March 16-19, 1992. The WTP was performing well during the inspection. The conventional parameters of 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), and fecal coliform indicate a well-treated, high quality effluent. The effluent met permit limits for $CBOD_5$, TSS, fecal coliform, and pH. A number of priority and other organic pollutants were detected in the samples collected. Six priority pollutant organics were found in the effluent, all at concentrations well below EPA water quality criteria. No pesticides were detected. Of the several priority pollutant metals detected in the effluent, cadmium, copper, and silver exceeded U.S. Environmental Protection Agency (EPA) water quality criteria. Bioassay organism sensitivity to Olympus Terrace effluent was variable. Microtox showed some toxicity. Rainbow trout experienced increased mortality. Fathead minnow showed no significant mortality, but impaired growth. No significant toxic effects were found for *Ceriodaphnia dubia* or *Daphnia pulex*. A cause of mortality in the tests may have been exposure of organisms to chlorine. The effluent samples were not dechlorinated prior to the bioassay tests.

In the sediment samples, only three organic compounds were detected. No organic compounds found that were included in the Department of Ecology Marine Sediment Quality Standards exceeded standards. No pesticides/PCB compounds were detected. Nine metals were detected in the sediments, all below applicable sediment standards. The sediment samples had a high sand content, indicating the non-depositional character of the receiving environment.

INTRODUCTION

A Class II inspection was conducted at the Olympus Terrace Sewer District (OT) Wastewater Treatment Plant (WTP) on March 16-19, 1992. Conducting the inspection were Rebecca Inman and Steven Golding from the Washington State Department of Ecology (Ecology) Toxics, Compliance and Ground Water Investigations Section. Assisting from the OT staff were Gil Bridges (Plant Supervisor and Lead Operator), Darin Janda (Operator 2), and Al Bahl (Lab Technician). David Wright of the Ecology Northwest Regional Office requested the inspection.

Located south of Mukilteo (Figure 1), the plant serves residential areas within the sewer district, the city of Mukilteo, plus a portion of the industrial development adjoining Paine Field. The WTP discharge into Puget Sound - Possession Sound is regulated by discharge permit WA-002339-6.

The plant is an oxidation-type secondary facility (Figure 2). Treatment units include two oxidation ditches, three secondary clarifiers, two chlorine contact chambers, and two aerobic digesters. Waste activated sludge is dewatered in a screw press, then transported by tank truck to a Metro wastewater treatment facility in Renton.

Objectives of the inspection included:

1. verify compliance with NPDES permit parameters;

2. analyze WTP loading and efficiency;

3. characterize wastewater toxicity with priority pollutant scans and bioassays;

4. assess toxicity of sediments near the outfall; and

5. assess permittee's self-monitoring by reviewing sampling, flow measurement, and lab procedures.

PROCEDURES

Composite samples were taken at influent (Inf-C) and effluent (Eff-C) locations. Ecology Isco composite samplers were set up to collect equal volumes of sample every 30 minutes for 24 hours. Samples of chlorinated effluent taken at two times comprised the grab-composite samples for bioassay tests. Influent, effluent, return activated sludge, and sludge grab samples were also taken. Sampler configurations and locations are summarized in Figure 2 and Table 1. Olympus Terrace also collected grab samples and composite influent and effluent samples. The OT samplers were set to collect equal volumes of sample every hour for 24 hours. All composite samples were split for both Ecology and OT laboratory analysis. The sampling schedule, parameters analyzed, and sample splits are included in Appendix A.

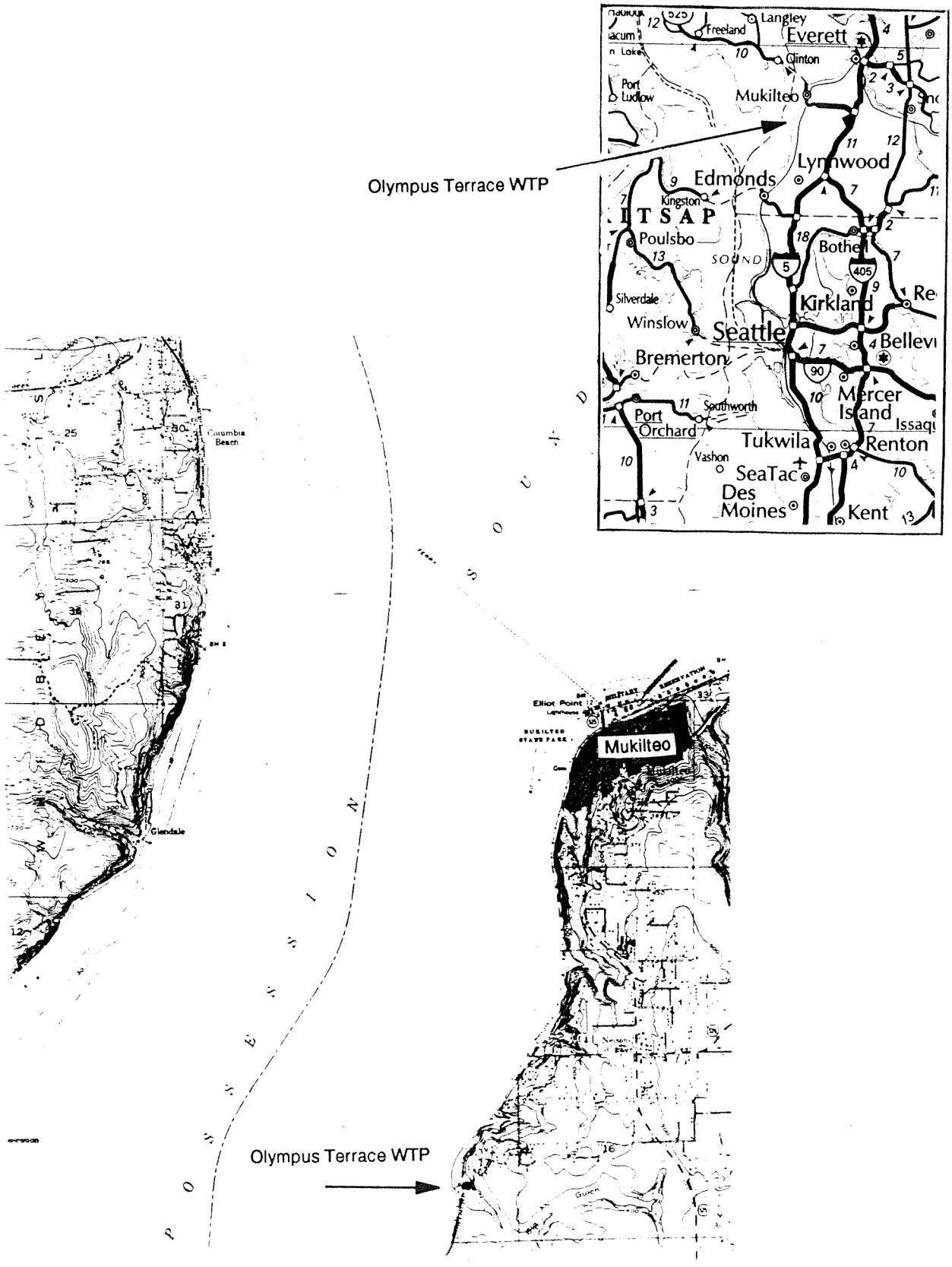

Figure 1 – Location Map – Olympus Terrace WTP, March 1992.

Figure 2 – Flow Schematic – Olympus Terrace, March 1992.

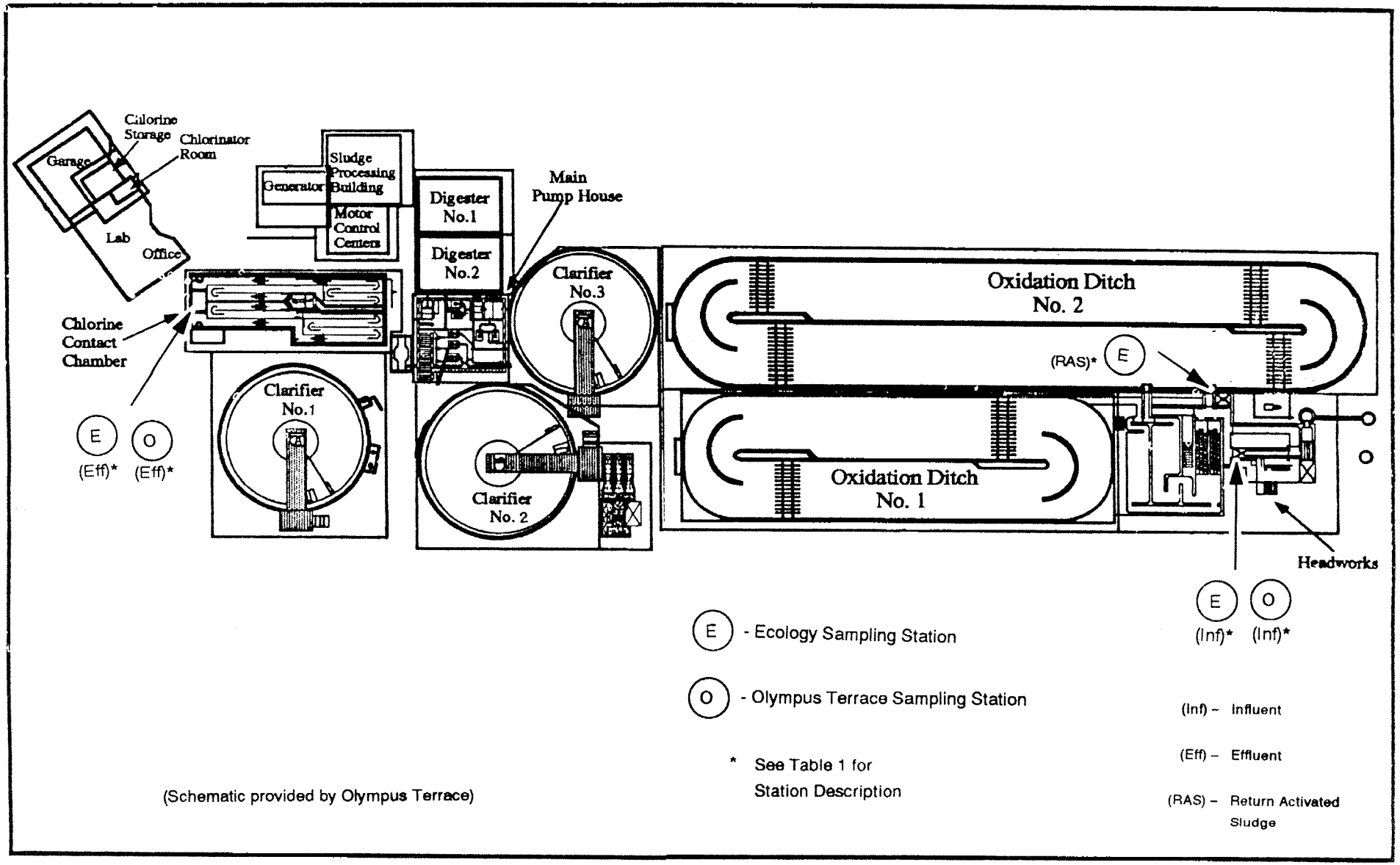

Table 1. Sampling Station Description - Olympus Terrace WTP, March 1992.

Ecology influent samples (Inf)

The grab and composite samples were collected in the influent channel, downstream of the bar screen, and eight feet upstream of the channel outlet into the return activated sludge. The composite sample intake was positioned in mid-channel, just above channel bottom.

Olympus Terrace composite influent sample (Inf-O)

The sample intake was mounted in the influent channel, downstream of the bar screen, and three feet upstream of the channel outlet into the return activated sludge. The intake was positioned just above channel bottom.

Return Activated Sludge (RAS)

Samples were collected from the return activated sludge outlet channel. The channel was well mixed.

Ecology effluent samples (Eff)

The samples were collected from the chlorine contact chamber outlet channel, just upstream of the outfall line. The composite sample intake was weighted to maintain position in the chlorine contact chamber.

Olympus Terrace composite effluent sample (Eff-O)

The sampler intake was positioned in the chlorine contact chamber outlet channel, just upstream of the outfall line.

Sludge

Sludge was sampled as it was exuded from the screw press.

Sed-1

Sample collected approximately 50 feet northwest of the buoy marking the outfall in 62-65 feet of water. 47°54.76'N. 122°19.35'W.

Sed-2

Sample collected approximately 100 yards south of the buoy marking the outfall in 50 feet of water. 47°54.68'N. 122°19.34'W.

Sed-3

Sample collected approximately 1/4 mile north of the buoy marking the outfall in approximately 70 feet of water. 47°55.13'N. 122°19.08'W.

Sediment samples were collected from Possession Sound by Ecology with a 0.1 m^2 van Veen grab sampler at three stations; one at a background site approximately 1/4 mile north of a buoy marking the outfall pipe (Sed-3), one approximately 50 feet northwest of the buoy (Sed-1), and one approximately 100 yards south of the buoy (Sed-2). The buoy had been placed in February 1992, for an outfall dilution study conducted by CH_2M Hill (1992).

At each sediment station, the top two centimeters of sample from successive grab samples were collected. A bottle was filled from the first grab for volatile organic analysis (VOA) while the remainder of the sample was put in a prepared stainless steel bucket. When the bucket was full, the contents of the bucket were homogenized by manual mixing, then put in appropriate containers for base-neutral acid extractables (BNA), pesticide/PCB, and metals analysis. Sampling times and parameters analyzed appear in Appendix A.

Samples for Ecology analysis were kept on ice and delivered to Manchester Laboratory on March 19, 1992, maintaining field chain-of-custody tracking on all samples. A summary of analytical methods, references, and the laboratory conducting the analysis is given in Appendix B.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Sampling

Ecology quality assurance procedures for sampling included special cleaning of the sampling equipment prior to the inspection to prevent sample contamination (Appendix C).

For sediment samples, sampling quality assurance/quality control steps included collecting only sediment not in direct contact with the sampler and pre-inspection special cleaning of equipment that would touch the samples (Appendix C).

Chain-of-custody procedures were followed to assure the security of the samples (Huntamer and Hyre, 1991).

Most Ecology laboratory data 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.

General Chemistry Analysis

Results were acceptable other than as qualified. Carbonaceous biochemical oxygen demand (CBOD), total organic carbon (TOC), chemical oxygen demand (COD), % solids, % volatile solids, and grain size all may be used without qualification. The method blank and standard for total (persulfate) nitrogen were well outside of control limits; total nitrogen was not reported.

VOA, BNA, and Pesticide/PCB Priority Pollutant Organics Analysis

VOA analyses were generally acceptable. Surrogate recoveries were below acceptable limits in water samples 128086 and 128087. A "J" qualifier was applied to these data to flag them as estimates. Matrix spike recoveries for cis-1,2-dichloroethene and bromochloromethane were high in sample 128081 and "J" qualifiers were added to the results of these compounds. Sample 92-128095 had recoveries above acceptable limits for a number of the earlier eluting compounds. The "J" qualifier was added to the results of these compounds. Low levels of the common laboratory solvents acetone and methylene chloride were detected in the laboratory blanks.

BNA analyses were generally acceptable. The "J" qualifier was added to data for sample no. 128091 because surrogate recoveries were not within acceptable limits. Low levels of some BNA target compounds were detected in laboratory blanks.

Chlorinated pesticides/PCBs were generally acceptable. No target compounds were detected in the laboratory blanks. A laboratory accident resulted in the loss of data for a number of compounds in sample 128088.

Metals Analysis

Spike recoveries for water samples were within the acceptable limits of +/-25%, with the exception of As and Hg. Spike recoveries for the ICP determination of As and for the CVAA determination of Hg were low. Because of the low recoveries, these results are qualified with an "N." For the sludge sample, spike recoveries for As and Se in the GFAA determination and Hg in the CVAA determination were low, and qualified with an "N." For the sediment samples, a trace amount of Cu was detected in the procedural blank, and the results are qualified with a "B." For the sediment samples, the spike recoveries for Sb and Cr fell outside of acceptable limits and are qualified with an "N."

RESULTS AND DISCUSSION

Wastewater

Flow

Flow is measured by a Parshall flume located between the clarifiers and chlorine contact chambers. The flume is not readily accessible and flow measurements were not verified by Ecology. The flume is calibrated every six months (Bridges, 1992).

There had been a question about the accuracy of the effluent flow meter. Subsequent testing found the meter to be accurate under all flow conditions (Wade, 1992).

There are three influent flow meters for the flow lines coming into the WTP. The WTP personnel reported that the meters measuring influent to the plant appear to be grossly

inaccurate. Wade (1992) reports the following: One meter is along the road and two are on the hillsides above the plant. The one on the north hillside is inaccurate, because of steep slope and a sharp turn in the line. The other two have been determined to have acceptable accuracy. The influent meters are used to indicate inflow and infiltration. They are not used as primary flow measurement devices. Wade reports that Hammond, Collier, and Wade - Livingstone Associates, Inc. will be trying to improve the accuracy of the north hillside meter.

NPDES Permit Compliance/General Chemistry

The WTP was performing well during the inspection. The conventional parameters of BOD_5, TSS, and fecal coliform indicate a well-treated, high quality effluent (Table 2). The effluent met National Pollutant Discharge Elimination System (NPDES) permit limits for 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, and pH (Table 3).

Indicators that the plant was operating well within design constraints were effluent $CBOD_5$ (5 mg/L), TSS (5 mg/L), and flow (1.57 MGD) compared with permitted $CBOD_5$ (25 mg/L monthly average), TSS (30 mg/L monthly average), and flow (2.27 MGD at 25 mg/L monthly average $CBOD_5$ and 474 lbs/day).

A comparison of influent ammonia and nitrate-nitrite concentrations indicate that the WTP was achieving substantial nitrification at the time of the inspection. Ammonia concentrations of approximately 20 mg/L in the influent were reduced to approximately 0.25 mg/L in the effluent, while $NO_2 + NO_3$ concentrations increased from approximately 0.3 mg/L in the influent to approximately 8 mg/L in the effluent (Table 2). The alkalinity in the effluent is somewhat low. Observations of pH and alkalinity should be made to assure that reduced alkalinity does not inhibit nitrification.

Split Sample Results

Samples were split to determine the comparability of Ecology and permittee laboratory results and sampling methods. Ecology and OT laboratory analyses for each sample were in close agreement, within 13% for influent and within 3 mg/L for effluent (Table 4). The results of analyses for Ecology effluent samples and corresponding Olympus Terrace effluent samples were also close, within 2 mg/L.

The Ecology and OT influent results, however, differed by a factor of two or more. The Ecology sample yielded very high concentrations of BOD_5, $CBOD_5$, and TSS. Substantial numbers of large particles were visible in the Ecology Inf-C sample.

The positioning of the Ecology sampler intake appears to be responsible for the excessive solids collected in the influent and the high values of BOD_5, $CBOD_5$, and TSS found. For this reason, the Inf-O appears to be more indicative of the WTP influent and has been used for the purposes of determining percent removal of influent BOD_5 and TSS in Table 3.

Table 2 – General Chemistry Results – Olympus Terrace, March 1992.

	Location:	Inf-1	Inf-2	Inf-3	Inf-C	Inf-O	RAS-1	RAS-2
	Type:	grab	grab	grab	E-comp	O-comp	grab	grab
	Date:	3/17	3/17	3/17	3/17	3/17	3/17	3/17
	Time:	1020	1550	1610	0745-0745	0745-0745	0900	1440
	Lab Log #:	128080	128081	128097	128082	128083	128084	128085
GENERAL CHEMISTRY								
Conductivity (umhos/cm)		590	582		631	543		
Alkalinity (mg/L CaCO3)					134	161		
Hardness (mg/L CaCO3)					120	51.2		
TS (mg/L)					857J	464J		
TNVS (mg/L)					229	169		
TSS (mg/L)		155	140		267	140	6480J	5830J
TNVSS (mg/L)					33	28	1620	1470
% Solids								
% Volatile Solids								
BOD5 (mg/L)					>225	162		
CBOD5 (mg/L)					>450	94		
COD (mg/L)		670	290		980	290		
TOC (water mg/L)		67.3	71.7		296	61.8		
TOC (soil mg/Kg)								
NH3-N (mg/L)		16.7	21.4		25.2	21.2		
NO2+NO3-N (mg/L)		0.412	0.327		0.305	0.111		
Total-P (mg/L)		5.63	5.16		13.2	5.53		
F-Coliform MF (#/100mL)								
Fecal Coliform (sediment)								
Total Coliform (sediment)								
Cyanide total (ug/L)		0.09	0.02					
Cyanide (wk & dis ug/L)		0.002	0.002					
FIELD OBSERVATIONS								
Temperature (C)		14						
Temp-cooled (C)*					2.5	7.3		
pH (S.U.)		7.1			6.8	7.7		
Conductivity (umhos/cm)		570			470	389		
Chlorine (mg/L)								
Free								
Total								
Sulfide (mg/L)		<0.1						

Inf – influent
E-comp – Ecology composite sample
O-comp – Olympus Terrace composite sample
RAS – return activated sludge
Eff – effluent
GC – grab composite sample
Sludge – sludge sample from the screw 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.

Sed-1 – Sediment sample collected approximately 50 feet northwest of buoy marking outfall pipe.
Sed-2 – Sediment sample collected approximately 100 yards south of buoy marking outfall pipe.
Sed-3 – Sediment sample collected approximately 1/4 mile north of buoy marking outfall pipe.

Table 2 – (cont'd) – Olympus Terrace, March 1992.

Parameter II	Location:	Eff-1	Eff-2	Eff-C	Eff-O	Eff-GC	Eff-3	Eff-4	Sludge	Sed-1	Sed-2	Sed-3
	Type:	grab	grab	E-comp	O-comp	grab-comp	grab	grab	grab	grab	grab	grab
	Date:	3/17	3/17	3/17	3/17	3/17	3/18	3/18	3/18	3/19	3/19	3/19
	Time:	0840	1415	0745-0745	0745-0745	*	0800	1145	1030	1150	1300	1415
	Lab Log #:	128086	128087	128088	128089	128090	128092	128093	128091	128094	128095	128096
GENERAL CHEMISTRY												
Conductivity (umhos/cm)		494	478	473	470	485						
Alkalinity (mg/L CaCO3)				54.2	53.3							
Hardness (mg/L CaCO3)				53.7	55.7	55.7						
TS (mg/L)				365J	357J							
TNVS (mg/L)				169	143							
TSS (mg/L)		7	6	5	5	7						
TNVSS (mg/L)				1	1							
% Solids									8.4	75.5	75.0	76.3
% Volatile Solids									6.4	0.72	0.74	0.67
BOD5 (mg/L)				5	3							
CBOD5 (mg/L)				5	4							
COD (mg/L)		29	29	34	34							
TOC (water mg/L)		8.1	8.5	8.6	8.2							
TOC (soil mg/Kg)									240000	1600	2800	2300
NH3-N (mg/L)		0.169	0.223	0.316	0.228							
NO2+NO3-N (mg/L)		7.92	8.61	8.03	8.20							
Total-P (mg/L)		0.989	1.46	1.27	1.28							
F-Coliform MF (#/100mL)							9	26				
Fecal Coliform (sediment)									16,000,000			
Total Coliform (sediment)									>16,000,000			
Cyanide total (ug/L)		0.01	0.01									
Cyanide (wk & dis ug/L)		0.002	0.002						7.2J	.09U	0.13U	0.13U
FIELD OBSERVATIONS												
Temperature (C)		12.8	13.7				12.6	13.2				
Temp-cooled (C)*				3.8	7.9							
pH (S.U.)		6.4	6.1	6.8	7.4		7.4	7.2				
Conductivity (umhos/cm)		710	130	370	410		380	473				
Chlorine (mg/L)												
Free		<0.1	<0.1	<0.1	<0.1		<0.1	<0.1				
Total		<0.1	1.0	0.6	0.3		0.6	0.1				
Sulfide (mg/L)		<0.1	<0.1									

* grab composite sample collected as two equal volumes at 0840 and 1415 on 3/17.

Table 3 – NPDES Permit Limits and Inspection Results – Olympus Terrace, March 1992.

	NPDES Limits		Inspection Results	
Parameter	Monthly Average	Weekly Average	Composite Samples	Grab Samples
CBOD5	25 mg/L 474 lbs/day 85 % removal	40 mg/L 759 lbs/day	5 mg/L 65 lbs/day 97 % removal*	
TSS	30 mg/L 540 lbs/day 85 % removal	45 mg/L 854 lbs/day	5 mg/L 65 lbs/day 96 % removal*	
Fecal Coliform	200/100 ml	400/100mL		9/100 mL 26/100 mL
pH	6.0 to 9.0 (continuous)			6.4; 6.1; 7.4; 7.2
Flow	--	--	1.57 MGD**	

* based on analyses of OT samples

** 24 hour effluent flow measured by Olympus Terrace

Table 4 – Split Sample Results Comparison – Olympus Terrace, March 1992.

Location:		Inf–C	Inf–O	Eff–C	Eff–O	Eff
Type:		E–comp	O–comp	E–comp	O–comp	Ef–grab
Date:		3/17	3/17	3/17	3/17	*
Time:		0745–0745	0745–0745	0745–0745	0745–0745	
Lab Log #:		128082	128083	128088	128089	
Sampled by:		Ecology	Olympus Terrace	Ecology	Olympus Terrace	
Parameter	Analysis by:					
BOD5 (mg/L)						
	Ecology	>225	162	5	3	
	Olympus Terrace	630	158	5	5	
CBOD5 (mg/L)						
	Ecology	>450	94	2	2	
	Olympus Terrace	390	85	5	4	
TSS (mg/L)						
	Ecology	267	140	5	5	
	Olympus Terrace	252	122	5	5	
F–Coliform MF (#100/mL)						
	Ecology					9; 26
	Olympus Terrace					10
pH						
	Ecology					6.4; 6.1
	Olympus Terrace					6.9
Total Chlorine (mg/L)						
	Ecology					0.6; 0.1
	Olympus Terrace					0.25

Inf –influent
Eff –effluent
E–comp –Ecology composite sample
O–comp –Olympus Terrace composite sample
grab – grab sample
Ef–grab –effluent grab samples

* Ecology data collected 3/18/92
Olympus Terrace data collected 3/17/92

Laboratory Audit

The Olympus Terrace laboratory was audited by Ecology's Quality Assurance Section during the inspection (Appendix I). The audit was performed in anticipation of the need for the laboratory to become accredited by Ecology before July 1, 1994. A number of suggestions for personnel training and for improved laboratory operations are included in the audit report.

Priority Pollutant Scans

A number of organic priority pollutants were detected in the samples collected (Table 5). With the exception of acetone in Inf-2 and 4-methylphenol in Inf-C, the 17 priority pollutant organics detected in influent samples were detected at low concentrations (less than 17 μg/L). Acetone is used for laboratory cleaning of sampling apparatus and is not likely representative of the influent.

Six organic priority pollutants and two other organic pollutants were detected in the effluent. All were at concentrations of 2 μg/L (est.) or lower, well below the EPA water quality criteria (Table 6 - EPA, 1986).

No pesticides were detected in the influent or effluent samples. A laboratory accident eliminated a number of the effluent pesticide compounds from analysis. OT took samples before and after the inspection, on March 12 and March 19, 1992. No pesticides/PCBs were detected in the samples, with the exception of 4,4'-DDE (0.20 μg/L) in the March 12 influent sample.

Of the seven priority pollutant metals detected in the effluent samples collected, copper exceeded the United States Environmental Protection Agency (EPA) acute marine water quality criterion by a factor of 5.5 (Table 6 - EPA, 1986). Olympus Terrace performed additional metals analyses for samples collected March 12, 1992, before the inspection, and March 19, 1992, after the inspection. Results agreed closely with those of the inspection, except for lead, with a concentration of 16 μg/L on March 12 (Table 7).

Complete priority pollutant scan results with detection limits are included in Appendix D - VOA's, Appendix E - BNA's, Appendix F - Pesticides/PCB's, and Appendix G - metals.

A number of Tentatively Identified Compounds (TICs) were found in the influent samples at concentrations up to 3,200 μg/L (est.). TICs were found in the effluent samples at concentrations of up to 61 μg/L (est.). In the sludge sample, TICs were found at concentrations of up to 120,000 μg/L (est.). In the sediment samples, TIC concentrations of up to 2900 μg/L (est.) were found. Appendix H summarizes TICs found.

During the inspection, on March 17 at 1605, the WTP influent became blue in color. A grab sample of the blue influent was collected (Inf-3). Cadmium, mercury, nickel, chromium, silver, and zinc in the grab were found in concentrations from 1.1 to four times higher than those of the Inf-C sample (Table 5).

Table 5 – VOA, BNA, Pesticide/PCB Compounds, Metals Detected – Olympus Terrace, March 1992.

	Location:	Inf–1	Inf–2	Inf–3	Inf–C	Inf–O
	Type:	grab	grab	grab	E–comp	O–comp
	Date:	3/17	3/17	3/17	3/17	3/17
	Time:	1020	1550	1610	0745–0745	0745–0745
	Lab Log #:	128080	128081	128097	128082	128083
VOA Compounds		ug/L	ug/L			
Acetone		21 U	187			
Chloroform		4	4.5 J			
1,1,1–Trichloroethane		0.3 J	1 J			
Bromomethane		1 U	1 U			
Bromodichloromethane		0.3 J	0.3 J			
Trichloroethene		0.1 J	0.1 J			
1,2–Dichlorobenzene		1 U	1 U			
p–Isopropyltoluene		1 U	8 J			
1,4–Dichlorobenzene		2.5	3 J			
4–Methyl–2–Pentanone (MIBK)		1	1 U			
Toluene		1 U	1 J			
Chlorobenzene		1 U	1 U			
Dibromochloromethane		1 U	1 U			
Tetrachloroethene		0.2 J	0.3 J			
BNA Compounds					ug/L	
Benzo(a)Pyrene					2 J	
Benzoic Acid					98 UJ	
Isophorone					8 U	
Diethyl Phthalate					9	
4–Methylphenol					150	
1,4–Dichlorobenzene					2 J	
Phenol					6 J	
Bis(2–Ethylhexyl)Phthalate					17	
Di–n–Octyl Phthalate					4 J	
2,4–Dinitrotoluene					20 U	
Pesticides/PCB Compounds						
(none detected)						
Metals			ug/L	ug/L	ug/L	
Arsenic			1.7 PN	1.5 UN	1.5 UN	
Beryllium			1.0 U	1.0 U	1.0 U	
Cadmium			9.26	5.12	5.27	
Chromium			31	21	18	
Copper			78.3	87.6	65.7	
Lead			8.5	6.5	4.4 P	
Mercury			0.27 PN	0.100 PN	0.26 PN	
Nickel			12 P	6.6	2.6 P	
Selenium			2.8 P	2.0 U	2.0 U	
Silver			33.9	8.90	9.82	
Zinc			162	146	82.4	

Inf – influent
Eff – effluent
grab – grab sample
comp – composite sample
E–comp – Department of Ecology composite sample
O–comp – Olympus Terrace composite sample

U – The analyte was not detected at or above the associated value.
J – The analyte was positively identified. The associated value is an estimate.
UJ – The analyte was not detected at or above the associated estimated value.
P – The analyte was detected above the instrument detection limit but below the established quantitation limit.
N – The spike sample recovery is not within control limits.
B – Analyte was found in the analytical method blank indicating the sample may have been contaminated.

Sed–1 – Sediment sample collected approximately 50 feet northwest of buoy marking outfall pipe.
Sed–2 – Sediment sample collected approximately 100 yards south of buoy marking outfall pipe.
Sed–3 – Sediment sample collected approximately 1/4 mile north of buoy marking outfall pipe.

[ ] – indicates detect

Table 5 -(cont'd) - Olympus Terrace, March 1992.

Location:	Eff-1	Eff-2	Eff-C	Eff-O	Sludge	Sed-1	Sed-2	Sed-3
Type:	grab	grab	E-comp	O-comp	grab	grab	grab	grab
Date:	3/17	3/17	3/17	3/17	3/18	3/19	3/19	3/19
Time:	0838	1417	0745-0745	0745-0745	1030	1150	1300	1415
Lab Log #:	128086	128087	128088	128089	128091	128094	128095	128096
VOA Compounds	ug/L	ug/L			ug/Kg	ug/Kg	ug/Kg	ug/Kg
Acetone	5 UJ	9 UJ			1500 J	15 U	17 UJ	10 U
Chloroform	0.5 J	2 J			59 U	4 U	4 U	2 U
1,1,1-Trichloroethane	1 UJ	1 UJ			59 U	4 U	4 U	2 U
Bromomethane	1 UJ	1 UJ			3 J	4 UJ	4 UJ	2 UJ
Bromodichloromethane	0.3 J	2 J			59 U	4 U	4 U	2 U
Trichloroethene	1 UJ	1 UJ			59 U	4 U	4 U	2 U
1,2-Dichlorobenzene	1 UJ	1 UJ			12 J	4 U	4 U	2 U
p-Isopropyltoluene	1 UJ	1 UJ			59 U	4 U	4 U	2 U
1,4-Dichlorobenzene	0.3 J	0.3 J			120	4 U	4 U	2 U
4-Methyl-2-Pentanone (MIBK)	1 UJ	1 UJ			59 U	4 U	4 UJ	2 U
Toluene	1 J	0.5 J			1900 J	4 U	4 U	2 U
Chlorobenzene	1 UJ	1 UJ			13 J	4 U	4 U	2 U
Dibromochloromethane	0.1 J	0.5 J			59 U	4 U	4 U	2 U
Tetrachloroethene	0.1 J	0.04 J			60	4 U	4 U	2 U
BNA Compounds			ug/L		ug/L	ug/L	ug/L	ug/L
Benzo(a)Pyrene			1 U		1100 UJ	110 U	130 U	110 U
Benzoic Acid			17 UJ		14000 UJ	250 J	310 J	350 J
Isophorone			1 U		480 J	110 UJ	130 UJ	14 J
Diethyl Phthalate			1 U		1100 UJ	110 U	130 U	110 U
4-Methylphenol			0.5 J		23000 J	110 U	130 U	110 U
1,4-Dichlorobenzene			0.2 J		1100 UJ	110 U	130 U	110 U
Phenol			1 U		1800 J	110 U	130 U	150 U
Bis(2-Ethylhexyl)Phthalate			1 U		16000 UJ	270 U	130 U	170 U
Di-n-Octyl Phthalate			1 UJ		1100 UJ	110 UJ	130 UJ	110 UJ
2,4-Dinitrotoluene			3 U		2800 UJ	17 J	330 U	280 U
Pesticides/PCB Compounds								
(none detected)								
Metals			ug/L	ug/L	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic			1.5 UN	1.5 UN	1.8 N	1.2	1.1	1.93
Beryllium			1.0 U	1.0 U	0.50 U	0.10 U	0.10 P	0.10 U
Cadmium			1.47	2.0 U	31.2	0.364	0.123	0.22 P
Chromium			5.4 P	5.0 P	267	27.5 N	35.6 N	28.3 N
Copper			16	17	492	5.57 B	4.71 B	4.62 B
Lead			1.3 P	20 U	58 P	3.82	9.18	4.26
Mercury			0.05 U	0.05 U	0.163 N	0.017 PJ	0.015 PJ	0.013 PJ
Nickel			2.4 P	2.3 P	28 P	21.7	24.5	22.0
Selenium			2.0 U	2.0 U	1.95 N	0.20 UJ	0.20 UJ	0.20 UJ
Silver			0.55 P	0.58 P	59.3	0.5 U	0.50 U	0.50 U
Zinc			51.8	53.6	983	29.6	26.5	27.5

Table 6 – Comparison of Data to Water Quality Criteria – Olympus Terrace, March 1992.

Location:	Eff–1	Eff–2	Eff–C	Eff–O	EPA Water Quality Criteria Summary	
Type:	grab	grab	E–comp	O–comp		
Date:	3/17	3/17	3/17	3/17	Acute Marine	Chronic Marine
Time:	0840	1415	0745–0745	0745–0745		
Lab Log #:	128086	128087	128088	128089		
VOA Compounds	ug/L	ug/L			(ug/L)	(ug/L)
Chloroform	0.5 J	2 J			12,000 *(a)	6,400 *(a)
Bromodichloromethane	0.3 J	2 J			12,000 *(a)	6,400 *(a)
1,4–Dichlorobenzene	0.3 J	0.3 J			1,970 *(h)	
Toluene	1 J	0.5 J			6,300 *	5,000 *
Dibromochloromethane	0.1 J	0.5 J			12,000 *(a)	6,400 *(a)
Tetrachloroethene	0.1 J	0.04 J			10,200 *	450 *
BNA Compounds						
4–Methylphenol			0.5 J			
1,4–Dichlorobenzene			0.2 J		1,970 *(h)	
Pesticides/PCB Compounds						
(none detected)						
Metals			ug/L	ug/L		
Cadmium			1.47	2.0 U	43	9.3
Chromium (total)			5.4 P	5.0 P		
Hexavalent					1,100	50
Trivalent					10,300 *	
Copper			16	17	2.9	
Lead			1.3 P	20 U	140	5.6
Nickel			2.4 P	2.3 P	75	8.3
Silver			0.55 P	0.58 P	2.3	
Zinc			51.8	53.6	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.

* Insufficient data to develop criteria. Value presented is the LOEL – Lowest Observed Effect Level.

Eff – effluent
grab – grab sample
E–comp – Department of Ecology composite sample
O–comp – Olympus Terrace composite sample

U The analyte was not detected at or above the reported result.
UJ The analyte was not detected at or above the reported estimated 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
h Total dichlorobenzenes

Table 7 – Comparison of Ecology Results with Olympus Terrace Pre– and Post–inspection Results – Olympus Terrace, March 1992.

	Ecology Analyses				Olympus Terrace Analyses	
Location:	Eff–C	Eff–O	Eff–1	Eff–2	Eff	Eff
Type:	E–comp	O–comp	grab	grab		
Date:	3/17	3/17	3/17	3/17	3/12	3/19
Time:	0745–0745	0745–0745	0840	1415		
Lab Log #:	128088	128089	128086	128087		
Metals						
Arsenic (ug/L)	1.5 UN	1.5 UN				
Beryllium (ug/L)	1.0 U	1.0 U				
Cadmium (ug/L)	1.47	2.0 U			1.3	0.10 U
Chromium (ug/L)	5.4 P	5.0 P				4.2
Hexavalent Chromium (ug/L)					10 U	
Copper (ug/L)	16	17			13	12
Lead (ug/L)	1.3 P	20 U			16	1.1
Mercury (ug/L)	0.05 U	0.05 U			0.50 U	0.50 U
Nickel (ug/L)	2.4 P	2.3 P			2.1	2.7
Selenium (ug/L)	2.0 U	2.0 U			5.0 U	5.0 U
Silver (ug/L)	0.55 P	0.58 P			10 U	10 U
Zinc (ug/L)	51.8	53.6			90	
Selected General Chemistry Parameters						
Ammonia (mg/L)	0.316	0.228	0.169	0.223	2.7	0.50 U
NO2+NO3–N (mg/L)	8.03	8.20	7.92	8.61		
Total Kjeldahl Nitrogen (mg/L)					5.3	1.1
Cyanide total (ug/L)			0.01	0.01	0.020	0.010 U
Chlorine (mg/L)			<0.1	1.0	<0.1	0.50

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

Eff– effluent sample
E–comp – Department of Ecology composite sample
O–comp – Olympus Terrace composite sample
grab – grab sample

OT reports that a blue dye sometimes found in its influent is an organic dye used by Packaging Alternatives. OT has sampled the dye, and has found it to contain no metals (Bridges, 1992). It is not clear whether the blue influent sampled by Ecology represented the same source as the blue dye sampled by OT. OT personnel have indicated that the WTP has also received slugs of printer's ink with elevated cadmium.

The Olympus Terrace WTP receives industrial wastes from industries adjoining Paine Field. The industries include metal platers. OT samples influent from industries which may contribute metals to the waste stream. Representatives of the WTP have been working with the industries to try to reduce metals loads (Bridges, 1992).

Bioassays

Bioassay organism sensitivity to Olympus Terrace effluent was variable (Table 8). The effluent showed some toxicity to Microtox at 15 minutes. No significant acute or chronic toxic effects were observed in *Ceriodaphnia dubia*, though survival at 100% effluent concentration was only 60%. Any toxic effects to *Ceriodaphnia dubia* would have been masked by high variability in test results. No toxicity to *Daphnia pulex* was found, with survival at or above 85% at all concentrations. The fathead minnow tests revealed no acute toxicity in the effluent. There was impairment of growth, with a no observable effect concentration (NOEC) of 25% effluent.

The rainbow trout test (in 100% effluent) showed 27% mortality as compared with 0% mortality in the control. The Class II inspection was carried out during the one-year period that an acute biomonitoring study was required by the permit. Any test result below 80% survival for a salmonid, *Ceriodaphnia dubia*, or fathead minnow requires the permittee to retest in a series of dilutions and to investigate any unusual conditions which might have caused the toxicity.

The effluent samples were not dechlorinated prior to the bioassay tests. Chlorine may have had a toxic effect in the tests. The total chlorine in Eff-GC at the time of collection is estimated as 0.5 mg/L, an average of the two composite-grab samples taken with Eff-1 (<0.1 mg/L) and Eff-2 (1.0 mg/L). The chlorinator was being adjusted manually during the inspection and chlorine dosages were fluctuating widely. Dosing was not automatic because the chlorinator was being converted to use WTP effluent rather than potable water.

Experience with bioassay testing has shown that effluent samples with initial total chlorine concentrations of less than 1 mg/L may still show a chlorine residual one week later in the laboratory (Stinson, 1992). Total chlorine was not measured during the bioassay testing of samples from OT.

A study of fish including the fathead minnow found 96-hour lethal concentrations at 50% mortality (LC_{50}s) ranging from 0.09 to 0.30 mg/L (EPA, 1976). Mortality was low in the Olympus Terrace fathead minnow bioassay test, indicating low total chlorine in the sample, or chlorine in a form less toxic than that cited above (Table 8). In the study cited by EPA (1976),

Table 8 – Effluent Bioassay Results – Olympus Terrace, March 1992.

Microtox

EC50 (% effluent)

Sample	Sample No.	5 minutes	15 minutes
Control		a	a
EFF-GC	128090	>100%	60%

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

Ceriodaphnia dubia - seven-day survival test

(Ceriodaphnia dubia)

Sample No. 128090

% effluent	# Tested*	# young produced	Percent Survival
Control	10	52	90
6.25 % Effluent	10	51	70
12.5 % Effluent	10	187	90
25 % Effluent	10	296	80
50 % Effluent	10	377	100
100 % Effluent	10	175	60

* 10 replicates per concentration, 1 organism per replicate.

Chronic	Acute
NOEC=100% effluent	NOEC=100% effluent

Daphnia pulex - 48-hour survival test

(Daphnia Pulex)

Sample No. 128090

% effluent	# Tested*	% survival
Control	20	100
6.25 % Effluent	20	85
12.5 % Effluent	20	90
25 % Effluent	20	95
50 % Effluent	20	95
100 % Effluent	20	85

* four replicates per concentration, 5 organism per replicate.

NOEC=100% effluent
LC50>100%

Table 8 - (cont'd) - Olympus Terrace, March 1992.

Fathead Minnow - 7 day survival and growth test
(Pimephales promelas)
Sample 228242 - 001GC

Sample Conc.	# Tested *	Percent Survival	Average Weight per Fish (mg)
Control	35	94.3	0.28
6.25% Effluent	35	100.0	0.22
12.5 % Effluent	35	91.4	0.19
25 % Effluent	36	91.4	0.26
50 % Effluent	35	97.1	0.19
100 % Effluent	35	97.1	0.17

Acute	Chronic
NOEC = 100 % effluent	NOEC = 25 % effluent
LC50 = >100 % effluent	

* five replicates per concentration, 7 organisms per replicate.

Rainbow Trout - 96 hour survival test
(Oncorhynchus mykiss)

Sample	Sample No.	% Effluent	# Tested	Percent Survival
Control		--	30	100
EFF-GC	128090	100	30	73.3

NOEC - no observable effects concentration
LC50 - lethal concentration for 50% of the organisms

rainbow trout exposed to chlorine had a 96-hour LC_{50} of 0.014 to 0.029 mg/L, a factor of ten lower than that for fathead minnows. Consistent with this, in the Olympus Terrace bioassay tests, higher mortality was found in the rainbow trout than in the fathead minnows, although other toxicants or other factors could be involved.

Sludge

Sludge is wasted from the RAS line to an aerobic digester. The digester was being used as a holding tank because, according to plant personnel, the digesters are insufficiently aerated. The other digester was not being used. From the digester, the sludge is dewatered by the screw press. The sludge is then transported by tank truck to a Metro wastewater treatment facility in Renton. Sludge samples were collected from the screw press as it operated. General chemistry parameters are shown in Table 2.

Priority Pollutant Organics

Seven VOA compounds were found in the sludge sample (Table 5). Acetone (1500 μg/Kg dry wt. est.) is used in the cleaning of sampling equipment and is not considered representative of the sample. Toluene (1900 μg/Kg dry wt. est.) was found in the sludge in the highest concentration. All other VOA compounds were found in concentrations of 120 μg/Kg or below.

Three BNA compounds were found in the sludge sample. They were 4-methylphenol (274 mg/Kg dry wt. est.), phenol (21.4 mg/Kg dry wt. est.), and isophorone (5.7 mg/Kg dry wt. est.).

Pesticides/PCBs

No Pesticides/PCBs were found in the sludge sample.

National Sludge Survey

The sludge data for Olympus Terrace were compared with means for data from a sludge survey of a large number of WTPs throughout the nation (Table 9 - EPA, 1990).

None of the VOA, BNA, or pesticides/PCB compounds listed in the national sludge survey were detected in the sludge sample. Ten metals were detected in the sludge sample (Table 5), two of which exceeded the means from the national sludge survey. Cadmium (31.2 mg/Kg) exceeded the mean of 6.9 mg/Kg and chromium (267 mg/Kg) exceeded the mean of 118.6 mg/Kg. Cadmium was the only analyte exceeding the mean+1SD from the national sludge survey. As discussed, both cadmium and chromium were found in the blue influent slug at higher concentrations than in the influent composite sample. There are, however, several contributors of metals to the OT WTP.

Table 9 – Comparison of Detected Compounds in Digested Sludge with the National Sewage Sludge Survey+ – Olympus Terrace, March 1992.

		Data from EPA Sludge Survey *			
Parameter	Location: Sludge Type: grab Lab Log # 128091 (mg/Kg**	Geometric Mean ** (mg/Kg***)	Geometric Mean + 1 S.D. (mg/Kg***)	Number of Samples	Percent Detected %
METALS					
Arsenic	1.8N	9.93	18.8	199	80
Cadmium	31.2	6.9	11.8	198	69
Chromium	267	118.6	339.0	199	91
Copper	492	741.0	962.0	199	100
Lead	58P	134.0	198.0	199	80
Mercury	0.163N	5.22	16	199	63
Nickel	28P	42.7	95.0	199	66
Selenium	1.95N	5.16	7.3	199	65
Zinc	983	1202	1554.0	199	100

\+ EPA 1990.

* Geometric mean and standard deviation are exponential conversions of arithmetic mean and standard deviation for log-normal distributions and were derived utilizing the Method of Maximum Likelihood.

** In general, concentrations are a weighted combination of flow rate group estimates.

*** dry weight basis

Weighted combination of only two flow groups - for flow > 100 MGD and 10<flow<+100 MGD.

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.

Sediment

General Chemistry/Physical Characteristics

General chemistry results for Sed-1 (near the outfall), Sed-2 (edge of dilution zone), and Sed-3 (background) were similar. Percent solids ranged from 75.0 to 76.3. Percent volatile solids ranged from 0.67 to 0.74. Total organic carbon ranged from 1,600 mg/Kg to 2,800 mg/Kg (Table 2). Grain size distributions were almost identical, with each sediment sample composed of 95% sand (Table 10). The sediment samples had a high sand content, indicating the non-depositional character of the receiving environment.

Priority Pollutant Scans

No VOA compounds were detected in the sediment samples. Three BNA compounds were detected (Table 5). None of the organic compounds included in the Department of Ecology Marine Sediment Quality Standards exceeded standards (Table 11 - Ecology, 1991). No pesticides/PCB compounds were detected. The paucity of organic compounds in these sediments is probably largely due to the non-depositional character of the receiving environment. The high sand content of the samples verifies this. Nine metals were detected in the sediment samples. All were well below criteria.

Bioassays

No toxicity was found by the Microtox test in any of the three sediment samples. The amphipod test showed no significant toxic effect, with four percent or less mortality in the samples (Table 12).

For the echinoderm embryo test, both abnormal/dead and mortality increased with distance from the WTP outfall. While this appears to be counterintuitive, these differences are not statistically significant (Stinson, 1992).

RECOMMENDATIONS AND CONCLUSIONS

Wastewater

Flow

Flow is measured by a Parshall flume. Testing has found the meter to be accurate under all flow conditions (Wade, 1992).

Table 10 – Sediment Grain Size Analysis and General Chemistry Results
Olympus Terrace, March 1992.

Station:	Sed-1	Sed-2	Sed-3
Type:	grab	grab	grab
Date:	3/19	3/19	3/19
Time:	1150	1300	1415
Lab Log#:	128094	128095	128096
Grain Size Analysis*	(%)	(%)	(%)
Gravel			
>4750	0	0	0
4750-2000	2	0	0
	2	0	0
Sand			
2000-850	3	0	6
850-425	13	1	8
425-250	44	16	11
250-106	28	59	54
106-75	5	15	12
75-62.5	2	4	4
	95	95	95
Silt			
62.5-31.2	0	2	0
31.2-15.6	1	0	1
15.6-7.8	0	1	0
7.8-3.9	0	0	0
	1	3	1
Clay			
3.9-1.9	0	0	0
1.9-0.9	1	0	1
<0.9	1	2	3
	2	2	4
% Solids	76	75	76
% Volatile Solids	0.72	0.74	0.67
% TOC (dry wt. basis)	1,600	2,800	2,300

* Grain sizes are in microns.

Sed-1 - Near outfall. Sediment sample collected approximately 50 feet northwest of buoy marking outfall pipe.

Sed-2 - Edge of dilution zone. Sediment sample collected approximately 100 yards south of buoy marking outfall pipe.

Sed-3 - Background. Sediment sample collected approximately 1/4 mile north of buoy marking outfall pipe.

Table 11 – Comparison of Sediment Sample Data to Toxicity Criteria – Olympus Terrace, March 1992.

	Dry Weight Basis			Organics Data Normalized to TOC			Criteria*	
Location:	Sed–1	Sed–2	Sed–3	Sed–1	Sed–2	Sed–3		
Type:	grab	grab	grab	grab	grab	grab		
Date:	3/19	3/19	3/19	3/19	3/19	3/19	Dry Wt.	TOC
Time:	1150	1300	1415	1150	1300	1415	Basis	Basis
Lab Log#:	128094	128095	128096	128094	128095	128096		
VOA Compounds	ug/Kg	ug/Kg	ug/Kg	mg/Kg	mg/Kg	mg/Kg	ug/Kg	mg/Kg
1,2–Dichlorobenzene	4 U	4 U	2 U	2.5 U	1.4 U	0.9 U		2.3
1,4–Dichlorobenzene	4 U	4 U	2 U	2.5 U	1.4 U	0.9 U		3.1
BNA Compounds	ug/Kg	ug/Kg	ug/Kg					
LPAH	110 U	130 U	110 U	69 U	46 U	48 U		370
Benzoic Acid	331 J	413 J	459 J				650	
Isophorone	146 UJ	173 UJ	18.3 J	91 U	62 U	8 J		
2,4–Dinitrotoluene	22.6 J	440 U	367 U	13 J	157 U	160 U		
HPAH	110 U	130 U	110 U	69 U	46 U	48 U		960
Pesticides/PCB Compounds							Dry Wt. Basis	
(none detected)								
Metals	mg/Kg	mg/Kg	mg/Kg				mg/Kg	
Arsenic	1.2	1.1	1.93				57	
Beryllium	0.10 U	0.10 P	0.10 U					
Cadmium	0.364	0.123	0.22 P				5.1	
Chromium	27.5 N	35.6 N	28.3 N				260	
Copper	5.57 B	4.71 B	4.62 B				390	
Lead	3.82	9.18	4.26				450	
Mercury	0.017 PJ	0.015 PJ	0.013 PJ				0.41	
Nickel	21.7	24.5	22.0					
Zinc	29.6	26.5	27.5				410	

*Department of Ecology Marine Sediment Quality Standards

U – the analyte was not detected at the given detection limit.
J –indicates an estimated value for a detected analyte.
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.
N – the spike sample recovery was not within control limits.
B – analyte was also found in the analytical method blank indicating the sample may have been contaminated.

LPAH – sum of Low Molecular Weight Polynuclear Aromatic Hydrocarbons.
HPAH – sum of High Molecular Weight Polynuclear Aromatic Hydrocarbons.

Sed–1 – Near outfall. Sediment sample collected approximately 50 feet northwest of buoy marking outall pipe.
Sed–2 – Edge of dilution zone. Sediment sample collected approximately 100 yards south of buoy marking outfall pipe
Sed–3 – Background. Sediment sample collected approximately 1/4 mile north of buoy marking outfall pipe.

[ ] – indicates detect

Table 12 – Sediment Bioassay Results – Olympus Terrace, March 1992.

Microtox Sediment Toxicity Test

Sample	Sample No.	EC50 (% extract) 5 minutes	15 minutes
Sed-1	128094	a	a
Sed-2	128095	a	a
Sed-3	128096	a	a

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

Echinoderm embryo 96-hour sediment test
(Strongylocentrotus purpuratus)

Sample	Sample No.	% Abnormal	% Abnormal or Dead	% Mortality
Sea water control		7.7	30.6	24.5
Yaquina Bay Control		12.1	29.7	20.1
Sed-1	128094	8.7	32.2	25.8
Sed-2	128095	7.8	40.0	35.0
Sed-3	128096	7.6	47.7	43.5

* Based on an average initial count of 300 embryos per 10 ml subsample. 5 replicates (subsamples) per sample.

Amphipod 10-day sediment test
(Rhepoxinius abronius)

Sample*	Sample No.	% Mortality
Yaquina Bay Control		1
Sed-1	128094	4
Sed-2	128095	2
Sed-3	128096	1

*Five replicates of twenty organisms per treatment

Sed-1 - Sediment sample collected approximately 50 feet northwest of buoy marking outfall pipe.
Sed-2 - Sediment sample collected approximately 100 yards south of buoy marking outfall pipe.
Sed-3 - Sediment sample collected approximately 1/4 mile north of buoy marking outfall pipe.

- The influent flow meter on the north hillside is reported to be inaccurate. It is recommended that the influent flow meters be fixed or reworked to provide for accurate influent measurements.

NPDES Permit Compliance/General Chemistry

The WTP was performing well during the inspection. Influent loading was well below permitted limits and the effluent met permitted limits for $CBOD_5$, TSS, fecal coliform, pH, and flow. The WTP was achieving substantial nitrification at the time of the inspection.

- The alkalinity in the effluent is somewhat low. Observations of pH and alkalinity should be observed to assure that alkalinity does not inhibit nitrification.

Split Sample Results

Ecology and OT laboratory analyses were in close agreement. Effluent samples also compared closely.

Laboratory Audit

In conjunction with the inspection, the Olympus Terrace laboratory was audited. A number of recommendations for improved laboratory operations and personnel training were included in the audit report (see Appendix I).

Priority Pollutant Scans

A number of organic priority pollutants were detected in the wastewater. All eight organic priority pollutants detected in the effluent were at concentrations of 2 μg/L (est.) or lower, well below EPA water quality criteria. Seven priority pollutant metals were detected in the effluent samples collected. Of these, copper exceeded EPA acute marine water quality criteria by a factor of 5.5.

Olympus Terrace personnel have indicated that the WTP has received slugs of printer's ink with elevated cadmium. During the inspection a grab sample of blue colored influent having somewhat elevated metals concentrations was collected. Olympus Terrace has been making an effort to control metals entering the plant.

- Efforts should continue to minimize influent metal loads, to reduce slug loads, and to prevent EPA water quality criteria from being exceeded.

Bioassays

Bioassay organism sensitivity to Olympus Terrace effluent was variable. No toxic effects were found in *Ceriodaphnia dubia* or *Daphnia pulex* tests. The fathead minnow test revealed no acute

toxicity, but there was impairment of growth. The effluent showed some toxicity to Microtox. The rainbow trout test produced 73% survival, slightly less than the 80% or greater specified in the permit.

The effluent samples were not dechlorinated prior to the bioassay tests. Chlorine in the effluent may have had a toxic effect on the organisms in the bioassay tests.

- Conducting the rainbow trout bioassay on unchlorinated or dechlorinated effluent is recommended to help determine if chlorine was the toxicant.

Sludge

Several analytes were detected in the priority pollutant scan. Toluene (1900 μg/Kg dry wt. est.) was the organic found in the sludge in the highest concentration.

Cadmium was the only analyte exceeding the mean+1SD from the national sludge survey.

Sediment

General chemistry results for the three sediment sampling locations were similar. Each sediment sample composed of 95% sand, suggesting the outfall is in a non-depositional area.

Only three organic compounds were detected. Nine metals were detected in the sediment samples. All organics and metals detected were at concentrations less than the Department of Ecology Marine Sediment Quality Standards.

No toxicity was found by the Microtox test or the amphipod test in any of the three sediment samples. Also, the echinoderm embryo test found no significant differences between sediment samples.

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APPENDICES

Appendix A – Sampling Schedule – Olympus Terrace, March 1992.

Parameter	Location:	Inf–1	Inf–2	Inf–3	Inf–C	Inf–O	RAS–1	RAS–2
	Type:	grab	grab	grab	E–comp	O–comp	grab	grab
	Date:	3/17	3/17	3/17	3/17	3/17	3/17	3/17
	Time:	1020	1550	1610	745–0745	745–0745	0900	1440
	Lab Log #:	128080	128081	128097	128082	128083	128084	128085
GENERAL CHEMISTRY								
Conductivity		E	E		E	E		
Alkalinity					E	E		
Hardness					E	E		
TS					E	E		
TNVS					E	E		
TSS		E	E		EO	EO	E	E
TNVSS					E	E	E	E
% Solids								
% Volatile Solids								
BOD5					EO	EO		
BOD INH					EO	EO		
COD		E	E		E	E		
TOC (water)		E	E		E	E		
TOC (soil)								
NH3–N		E	E		E	E		
NO2+NO3–N		E	E		E	E		
Total–P		E	E		E	E		
Total Persulfate N (TPN)								
F–Coliform MF								
F–Coliform (sediment)								
T–Coliform (sediment)								
Grain Size								
Cyanide total		E	E					
Cyanide (wk & dis)		E	E					
ORGANICS								
VOC (water)		E	E					
VOC (soil)								
BNAs (water)					E			
BNAs (soil)								
Pest/PCB (water)					E			
Pest/PCB (soil)								
METALS								
PP Metals					E	E		
BIOASSAYS								
Salmonid (acute 100%)								
Microtox (acute)								
Daphnia pulex (acute)								
Ceriodaphnia (chronic)								
Fathead Minnow (chronic)								
Echinoderm sperm cell								
Rhepoxinius (solid acute)								
Microtox (solid acute)								
FIELD OBSERVATIONS								
Temp		E	E		E	E		
pH		E	E		E	E		
Conductivity		E	E		E	E		
Sulfide		E						
Chlorine								

E–comp – composite sample collected by Ecology
O–comp – composite sample collected by Olympus Terrace
E – Ecology analysis
O – Olympus Terrace analysis
grab – grab sample
comp – composite sample

Inf – influent
RAS – return activated sludge
Eff – final effluent
Sludge – sludge from the screw press
Sed – sediment sample

Appendix A – (Cont'd) – Olympus Terrace, March 1992.

Parameter II	Location:	Eff–1	Eff–2	Eff–C	Eff–O	Eff–GC	Eff–3	Eff–4	Sludge	Sed–1	Sed–2	Sed–3
	Type:	grab	grab	E–comp	O–comp	grab–comp	grab	grab	grab	grab	grab	grab
	Date:	3/17	3/17	3/17	3/17	3/17	3/18	3/18	3/18	3/19	3/19	3/19
	Time:	0840	1415	0745–0745	0745–0745	*	0800	1145	1030	1150	1300	1415
	Lab Log #:	128086	128087	128088	128089	128090	128092	128093	128091	128094	128095	128096
GENERAL CHEMISTRY												
Conductivity		1	E	E	E	E						
Alkalinity				E	E							
Hardness				E	E	E						
				E	E							
				E	E							
TSS		E	E	EO	EO	E						
TNVSS				E	E							
% Solids									E	E	E	E
% Volatile Solids									E	E	E	E
BOD5				EO	EO							
BOD INH				EO	EO							
COD		E	E	E	E							
TOC (water)		E	E	E	E							
TOC (soil)									E	E	E	E
NH3–N		E	E	E	E							
NO2+NO3–N		E	E	E	E							
Phosphorous – Total		E	E	E	E							
Total Persulfate N (TPN)									E			
F–Coliform MF							E	E				
F–Coliform (sediment)									E			
T–Coliform (sediment)									E			
Grain Size										E	E	E
Cyanide total		E	E									
Cyanide (wk & dis)		E	E						E	E	E	E
ORGANICS												
VOC (water)		E	E									
VOC (soil)									E	E	E	E
BNAs (water)				E								
BNAs (soil)									E	E	E	E
Pest/PCB (water)				E								
Pest/PCB (soil)									E	E	E	E
METALS												
PP Metals				E	E				E	E	E	E
BIOASSAYS												
Salmonid (acute 100%)						E						
Microtox (acute)						E						
Daphnia pulex (chronic)						E						
Ceriodaphnia (chronic)						E						
Fathead Minnow (chronic)						E						
Echinoderm sperm cell										E	E	E
Rhepoxinius (solid acute)										E	E	E
Microtox (solid acute)										E	E	E
FIELD OBSERVATIONS												
Temp		E	E	E	E		E	E				
pH		E	E	E	E		E	E	E			
Conductivity		E	E	E	E		E	E				
Sulfide		E	E									
Chlorine		E	E				E	E				

* grab composite sample collected as two equal volumes at 0840 and 1415 on 3/17.

Appendix B – Ecology Analytical Methods – Olympus Terrace, March 1992.

Laboratory Analysis	Method Used for Ecology Analysis	Laboratory Performing Analysis
Conductivity	EPA, Revised 1983: 120.1	Ecology Manchester Laboratory
Alkalinity	EPA, Revised 1983: 310.1	Ecology Manchester Laboratory
Hardness	EPA, Revised 1983: 130.2	Ecology Manchester Laboratory
TS	EPA, Revised 1983: 160.3	Ecology Manchester Laboratory
TNVS	EPA, Revised 1983: 106.3	Ecology Manchester Laboratory
TSS	EPA, Revised 1983: 106.2	Ecology Manchester Laboratory
TNVSS	EPA, Revised 1983: 106.2	Ecology Manchester Laboratory
% Solids	APHA, 1989: 2540G	Sound Analytical Services
% Volatile Solids	EPA, Revised 1983: 160.4	Sound Analytical Services
BOD5	EPA, Revised 1983: 405.1	Water Managment Laboratories
BOD INH	EPA, Revised 1983: 405.1	Water Managment Laboratories
COD	EPA, Revised 1983: 410.1	Sound Analytical Services
TOC (water)	EPA, Revised 1983: 415.1	Ecology Manchester Laboratory
TOC (soil)	EPA, Revised 1983: 415.1	Sound Analytical Services
NH3-N	EPA, Revised 1983: 350.1	Ecology Manchester Laboratory
NO2+NO3-N	EPA, Revised 1983: 353.2	Ecology Manchester Laboratory
Phosphorous - Total	EPA, Revised 1983: 365.3	Ecology Manchester Laboratory
Total Persulfate N (TPN)	EPA, Revised 1983: 350.1	Sound Analytical Services
F-Coliform MF	APHA, 1989: 9222D	Ecology Manchester Laboratory
F-Coliform (sediment)	APHA, 1989:9221A/9221C	Ecology Manchester Laboratory
T-Coliform (sediment)	APHA, 1989:9221A/9221	Ecology Manchester Laboratory
Grain Size	Tetra Tech TC-3991-04,1986	Soil Technology, Inc.
Cyanide total	EPA, Revised 1983: 335.2	Ecology Manchester Laboratory
Cyanide (wk & dis)	APHA, 1989: 4500-CN I.	Ecology Manchester Laboratory
VOC (water)	EPA-SW846, 1986:8260	Ecology Manchester Laboratory
VOC (soil)	EPA-SW846, 1986:8240	Ecology Manchester Laboratory
BNA's (water)	EPA-SW846, 1986:8270	Ecology Manchester Laboratory
Pesticide/PCB (water)	EPA-SW846, 1986:8080	Ecology Manchester Laboratory
Pesticide/PCB (soil)	EPA-SW846, 1986:8080	Ecology Manchester Laboratory
PP Metals	EPA, Revised 1983:200-299	Ecology Manchester Laboratory
Salmonid (acute 100%)	WDOE 80-12, 1981:80-12	Ecology Manchester Laboratory
Microtox (acute)	Beckman, 1982	Ecology Manchester Laboratory
Daphnia pulex (acute)	EPA, 1989a	Ecology Manchester Laboratory
Ceriodaphnia (chronic)	EPA 1989b	Ecology Manchester Laboratory
Fathead minnow (chronic)	EPA, 1989b	Ecology Manchester Laboratory
Echinoderm sperm cell	Dinnel-AECT, 1987	Northwestern Aquatic Sciences
Rhepoxinius (solid acute)	ASTM E1367-1990	Northwestern Aquatic Sciences
Microtox (solid acute)	Beckman Manual, 1982	Ecology Manchester Laboratory

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Appendix C
- Priority Pollutant Cleaning Procedures
- Olympus Terrace, March 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 D – VOA Scan Results – Olympus Terrace, March 1992.

Location:	Inf–1		Inf–2		Inf–3	Eff–1		Eff–2	
Type:	grab		grab		grab	grab		grab	
Date:	3/17		3/17		3/17	3/17		3/17	
Time:	1020		1550		1610	0838		1417	
Lab Log#:	128080		128081		128097	128086		128087	
VOA Compounds	ug/L		ug/L		ug/L	ug/L		ug/L	
Carbon Tetrachloride	1	U	1	U		1	UJ	1	UJ
Acetone	21	U	187			5	UJ	9	UJ
Chloroform	4		4.5	J		0.5	J	2	J
Benzene	1	U	1	U		1	UJ	1	UJ
1,1,1–Trichloroethane	0.3	J	1	J		1	UJ	1	UJ
Bromomethane	1	U	1	U		1	UJ	1	UJ
Chloromethane	1	U	1	UJ		1	UJ	1	UJ
Dibromomethane	1	U	1	U		1	UJ	1	UJ
Bromochloromethane	1	U	1	UJ		1	UJ	1	UJ
Chloroethane	1	UJ	1	UJ		1	UJ	1	UJ
Vinyl Chloride	1	U	1	U		1	UJ	1	UJ
Methylene Chloride	1	U	1	U		1	UJ	1	UJ
Carbon Disulfide	5	U	5	U		5	UJ	5	UJ
Bromoform	1	U	1	U		1	UJ	1	UJ
Bromodichloromethane	0.3	J	0.3	J		0.3	J	2	J
1,1–Dichloroethane	1	U	1	U		1	UJ	1	UJ
1,1–Dichloroethene	1	U	1	U		1	UJ	1	UJ
Trichlorofluoromethane	1	U	1	U		1	UJ	1	UJ
Dichlorodifluoromethane	1	UJ	1	UJ		1	UJ	5	UJ
1,2–Dichloropropane	1	U	1	U		1	UJ	1	UJ
2–Butanone (MEK)	7	U	9	U		1	UJ	2	UJ
1,1,2–Trichloroethane	1	U	1	U		1	UJ	1	UJ
Trichloroethene	0.1	J	0.1	J		1	UJ	1	UJ
1,1,2,2–Tetrachloroethane	1	U	1	U		1	UJ	1	UJ
1,2,3–Trichlorobenzene	1	U	1	U		1	UJ	1	UJ
Hexachlorobutadiene	1	U	1	U		1	UJ	1	UJ
Naphthalene	1	U	1	U		1	UJ	1	UJ
2–Chlorotoluene	1	U	1	U		1	UJ	1	UJ
1,2–Dichlorobenzene	1	U	1	U		1	UJ	1	UJ
1,2,4–Trimethylbenzene	1	U	1	U		1	UJ	1	UJ
1,2–Dibromo–3–Chloropropane (DB	5	U	5	U		5	UJ	5	UJ
1,2,3–Trichloropropane	1	U	1	U		1	UJ	1	UJ
tert–Butylbenzene	1	U	1	U		1	UJ	1	UJ
Isopropylbenzene	1	U	1	U		1	UJ	1	UJ
p–Isopropyltoluene	1	U	8	J		1	UJ	1	UJ
Ethylbenzene	1	U	1	U		1	UJ	1	UJ
Ethenylbenzene	1	U	1	U		1	UJ	1	UJ
Propylbenzene	1	U	1	U		1	UJ	1	UJ
Butylbenzene	1	U	1	U		1	UJ	1	UJ
4–Chlorotoluene	1	U	1	U		1	UJ	1	UJ
1,4–Dichlorobenzene	2.5		3	J		0.3	J	0.3	J
1,2–Dibromoethane (EDB)	1	U	1	U		1	UJ	1	UJ

Inf – influent
grab – grab sample
E–comp – Department of Ecology composite sample
O–comp – Olympus Terrace composite sample

RAS – return activated sludge
Eff – effluent
grab–comp – grab–composite sample
Sludge – sludge from the screw press
Sed – sediment sample

U – not detected at the given detection limit.
J – indicates and estimated value for a detected analyte.
UJ – indicates the analyte was not detected at or above the reported estimated result.

Appendix D – (cont'd) – Olympus Terrace, March 1992.

Location:	Sludge		Sed–1		Sed–2		Sed–3	
Type:	grab		grab		grab		grab	
Date:	3/18		3/19		3/19		3/19	
Time:	1030		1150		1300		1415	
Lab Log#:	128091		128094		128095		128096	
VOA Compounds	ug/Kg		ug/Kg		ug/Kg		ug/Kg	
Carbon Tetrachloride	59	U	4	U	4	U	2	U
Acetone	1500	J	15	U	17	UJ	10	U
Chloroform	59	U	4	U	4	U	2	U
Benzene	59	U	4	U	4	UJ	2	U
1,1,1–Trichloroethane	59	U	4	U	4	U	2	U
Bromomethane	3	J	4	UJ	4	UJ	2	UJ
Chloromethane	59	U	4	U	4	UJ	2	U
Dibromomethane	59	U	4	U	4	U	2	U
Bromochloromethane	59	U	4	U	4	U	2	U
Chloroethane	59	UJ	4	U	4	UJ	2	U
Vinyl Chloride	59	U	4	U	4	UJ	2	U
Methylene Chloride	59	U	4	UJ	4	UJ	2	UJ
Carbon Disulfide	59	U	4	UJ	4	UJ	2	UJ
Bromoform	59	U	4	U	4	U	2	U
Bromodichloromethane	59	U	4	U	4	U	2	U
1,1–Dichloroethane	59	U	4	U	4	U	2	U
1,1–Dichloroethene	59	U	4	UJ	4	UJ	2	UJ
Trichlorofluoromethane	59	U	4	U	4	U	2	U
Dichlorodifluoromethane	59	UJ	9	UJ	4	UJ	3	UJ
1,2–Dichloropropane	59	U	4	U	4	U	2	U
2–Butanone (MEK)	59	UJ	7	UJ	12	UJ	4	UJ
1,1,2–Trichloroethane	59	U	4	U	4	U	2	U
Trichloroethene	59	U	4	U	4	U	2	U
1,1,2,2–Tetrachloroethane	59	U	4	U	4	U	2	U
1,2,3–Trichlorobenzene	59	U	4	U	4	U	2	U
Hexachlorobutadiene	59	U	4	U	4	U	2	U
Naphthalene	59	U	4	UJ	4	UJ	2	UJ
2–Chlorotoluene	59	U	4	U	4	U	2	U
1,2–Dichlorobenzene	12	J	4	U	4	U	2	U
1,2,4–Trimethylbenzene	59	U	4	U	4	U	2	U
1,2–Dibromo–3–Chloropropane (DBCP)	59	U	4	UJ	4	UJ	2	UJ
1,2,3–Trichloropropane	59	U	4	U	4	U	2	U
tert–Butylbenzene	59	U	4	U	4	U	2	U
Isopropylbenzene	59	U	4	U	4	U	2	U
p–Isopropyltoluene	59	U	4	U	4	U	2	U
Ethylbenzene	59	U	4	U	4	U	2	U
Ethenylbenzene	59	U	4	U	4	U	2	U
Propylbenzene	59	U	4	U	4	U	2	U
Butylbenzene	59	U	4	U	4	U	2	U
4–Chlorotoluene	59	U	4	U	4	U	2	U
1,4–Dichlorobenzene	120		4	U	4	U	2	U
1,2–Dibromoethane (EDB)	59	U	4	U	4	U	2	U

Appendix D – (cont'd) – Olympus Terrace, March 1992.

Location:	Inf–1		Inf–2		Inf–3	Eff–1		Eff–2	
Type:	grab		grab		grab	grab		grab	
Date:	3/17		3/17		3/17	3/17		3/17	
Time:	1020		1550		1610	0838		1417	
Lab Log#:	128080		128081		128097	128086		128087	
VOA Compounds	ug/L		ug/L		ug/L	ug/L		ug/L	
1,2–Dichloroethane	1	U	1	U		1	UJ	1	UJ
4–Methyl–2–Pentanone (MIBK)	1		1	U		1	UJ	1	UJ
1,3,5–Trimethylbenzene	1	U	1	U		1	UJ	1	UJ
Bromobenzene	1	U	1	U		1	UJ	1	UJ
Toluene	1	U	1	J		1	J	0.5	J
Chlorobenzene	1	U	1	U		1	UJ	1	UJ
1,2,4–Trichlorobenzene	1	U	1	U		1	UJ	1	UJ
Dibromochloromethane	1	U	1	U		0.1	J	0.5	J
Tetrachloroethene	0.2	J	0.3	J		0.1	J	0.04	J
sec–Butylbenzene	1	U	1	U		1	UJ	1	UJ
1,3–Dichloropropane	1	U	1	U		1	UJ	1	UJ
cis–1,2–Dichloroethene	1	U	1	UJ		1	UJ	1	UJ
trans–1,2–Dichloroethene	1	U	1	U		1	UJ	1	UJ
1,3–Dichlorobenzene	1	U	1	U		1	UJ	1	UJ
1,1–Dichloropropene	1	U	1	U		1	UJ	1	UJ
2,2–Dichloropropane	1	U	1	U		1	UJ	1	UJ
2–Hexanone	1	U	1	U		1	UJ	1	UJ
1,1,1,2–Tetrachloroethane	1	U	1	U		1	UJ	1	UJ
Total Xylenes	1	U	1	U		1	UJ	1	UJ
cis–1,3–Dichloropropene	1	U	1	U		1	UJ	1	UJ
trans–1,3–Dichloropropene	1	U	1	U		1	UJ	1	UJ

Appendix D – (cont'd) – Olympus Terrace, March 1992.

VOA Compounds	Sludge grab 3/18 1030 128091 ug/Kg		Sed–1 grab 3/19 1150 128094 ug/Kg		Sed–2 grab 3/19 1300 128095 ug/Kg		Sed–3 grab 3/19 1415 128096 ug/Kg	
1,2–Dichloroethane	59	U	4	U	4	U	2	U
4–Methyl–2–Pentanone (MIBK)	59	U	4	U	4	UJ	2	U
1,3,5–Trimethylbenzene	59	U	4	U	4	U	2	U
Bromobenzene	59	U	4	U	4	U	2	U
Toluene	1900	J	4	U	4	U	2	U
Chlorobenzene	13	J	4	U	4	U	2	U
1,2,4–Trichlorobenzene	59	U	4	U	4	U	2	U
Dibromochloromethane	59	U	4	U	4	U	2	U
Tetrachloroethene	60		4	U	4	U	2	U
sec–Butylbenzene	59	U	4	U	4	U	2	U
1,3–Dichloropropane	59	U	4	U	4	U	2	U
cis–1,2–Dichloroethene	59	U	4	U	4	U	2	U
trans–1,2–Dichloroethene	59	U	4	UJ	4	UJ	2	UJ
1,3–Dichlorobenzene	59	U	4	U	4	U	2	U
1,1–Dichloropropene	59	U	4	U	4	U	2	U
2,2–Dichloropropane	59	U	4	U	4	U	2	U
2–Hexanone	59	U	4	U	4	UJ	2	U
1,1,1,2–Tetrachloroethane	59	U	4	U	4	U	2	U
Total Xylenes	59	U	4	U	4	U	2	U
cis–1,3–Dichloropropene	59	U	4	U	4	U	2	U
trans–1,3–Dichloropropene	59	U	4	U	4	U	2	U

Appendix E – BNA Scan Results – Olympus Terrace, March 1992.

Location:	Inf–C		Inf–O		Inf–3	Eff–C		Eff–O	
Type:	E–comp		O–comp		grab	E–comp		O–comp	
Date:	3/17		3/17		3/17	3/17		3/17	
Time:	0745–0745		0745–0745		1610	0745–0745		0745–0745	
Lab Log#:	128082		128083		128097	128088		128089	
BNA Compounds	ug/L		ug/L		ug/L	ug/L		ug/L	
Benzo(a)Pyrene	2	J				1	U		
2,4–Dinitrophenol		REJ					REJ		
Dibenzo(a,h)Anthracene	20	U				3	U		
Benzo(a)Anthracene	8	U				1	U		
4–Chloro–3–Methylphenol	39	U				7	U		
Benzoic Acid	98	UJ				17	UJ		
Hexachloroethane	8	U				1	U		
Hexachlorocyclopentadiene	39	UJ				7	UJ		
Isophorone	8	U				1	U		
Acenaphthene	8	U				1	U		
Diethyl Phthalate	9					1	U		
Di–n–Butyl Phthalate	8	U				1	U		
Phenanthrene	8	U				1	U		
Butylbenzyl Phthalate	20	U				1	U		
N–Nitrosodiphenylamine	98	U				17	U		
Fluorene	8	U				1	U		
Carbazole	39	UJ				7	UJ		
Hexachlorobutadiene	20	U				3	U		
Pentachlorophenol		REJ					REJ		
2,4,6–Trichlorophenol	20	U				3	U		
2–Nitroaniline	20	U				3	U		
2–Nitrophenol	20	U				3	U		
1–Methylnaphthalene	8	U				1	U		
Naphthalene	8	U				1	U		
2–Methylnaphthalene	8	U				1	U		
2–Chloronaphthalene	8	U				1	U		
3,3'–Dichlorobenzidine		REJ					REJ		
2–Methylphenol	8	U				1	U		
1,2–Dichlorobenzene	8	U				1	U		
o–Chlorophenol	8	U				1	U		
2,4,5–Trichlorophenol	39	U				7	U		
Nitrobenzene	8	U				1	U		
3–Nitroaniline	98	UJ				17	UJ		
4–Nitroaniline	98	UJ				17	UJ		
4–Nitrophenol		REJ					REJ		
Benzyl Alcohol		REJ					REJ		
4–Bromophenyl Phenylether	8	U				1	U		
2,4–Dimethylphenol	8	U				1	U		
4–Methylphenol	150					0.5	J		
1,4–Dichlorobenzene	2	J				0.2	J		
4–Chloroaniline	98	U				17	U		
Phenol	6	J				1	U		
Bis(2–Chloroethyl)Ether	8	U				1	U		

Inf – influent
grab – grab sample
E–comp – Dept. of Ecology composite sample
O–comp – Olympus Terrace composite sample
RAS – return activated sludge
Eff – effluent
grab–comp – grab–composite sample
Sludge – sludge from the screw press
Sed – sediment sample
U – The analyte was not detected at or above the associated value
J – The analyte was positively identified. The associated numerical result is an estimate.
UJ – The result was not detected at or above associated estimated value.
REJ – The data are unusable for all purposes.

Appendix E – (cont'd) – Olympus Terrace, March 1992.

Location:	Sludge		Sed-1		Sed-2		Sed-3	
Type:	grab		grab		grab		grab	
Date:	3/18		3/19		3/19		3/19	
Time:	1030		1150		1300		1415	
Lab Log#:	128091		128094		128095		128096	
BNA Compounds	ug/L		ug/L		ug/L		ug/L	
Benzo(a)Pyrene	1100	UJ	110	U	130	U	110	U
2,4-Dinitrophenol	14000	UJ	1400	UJ	1700	UJ	1400	UJ
Dibenzo(a,h)Anthracene	2800	UJ	110	U	130	U	110	U
Benzo(a)Anthracene	1100	UJ	110	U	130	U	110	U
4-Chloro-3-Methylphenol	5600	UJ	570	U	680	U	560	U
Benzoic Acid	14000	UJ	250	J	310	J	350	J
Hexachloroethane	1100	UJ	110	U	130	U	110	U
Hexachlorocyclopentadiene	5600	UJ	570	UJ	680	UJ	560	UJ
Isophorone	480	J	110	UJ	130	UJ	14	J
Acenaphthene	1100	UJ	110	U	130	U	110	U
Diethyl Phthalate	1100	UJ	110	U	130	U	110	U
Di-n-Butyl Phthalate	1100	UJ	110	UJ	130	UJ	110	UJ
Phenanthrene	1100	UJ	110	U	130	U	110	U
Butylbenzyl Phthalate	1100	UJ	110	U	130	U	110	U
N-Nitrosodiphenylamine	14000	UJ	110	UJ	130	UJ	110	UJ
Fluorene	1100	UJ	110	U	130	U	110	U
Carbazole	5600	UJ	570	UJ	130	UJ	110	UJ
Hexachlorobutadiene	2800	UJ	280	U	330	U	280	U
Pentachlorophenol	5600	UJ	570	U	680	U	560	U
2,4,6-Trichlorophenol	2800	UJ	280	U	330	U	280	U
2-Nitroaniline	2800	UJ	280	UJ	330	UJ	280	UJ
2-Nitrophenol	2800	UJ	280	U	330	U	280	U
1-Methylnaphthalene	1100	UJ	110	U	130	U	110	U
Naphthalene	1100	UJ	110	U	130	U	110	U
2-Methylnaphthalene	1100	UJ	110	U	130	U	110	U
2-Chloronaphthalene	1100	UJ	110	U	130	U	110	U
3,3'-Dichlorobenzidine	28000	UJ	2800	U	3300	U	2800	U
2-Methylphenol	1100	UJ	110	U	130	U	110	U
1,2-Dichlorobenzene	1100	UJ	110	U	130	U	110	U
o-Chlorophenol	1100	UJ	110	U	130	U	110	U
2,4,5-Trichlorophenol	5500	UJ	560	UJ	670	UJ	560	UJ
Nitrobenzene	1100	UJ	110	U	130	U	110	U
3-Nitroaniline	14000	UJ	1400	UJ	1700	UJ	1400	UJ
4-Nitroaniline	14000	UJ	1400	U	1700	U	1400	U
4-Nitrophenol	14000	UJ	1400	U	1700	U	1400	U
Benzyl Alcohol		REJ		REJ		REJ		REJ
4-Bromophenyl Phenylether	1100	UJ	110	U	130	U	110	U
2,4-Dimethylphenol	1100	UJ	110	U	130	U	110	U
4-Methylphenol	23000	J	110	U	130	U	110	U
1,4-Dichlorobenzene	1100	UJ	110	U	130	U	110	U
4-Chloroaniline	14000	UJ	1400	U	1700	U	1400	U
Phenol	1800	J	110	U	130	U	150	U
Bis(2-Chloroethyl)Ether	1100	UJ	110	U	130	U	110	U

Appendix E (cont'd) – Olympus Terrace, March 1992.

Location:	Inf–C		Inf–O		Inf–3	Eff–C		Eff–O	
Type:	E–comp		O–comp		grab	E–comp		O–comp	
Date:	3/17		3/17		3/17	3/17		3/17	
Time:	0745–0745		0745–0745		1610	0745–0745		0745–0745	
Lab Log#:	128082		128083		128097	128088		128089	
BNA Compounds	ug/L		ug/L		ug/L	ug/L			
Bis(2–Chloroethoxy)Methane	8	U				1	U		
Bis(2–Ethylhexyl)Phthalate	17					1	U		
Di–n–Octyl Phthalate	4	J				1	UJ		
Hexachlorobenzene	8	U				1	U		
Anthracene	8	U				1	U		
1,2,4–Trichlorobenzene	8	U				1	U		
2,4–Dichlorophenol	8	U				1	U		
2,4–Dinitrotoluene	20	U				3	U		
Pyrene	8	U				1	U		
Dimethyl Phthalate	8	U				1	U		
Dibenzofuran	8	U				1	U		
Benzo(g,h,i)Perylene	8	U				1	U		
Indeno(1,2,3–cd)Pyrene	8	U				1	U		
Benzo(b)Fluoranthene	8	U				1	U		
Fluoranthene	8	U				1	U		
Benzo(k)Fluoranthene	8	U				1	U		
Acenaphthylene	8	U				1	U		
Chrysene	8	U				1	U		
Retene	8	U				1	U		
4,6–Dinitro–2–Methylphenol		REJ					REJ		
1,3–Dichlorobenzene	8	U				1	U		
2,6–Dinitrotoluene	20	U				3	U		
N–Nitroso–di–n–Propylamine	8	U				1	U		
4–Chlorophenyl Phenylether	8	U				1	U		
Bis(2–Chloroisopropyl)Ether	8	U				1	U		

Appendix E (cont'd) – Olympus Terrace, March 1992.

Location:	Sludge		Sed-1		Sed-2		Sed-3	
Type:	grab		grab		grab		grab	
Date:	3/18		3/19		3/19		3/19	
Time:	1030		1150		1300		1415	
Lab Log#:	128091		128094		128095		128096	
BNA Compounds	ug/L		ug/L		ug/L		ug/L	
Bis(2-Chloroethoxy)Methane	1100	UJ	110	U	130	U	110	U
Bis(2-Ethylhexyl)Phthalate	16000	UJ	270	U	130	U	170	U
Di-n-Octyl Phthalate	1100	UJ	110	UJ	130	UJ	110	UJ
Hexachlorobenzene	1100	UJ	110	U	130	U	110	U
Anthracene	1100	UJ	110	U	130	U	110	U
1,2,4-Trichlorobenzene	1100	UJ	110	U	130	U	110	U
2,4-Dichlorophenol	1100	UJ	110	U	130	U	110	U
2,4-Dinitrotoluene	2800	UJ	17	J	330	U	280	U
Pyrene	1100	UJ	110	U	130	U	110	U
Dimethyl Phthalate	1100	UJ	110	U	130	U	110	U
Dibenzofuran	1100	UJ	110	U	130	U	110	U
Benzo(g,h,i)Perylene	1100	UJ	110	U	130	U	110	U
Indeno(1,2,3-cd)Pyrene	1100	UJ	110	U	130	U	110	U
Benzo(b)Fluoranthene	1100	UJ	110	U	130	U	110	U
Fluoranthene	1100	UJ	110	U	130	U	110	U
Benzo(k)Fluoranthene	1100	UJ	110	U	130	U	110	U
Acenaphthylene	1100	UJ	110	U	130	U	110	U
Chrysene	1100	UJ	110	U	130	U	110	U
Retene	1100	UJ	110	U	130	U	110	U
4,6-Dinitro-2-Methylphenol	14000	UJ	1400	UJ	1700	UJ	1400	UJ
1,3-Dichlorobenzene	1100	UJ	110	U	130	U	110	U
2,6-Dinitrotoluene	2800	UJ	280	U	330	U	280	U
N-Nitroso-di-n-Propylamine	1100	UJ	110	U	130	U	110	U
4-Chlorophenyl Phenylether	1100	UJ	110	U	130	U	110	U
Bis(2-Chloroisopropyl)Ether	1100	UJ	110	UJ	130	UJ	110	UJ

Appendix F – Pesticide/PCB Scan Results – Olympus Terrace, March 1992.

Location:	Inf–C		Inf–O		Inf–3		Eff–C		Eff–O	
Type:	E–comp		O–comp		grab		E–comp		O–comp	
Date:	3/17		3/17		3/17		3/17		3/17	
Time:	0745–0745		0745–0745		1610		0745–0745		0745–0745	
Lab Log#:	128082		128083		128097		128088		128089	
Pesticides/PCB Compounds	ug/L		ug/L		ug/L		ug/L		ug/L	
alpha–BHC	0.020	U						LAC		
beta–BHC	0.020	U						LAC		
delta–BHC	0.020	U						LAC		
gamma–BHC (Lindane)	0.020	U						LAC		
Heptachlor	0.020	U					0.017	U		
Aldrin	0.020	U					0.017	U		
Heptachlor Epoxide	0.020	U						LAC		
Endosulfan I	0.020	U						LAC		
Dieldrin	0.020	U						LAC		
4,4'–DDE	0.020	U					0.017	U		
Endrin	0.020	U						LAC		
Endosulfan II	0.020	U						LAC		
4,4'–DDD	0.020	U						LAC		
Endosulfan Sulfate	0.020	U						LAC		
4,4'–DDT	0.020	U						LAC		
Methoxychlor	0.020	U						LAC		
Endrin Ketone	0.0098	U						LAC		
Toxaphene	0.39	U						LAC		
Aroclor–1016	0.20	U					0.17	U		
Aroclor–1221	0.20	U					0.17	U		
Aroclor–1232	0.20	U					0.17	U		
Aroclor–1242	0.20	U					0.17	U		
Aroclor–1248	0.20	U					0.17	U		
Aroclor–1254	0.20	U					0.17	U		
Aroclor–1260	0.20	U					0.17	U		
Endrin Aldehyde	0.020	U						LAC		*
Chlordane	0.59	U						LAC		

Inf – influent
grab – grab sample
E–comp – Department of Ecology composite sample
O–comp – Olympus Terrace composite sample

RAS – return activated sludge
Eff – effluent
grab–comp – grab–composite sample
sludge – sludge from the screw press
Sed – sediment sample

U – the analyte was not detected at the given detection limit.
LAC – laboratory accident

Appendix F – (cont'd) – Olympus Terrace, March 1992.

Location:	Sludge		Sed–1		Sed–2		Sed–3	
Type:	grab		grab		grab		grab	
Date:	3/18		3/19		3/19		3/19	
Time:	1030		1150		1300		1415	
Lab Log#:	128091		128094		128095		128096	
Pesticides/PCB Compounds	ug/L		ug/L		ug/L		ug/L	
alpha–BHC	560	U	57	U	67	U	56	U
beta–BHC	560	U	57	U	67	U	56	U
delta–BHC	560	U	57	U	67	U	56	U
gamma–BHC (Lindane)	560	U	57	U	67	U	56	U
Heptachlor	560	U	57	U	67	U	56	U
Aldrin	560	U	57	U	67	U	56	U
Heptachlor Epoxide	560	U	57	U	67	U	56	U
Endosulfan I	560	U	57	U	67	U	56	U
Dieldrin	560	U	57	U	67	U	56	U
4,4'–DDE	560	U	57	U	67	U	56	U
Endrin	560	U	57	U	67	U	56	U
Endosulfan II	560	U	57	U	67	U	56	U
4,4'–DDD	560	U	57	U	67	U	56	U
Endosulfan Sulfate	560	U	57	U	67	U	56	U
4,4'–DDT	560	U	57	U	67	U	56	U
Methoxychlor	560	U	57	U	67	U	56	U
Endrin Ketone	280	U	28	U	34	U	28	U
Toxaphene	11000	U	1100	U	1300	U	1100	U
Aroclor–1016	5600	U	570	U	670	U	560	U
Aroclor–1221	5600	U	570	U	670	U	560	U
Aroclor–1232	5600	U	570	U	670	U	560	U
Aroclor–1242	5600	U	570	U	670	U	560	U
Aroclor–1248	5600	U	570	U	670	U	560	U
Aroclor–1254	5600	U	570	U	670	U	560	U
Aroclor–1260	5600	U	570	U	670	U	560	U
Endrin Aldehyde	560	U	57	U	67	U	56	U
Chlordane	17000	U	1700	U	2000	U	1700	U

Appendix G – Metals Scan Results – Olympus Terrace, March 1992.

	Location:	Inf–C		Inf–O		Inf–3		Eff–C		Eff–O	
	Type:	E–comp		O–comp		grab		E–comp		O–comp	
	Date:	3/17		3/17		3/17		3/17		3/17	
	Time:	0745–0745		0745–0745		1610		0745–0745		0745–0745	
	Lab Log#:	128082		128083		128097		128088		128089	
Metals	Hardness = *	ug/L		ug/L		ug/L		ug/L		ug/L	
Antimony		30	U	30	U	30	U	30	U	30	U
Arsenic		1.5	UN	1.5	UN	1.7	PN	1.5	UN	1.5	UN
Beryllium		1.0	U	1.0	U	1	U	1.0	U	1.0	U
Cadmium		5.12		5.27		9.26		1.47		2.0	U
Chromium		21		18		31		5.4	P	5.0	P
Copper		87.6		65.7		78.3		16		17	
Lead		6.5		4.4	P	8.5		1.3	P	20	U
Mercury		0.100	PN	0.26	PN	0.27	PN	0.05	U	0.05	U
Nickel		6.6		2.6	P	12	P	2.4	P	2.3	P
Selenium		2.0	U	2.0	U	2.8	P	2.0	U	2.0	U
Silver		8.90		9.82		33.9		0.55	P	0.58	P
Thallium		2.5	U		U	2.5	U	2.5	U	2.5	U
Zinc		146	U		U	162		51.8		53.6	

Inf – influent
grab – grab sample
E–comp – Department of Ecology composite sample
O–comp – Olympus Terrace composite sample

RAS – return activated sludge
Eff – effluent
grab–comp – grab–composite sample
sludge – sludge from the screw press
Sed – sediment sample

U – indicates the analyte was not detected at the given detection limit.
N – indicates the spike sample recovery is not within conttrol limits.
P – indicates the analyte was detected above the instrument detection limit but below the established minimum quantitation limit.

Appendix G – (cont'd) – Olympus Terrace, March 1992.

	Location:	Sludge		Sed–1		Sed–2		Sed–3	
	Type:	grab		grab		grab		grab	
	Date:	3/18		3/19		3/19		3/19	
	Time:	1030		1150		1300		1415	
	Lab Log#:	128091		128094		128095		128096	
Metals		mg/Kg–dr		mg/Kg–dr		mg/Kg–dr		mg/Kg–dr	
Antimony		15	UN	3.0	UN	3.0	UN	3.0	UN
Arsenic		1.8	N	1.2		1.1		1.93	
Beryllium		0.50	U	0.10	U	0.10	P	0.10	U
Cadmium		31.2		0.364		0.123		0.22	P
Chromium		267		27.5	N	35.6	N	28.3	N
Copper		492		5.57	B	4.71	B	4.62	B
Lead		58	P	3.82		9.18		4.26	
Mercury		0.163	N	0.017	PJ	0.015	PJ	0.013	PJ
Nickel		28	P	21.7		24.5		22.0	
Selenium		1.95	N	0.20	UJ	0.20	UJ	0.20	UJ
Silver		59.3		0.5	U	0.50	U	0.50	U
Thallium		0.25	U	0.25	UN	0.25	UN	0.25	UN
Zinc		983		29.6		26.5		27.5	

Appendix H – VOA and BNA Scan Tentatively Identified Compounds (TICs) – Olympus Terrace, March 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.

Location:	Inf-1	Inf-2	Inf-C	Eff-1	Eff-2	Eff-C
Type:	grab	grab	E-comp	grab	grab	E-comp
Date:	3/17	3/17	3/17	3/17	3/17	3/17
Time:	1020	1550	0745-0745	0840	1415	0745-0745
Lab Log #:	128080	128081	128082	128086	128087	128088

Location:	Sludge	Sed-1	Sed-2	Sed-3
Type:	grab	grab	grab	grab
Date:	3/18	3/19	3/19	3/19
Time:	1030	1150	1300	1415
Lab Log #:	128091	128094	128095	128096

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

Inf – influent
C – composite sample
Eff – effluent
Sludge – sludge sample
Sed – sediment sample
grab – grab sample
E-comp – Ecology composite sample

Appendix H - (cont'd) - Olympus Terrace, March 1992.

Description: INF-1

Sample No: 92 128080

Tent Ident - VOA Sca	Water-Total Result	Units
LIMONENE	27NJ*	ug/l
UNKNOWN COMPOUND 1	6.4NJ*	ug/l
UNKNOWN COMPOUND 2	1.5NJ*	ug/l
UNKNOWN COMPOUND 3	8.5NJ*	ug/l
UNKNOWN COMPOUND 4	4.0NJ*	ug/l
UNKNOWN COMPOUND 5	5.9NJ*	ug/l
UNKNOWN COMPOUND 6	3.4NJ*	ug/l
UNKNOWN COMPOUND 7	8.7NJ*	ug/l
UNKNOWN COMPOUND 8	4.9NJ*	ug/l
UNKNOWN COMPOUND 9	2.3NJ*	ug/l
UNKNOWN COMPOUND 10	7.0NJ*	ug/l
CYCLOHEXANOL, 1-METHYL+	3.4NJ*	ug/l
HEXANE, 2,2,3,4,5,5-HE+	4.4NJ*	ug/l
DECANE, 2,5,9 TRIMETHYL	4.2NJ*	ug/l
DECANE, 2,6,7-TRIMETHY+	9.5NJ*	ug/l

Appendix H - (cont'd) - Olympus Terrace, March 1992.

Description: INF-2

Sample No: 92 128081

Tent Ident - VOA Sca	Water-Total Result	Units
1-TRIDECANOL	2900NJ*	ug/l
DODECANE, 2-METHYL-	470NJ*	ug/l
CYCLOHEXANE, 1-BROMO-2+	970NJ*	ug/l
UNKNOWN COMPOUND 1	2000NJ*	ug/l
UNKNOWN COMPOUND 2	800NJ*	ug/l
UNKNOWN COMPOUND 3	2100NJ*	ug/l
UNKNOWN COMPOUND 4	1200NJ*	ug/l
UNKNOWN COMPOUND 5	1200NJ*	ug/l
UNKNOWN COMPOUND 6	3000NJ*	ug/l
UNKNOWN COMPOUND 7	730NJ*	ug/l
7-DODECENOL	1200NJ*	ug/l
NONANE, 4,5 DIMETHYL	3000NJ*	ug/l
DECANE, 3,6-DIMETHYL	1200NJ*	ug/l
UNDECANE, 3,4-DIMETHYL-	680NJ*	ug/l
CYCLOPENTANE, 1-HEXYL-+	1100NJ*	ug/l
DECANE, 2,6,7-TRIMETHY+	1700NJ*	ug/l
NONANE, 5-(1-METHYLPRO+	1200NJ*	ug/l
1,6-HEPTADIENE, 2,5,5-+	340NJ*	ug/l

Appendix H - (cont'd) - Olympus Terrace, March 1992.

Description: INF-C

Sample No: 92 128082

Tent Ident - B/N/Aci	Water-Total Result	Units
Decanoic Acid, Hexa-	1300NJ*	ug/l
OCTADECANOIC ACID	3200NJ*	ug/l
Oleic acid	1300NJ*	ug/l
PHOSPHORIC ACID TRIBUT+	64NJ*	ug/l
Decanoic Acid, Tetra-	110NJ*	ug/l
OCTACOSANE/PHTHALATE	54NJ*	ug/l
CYCLOHEXENE, 1-METHYL-+	48NJ*	ug/l
UNKNOWN COMPOUND 1	240NJ*	ug/l
UNKNOWN COMPOUND 2	45NJ*	ug/l
UNKNOWN COMPOUND 3	100NJ*	ug/l
a-Terpeneol	140NJ*	ug/l

Appendix H - (cont'd) - Olympus Terrace, March 1992.

Description: EFF-1

Sample No: 92 128086

Tent Ident - VOA Sca	Water-Total Result	Units
DECANE, 2,9-DIMETHYL-	33NJ*	ug/l
CYCLOHEXANE,2-PROPENYL	11NJ*	ug/l
UNKNOWN COMPOUND 1	8.2NJ*	ug/l
UNKNOWN COMPOUND 2	17NJ*	ug/l
UNKNOWN COMPOUND 3	26NJ*	ug/l
UNKNOWN COMPOUND 4	8.3NJ*	ug/l
UNKNOWN COMPOUND 5	8.6NJ*	ug/l
UNKNOWN COMPOUND 6	12NJ*	ug/l
UNDECANE, 5,7-DIMETHYL-	11NJ*	ug/l
DECANE, 2,5,9 TRIMETHYL	26NJ*	ug/l
DECANE, 2,5,9 TRIMETHYL	61NJ*	ug/l
DECANE, 2,6,7-TRIMETHY+	13NJ*	ug/l

Description: EFF-2

Sample No: 92 128087

Tent Ident - VOA Sca	Water-Total Result	Units
UNKNOWN COMPOUND 1	1.7NJ*	ug/l
UNKNOWN COMPOUND 2	2.5NJ*	ug/l
UNKNOWN COMPOUND 3	2.1NJ*	ug/l
UNKNOWN COMPOUND 4	2.6NJ*	ug/l
CYCLOHEPTANONE, 4-METH+	3.7NJ*	ug/l
HEXANE, 2,2,3,4,5,5-HE+	2.2NJ*	ug/l

Appendix H - (cont'd) - Olympus Terrace, March 1992.

Description: EFF-C

Sample No: 92 128088

Tent Ident - B/N/Aci	Water-Total Result	Units
ETHANOL, 2-BUTOXY-, PH+	1.3NJ*	ug/l
7-ACETYL-6-ETHYL-1,1,4+	0.93NJ*	ug/l
ETHANOL, 2-(2-BUTOXYET+	5.8NJ*	ug/l
CYCLOHEXANE, 1,3-DICHL+	2.5NJ*	ug/l

Appendix H - (cont'd) - Olympus Terrace, March 1992.

Description: SLUDGE

Sample No: 92 128091

Tent Ident - VOA Sca	Sediment Result	Units
UNKNOWN COMPOUND	600NJ*	ug/kg
METHANE, THIOBIS	7300NJ*	ug/kg
LIMONENE	1300NJ*	ug/kg
TRISULFIDE, DIMETHYL	460NJ*	ug/kg
1-PROPENE, 3-(METHYLTH+	250NJ*	ug/kg
2-PROPENOIC ACID, 3-PH+	390NJ*	ug/kg
HEXANE, 2,2,3,4,5,5-HE+	290NJ*	ug/kg
HEXANE, 2,2,3,4,5,5-HE+	590NJ*	ug/kg
DECANE, 2,5,9 TRIMETHYL	150NJ*	ug/kg
DECANE, 2,4,6-TRIMETHY+	520NJ*	ug/kg

Tent Ident - B/N/Aci	Water-Total Result	Units
OCTADECANOIC ACID	73000NJ*	ug/l
Phenylacetic Acid	3100NJ*	ug/l
BUTANOIC ACID	66000NJ*	ug/l
DODECANOIC ACID, METHY+	2500NJ*	ug/l
Decanoic Acid, Methyl +	110000NJ*	ug/l
9-OCTADECENOIC ACID (Z+	120000NJ*	ug/l
TETRADECANOIC ACID, ME+	25000NJ*	ug/l
Decanoic Acid, Di-	7800NJ*	ug/l
BENZENEPROPANOIC ACID	12000NJ*	ug/l
PENTANOIC ACID, 4-METH+	29000NJ*	ug/l
9-HEXADECENOIC ACID, M+	75000NJ*	ug/l
2-CYCLOHEXEN-1-ONE, 3,+	10000NJ*	ug/l
PENTADECANOIC ACID, ME+	30000NJ*	ug/l
UNKNOWN COMPOUND 1	2400NJ*	ug/l
UNKNOWN COMPOUND 2	78000NJ*	ug/l
UNKNOWN COMPOUND 3	17000NJ*	ug/l
UNKNOWN COMPOUND 4	36000NJ*	ug/l
UNKNOWN COMPOUND 5	74000NJ*	ug/l
UNKNOWN COMPOUND 6	48000NJ*	ug/l
3,5-HEPTADIEN-2-ONE, 6+	12000NJ*	ug/l
HEPTADECANOIC ACID, 15+	80000NJ*	ug/l

Description: SED-1

Sample No: 92 128094

Tent Ident - VOA Sca	Sediment Result	Units
UNKNOWN COMPOUND 1	0.61NJ*	ug/kg

Tent Ident - B/N/Aci	Water-Total Result	Units
ETHANONE, 1-PHENYL-	220NJ*	ug/l
Decanoic Acid, Methyl +	150NJ*	ug/l
9-OCTADECENOIC ACID (Z+	110NJ*	ug/l
Triphenyl phosphate	130NJ*	ug/l
9-HEXADECENOIC ACID, M+	170NJ*	ug/l
2-CYCLOHEXEN-1-ONE, 3,+	610NJ*	ug/l
9-HEXADECENOIC ACID	98NJ*	ug/l
UNKNOWN COMPOUND 1	2100NJ*	ug/l
UNKNOWN COMPOUND 2	860NJ*	ug/l
UNKNOWN COMPOUND 3	62NJ*	ug/l
UNKNOWN COMPOUND 4	82NJ*	ug/l

Description: SED-2

Sample No: 92 128095

Tent Ident - VOA Sca	Sediment Result	Units
METHANE, THIOBIS	9.9NJ*	ug/kg

Tent Ident - B/N/Aci	Water-Total Result	Units
ETHANONE, 1-PHENYL-	210NJ*	ug/l
BENZALDEHYDE (ACN) (DO+	1000NJ*	ug/l
Decanoic Acid, Methyl +	160NJ*	ug/l
9-OCTADECENOIC ACID (Z+	55NJ*	ug/l
Triphenyl phosphate	170NJ*	ug/l
TETRADECANOIC ACID, ME+	73NJ*	ug/l
Decanoic Acid, Tetra-	93NJ*	ug/l
9-HEXADECENOIC ACID, M+	170NJ*	ug/l
2-CYCLOHEXEN-1-ONE, 3,+	400NJ*	ug/l
9-HEXADECENOIC ACID	200NJ*	ug/l
UNKNOWN COMPOUND 1	520NJ*	ug/l
UNKNOWN COMPOUND 2	450NJ*	ug/l
UNKNOWN COMPOUND 3	2900NJ*	ug/l
UNKNOWN COMPOUND 4	110NJ*	ug/l
UNKNOWN COMPOUND 5	76NJ*	ug/l
UNKNOWN COMPOUND 6	110NJ*	ug/l
UNKNOWN COMPOUND 7	270NJ*	ug/l
UNKNOWN COMPOUND 7	110NJ*	ug/l
UNKNOWN COMPOUND 8	90NJ*	ug/l

Description: SED-3

Sample No: 92 128096

Tent Ident - VOA Sca	Sediment Result	Units
UNKNOWN COMPOUND 1	0.33NJ*	ug/kg

Tent Ident - B/N/Aci	Water-Total Result	Units
BENZOIC ACID, METHYL E+	140NJ*	ug/l
ETHANONE, 1-PHENYL-	250NJ*	ug/l
BENZALDEHYDE (ACN) (DO+	1000NJ*	ug/l
Decanoic Acid, Methyl +	190NJ*	ug/l
9-OCTADECENOIC ACID (Z+	140NJ*	ug/l
Triphenyl phosphate	140NJ*	ug/l
TETRADECANOIC ACID, ME+	92NJ*	ug/l
Decanoic Acid, Tetra-	98NJ*	ug/l
9-HEXADECENOIC ACID, M+	220NJ*	ug/l
2-CYCLOHEXEN-1-ONE, 3,+	720NJ*	ug/l
9-HEXADECENOIC ACID	200NJ*	ug/l
UNKNOWN COMPOUND 1	2000NJ*	ug/l
UNKNOWN COMPOUND 2	860NJ*	ug/l
UNKNOWN COMPOUND 3	72NJ*	ug/l
UNKNOWN COMPOUND 4	84NJ*	ug/l
UNKNOWN COMPOUND 5	67NJ*	ug/l
UNKNOWN COMPOUND 6	98NJ*	ug/l
UNKNOWN COMPOUND 7	120NJ*	ug/l

Appendix I – Olympus Terrace, March 1992.

WASHINGTON STATE DEPARTMENT OF ECOLOGY
ENVIRONMENTAL INVESTIGATIONS AND LABORATORY SERVICES
QUALITY ASSURANCE SECTION

SYSTEM AUDIT REPORT

LABORATORY: Olympus Terrace Wastewater Treatment Plant Laboratory

ADDRESS: 9417 62nd Pl W
Mukilteo, WA 98275

DATE OF AUDIT: March 18, 1992

AUDITORS:	Dale Van Donsel	Microbiology
	Dennis Julvezan	General Chemistry
PERSONNEL INTERVIEWED:	Al Bahl	Operator
	Genna Drewry	Lab Technician

AUTHENTICATION:

Dale J. Van Donsel

Dennis G. Julvezan

GENERAL FINDINGS AND RECOMMENDATIONS

General

1. A system audit was conducted at the Olympus Terrace Wastewater Treatment Plant laboratory on March 18, 1992, in conjunction with the Class II Inspection of the treatment plant. The purpose of the audit was to verify laboratory capabilities pertaining to analyses required in the treatment plant discharge permit (WA-002339-6) and to review analytical and quality control data. General audit findings and recommendations are documented below. Significant recommendations for improvement of laboratory operations are highlighted by use of *italics*.

2. This plant is not a major discharger, and as such is not required to use an accredited laboratory for reporting permit parameter results until July 1, 1994. A secondary purpose of this audit was to help familiarize lab personnel with accreditation procedures and requirements. Some of the recommendations were made to help the lab prepare for this.

Personnel

3. Mr. Bahl is the plant operator and is responsible for all analytical procedures used in the lab and is the immediate supervisor of laboratory operations. He has been learning the laboratory procedures with the help of only *Standard Methods* and personnel from the Everett Wastewater Treatment Plant. Ms. Drewry has just recently joined the lab; she has had experience in a commercial laboratory, but not with the test methods used here. Both are conscientious and doing a commendable job considering their relative inexperience with the procedures. They would benefit greatly by exposure to outside training courses such as those offered by Green River Community College. The Lab Analyst Section of the Pacific Northwest Pollution Control Association (PNPCA) is another source of information through meetings and contact with other analysts. Robert Waddle of the Everett Lab can provide information about this organization.

4. A package of technical and QA/QC information is being provided to the lab, and personnel are encouraged to contact the QA Section if they have questions.

Facility

5. The lab facility consists of one small room. Current floor and bench space is congested when two analysts are working and is marginally adequate to support current lab operations. Significant expansion of lab operations to include any new analytical capability would require additional bench space.

Equipment and Supplies

6. The laboratory apparently has the support of management in obtaining whatever is required. Most equipment is quite new and satisfactory for the lab's purposes. A few matters affecting operations are addressed below:

a. The lab has a glass still that should produce an excellent quality water. However, one practice could affect the fecal coliform test (and possibly the BOD). The water is stored in plastic carboys that are not regularly cleaned. It would be better to bypass the carboys and use freshly drawn water for preparation of media and buffered rinse water. If water must be stored, it is recommended that carboys be cleaned periodically. Monthly intervals would be adequate for this. Old tubing should be discarded. This is to reduce the bacterial growth that can occur on surfaces and serve as an inoculum for the next batch of water. Common organisms such as *Pseudomonas* are notorious for growing in stored water and producing toxic compounds that can interfere with microbiological test results.

b. The laboratory refrigerator is not capable of maintaining 4°C, which is necessary for sample (mainly BOD) storage. It was recommended that it be repaired or replaced.

c. A recommendation was made for the lab to purchase a spill cleanup kit (as a safety matter and not a matter affecting quality of the analytical work done in the lab). Information on "Kolor-safe" liquid neutralizers available from Aldrich is being provided to the lab. These or similar kits would be sufficient.

Sample Management

7. Because of the nature of treatment plant operations, sample management, storage, and security is not a major problem. However, as part of its QA program, a documented chain-of-custody process should be established to assure samples are being properly secured and accounted for from time of receipt in the lab to disposal. *A recommendation was made to establish and implement such procedures without delay to preclude potential problems should future analytical results be involved in litigation.* With minor modifications and proper documentation, sample handling procedures currently used in the lab will suffice for chain-of-custody purposes. When the lab prepares its QA manual, it should document that fact that those procedures, which include identification of all plant personnel involved in analyzing a specific sample, constitute the chain-of-custody procedures for the lab. A copy of ASTM Standard D 4840-88, "Sampling Chain of Custody Procedures" is being provided.

Data Management

8. BOD calculations were not always being performed properly; results from samples with 5-day DO depletions of less than the minimum requirement of 2.0 mg/L were being used. It was suggested that when 3 sample dilutions are analyzed, only those with 5-day DO depletions ≥ 2.0 mg/L be used for calculating the average BOD of the sample.

In cases where all 3 sample dilutions have less than a 2.0 mg/L 5-day DO depletion, the sample dilution with the largest depletion should be used to calculate the BOD. But in doing so, the result should be calculated as if the 5-day DO depletion (on this sample dilution) were 2.0 mg/L. The sample BOD should then be indicated as less than or equal to the calculated result.

Example:

	% SAMPLE DILUTION	INITIAL DO	FINAL DO	5-DAY DEPLETION
Dilution 1:	20	8.60	8.00	0.60
Dilution 2:	30	8.60	7.80	0.80
Dilution 3:	50	8.60	7.00	1.60

Calculation:

BOD_5 mg/L = $(D_1 - D_2)/P$,

where: D_1 = DO of diluted sample immediately after preparation, mg/L,
D_2 = DO of diluted sample after 5 day incubation at 20 °C, mg/L
P = decimal volumetric fraction of sample used

If all sample dilution 5-day depletions are less than 2.0 mg/L, use only dilution #3 (largest depletion) for the calculation. Indicate the final DO, in parenthesis, on the bench sheet as 6.60, so the 5-day depletion is 2.00 mg/L. The sample BOD would then be: 2.00/0.50 or ≤ 4.0 mg/L.

(Note: Reporting BOD results as less than or equal to a certain value should be coordinated with the NPDES permit writer.)

Of course, when setting-up BODs, sample dilutions should be chosen as well as possible to meet the method requirement for the 2.0 mg/L depletion, with a final DO of at least 1.0 mg/L. Suggested sample dilutions for high quality final effluents might be 25, 50, and 75%.

9. It was also recommended that for calculation of fecal coliform results, counts from different dilutions (*e.g.*, 10 mL and 1 mL) not be averaged. A switch to larger volumes as recommended under Methods will avoid this.

PE Samples

10. Because the plant is not a major discharger, the lab does not participate in the EPA DMR-QA performance evaluation sample studies. A recommendation was made that the lab contact EPA Region 10 (Dan Baker at 206/553-1692) and enroll in the WP (Water Pollution) program. These samples will provide the lab with an objective evaluation of its capabilities, and successful analysis of these will satisfy the lab's eventual accreditation requirements.

Quality Assurance/Quality Control

11. There has been no requirement yet to prepare a formal QA program or document, but the lab was encouraged to begin the process. One of the critical elements in the program is that the lab establish data quality objectives, (DQOs) for each analytical method sufficient to determine whether or not the lab is "in control". Initially, these should be the

targets for accuracy given in *Standard Methods*, and as data are accumulated, the lab can develop its own and more meaningful DQOs based upon control charts. Information about QA manual preparation and control charting is also being provided.

a. *The lab should establish a schedule for routinely analyzing quality control (QC) samples along with other analyses.*

(1) *First priority should go to analyzing standard solutions (solutions of known concentration) for those parameters where it is appropriate to do so.* The objective in doing this QC test is to discover any bias in the test by comparing the observed value to the known or expected value, and to track precision as the tests are done repetitively . For the plant performance parameters reported by this lab, appropriate standard solution tests would be BOD (the glucose-glutamic acid solution described in the method) and TSS (using a suspension of a suitable material such as Sigma Cell 20, information on which was provided to the lab by the visiting team).

(2) *Second priority should go to analyzing duplicate samples, preferably from the effluent stream since duplicates taken elsewhere in the plant are likely to vary widely in concentration.* The objective here is to track precision of analyses on real samples (as opposed to the relatively clean standard solutions). For the plant performance parameters reported by the Mukilteo laboratory, appropriate duplicate tests (on effluent samples) would be BOD, TSS, chlorine residual and pH. Duplicate tests can also be done on fecal coliforms if time and manpower resources allow.

b. *After running sufficient QC tests to provide statistically significant data (ten tests of a given type are enough but 20 are better), control charts should be constructed and used as a means to check precision as a routine procedure.* Information on how to construct and use control charts for both standard solutions and duplicate analyses can be found in the Procedural Manual for the Environmental Laboratory Accreditation Program. Consistent use of control charts will provide evidence to interested parties, inside and outside the lab, concerning capability of the lab to accurately analyze its permit parameters.

Methods

12. **Fecal coliform test.** There are several steps the lab can take to improve recovery of organisms damaged by chlorine or "stressed". A slight modification of the M-FC medium and a specialized type of membrane can help. Several other items that will improve laboratory operation are also noted.

a. The MFS membranes used for the fecal coliform test appear to be acceptable and similar to the recommended Millipore HC membranes, and should help recover organisms from the plant's chlorinated effluent. (If we obtain any information to the contrary the lab will be informed.)

b. The lab prepares its own M-FC agar from dehydrated medium, so it has the option of deleting rosolic acid. This is normally added to suppress "background" organisms that can interfere with the test, but it can also inhibit growth of "stressed" fecal coliforms. It is recommended that the lab do a comparison of the medium with and without rosolic acid with the same samples to see whether it can be eliminated. If there is no overgrowth of nuisance organisms, use of rosolic acid should be discontinued, but it should be kept available in the event background organism numbers increase. The pH of the medium should also be regularly checked, because eliminating rosolic acid also eliminates addition of the 0.2N NaOH. Checking pH will also help detect deteriorating dehydrated medium or an overheated batch.

c. Volumes of 10, 1, and 0.1 mL are usually filtered. Counts are low with this plant's chlorinated effluent, and numbers on the 1 and 0.1 and often the 10 mL portions are too low to yield useful data. When low number are expected, it would be better to filter larger volumes, such as 5, 20, and 50 mL. Suggested volumes when high counts are expected would be 1, 5, and 20 mL if high counts are expected. The judgement of the analyst should be the deciding factor as more experience is acquired with the test, but it is not advisable to go beyond a 5-fold difference between volumes. If erratic numbers are expected, it is better to filter an additional volume at either end.

13. **pH**. Temperature compensation was not being performed for pH measurements. It was recommended that the laboratory obtain an Automatic Temperature Compensation (ATC) probe, to be installed on the current pH meter. Also, the laboratory was not performing QC analysis for the pH method. It was recommended that a pH 7.00 standard (buffer) be obtained from a source other than that of the pH calibration buffers, to be analyzed with each batch of samples as a check standard. It was also recommended that at least one set of duplicate samples be analyzed per week as a precision check.

14. **Chlorine Residual**. Analysis of duplicates was recommended to monitor precision.

15. **Total Suspended Solids**. It was recommended that a daily temperature log be kept for the solids drying oven (required temperature of 103-105°C). A QC procedure was also recommended: a standard solution for the TSS test can be made from a suspension of cellulose (such as Sigma Cell 20, available from Sigma Chemical Company). This is a stable suspension and can be kept on the shelf for extended periods (essentially until used up). Because it makes the TSS check standard relatively easy to run, the laboratory should consider running check standards once per week as a minimum.

16. **BOD**. A daily temperature log was also recommended for the BOD incubator (required temperature of 20±1°C). Several other recommendations were made for this test.

a. QC was not being performed for this test. Routine glucose-glutamic acid checks and duplicate sample sets were recommended for monitoring accuracy and precision, at a minimum of once per week. Control charting for these is also recommended after the laboratory develops the capability.

b. The laboratory was experiencing a problem with excessive dissolved oxygen depletion (above 0.2 mg/L) in the BOD dilution water blanks. In order to obtain more consistent quality, it was recommended that the dilution water be aerated with high purity air (filtered for particulates and oil residues) and then stored (stoppered with a cotton or glass fiber plug) in the BOD incubator (or at room temperature, if 20 ± 1 °C) , for 24 hours prior to use. Another suggestion was to clean the BOD bottles more rigorously, *i.e.*, acid rinsing once every 1-2 weeks with 50% sulfuric acid. Also recommended were quality checks on the laboratory pure water, if possible, such as TOC, conductivity, and/or total plate count (specifications for Type I, reagent grade water are given in *Standard Methods, 17th ed., p. 1-55)*.