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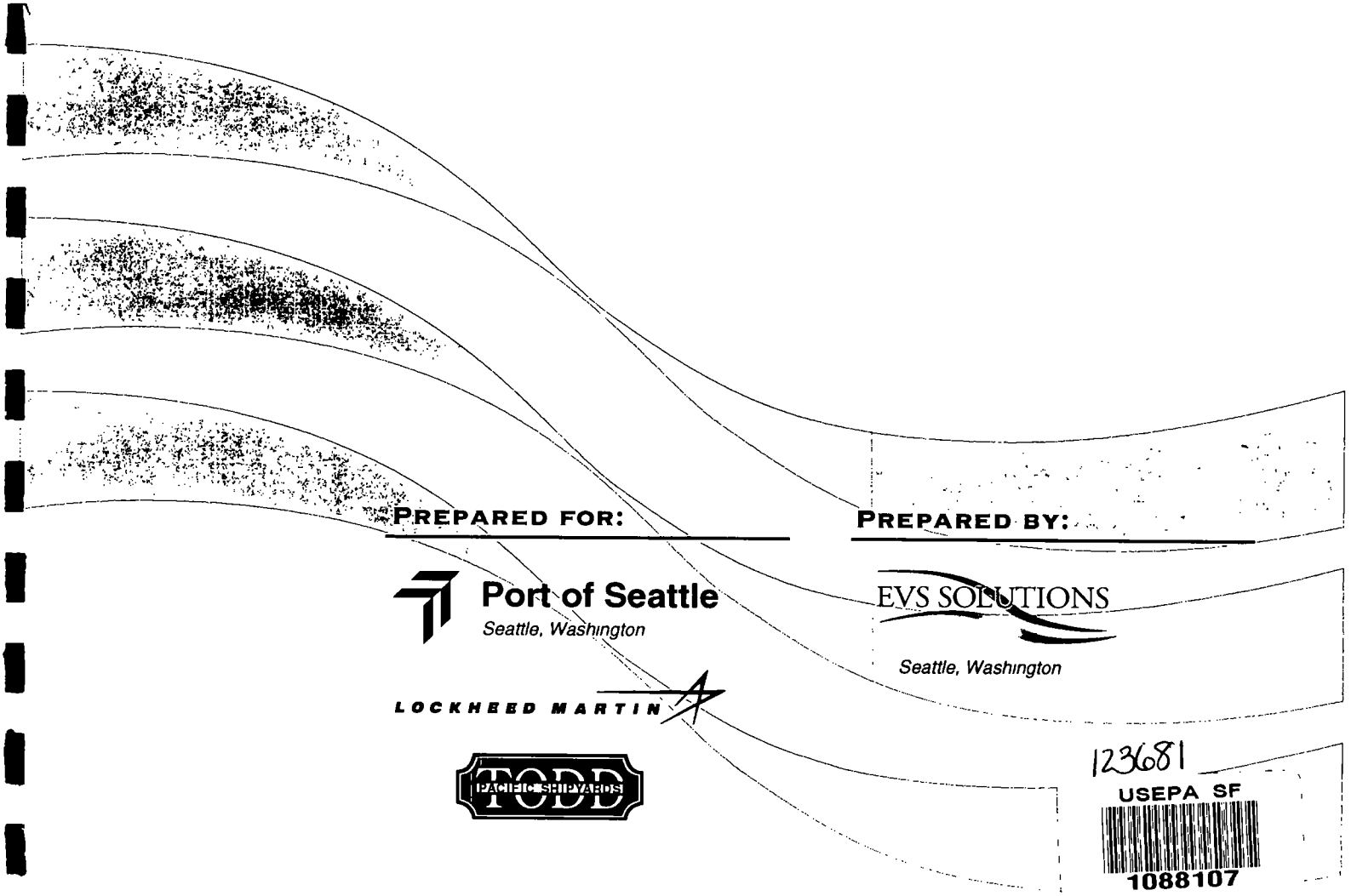
Waterway Sediment Operable Unit
Harbor Island Superfund Site

TRIBUTYLTIN IN MARINE SEDIMENTS AND THE BIOACCUMULATION OF TRIBUTYLTIN: COMBINED DATA REPORT



PREPARED FOR:

Port of Seattle
Seattle, Washington

LOCKHEED MARTIN

TODD PACIFIC SHIPYARDS

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Waterway Sediment Operable Unit
Harbor Island Superfund Site

TRIBUTYLTIN IN MARINE SEDIMENTS AND THE BIOACCUMULATION OF TRIBUTYLTIN: COMBINED DATA REPORT

Prepared for

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Lockheed Martin Corporation
Todd Shipyards Corporation

Prepared by

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For submittal to

U.S. Environmental Protection Agency
Region 10

ESI Project No.

8/203-16.3

MAY 1999

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LIST OF ACRONYMS

AOC	Administrative Order on Consent
Battelle	Battelle Marine Sciences Laboratory
CAS	Columbia Analytical Services
COC	chain of custody
DGPS	differential global positioning system
DOC	dissolved organic carbon
ESI	EVS Solutions, Inc.
GPS	global positioning system
HDPE	high-density polyethylene
HSP	health and safety plan
Lockheed	Lockheed Martin Corporation
MSS	Marine Sampling Systems
PCB	polychlorinated biphenyl
Port	Port of Seattle
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
Rosa	Rosa Environmental and Geotechnical Laboratory
RPD	relative percent difference
SAP	sampling and analysis plan
SOP	standard operating procedure
SOW	statement of work
SSOU	Shipyard Sediment Operable Unit
Todd	Todd Shipyards Corporation
TOC	total organic carbon
TBT	tributyltin
USEPA	U.S. Environmental Protection Agency
WSOU	Waterway Sediment Operable Unit

1.0
INTRODUCTION

The Port of Seattle (Port), Lockheed Martin Corporation (Lockheed), and Todd Shipyards Corporation (Todd) voluntarily entered into an Administrative Order on Consent (AOC) with the U.S. Environmental Protection Agency (USEPA; May 14, 1998). The objective of the AOC and attached Statement of Work (SOW) was to evaluate risks to human health and the environment associated with the bioaccumulation of polychlorinated biphenyls (PCBs), tributyltin (TBT), and mercury at the Harbor Island Superfund Site, Waterway Sediment Operable Unit (WSOU). The SOW outlines specific tasks designed to address the importance of PCBs, TBT, and mercury concentrations within the WSOU. The WSOU is located in the West Waterway, a navigable channel of the Duwamish River on the west side of Harbor Island, and is adjacent to the Lockheed and Todd Shipyards Sediment Operable Units (SSOUs). The data and subsequent interpretation resulting from this study are expected to be useful in defining future activities regarding the SSOUs.

This report, *Tributyltin in Marine Sediments and the Bioaccumulation of Tributyltin: Combined Data Report,* fulfills Tasks 2 and 3 of the SOW. These tasks examined the ecological impacts associated with exposure to TBT within the WSOU. The two main objectives of these tasks are:

- Analyze TBT in bulk sediment and filtered and unfiltered porewater of surface sediments collected from 30 stations within the WSOU (Task 2 of the SOW)

- Conduct laboratory bioaccumulation testing for TBT using sediments selected from the same 30 stations (Task 3 of the SOW)

This report presents an assessment of the predictive relationships between concentrations of TBT in tissue and those in bulk sediment and filtered and unfiltered porewater, based on the results of the chemical analyses and bioaccumulation tests. The relationships are then used to identify areas of the West Waterway with porewater or sediment concentrations of TBT that could potentially result in tissue concentrations exceeding the TBT tissue trigger concentration. This proposed trigger concentration was established based on the results of a literature review conducted under Task 1.

Sediment was collected by EVS Solutions, Inc. (ESI); Blue Water Engineering, Seattle, WA; and Marine Sampling Systems (MSS), Burley, WA. Sediment bioaccumulation testing was conducted by Battelle Marine Science Laboratory (Battelle), Sequim, WA.

Porewater extraction and grain-size determinations were provided by Rosa Environmental & Geotechnical Laboratory (Rosa), Seattle, WA. Chemical analyses of sediment, porewater, and tissue samples were conducted by Columbia Analytical Services (CAS), Kelso, WA.

At the request of Todd Shipyards, four stations located on the Todd SSOU were added to the study (Stations TBT-31 to TBT-34). These stations and the resulting analyses and data related to them are considered for comparative purposes only; this study primarily addresses TBT contamination within the WSOU. Results from these four stations may be used for future evaluations of the adjacent SSOUs.

The rest of this document is organized as follows: Section 2.0 of this report presents the study design and methods for sample collection; porewater extraction; bioaccumulation testing; and the chemical analysis of sediment, porewater, and tissues. The results and data quality summaries for the analytical and bioaccumulation testing are presented in Section 3.0. The analysis, discussion, and trigger value comparison for TBT concentrations in tissue are presented in Section 4.0. Section 5.0 contains the references used for this report. Appendix A is the navigation report from the data collection effort. Appendices B, C, D, and E contain detailed results of sediment chemistry analyses, porewater chemistry analyses, bioaccumulation testing, and subsequent tissue chemistry analyses, respectively. Appendix F contains data validation reports, and Appendix G contains field logs. The final version of the Task 1 report, *Review of Tissue Residue Effects Data for Tributyltin, Mercury, and Polychlorinated Biphenyls*, is available as a separate document (ESI 1999a).

2.0
METHODS

To determine the concentrations of TBT (ion) in bulk sediment and the porewater of sediments from the WSOU, bulk sediment and porewater samples were withdrawn from surficial sediment samples (0 - 10 cm) which had been collected from 30 stations in the WSOU and 4 stations in the Todd SSOU (Figure 2-1 and Table 2-1). Samples of filtered and unfiltered porewater and bulk sediment were analyzed for TBT ion and ancillary parameters.

To determine the extent to which TBT in sediments from the WSOU accumulates in marine benthic species, bioaccumulation tests were conducted using 20 of the 30 samples collected from the WSOU during the field survey from which porewater samples were obtained. Twenty was determined to be an adequate number of stations to provide sufficient spatial distribution and to represent the range of porewater concentrations. The 20 samples selected were those having measured TBT concentrations in porewater greater than 0.05 μg/L TBT ion, as stipulated in the SOW (Figure 2-2). A discussion of the procedure used to select stations for bioaccumulation testing is presented in Section 2.2.3.

Bioaccumulation testing was performed by exposing *Macoma nasuta*, a suspension-feeding/filter-feeding bivalve, and *Nephtys caecoides*, a burrowing deposit-feeding polychaete, to the sediment samples for 45 days.

The bioaccumulation data, together with the sediment and porewater data, were used to evaluate the site-specific relationship between concentrations of TBT in tissue and in porewater.

2.1 STATION LOCATIONS

Stations were originally selected for this study based on historical TBT measurements and spatial coverage of the WSOU. Stations were located using a differential global positioning system (DGPS). At the start and end of each sampling day the sampling vessel was positioned at a calibration point located at the south end of the Fisher Mills dock in the West Waterway (FM-4). The GPS antenna on the sampling vessel was positioned as close to the surveyed calibration point as possible. A visual estimate of the range and bearing from the monument to the GPS antenna was made and compared to the range and bearing displayed of the screen to confirm the accuracy of the positioning system.

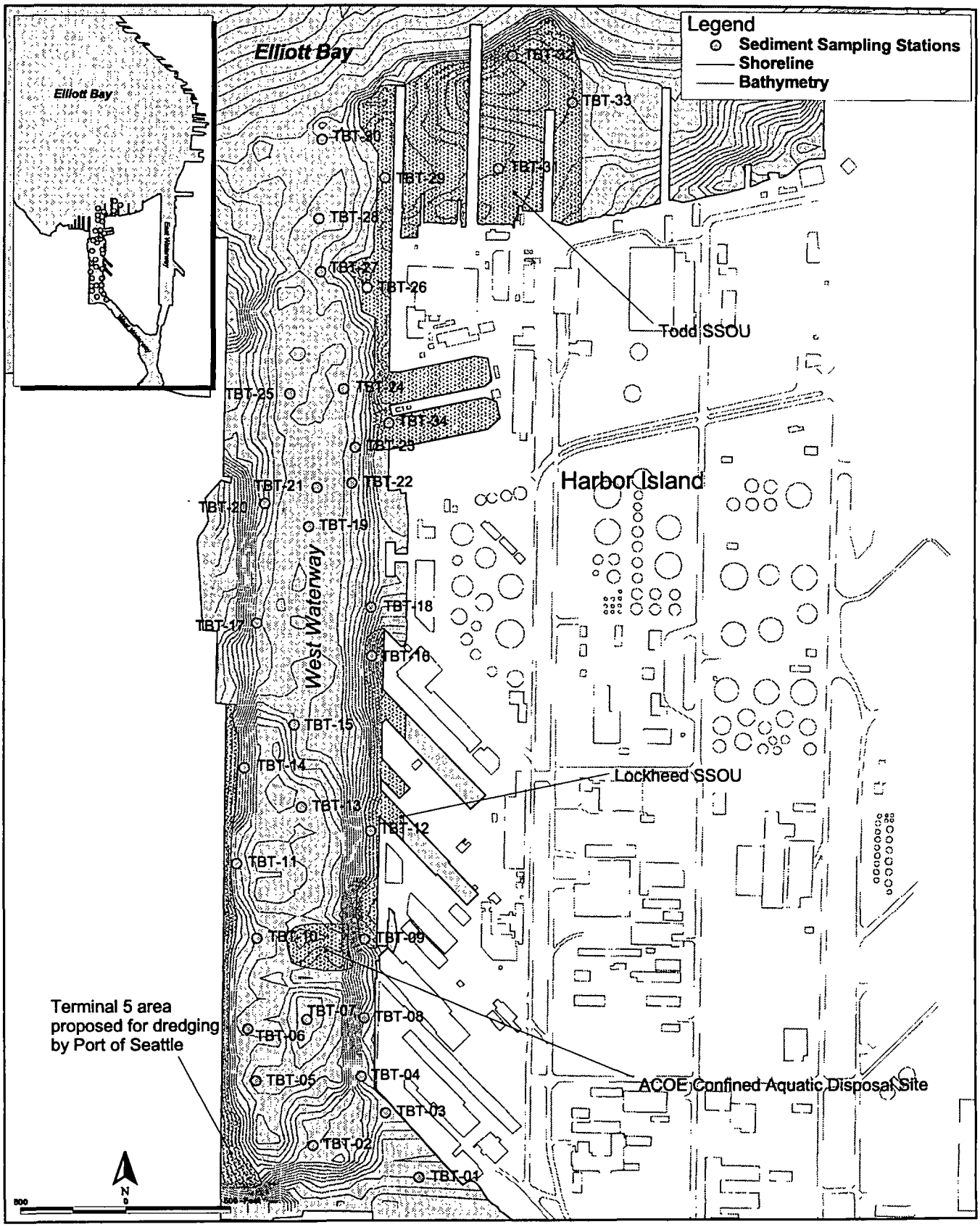

Figure 2-1. Station locations for sediment collection

Table 2-1. TBT study station locations

STATION ID	LONGITUDE	LATITUDE
WSOU Stations		
TBT-001	122°21'27.00041"	47°34'27.26951"
TBT-002	122°21'34.46864"	47°34'28.74578"
TBT-003	122°21'29.43603"	47°34'30.39172"
TBT-004	122°21'31.25884"	47°34'32.21222"
TBT-005	122°21'38.54895"	47°34'31.88535"
TBT-006	122°21'39.18205"	47°34'34.37133"
TBT-007	122°21'35.07712"	47°34'34.87263"
TBT-008	122°21'31.09806"	47°34'34.99019"
TBT-009	122°21'31.10402"	47°34'38.72936"
TBT-010	122°21'38.64838"	47°34'38.70608"
TBT-011	122°21'40.13763"	47°34'42.22889"
TBT-012	122°21'30.81096"	47°34'43.86440"
TBT-013	122°21'35.82178"	47°34'44.94618"
TBT-014	122°21'39.74881"	47°34'46.77689"
TBT-015	122°21'36.33728"	47°34'48.84435"
TBT-016	122°21'31.00066"	47°34'52.18238"
TBT-017	122°21'39.09707"	47°34'53.65213"
TBT-018	122°21'31.09299"	47°34'54.48708"
TBT-019	122°21'35.58952"	47°34'58.27063"
TBT-020	122°21'38.67584"	47°34'59.33478"
TBT-021	122°21'35.06927"	47°35'00.12730"
TBT-022	122°21'32.61894"	47°35'00.35800"
TBT-023	122°21'32.45611"	47°35'02.05538"
TBT-024	122°21'33.36100"	47°35'04.79369"
TBT-025	122°21'37.12887"	47°35'04.53276"
TBT-026	122°21'31.84589"	47°35'09.60663"
TBT-027	122°21'35.14700"	47°35'10.32717"
TBT-028	122°21'35.36021"	47°35'12.84633"
TBT-029	122°21'30.77453"	47°35'14.84144"
TBT-030	122°21'35.26061"	47°35'16.59007"
Todd SSOU Stations		
TBT-031	122°21'22.84361"	47°35'15.38659"
TBT-032	122°21'22.09038"	47°35'20.75216"
TBT-033	122°21'17.80420"	47°35'18.60318"
TBT-034	122°21'30.12346"	47°35'03.23608"

NOTE: Survey datum = NAD83

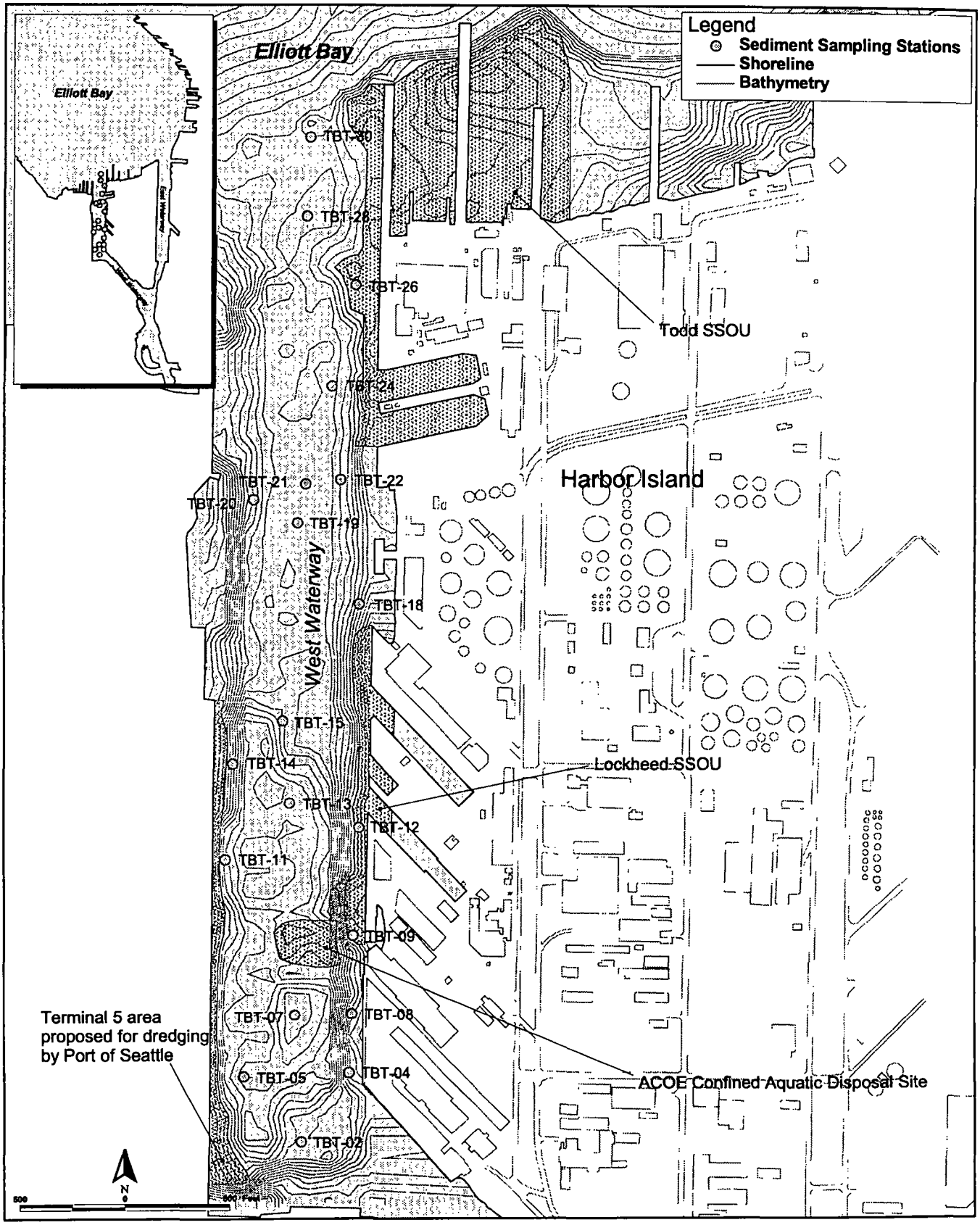

Figure 2-2. Stations for sediment bioaccumulation testing

The actual station locations sampled and positions recorded are presented in Figure 2-1 and Table 2-1. Locations are accurate to within ± 1 m. The complete navigation report in contained in Appendix A.

2.2 SEDIMENT SAMPLES

Sediment collection field activities took place from Wednesday, July 15 through Friday, July 17, 1998. The R/V *Nancy Anne*, provided by MSS, served as the sampling platform. There were no substantial deviations from the sampling and analysis plan (SAP; EVS 1998).

2.2.1 Field Methods

Surface sediment samples (0-10 cm) were collected from 30 stations in the WSOU and 4 stations in the Todd SSOU using a modified, hydraulic-assisted, stainless-steel van Veen grab sampler. Sediment was removed from the sampler using stainless steel spoons and placed into a 10-gallon high-density polyethylene (HDPE) bucket for homogenization. Successive grabs were taken until a sufficient quantity of sediment for all analyses was obtained. The sediment was then homogenized using a handheld power drill with a stainless steel mixing paddle. Aliquots of sediment were then transferred to the appropriate sample containers. Sediment collected for porewater extraction and bioaccumulation analysis was stored under anaerobic conditions, maintained by flooding the headspace of the sample containers with nitrogen. More detailed information on the methodology used for sample collection can be found in Section 3.4.2 of the SAP (EVS 1998).

Three types of field quality assurance samples were collected during surface sediment sampling as specified in the quality assurance project plan (QAPP; EVS 1998): four field homogenate replicates, two cross contamination blanks of the compositing equipment, and a filter blank. Field homogenate replicates were collected at Stations TBT-02, TBT-07, TBT-14, and TBT-28 and were submitted blind, as separate samples, to the laboratories for analysis.

2.2.2 Chemical Analyses

Bulk sediment samples were analyzed by CAS for TBT (reported as μg/kg ion) and total organic carbon (TOC). Grain-size analyses were conducted by Rosa. Methods, holding times, target detection limits, method detection limits, and quality assurance/quality control (QA/QC) samples are discussed in Section 7.0 of the QAPP (EVS 1998). A laboratory audit conducted by Bruce Woods of USEPA on July 22, 1998, indicated that

there were no significant deviations in the laboratory's procedures that adversely affected the data quality. Detailed results of chemical analyses of bulk sediment are provided in Appendix B.

2.2.3 Bioaccumulation Testing

The selection of sediments for bioaccumulation testing was based on the sediment and porewater concentrations of TBT. The concentrations were ranked from lowest to highest for sediment, filtered porewater, and unfiltered porewater (Table 2-2). Three stations that had porewater concentrations below 0.05 μg/L TBT (TBT-01, TBT-10, and TBT-17) and the four stations that were sampled from the Todd SSOU were not considered for bioaccumulation testing. Station TBT-29 was not selected for testing because the measured TBT concentrations appeared to be outliers when compared to the complete dataset. The final selection of the stations for testing provided a representative range of TBT concentrations and a geographical distribution throughout the WSOU. Sediments recommended for testing were presented to USEPA for approval in a meeting on August 19, 1998. The stations selected and subsequently tested for bioaccumulation are presented in Figure 2-2. Results of the chemical analyses of porewater are summarized in Section 3.2 of this report and presented in Appendix C.

Bioaccumulation testing was performed by Battelle with 20 of the 30 samples collected in the WSOU using *M. nasuta* and *N. caecoides*. The two species were tested together in the same aquaria. To avoid having to extrapolate standard 28-day bioaccumulation testing results to theoretical steady-state conditions, the test was extended to a maximum of 45 days to provide a better experimental estimate of steady-state tissue concentrations (EVS 1996). Sediment additions were performed in accordance with discussions with USEPA (Boese 1998) and USEPA guidance (USEPA 1993).

Only one replicate was tested for 17 of the 20 test sediments. For the remaining three test sediments, five replicate aquaria were used to provide a measure of potential variations in tissue concentrations associated with West Waterway sediments. The replicated test sediments were selected from four randomly determined stations from which extra sediment was collected during the field survey.

The bioaccumulation data are being used to delineate areas of the West Waterway which have porewater TBT concentrations high enough to result in tissue TBT concentrations that may exceed the trigger value established as part of Task 1 of the SOW. The bioaccumulation tests for all 20 samples were not replicated, because single measurements of tissue concentration are sufficient for the purpose of establishing areas that exceed the trigger concentration.

Table 2-2. Rankings by TBT concentration of stations selected for bioaccumulation testing

Station	Bulk Sediment[a] TBT (µg/kg)	Station	Filtered Porewater[b] TBT (µg/L)	Station	Unfiltered Porewater[b] TBT (µg/L)
TBT-10	8	TBT-10	0.01	TBT-10	0.01
TBT-01	31	TBT-01	0.02	TBT-17	0.02
TBT-11	130	TBT-17	0.02	TBT-01	0.06
TBT-18	210	TBT-18	0.06	TBT-18	0.08
TBT-25	310	TBT-19	0.06	TBT-19	0.08
TBT-30	310	TBT-11	0.07	TBT-11	0.1
TBT-04	330	TBT-22	0.09	TBT-26	0.17
TBT-22	350	TBT-06	0.11	TBT-07[c]	0.21
TBT-08	400	TBT-15	0.13	TBT-05	0.22
TBT-19	450	TBT-26	0.13	TBT-15	0.24
TBT-23	510	TBT-23	0.14	TBT-23	0.24
TBT-15	530	TBT-24	0.14	TBT-09	0.27
TBT-03	540	TBT-04	0.15	TBT-04	0.29
TBT-17	560	TBT-05	0.16	TBT-22	0.29
TBT-24	570	TBT-07[c]	0.16	TBT-06	0.3
TBT-21	610	TBT-08	0.21	TBT-24	0.33
TBT-06	660	TBT-09	0.21	TBT-16	0.36
TBT-28[c]	670	TBT-12	0.24	TBT-02[c]	0.38
TBT-05	680	TBT-25	0.26	TBT-08	0.38
TBT-02[c]	690	TBT-02[c]	0.265	TBT-25	0.44
TBT-27	730	TBT-13	0.37	TBT-13	0.47
TBT-09	800	TBT-21	0.38	TBT-03	0.51
TBT-07[c]	820	TBT-20	0.41	TBT-12	0.51
TBT-12	830	TBT-16	0.44	TBT-21	0.51
TBT-14[c]	1050	TBT-14[c]	0.445	TBT-28[c]	0.69
TBT-13	1100	TBT-03	0.45	TBT-14[c]	0.715
TBT-26	1100	TBT-28[c]	0.575	TBT-30	0.9
TBT-16	1200	TBT-27	0.71	TBT-27	0.97
TBT-20	3500	TBT-30	0.76	TBT-20	1.01
TBT-29	6200	TBT-29	1.29	TBT-29	1.87

NOTE: Shaded area represents stations selected for bioaccumulation testing

[a] Complete data results for sediment are presented in Table 3-1.

[b] Complete data results for filtered and unfiltered porewater are presented in Table 3-2.

[c] Mean of two replicates.

Bioaccumulation tests followed standard QA/QC procedures, including the use of negative controls, positive controls, replicates (for three test sediments), and water quality measurements as described in Section 8.0 of the QAPP (EVS 1998). The QA/QC data and the results of the QA/QC procedures are summarized in Section 3.3.1 and presented in Appendix D of this report.

2.3 POREWATER SAMPLES

2.3.1 Extraction Methods

Two gallons of sediment from each of the 34 locations was sent to Rosa for porewater extraction. Sediment samples were transported in HDPE buckets with nitrogen-purged headspace. The porewater extraction was performed under anaerobic conditions in a nitrogen atmosphere. Sediment samples were double-centrifuged at 4°C: first at 3,000 rpm (2,700 G) for 30 min; the resulting supernatant was removed and centrifuged again at 9,000 rpm (14,300 G) for 30 min.[1] One half (approximately 500 mL) of the supernatant from the second centrifugation was then filtered through a 0.45-μm silver filter. The filtered and unfiltered porewater samples were acidified with HCl for preservation until analysis of TBT. A separate extraction was performed for the unfiltered dissolved organic carbon (DOC) and filtered DOC analyses. The porewater samples were then shipped to CAS for TBT and organic carbon analysis. The Rosa case narrative with details of the extraction methodology is presented in Appendix C.

2.3.2 TBT Analysis

CAS performed all chemical analyses conducted on the porewater samples. Methods, holding times, target detection limits, method detection limits, and QA/QC controls are discussed in Section 7.0 of the QAPP and in Appendix D of the SAP (EVS 1998). The results of the porewater analyses are discussed in Section 3.2 and Appendix C of this report.

2.4 TISSUE SAMPLES

At the completion of the 45-day bioaccumulation testing and 24-hr depuration period in clean flowing seawater, tissue samples were collected from *M. nasuta* and *N. caecoides*. A total of 37 samples was collected for each species, including 17 samples from the single replicate treatments, 15 samples from the three treatments with five replicates, and 5 replicate samples from the control treatments. Because of reduced survival and consequent low tissue volumes for the *N. caecoides* samples, tissues from the surviving

1. The laboratory inadvertently centrifuged the sample at 9,000 rpm rather the 9,000 g specified in the QAPP. It is uncertain what effect, if any, this may have had on the resulting supernatant.

organisms in the control replicates were composited and split into five replicates for analysis at CAS. All tissue samples were frozen immediately and stored at temperatures below -20°C. Samples were shipped by overnight courier to CAS for analysis of TBT and percent lipids.

CAS performed all chemical analyses on tissue samples. The data are considered usable as qualified. Methods, holding times, target detection limits, method detection limits, and QA/QC controls are discussed in Section 7.0 of the QAPP (EVS 1998). The results of the tissue analyses are discussed in Section 3.4 and Appendix E of this report.

2.5 DATA EVALUATION

Exploratory data analysis was used to determine evidence of linear relationships between sediment, porewater, and tissue TBT concentrations. Linear regressions were applied to pairs of variables that had evidence of a linear relationship in linear or log (base 10) units. The relative strengths of these relationships were described by the magnitude of R^2. All statistical analyses were conducted using S-PLUS™ statistical software (version 4.5, MathSoft, Inc.).

3.0
RESULTS

3.1 SEDIMENT SAMPLES

3.1.1 Data Summary

The bulk sediment TBT concentrations (as TBT ion) ranged from a minimum of 8 μg/kg dry weight at Station TBT-10 to a maximum of 6,600 μg/kg dry weight at Station TBT-31 (Table 3-1). The concentrations of TBT in sediment ranged over 3 orders of magnitude. When the two lowest and two highest concentrations are excluded, the range from lowest to highest is only 30-fold. The variability of TBT concentrations measured among field homogenization replicates ranged from 6 to 31 percent for the four replicates tested. With the exception of Station TBT-01, there was a general trend of decreasing TOC and fractions of fine-grained material approaching the mouth of the waterway. Sediments collected adjacent to Harbor Island tended to be richer in organic material and finer than sediments collected from middle channel or east side stations. Overall, the TBT and organic carbon concentrations and grain-size characteristics were consistent with the sediments collected from previous studies in the West Waterway (EVS and Hart Crowser 1995).

Concentrations of TOC in bulk sediment (percent of dry weight) ranged from a minimum of 0.5 percent for Station TBT-10 to a maximum of 4.24 percent at Station TBT-34. Sediment grain-size analysis showed a minimum of 10.16 percent fines at Station TBT-01 and a maximum of 77.19 percent fines at Station TBT-12. As expected, sediment TOC correlated positively with percent fines. The sediment sample from Station TBT-34 was an exception to this correlation, having a high concentration of organic carbon and a low fraction of fine-grained material.

3.1.2 Data Quality

All analyses were performed in a manner consistent with the methods and guidelines stated in the QAPP. No substantial deviations from the QAPP occurred. All recommended holding times were met for the sediment sample analyses. The results of all laboratory analyses including the case narrative, test sediments, and QA/QC samples are presented in Appendix B. The chemistry data were independently reviewed and validated by Quality by Design. The data are considered usable as reported and qualified. The complete data validation report is presented in Appendix F.

Table 3-1. Sediment chemistry and conventional parameters

Station	TBT Ion (µg/kg)	Total Organic Carbon (%)	Total Solids (%)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines (%)
TBT-01	31	0.58	74.3	11.8	78.0	6.48	3.68	10.2
TBT-02	730	2 09	54 8	0 17	33.6	45.7	20.6	66.3
TBT-03	540	2.01	53.5	5.40	30 9	39.8	23.9	63.7
TBT-04	330	1.10	64 2	1.11	58.4	25.3	15 2	40.5
TBT-05	680	1.83	52 6	0 00	32 6	44.0	23 4	67.4
TBT-06	660	1 81	53 9	0.05	35 2	41.2	23.6	64.8
TBT-07	670	1.66	52.8	0.16	38.2	42.1	19.6	61.7
TBT-08	400	3.25	48.4	4.17	39 9	35.4	20.5	56.0
TBT-09	800	2.02	49.6	1.43	27.2	46.6	24.8	71.4
TBT-10	8	0.50	72 5	0 73	75.9	18.2	5.18	23.4
TBT-11	130	0.75	67 0	0.73	70.0	22.0	7.19	29.2
TBT-12	830	2.30	51.7	2.47	20.3	49.1	28.1	77.2
TBT-13	1,100	1.31	59.1	2.11	52.3	29.4	16.2	45.6
TBT-14	1,100	1.03	60.4	8.72	52.5	25.2	13.6	38.8
TBT-15	530	1.35	63.2	5.39	56.0	26.4	12.2	38.6
TBT-16	1,200	2.07	52.7	0.70	37.9	37.2	24.2	61.4
TBT-17	560	0.86	66.6	0.06	71.4	22.2	6.37	28.5
TBT-18	210	1.15	77.7	0.66	70.8	18 3	10.2	28.6
TBT-19	450	1.22	60.5	2.34	44.4	37.7	15.5	53.2
TBT-20	3,500	1.60	56.5	3.44	44.5	33.3	18.8	52.1
TBT-21	610	1.23	61 1	1.17	52.2	33.9	12.8	46.6
TBT-22	350	0.94	64.8	0.13	61.5	27 8	10.5	38.3
TBT-23	510	0.93	65 5	0.03	61.6	27.7	10.6	38.3
TBT-24	570	1.27	60.0	0.13	50.9	34.6	14.4	49.0
TBT-25	310	1.12	63.6	0.85	44.7	42.4	12.0	54.4
TBT-26	1,100	1.21	60.0	1.14	70.6	19.0	9.25	28.3
TBT-27	730	1.45	63.4	10.5	54.1	24.6	10.8	35.5
TBT-28	690	1 22	60.0	0.08	52.0	35.5	12.4	47.9
TBT-29	6,200	2 41	46 3	1.21	53.5	30 7	14.6	45.3
TBT-30	310	1.28	61.2	1.17	42.6	42.1	14.2	56.3
TBT-31	6,600	1 70	51.0	5.09	58.7	25.2	11.1	36.3
TBT-32	2,200	0.99	61.8	0.33	67.6	22.0	10.1	32.1
TBT-33	1,000	1.25	61 1	0.59	80.9	12.8	5.70	18.5
TBT-34	850	4.24	51.6	27 3	42.8	18.7	11.2	29.9
TBT-35[a]	650	1.89	55.6	0 00	33.2	44.9	22.0	66.8
TBT-36[b]	970	1 71	54.1	0 53	40.2	39.6	19.6	59.3
TBT-37[c]	1,000	1.22	63.2	9.68	51.1	25 9	13.3	39.2
TBT-38[d]	650	1 40	61.3	0.48	51.4	36 0	12 1	48.2

[a] Homogenate replicate collected at station TBT-02.
[b] Homogenate replicate collected at station TBT-07.
[c] Homogenate replicate collected at station TBT-14.
[d] Homogenate replicate collected at station TBT-28

3.2 POREWATER SAMPLES

3.2.1 Data Summary

TBT concentrations (as TBT ion) in unfiltered porewater ranged from a minimum of 0.01 μg/L at Station TBT-10 to a maximum of 1.87 μg/L at Station TBT-31 (Table 3-2). TBT concentrations (as TBT ion) in filtered porewater ranged from a minimum of 0.01 μg/L at Station TBT-10 to a maximum of 1.49 μg/L at Station TBT-31.

DOC concentrations in unfiltered porewater ranged from a minimum of 7.8 mg/L at Station TBT-10 to a maximum of 39.9 mg/L at Station TBT-25. DOC concentrations in filtered porewater ranged from a minimum of 6.3 mg/L at Station TBT-33 to a maximum of 32.9 mg/L at Station TBT-25 (Table 3-2).

The effect of filtering the samples can be evaluated by comparing the TBT concentrations in unfiltered and filtered porewater, as well as the differences between unfiltered DOC and filtered DOC concentrations. In general, the filtered samples had lower TBT concentrations than the unfiltered samples, although one sample had a filtered concentration that was 22 percent higher than the unfiltered concentration. The greatest loss of TBT was 69 percent of the unfiltered concentration. The mean change in concentration over all porewater samples was a loss of 30 percent of the initial or unfiltered TBT concentration. A similar difference was seen between the unfiltered DOC and filtered DOC concentrations. In general, the filtered DOC concentrations were less than the corresponding unfiltered DOC concentrations, although one sample, TBT-27, had a DOC concentration that was 107 percent higher than the unfiltered DOC concentration. The greatest loss was 42 percent of the unfiltered DOC concentration. The mean difference over all porewater samples was a loss of 7 percent of the unfiltered DOC concentration. If sample TBT-27 is excluded from the mean, the mean was a loss of 10 percent of the unfiltered DOC concentration.

There was no consistent relationship between the concentration of TBT in unfiltered and filtered samples and the difference between the unfiltered DOC and filtered DOC concentrations. The samples with the greatest loss of TBT did not correspond to the samples with the greatest difference between their unfiltered DOC and filtered DOC concentrations. Most of the differences were within the range of analytical uncertainty.

The homogenate replicate relative percent differences (RPDs) for TBT and DOC measured in filtered porewater ranged from 23 to 87 percent and 12 to 73 percent, respectively. The homogenate replicate RPDs for TBT and DOC measured in unfiltered porewater ranged from 14 to 53 percent and 2 to 78 percent, respectively.

Table 3-2. Filtered and unfiltered porewater chemistry

Station	TBT-Filtered (µg/L)	Filtered Dissolved Organic Carbon (mg/L)	TBT-Unfiltered (µg/L)	Unfiltered Dissolved Organic Carbon (mg/L)
TBT-01	0.02	10.2	0.06	13.8
TBT-02	0.38	8.7	0.48	10.5
TBT-03	0.45	19.7	0.51	24.7
TBT-04	0.15	17.2	0.29	19.6
TBT-05	0.16	12.9	0.22	14.8
TBT-06	0.11	14.0	0.30	15.9
TBT-07	0.13	12.5	0.16	11.0
TBT-08	0.21	14.3	0.38	15.2
TBT-09	0.21	12.7	0.27	12.6
TBT-10	0.01	7.6	0.01	7.8
TBT-11	0.07	12.2	0.10	21.2
TBT-12	0.24	17.4	0.51	18.9
TBT-12R[a]	0.37	nr	0.46	nr
TBT-13	0.37	7.4	0.47	8.8
TBT-14	0.31	16.3	0.58	16.9
TBT-15	0.13	11.4	0.24	13.3
TBT-16	0.44	15.3	0.36	15.0
TBT-17	0.02	8.9	0.02	8.4
TBT-18	0.06	14.6	0.08	15.4
TBT-19	0.06	7.7	0.08	8.5
TBT-20	0.41	14.3	1.01	16.6
TBT-21	0.38	13.8	0.51	15.7
TBT-22	0.09	24.7	0.29	32.7
TBT-23	0.14	14.1	0.24	14.6
TBT-24	0.14	17.0	0.33	18.7
TBT-25	0.26	32.9	0.44	39.9
TBT-26	0.13	13.1	0.17	13.3
TBT-27	0.71	29.6	0.97	14.3
TBT-28	0.64	17.4	0.74	18.5
TBT-29	1.29	9.4	1.87	10.7
TBT-30	0.76	30.0	0.90	22.4
TBT-31	1.49	14.5	1.50	15.1
TBT-32	0.28	16.4	0.35	18.7
TBT-33	0.09	6.3	0.11	8.0
TBT-34	0.14	14.4	0.19	18.6
TBT-35[b]	0.15	18.6	0.28	24.0
TBT-36[c]	0.19	11.1	0.26	11.2
TBT-37[d]	0.58	19.8	0.85	24.3
TBT-38[e]	0.51	22.4	0.64	28.0

NOTE: nr - not reported

[a] Reanalyzed sample.

[b] Homogenate replicate collected at station TBT-02.

[c] Homogenate replicate collected at station TBT-07.

[d] Homogenate replicate collected at station TBT-14.

[e] Homogenate replicate collected at station TBT-28.

The difference in measurements between the replicates can be attributed to analytical variability, matrix complexity, and sediment heterogeneity.

3.2.2 Data Quality

All analyses were performed in a manner consistent with the methods and guidelines of the QAPP with the following exceptions:

- The recommended holding time of 7 days, which included collection, extraction, and analysis, was met for 64 of the 76 porewater samples. However, the filtered and unfiltered porewater samples from Stations TBT-15, TBT-16, TBT-17, TBT-18, TBT-19, and TBT-20, were mishandled at the analytical laboratory and had to be re-extracted from the bulk sediment and re-analyzed. The re-extraction was performed 12 days after the samples were collected. An additional sample from Station TBT-12 was also re-extracted and re-analyzed to provide a basis for comparing samples that met their holding times with samples that did not. The results from the second analysis of TBT-12 were within 35 percent and 11 percent of the initial results for filtered and unfiltered porewater, respectively. These measurements are within the data quality objectives for precision of $\pm$ 40 percent as outlined in the QAPP (EVS 1998). Therefore, all data are considered usable as reported and qualified.

- The laboratory inadvertently performed the centrifugation at speeds in rpms rather than in Gs. This resulted in the second centrifugation being performed at the higher rate of 14,300 G (9,000 rpm) rather than the recommended 9,000 G.

The results of all laboratory analyses, including the case narrative and results for porewater and QA/QC samples, are presented in Appendix C. The chemistry data were independently reviewed and validated by Quality by Design. The complete data validation report is presented in Appendix F.

3.3 BIOACCUMULATION TESTING

Survival in the native control sediments was 95 percent for *M. nasuta* and 66 percent for *N. caecoides*. If an outlier *N. caecoides* replicate which had 33 percent survival is removed, mean survival in control sediments was 74 percent for *N. caecoides*. Both a low TOC content of 0.07 percent in the control sediment and the extended exposure

period may have been contributing factors to reduced survival.[2] Survival of *M. nasuta* in test sediments ranged from 93.3 percent to 100 percent, with a mean survival of 97.1 percent. Survival of *N. caecoides* in test sediments ranged from 64.4 percent to 95.6 percent, with a mean survival of 83.96 percent. The relative good health of *N. caecoides* in the test treatments suggests that this organism's poor survival in control sediment was not the result of a weak strain of test organism or due solely to the duration of the test.

All water quality parameters were within acceptable ranges throughout the test. The water-only reference toxicant tests using copper resulted in an LC50 of 2.05 mg/L Cu for *M. nasuta,* which is within the laboratory acceptable range of 0.28 mg/L - 2.8 mg/L Cu; and an LC50 of 0.10 mg/L Cu for *N. caecoides,* which is within literature reported values 0.09 mg/L to 0.16 mg/L Cu (Appendix D). Based on the results of the organism survival, reference toxicant tests, and water quality observations, the bioaccumulation tests are considered acceptable. Table 3-3 presents the survival data for *M. nasuta* and *N. caecoides*. The complete case narrative for the bioaccumulation tests, including water quality observations and reference toxicant results, is found in Appendix D.

2. The supplier of *N. caecoides* (John Brezina and Associates, Dillon Beach, CA) collects the organisms and the control sediment from two nearby, but slightly different sites. The organisms are collected from an area of high population density and high amount of organic debris. In previous studies at several laboratories the organic debris has interfered with the use of the sediment at this site as a negative control, because of the effects of organic debris decaying during sediment holding. Therefore, control sediments have intentionally been collected from a nearby site with less organic debris, where *N. caecoides* is present at lower population densities. It is possible that the TOC content of the control sediment collected for this study was too low to support the required number of organisms for the extended duration (45 days) of the test, despite periodic sediment replenishment (Gardiner pers. comm. 1999b).

Table 3-3. Summary of survival of *M. nasuta* and *N. caecoides* in 45-day bioaccumulation tests

	N. CAECOIDES		*M. NASUTA*	
TREATMENT	MEAN PERCENT SURVIVAL	STANDARD DEVIATION	MEAN PERCENT SURVIVAL	STANDARD DEVIATION
Native Control	65 8	25.1	95.3	4.5
TBT-02	95 6	na	100.0	na
TBT-04	88.9	na	96.7	na
TBT-05	88.9	na	96.7	na
TBT-07	88.9	na	96.7	na
TBT-08	68.9	na	100.0	na
TBT-09	86.7	na	100.0	na
TBT-11	82.2	na	100.0	na
TBT-12	88.9	na	93.3	na
TBT-13	87.1	7.4	93.3	7.8
TBT-14	88.9	na	96.7	na
TBT-15	64.4	na	96.7	na
TBT-18	88.9	na	96.7	na
TBT-19	87.6	8 0	98.0	3.0
TBT-20	68.9	na	96.7	na
TBT-21	77.8	na	93.3	na
TBT-22	64.4	na	93.3	na
TBT-24	91.1	na	100.0	na
TBT-26	91.1	na	100.0	na
TBT-28	91.1	na	96.7	na
TBT-30	88.9	4.2	96.7	5.8

NOTE: na - not applicable; one replicate

3.4 TISSUE SAMPLES

3.4.1 Data Summary

TBT concentrations in *M. nasuta* ranged from a minimum of 4 µg/kg wet weight at Station TBT-08 to a maximum of 380 µg/kg wet weight at Station TBT-20 (Table 3-4). The percent lipids in *M. nasuta* ranged from a minimum of 2.86 percent dry weight at Station TBT-07 to a maximum of 5.26 percent dry weight at Station TBT-28.

Table 3-4. Tissue chemistry for *M. nasuta* and *N. caecoides*

Station	*M. nasuta* TBT (µg/kg wet wt)	*M. nasuta* Lipids (% dry wt)	*M. nasuta* Total Solids (%)	*N. caecoides* TBT (µg/kg wet wt)	*N. caecoides* Lipids (% dry wt)	*N. caecoides* Total Solids (%)
TBT-00[a]	2 0 U	4.66	16 6	2 0 U	6.23	19.9
TBT-02	21	4.05	16.3	118	6.07	11 7
TBT-04	99	4.30	15.8	92	6.71	15 8
TBT-05	15	4.76	14 7	117	7 78	18 0
TBT-07	52	2.86	15 4	129	8.82	14.4
TBT-08	4 0	4.53	15 0	15	6 59	17 0
TBT-09	18	4.31	16.0	114	5 35	21.3
TBT-11	13	4 23	15 6	101	5.78	18 5
TBT-12	25	4.83	14.7	134	6.97	16.5
TBT-13[a]	177	4.02	15 2	211	5.79	19.1
TBT-14	94	4.88	16 6	192	5.96	17 8
TBT-15	9.0	3.67	15.0	131	4 94	17.2
TBT-18	25	3.46	15.9	90	5.82	17.7
TBT-19[a]	30	5.22	15 2	68	5 51	16.3
TBT-20	376	4.15	14.7	384	5.70	16.5
TBT-21	14	4.11	15.1	120	7.43	14.4
TBT-22	10	3.95	15.2	89	6 80	16.9
TBT-24	11	4.81	15.8	104	5.96	19.3
TBT-26	195	4 39	15.5	359	5.30	16.4
TBT-28	43	5.26	15.4	130	8.00	14.5
TBT-30[a]	47	4 13	15.1	66	8.95	15.9

NOTE: U - not detected at detection limit shown

[a] Mean of five replicates.

TBT concentrations in *N. caecoides* ranged from a minimum of 15 µg/kg wet weight at Station TBT-08 to a maximum of 380 µg/kg wet weight at Station TBT-20. The percent lipids in *N. caecoides* ranged from a minimum of 4.94 percent dry weight at Station TBT-15 to a maximum of 8.95 percent dry weight at Station TBT-30.

The relationships among porewater, sediment, and tissue TBT concentrations are analyzed and discussed in Section 4.3.

The mean, standard deviation, and coefficient of variation (standard deviation/mean) of TBT concentrations for the bioaccumulation replicates are presented in Table 3-5.

Table 3-5. Tributyltin concentrations for replicated bioaccumulation tests

	Station		
	TBT-13	TBT-19	TBT-30
M. nasuta			
Mean (μg/kg wet wt)	177	29.8	47.4
Standard deviation (μg/kg wet wt)	102	21.8	36.9
Coefficient of variation	57.7%	73.2%	77.9%
N. caecoides			
Mean (μg/kg wet wt)	211	67.8	65.6
Standard deviation (μg/kg wet wt)	17.4	7.16	10.1
Coefficient of variation	8.3%	10.6%	15.3%

This table clearly shows that results for *M. nasuta* were more variable than results for *N. caecoides*. The difference in variability between the tissue values in *M. nasuta* and *N. caecoides* is possibly due to the inherent variability of feeding regimes of the two species. *N. caecoides* is a mobile sediment deposit feeder whose feeding activities result in a greater integration of sediment within the aquaria. *M. nasuta* is a more stationary organism that feeds on surface sediments and filters overlying water. Greater variability in *M. nasuta* tissue concentrations may be due to the fact that feeding is limited to sediment in the organism's immediate vicinity. Any heterogeneity in sediment TBT concentrations within or between the aquaria might be reflected in the *M. nasuta* tissue concentrations. The coefficients of variation are highly consistent across replicates for intraspecies comparisons.

From a statistical standpoint, the fit of a regression line can be evaluated using R^2 values defined as the percent of total variability in tissue concentrations "explained" by the regression model. The residual, or "unexplained" variance can be broken down into pure error, or the intrinsic variability among replicates as shown in Table 3-5, plus the lack-of-fit error associated with deviations from the linear model. While the absolute magnitude of the replicate variability for *M. nasuta* is larger than that for *N. caecoides*, what is relevant is whether the ratio of replicate variability to residual variance is greater for one species than for the other. For a fixed R^2 value, if the replicate variability for one species makes up a greater proportion of the residual variance, this suggests a better linear fit because it means that the lack-of-fit error makes up a smaller proportion of the residual variance. However, neither of the regression models is subsequently used, because of poor overall fit; whether the source of this poor fit is intrinsic variability in the test or a poor linear fit is irrelevant.

3.4.2 Data Quality

All analyses were performed consistent with the methods and guidelines as stated in the QAPP. All recommended holding times were met for the tissue sample analyses. Because of an error in initial extraction of the sample for the lipid analysis, CAS re-extracted and analyzed the samples for lipids using the method in Bligh and Dyer (1959) referenced in the QAPP. The re-analysis occurred within the recommended holding time of 1 year. For the *N. caecoides* control samples, the sample quantity available limited re-analysis to one sample replicate. Since the replicate sample was created from a composite, the lipid result should be considered representative of each of the replicates originally tested. The data are considered usable as reported and qualified. The results of all laboratory analyses, including the case narrative, test tissues, and QA/QC samples, are presented in Appendix E. The chemistry data were independently reviewed and validated by Quality by Design. The complete data validation report is presented in Appendix F.

At the completion of the test, lipid contents were within the range expected for healthy organisms based on the mean values from previous studies—*M. nasuta* 1.4 to 6.3 percent; polychaetes 5.0 to 16.7 percent; no specific data for *N. caecoides* (Gardiner pers. comm. 1999a). The range for *M. nasuta* was 2.86 to 5.26 percent dry weight and the range for *N. caecoides* was 4.94 to 8.95 percent dry weight.

4.0
DISCUSSION

The bioavailability of sediment contaminants has been shown to be affected both by the chemical and environmental speciation of the contaminant, and by the behavior and physiology of the organisms. The two primary routes of exposure for organisms in sediments are transport of dissolved contaminants in sediment porewater across biological membranes and the ingestion of contaminated sediment particles. Exposure to dissolved contaminant concentrations in sediment porewaters appears to be the predominant route of exposure for many benthic organisms (Muir et al. 1985; Oliver 1987; Shaw and Connell 1987). However, exposure from sediment ingestion may be an important route of exposure for some species (Landrum 1989; Harkey et al. 1994; Meador et al. 1995).

TBT in marine sediments can exist in a variety of different forms, including TBT sorbed to sediment particles, and, in sediment porewaters, free ions, inorganic TBT complexes, and TBT associated with organic colloids. TBT has a relatively high affinity for organic carbon, reflected in the measured octanol-water partition coefficient (log K_{ow}) for this compound of 4.41 (Arnold et al. 1998). Several studies have shown that the distribution of TBT between sediment particles and porewater can be related to the organic carbon content of the sediment (Harris and Cleary 1987; Meador et al.1997). TBT sorption has also been related to the clay content of sediments (Dooley and Homer 1983). Several authors have suggested that the presence of TBT associated with paint chips in the sediment can influence the bioavailability of the compound in the field (Parametrix 1995; Weston 1996).

During this study, the second centrifugation of the porewater samples that was conducted for 30 minutes at 9,000 rpm removed suspended particulate material and a substantial fraction of the large colloidal material. The remaining samples were then analyzed directly or filtered through a 0.45 micron filter and analyzed. Both the filtered and unfiltered porewater samples contained dissolved TBT and possibly TBT associated with colloidal organic macromolecules that were not removed during the centrifugation of the sample.

The TBT concentrations measured in *N. caecoides* are compared with the bulk sediment and porewater concentrations measured for the same samples used in the bioaccumulation testing in Table 4-1 and Figure 4-1.

Table 4-1. TBT concentrations in *N. caecoides*, sediment, and porewater

	N. caecoides (µg/kg)			Sediment (µg/kg)		Porewater (µg/L)	
Rank[a]	Wet Weight	Dry Weight	Station	Bulk	TOC-normalized	Filtered	Unfiltered
1	15.0	88.0	TBT-08	400	12,300	0.21	0.38
2	65.6[b]	417	TBT-30	310	24,200	0.76	0.90
3	67.8[b]	416	TBT-19	450	36,900	0.06	0.08
4	89.0	527	TBT-22	350	37,200	0.09	0.29
5	90.0	508	TBT-18	210	18,300	0.06	0.08
6	92.0	582	TBT-04	330	30,000	0.15	0.29
7	101	546	TBT-11	130	17,300	0.07	0.10
8	104	539	TBT-24	570	44,900	0.14	0.33
9	114	535	TBT-09	800	39,600	0.21	0.27
10	117	650	TBT-05	680	37,200	0.16	0.22
11	118	1,010	TBT-02[c]	690	34,700	0.27	0.38
12	120	833	TBT-21	610	49,600	0.38	0.51
13	129	896	TBT-07[c]	820	48,700	0.16	0.21
14	130	897	TBT-28[c]	670	51,100	0.57	0.69
15	131	762	TBT-15	530	39,300	0.13	0.24
16	134	812	TBT-12	830	36,100	0.30	0.48
17	192	1,080	TBT-14[c]	1,050	93,300	0.45	0.71
18	211[b]	1,140	TBT-13	1,100	84,000	0.37	0.47
19	359	2,190	TBT-26	1,100	90,900	0.13	0.17
20	384	2,330	TBT-20	3,500	219,000	0.41	1.01

[a] Rank order determined by TBT concentration in *N. caecoides* (wet weight).

[b] Average of 5 replicate bioassays.

[c] Sediment concentrations at these stations are means of two homogenate replicates (see Table 3-1).

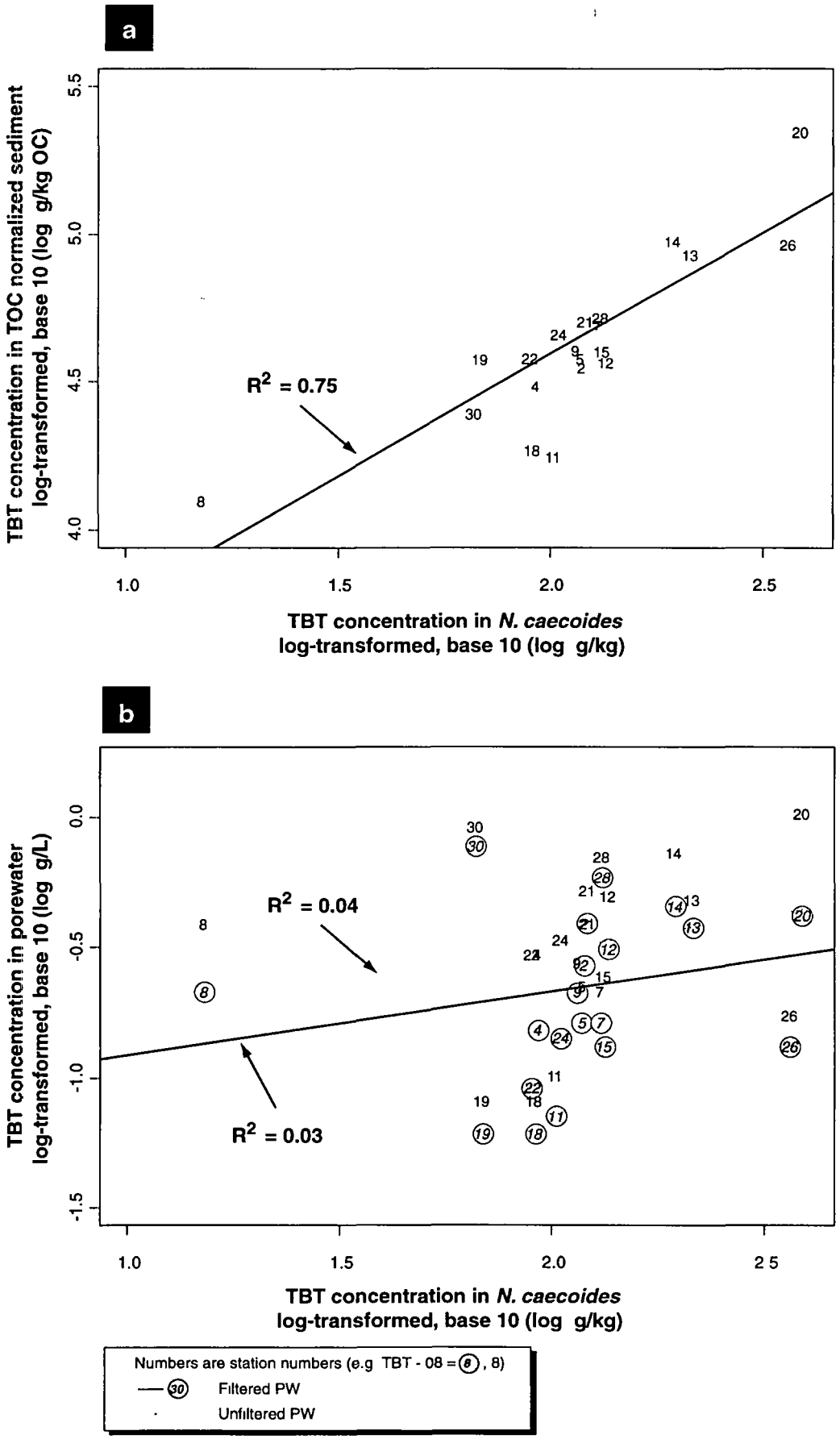

Figure 4-1. Scatter plots and best-fit lines for TBT concentrations in *N. caecoides*, normalized sediment, and porewater

The relationship between the *N. caecoides* tissue concentrations and the organic carbon-normalized sediment concentrations appears to be stronger than the relationship with the filtered and unfiltered porewater concentrations. These relationships will be explored in more detail in the following sections.

The TBT concentrations measured in *M. nasuta* are compared with the sediment and porewater TBT concentrations in Table 4-2 and Figure 4-2. In general, the *M. nasuta* tissue concentrations are lower than the corresponding *N. caecoides* tissue concentrations. As was observed with the *N. caecoides* tissue concentrations, the relationship between tissue concentrations and the organic carbon-normalized sediment concentrations is stronger than the relationship between the tissue concentrations and the porewater concentrations.

Table 4-2. TBT concentrations in *M. nasuta*, sediment, and porewater

	M. nasuta (µg/kg)			Sediment (µg/kg)		Porewater (µg/L)	
Rank[a]	Wet Weight	Dry Weight	Station	Bulk	TOC-normalized	Filtered	Unfiltered
1	4.0	24.0	TBT-08	400	12,300	0.21	0.38
2	9.0	52.0	TBT-15	530	39,300	0.13	0 24
3	10.0	59.0	TBT-22	350	37,200	0.09	0 29
4	11.0	57.0	TBT-24	570	44,900	0.14	0 33
5	13.0	70.0	TBT-11	130	17,300	0.07	0.10
6	14.0	97.0	TBT-21	610	49,600	0.38	0.51
7	15.0	83.0	TBT-05	680	37,200	0.16	0.22
8	18.0	85.0	TBT-09	800	39,600	0.21	0.27
9	21.0	179	TBT-02	690	34,700	0.27	0 38
10	25.0	152	TBT-12	830	36,100	0.30	0.48
11	25.0	141	TBT-18	210	18,300	0.06	0.08
12	29.8[b]	195	TBT-19	450	36,900	0.06	0.08
13	43.0	297	TBT-28	670	51,100	0.57	0.69
14	47.4[b]	321	TBT-30	310	24,200	0.76	0.90
15	52 0	361	TBT-07	820	48,700	0 16	0 21
16	94.0	528	TBT-14	1,050	93,300	0.45	0 71
17	99.0	627	TBT-04	330	30,000	0.15	0 29
18	177[b]	911	TBT-13	1,100	84,000	0.37	0 47
19	195	1,190	TBT-26	1,100	90,900	0.13	0.17
20	376	2,280	TBT-20	3,500	219,000	0.41	1.01

[a] Rank order determined by TBT concentration in *M. nasuta* (wet weight).

[b] Average of 5 replicate bioassays

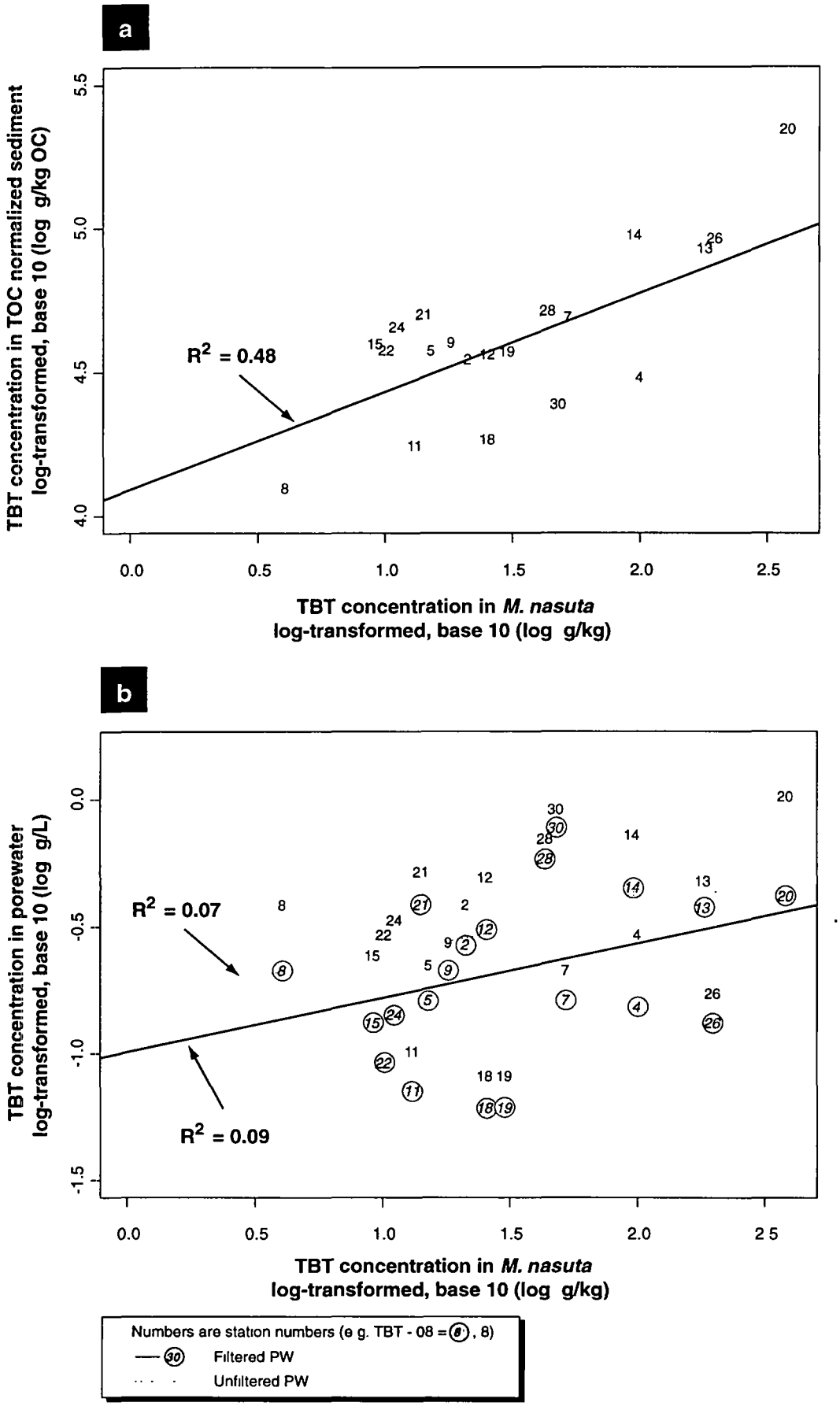

Figure 4-2. Scatter plots and best-fit lines for TBT concentrations in *M. nasuta*, normalized sediment, and porewater

4.1 COMPARISON WITH TRIGGER VALUES

None of the measured tissue concentrations exceeded the USEPA Superfund site-specific tissue trigger value of 0.6 μg/g wet weight (3.0 μg/g dry weight) (ESI 1999b). The highest measured tissue concentrations were 0.376 μg/g wet weight for *M. nasuta* and 0.384 μg/g wet weight for *N. caecoides*, both measured in the test conducted with sediment from Station TBT-20.

The measured tissue concentrations of TBT for both *N. caecoides* and *M. nasuta* were low, despite the presence of TBT in both the bulk sediment and porewaters. The relationship between the measured tissue concentrations and the sediment and porewater concentrations of TBT is explored in detail in Section 4.3.

4.2 DELINEATION OF WSOU

The results of the bioaccumulation testing did not identify any of the areas tested as being of concern due to the bioaccumulation of TBT from the sediments.

4.3 COMPARISON OF TISSUE, SEDIMENT, AND POREWATER TBT CONCENTRATIONS

Sediment bioaccumulation testing was conducted using *M. nasuta* and *N. caecoides*, as described in Section 2.2.3. In the following sections, the measured TBT concentrations in tissue for these species are compared with the measured concentrations of TBT in bulk sediment, organic carbon-normalized sediments, and porewater.

For each comparison, exploratory data analyses were used to determine whether there was any evidence of a linear relationship in the original or log-transformed units. Linear regressions were applied to those pairs of variables which had evidence of a linear relationship on some scale. Standard residual diagnostic techniques were used to determine whether the fit of the linear model could be improved by transformation. All statistical analyses were conducted using S-PLUS™ statistical software (Version 4.0, MathSoft, Inc.).

Correlation and regression analyses can be very sensitive to the data distribution, and to outliers (recorded measurements far from the trend of the bulk of the data). For this reason, the data were transformed or outliers were removed in order to assess the impact of outliers on the linear relationship. These actions were intended to result in the most

accurate measure of linear association between the two variables, and did not always result in the highest correlation or R^2 value. The parameter estimates displayed in the figures and tables represent the best linear fit for each hypothesized relationship.

It is important to note that R^2 is a descriptive measure of the linear association between the dependent and independent variables in each model. Intercept and slope estimates are given for completeness. The presentation of these estimates does not imply that adequate or meaningful predictions can be made on exact bioaccumulation values using this model. Unbiased calculation of parameter estimates and confidence intervals relies on the assumption that the measurements of the independent variable are obtained without error, or at least that the measurement error is small when compared to the measurement error on the dependent variable (bioaccumulation). For most of these regressions, the independent variable was subject to random measurement error which may or may not be smaller in magnitude than the measurement error in the dependent variable. Hypothesis tests and confidence intervals were intentionally not calculated, since the intercept and slope estimates are likely to be biased.

4.3.1 Comparison of Tissue Concentrations and Sediment Concentrations

A comparison was made between TBT concentrations in tissue and those in bulk sediment (Figure 4-3). A stronger relationship was observed between TBT concentrations in sediment and the tissue concentrations for *N. caecoides* than for *M. nasuta*, which is reflected in R^2 values for each of the regressions (Table 4-3). In addition, the relationship between the tissue concentrations and the organic carbon-normalized sediment TBT concentrations was examined (Figure 4-4). For the complete dataset, the relationship between the tissue concentrations and the organic carbon-normalized sediment concentrations was stronger for both *M. nasuta* and *N caecoides* than the relationship between the tissue concentrations and the bulk sediment concentrations (Table 4-3). When potential outliers are removed, the R^2 values are similar (Table 4-3).

Table 4-3. Relationship between tissue concentrations and bulk and organic carbon-normalized sediment concentrations

Independent variable	Log transformed?	Dependent variable	Log transformed?	R^2	Potential outliers	R^2 with outliers excluded
Sediment concentration	Yes	*M. nasuta* tissue conc.	Yes	0.34		
Sediment concentration	Yes	*N. caecoides* tissue conc.	Yes	0.53	TBT-08, TBT-11	0.78
Sediment TOC-normalized	Yes	*M. nasuta* tissue conc.	Yes	0.48		
Sediment TOC-normalized	Yes	*N. caecoides* tissue conc.	Yes	0.75	TBT-08	0.74

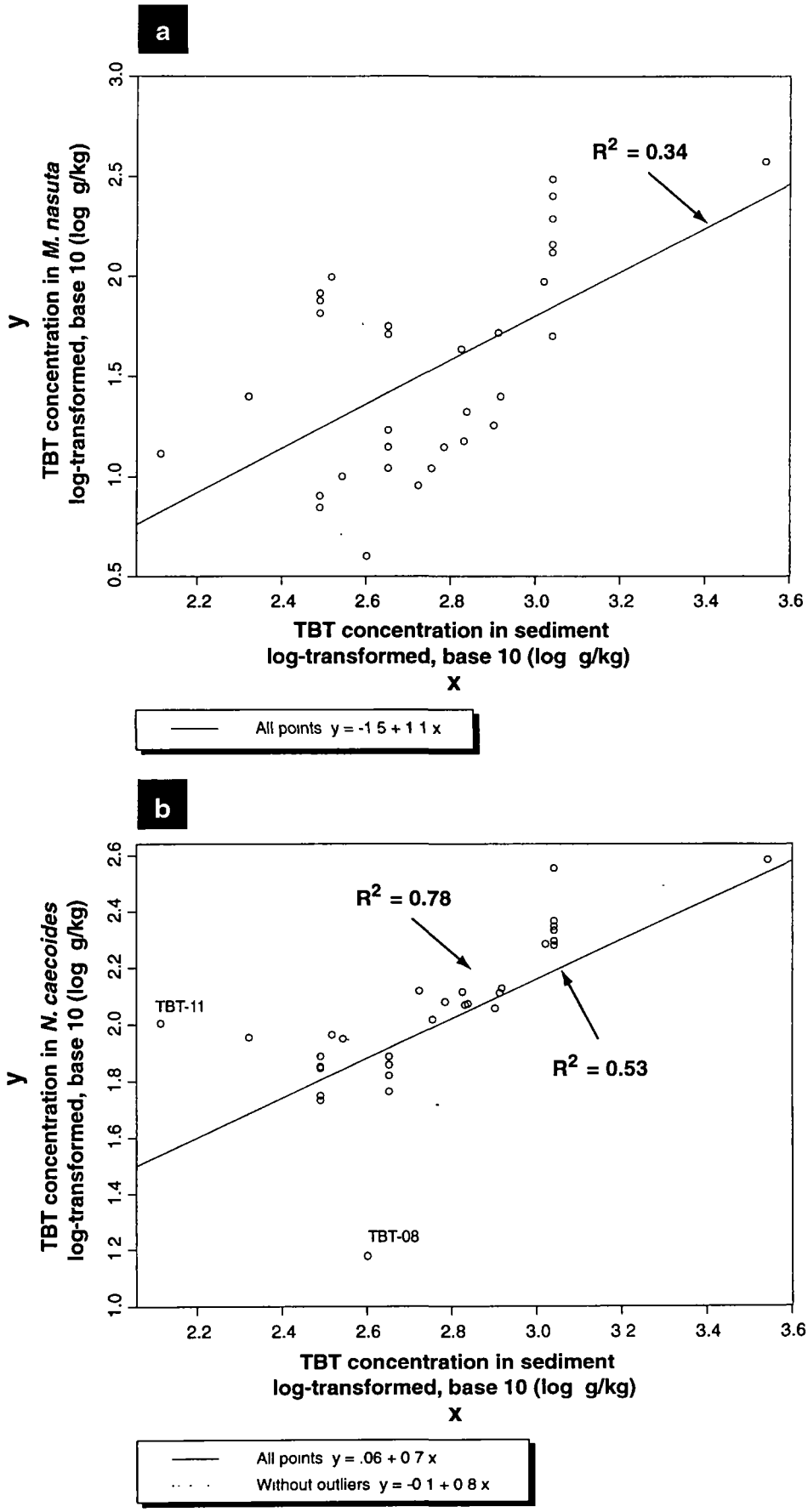

Figure 4-3. Scatter plots and linear regression lines for TBT concentrations in sediment and tissue

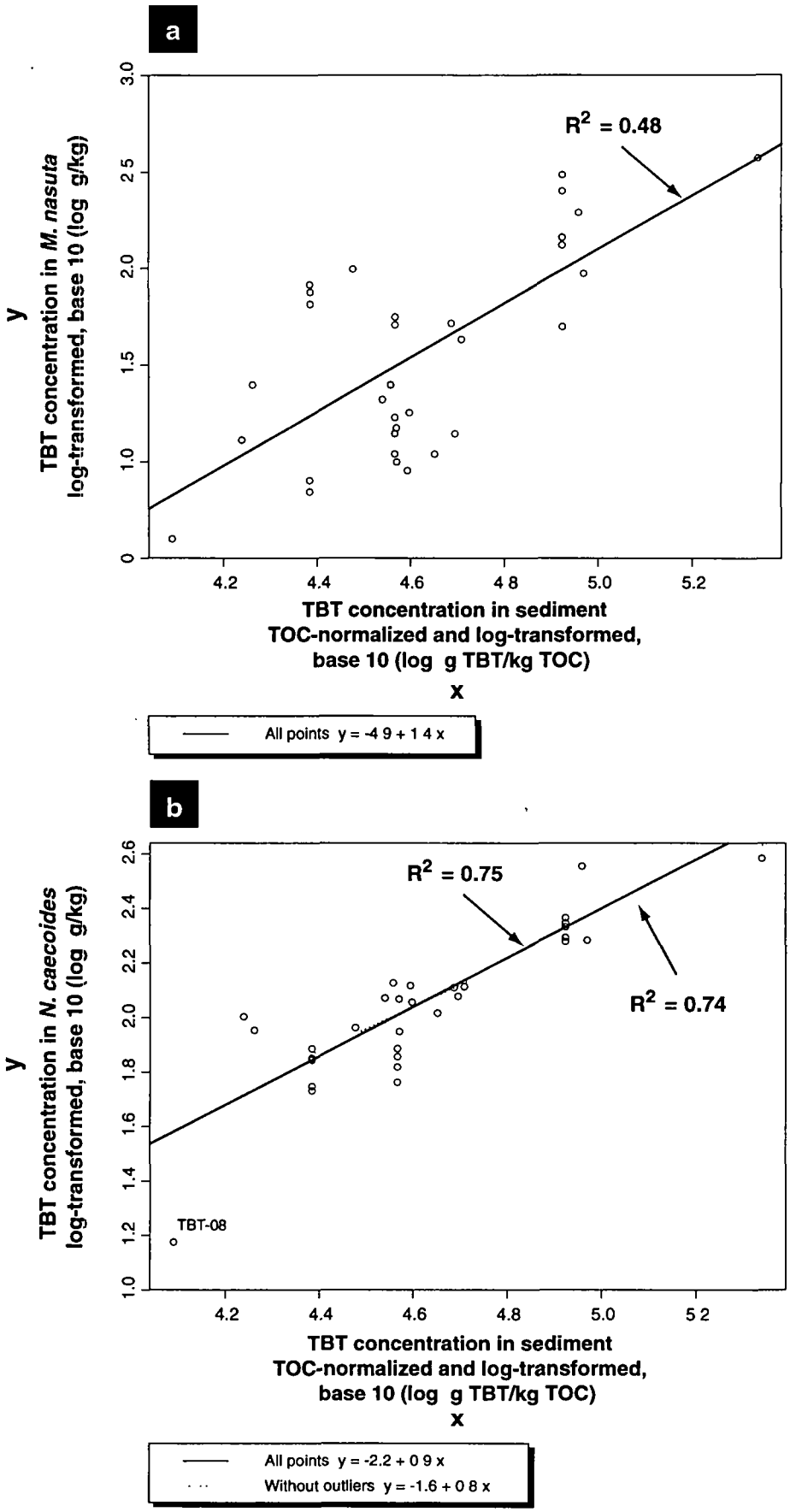

Figure 4-4. Scatter plots and linear regression lines for TOC-normalized TBT concentrations in sediment and TBT concentrations in tissues

4.3.2 Comparison of Tissue Concentrations and Porewater Concentrations

An initial comparison of TBT concentrations in tissue with TBT concentrations in unfiltered and filtered porewater revealed no relationship between the concentrations in tissue and the concentrations in porewater measured by either method (Figure 4-5).

Concentrations in tissue were then compared to concentrations in porewater normalized for their organic content. TBT concentrations in tissue measured in both species were compared to TBT concentrations measured in unfiltered porewater and normalized to the DOC content of the porewater samples (Figure 4-6). The linear regressions between the tissue concentrations and the porewater concentrations are weak for both species. The equations for the regression lines and the R^2 values are presented in Table 4-4.

Table 4-4. Relationship between tissue TBT concentrations and porewater TBT concentrations

INDEPENDENT VARIABLE	DEPENDENT VARIABLE	R^2	POTENTIAL OUTLIERS	R^2 WITH OUTLIERS EXCLUDED
Unfiltered conc./DOC	*M. nasuta* tissue	0.30		
Unfiltered conc. /DOC	*N. caecoides* tissue	0.23	TBT-20, TBT-26	0.35
Filtered conc./DOC	*M. nasuta* tissue	0.31		
Filtered conc/DOC	*N. caecoides* tissue	0.21	TBT-20, TBT-26	0 55
Dissolved conc.	*M. nasuta* tissue	0.48		
Dissolved conc.	*N. caecoides* tissue	0.75	TBT-08	0.74

TBT concentrations measured in filtered porewater and normalized to the DOC concentrations measured in the porewater samples are compared to TBT concentrations in tissue in Figure 4-7. The relationship between the normalized TBT concentrations in filtered porewater and the concentrations in tissue are similar to those seen between normalized TBT concentrations in unfiltered porewater and the concentrations in tissue. The R^2 values presented in Table 4-3 reflect the variability of the data.

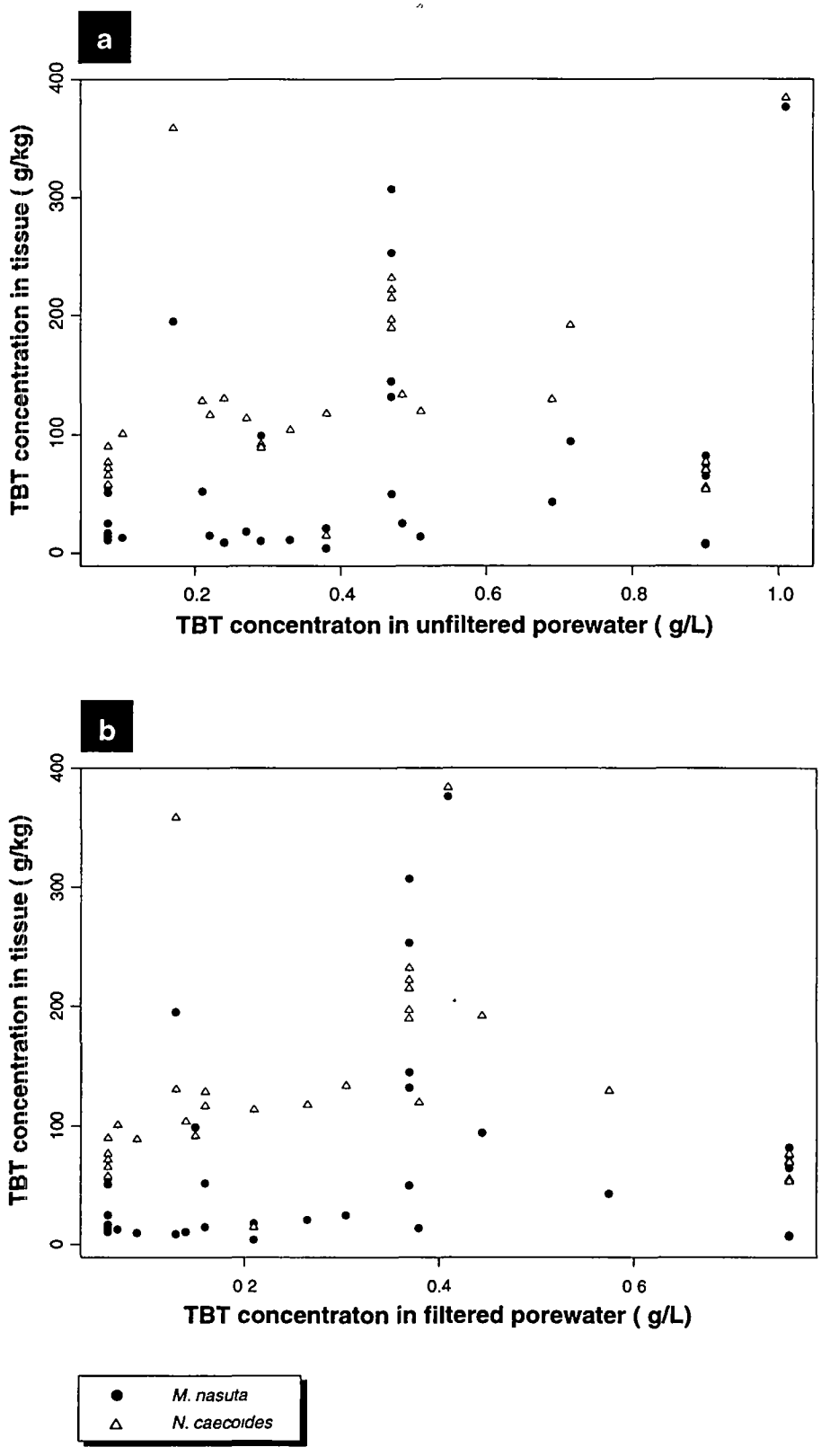

Figure 4-5. Scatter plots for TBT concentrations in porewater and tissue

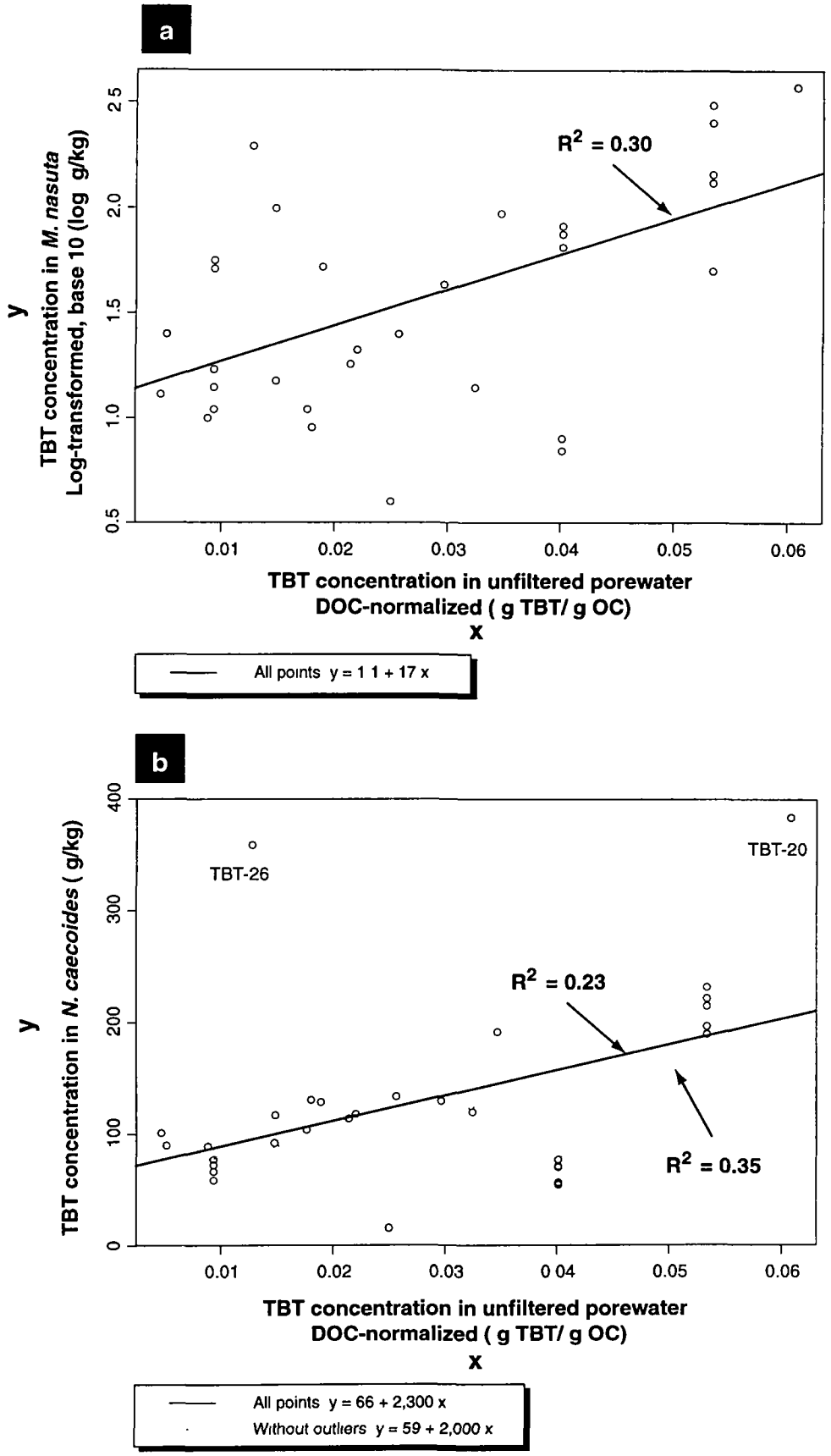

Figure 4-6. Scatter plots and linear regression lines for DOC-normalized TBT concentrations in unfiltered porewater and tissue

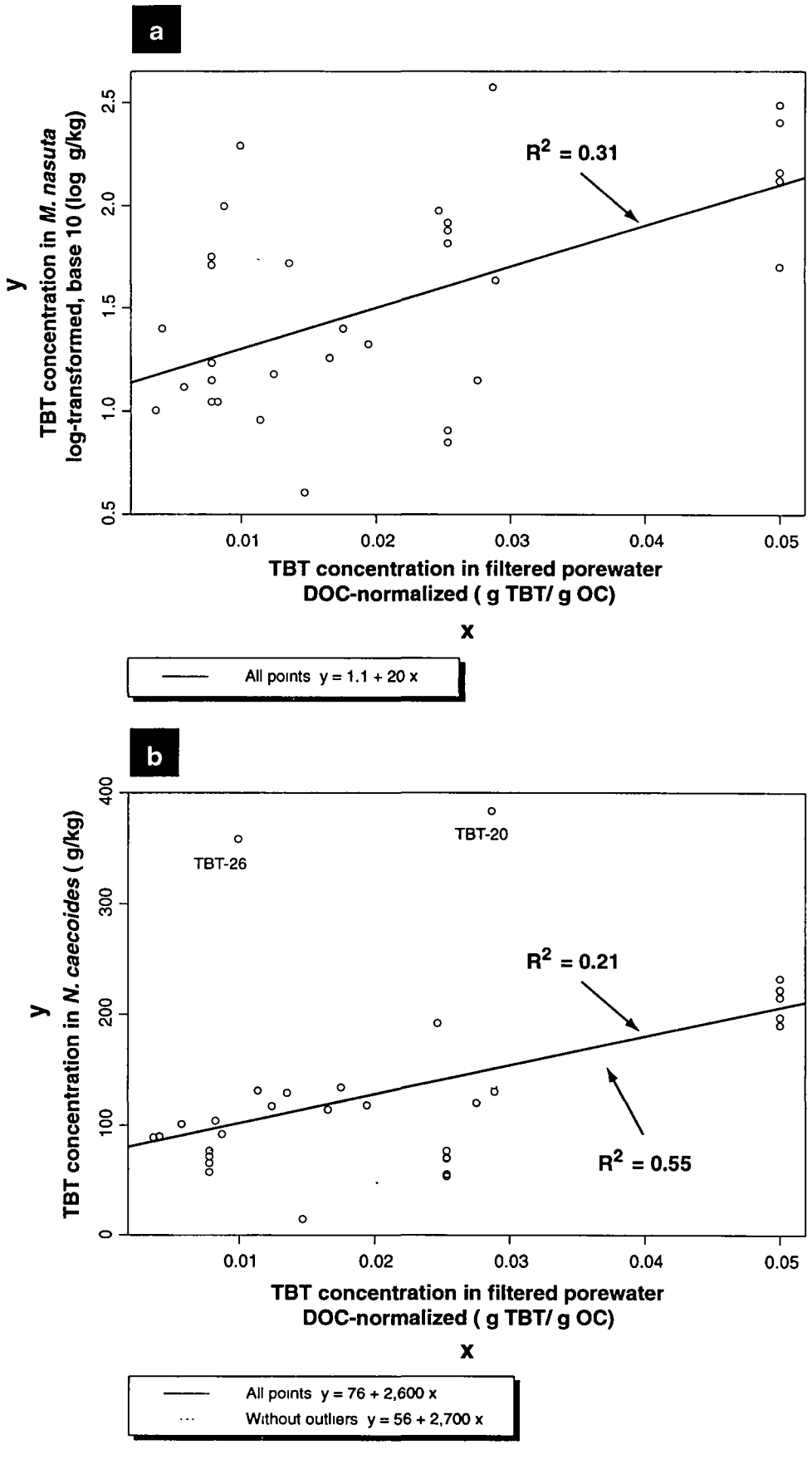

Figure 4-7. Scatter plots and linear regression lines for DOC-normalized TBT concentrations in filtered porewater and tissue

4.4 SEDIMENT-POREWATER RELATIONSHIP

The sediment and the corresponding unfiltered and filtered porewater TBT concentrations are compared in Figure 4-8. The correlations between sediment and both the filtered and unfiltered porewater TBT concentrations were weak (Figure 4-8, Table 4-5). Station 17 was identified as a potential outlier in both plots. Station 10 was identified as a potential outlier in the plot of sediment vs. unfiltered porewater concentrations.

Table 4-5. Relationship between bulk sediment concentrations of TBT and those in filtered and unfiltered porewater

INDEPENDENT VARIABLE	LOG TRANSFORMED?	DEPENDENT VARIABLE	LOG TRANSFORMED?	R^2	POTENTIAL OUTLIERS	R^2 WITH OUTLIERS EXCLUDED
Sediment concentration	Yes	Filtered porewater	Yes	0.56	TBT-17	0.64
Sediment concentration	Yes	Unfiltered porewater	Yes	0.52	TBT-10, TBT-17	0.44

Distribution coefficients (K_d) can be calculated to express the relationship between measured sediment and porewater concentrations.

$$K_d = \frac{C_{sed}}{C_{pw}}$$

where:

C_{sed} = sediment concentration
C_{pw} = porewater concentration

For organic contaminants, organic carbon-normalized distribution or partition coefficients (K_{oc}) are calculated using the following equation:

$$K_{oc} = \frac{K_d}{f_{oc}}$$

where:

f_{oc} = sediment fraction organic carbon

The calculation of K_{oc} values is based on the assumption that the sediment organic carbon is controlling the distribution of the contaminant between the sediment and porewater.

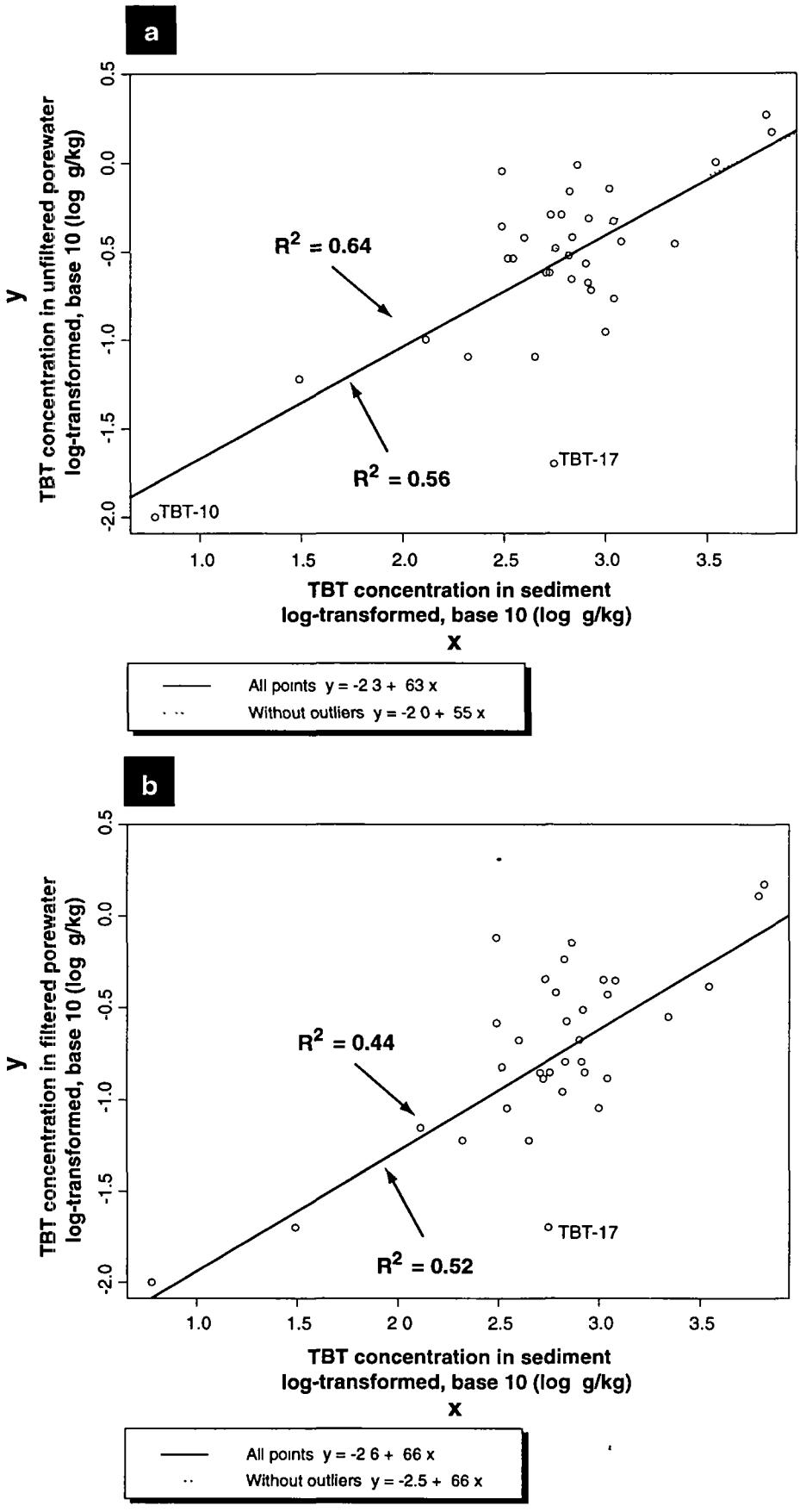

Figure 4-8. Scatter plots and linear regression lines for TBT concentrations in sediment and porewater

The mechanisms controlling the distribution of TBT in sediments are not well understood. In addition to the sediment fraction organic carbon, the chemical characteristics of the sedimentary organic matter, sediment mineralogy, and other sediment properties may influence the sorption behavior of TBT (Unger et al. 1996). Therefore, more variability may be expected in the calculation and use of K_{oc} values for TBT relative to nonpolar organic compounds such as polychlorinated biphenyls.

Two K_{oc} values were calculated for each sediment sample, using the TBT concentrations in unfiltered and filtered porewater. The calculated distribution coefficients ranged over two orders of magnitude. The log K_{oc} values calculated using the unfiltered porewater concentrations ranged from 4.43-6.51. A similar range of values was calculated using the filtered porewater concentrations (log K_{oc}: 4.5-6.51).

The relationship between the measured log K_{oc} values and the measured DOC concentrations in the filtered porewater samples is illustrated in Figure 4-9. There is a trend of decreasing log K_{oc} values with increasing DOC. However, the relationship between the two variables is weak ($R^2 = 0.28$). Therefore, the presence of DOC does not appear to be contributing to the variability seen in the measured log K_{oc} values.

4.5 SUMMARY AND CONCLUSIONS

Bioaccumulation testing was conducted with two species, *N. caecoides* and *M. nasuta*. None of the measured concentrations of TBT in tissue exceeded the USEPA Superfund site-specific tissue trigger value of 0.6 μg/g wet weight (3 μg/g dry weight) or the Respondents' trigger value of 1.0 μg/g wet weight (5 μg/g dry weight) (ESI 1999b). Therefore, none of the areas sampled were identified as areas of concern on the basis of TBT bioaccumulation testing.

Further investigation into the relationships between the measured tissue concentrations and sediment and porewater TBT concentrations revealed that the strongest relationships were observed between tissue concentrations and bulk sediment and organic carbon-normalized sediment concentrations. The relationships between the tissue concentrations and the porewater concentrations were weak. In addition, a strong relationship was not observed between measured sediment and porewater TBT concentrations.

The effect of filtering the porewater samples can be evaluated by comparing the filtered and unfiltered porewater samples. Both the TBT and DOC concentrations were generally lower in the filtered porewater samples relative to the unfiltered samples. The greatest loss of TBT was 69 percent of the unfiltered concentration. The mean change in

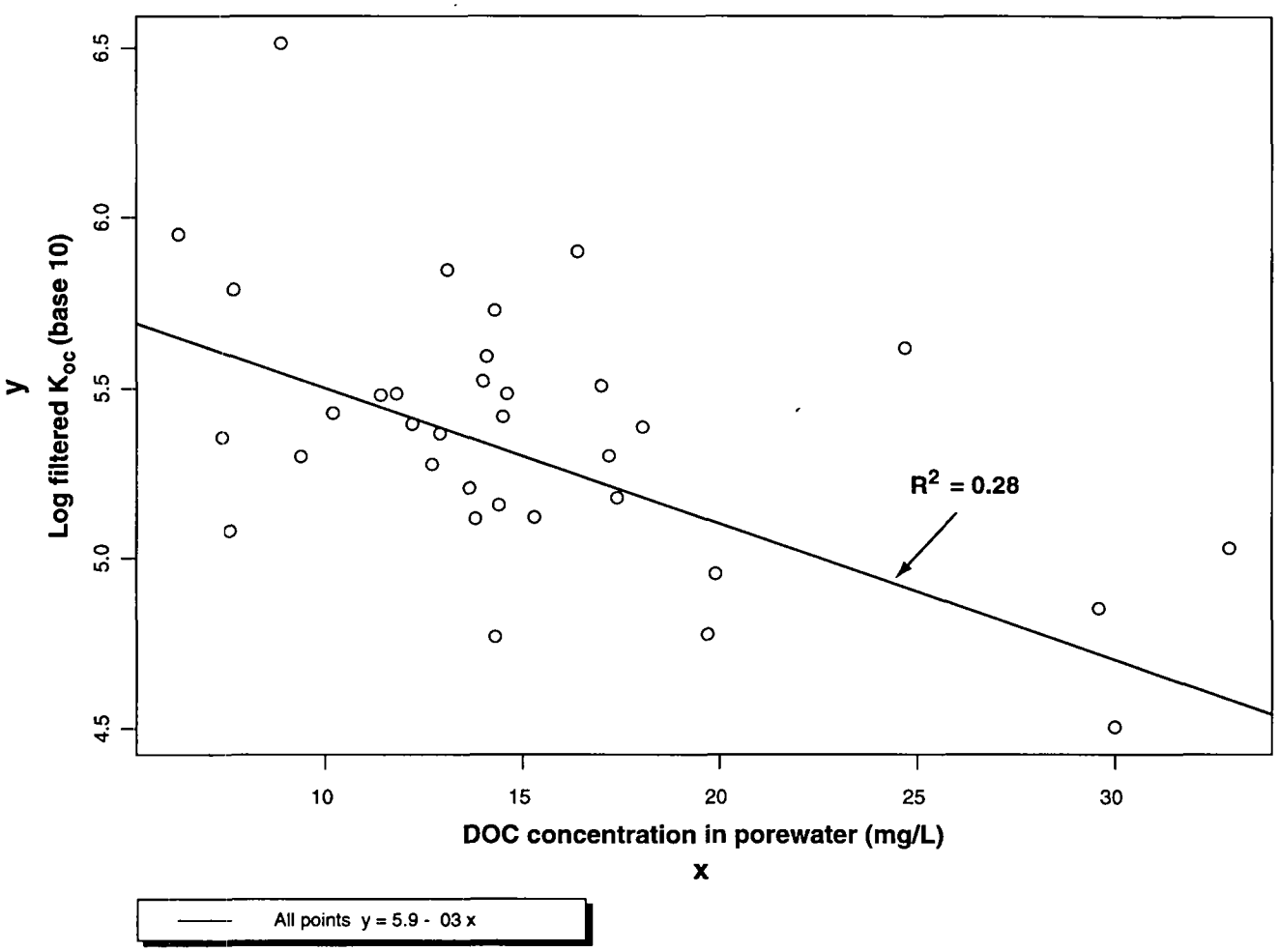

Figure 4-9. Scatter plot and linear regression line for porewater DOC and filtered K_{oc} (log-transformed, base 10)

concentration for all porewater samples was a loss of 30 percent of the unfiltered concentration. The greatest loss of DOC was a loss of 42 percent of the unfiltered DOC concentration. The mean difference for all porewaters was a loss of 7 percent of the unfiltered DOC concentration. There was no consistent relationship between the loss of TBT and the loss of DOC as a result of filtering. It is important to note that all the porewater samples were subject to ultrafiltration. Therefore, the unfiltered porewater DOC concentrations are not representative of the DOC concentrations that would be expected in the undisturbed porewater samples

A complete discussion of the uncertainties associated with the study design, study execution, and data analysis is contained in a separate technical memorandum (ESI 1999b).

5.0
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APPENDIX A

Navigation Report

BLUE WATER ENGINEERING

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July 19, 1998

Mr. Tim Hammermeister
EVS Environment Consultants, Inc.
200 West Mercer, Suite 403
Seattle, WA 98117

Subject: West Waterway Sediment Operable Unit Sediment Sampling Positioning Report

Dear Tim:

Enclosed please find:

1. a final positioning report on the sediment sampling project and
2. a final invoice for the work.

I will e-mail you the report text and the table of coordinates.

If you have any questions please call me at (206) 633-5567.

Best regards,

Tony Petrillo, P.E.
BLUE WATER ENGINEERING

Enclosures

BLUE WATER ENGINEERING
4019 Phinney Ave. N. • Seattle, WA 98103 U.S.A. • Phone/Fax (206) 633-5567 • bluewater@seanet.com

FINAL REPORT

POSITIONING METHODS AND COORDINATES FOR THE WEST WATERWAY SEDIMENT OPERABLE UNIT PROJECT, SEATTLE, WASHINGTON

Prepared for:

EVS Environment Consultants
200 West Mercer Street, Suite 403
Seattle, WA 98119

Prepared by:

Blue Water Engineering
4019 Phinney Avenue North
Seattle, WA 98103
(206) 633-5567

July 1998

1.0 INTRODUCTION

Blue Water Engineering of Seattle, WA was contracted by EVS Environment Consultants, Inc. to provide sampling vessel positioning services for the West Waterway Sediment Operable Unit Project near Harbor Island at the mouth of the Duwamish River in Seattle, WA. A positioning system was installed on the R/V Nancy Anne operated by Marine Sampling Systems of Burley, WA on Tuesday, July 14th. The sampling was conducted on Wednesday, July 15th through Friday, July 17th.

2.0 STATION POSITIONING METHODOLOGY

2.1 Differential Global Positioning System (DGPS)

Global positioning system (GPS) navigation was used to position the sampling vessel during the project. GPS is a satellite-based positioning system that receives positioning data from multiple satellites of known positions in space at 1 second intervals. The position of the GPS receiver, located on sampling vessel, is accurate to about ± 50 meters in stand-alone mode. Sub-meter accuracies may be obtained by applying differential corrections to the standard GPS positioning data. This is known as DGPS. During this project differential corrections were applied by receiving GPS error corrections on the sampling vessel from the Coast Guard beacon differential corrections system.

This method utilizes differential corrections generated and transmitted by U.S. Coast Guard installations. The U.S. Coast Guard beacon transmits differential corrections data from a fixed position (in the Seattle area, on Vashon Island or Whidbey Island). The Coast Guard uses a high quality GPS receiver, such as a Trimble or Ashtech system, to generate differential corrections. The resultant accuracy of the combined system is better than ± 1 meter.

On the sampling vessel the GPS receiver sends differentially corrected positioning data to an integrated navigation software package called HYPACK. The GPS receiver displays and transmits data to the computer in North American Datum 1983 (NAD 83) geographic coordinates (latitude /longitude). HYPACK converts the NAD 83 geographic coordinates to NAD 83 Washington state plane - north zone coordinates. HYPACK, acting as a data manager, shows the vessel's position relative to a proposed sampling location in plan view to a video screen. The resultant pictorial screen presentation, as well as numeric navigation data including range and bearing to the target sampling location, assist the vessel operator in approaching and maintaining station while sampling.

2.2 Mobilization

The Nancy Anne was mobilized on July 14th at Harbor Island Marina (HIM). The sampling vessel, used for hydraulic power-assisted sediment grab sampling, has the cabin aft and an A-frame on the bow. It was set up with the GPS antenna mounted vertically atop the A-frame as positioned during sampling. The GPS antenna cable was run from the top of the A-frame down the port side aft into the cabin. The GPS receiver, the Coast Guard beacon, and the laptop computer were located in the cabin. The video screen for the computer was oriented to allow the vessel operator to observe on-screen positioning data and maintain station.

2.3 Daily Sediment Sampling Positioning Activities

The routine for each day's positioning activities on the sampling vessel was similar. Once the GPS and computer equipment was operating properly the vessel left the dock for the calibration point located at the south end of the Fisher Mills dock in the west waterway (FM-4). The GPS antenna on the sampling vessel was positioned as close to the surveyed calibration point as possible. A visual estimate of the range and bearing from the monument to the GPS antenna was made and compared to the range and bearing displayed of the screen to confirm the accuracy of the positioning system. This was done at the start and end of each day.

The coordinates for the calibration point at FM-4 were determined by surveying in a point based on established coordinates located around Harbor Island. These coordinates were obtained from a 1992 USACE bathymetry map. All coordinates were originally surveyed in North American Datum (NAD) 1927 in Washington state plane coordinates - north zone. The coordinates were converted from NAD 1927 to NAD 1983 using the USACE coordinate conversion software package "CORPSCON" (version 4.01).

Once the positioning system calibration was complete the sampling vessel proceeded to a sample station location selected by the sampling party chief. The sample location was selected from a number of pre-chosen sample locations entered into a data base in HYPACK. Upon selection the positioning data was displayed on the CRT to assist the operator in proceeding to and maintaining station during the sampling event. A confirmed position was recorded electronically each time the sampling device impacted the bottom. Accepted and rejected grabs were both recorded in the positioning logbook. Samples were taken generally within 10 ft of the target position.

Upon recovery the sample position northing (y) and easting (x) was read from the electronic file and recorded by hand in the positioning log along with time, water depth, and predicted and/or measured tide. Ancillary information recorded in the positioning log included personnel on board, weather, type of

sampling activity, and time of arrival and departure from HIM.

A daily activities log is provided as an appendix for Wednesday, July 15th to Friday, July 17th.

2.4 Vertical Control

Water depth and stage of the tide were recorded for each sampling event. Water depth was determined using the sampling vessel depth sounder located near the bow. These depths were recorded manually in the log.

To reduce measured depths to the MLLW vertical datum the stage of the tide was recorded at the time of sample recovery. The tide was determined by one of two methods. The first method was to use an estimate of the tide height using an electronic tidal prediction from a commercially available software package. The second method was to call a telephone number maintained by National Oceanic and Atmospheric Administration. The telephone number announces the elevation of the water at the Colman Dock on the Seattle Waterfront.

The predicted tide was used only to confirm the relative accuracy of the measured tide. The measured tide was then subtracted from the recorded depth and a mean lower low water (MLLW) tide was recorded in the logbook.

3.0 POSITIONING DATA

The positioning data acquired during sediment sampling from the Nancy Anne is presented in Table 1.

Table 1 West Waterway Sediment Operable Unit Grab Sampling Locations - July 15-17, 1998

Wednesday, July 15th

Station Name	Time (hh:mm:ss)	WA State Plane - N Zone Easting (ft)	Northing (ft)	Raw Depth (ft)	Tidal Ht. (ft)	MLLW Depth (ft)	Geographic Position Latitude dd mm ss.sssss	Longitude ddd mm ss.sssss
FM-4	"08:40:54"	1,264,417.9	213,150.9		Positioning Check		47 34 26.90770	122 21 24.09278
TBT-001	"09:00:21"	1,264,219.3	213,191.5	42.5	8.7	33.8	47 34 27.26951	122 21 27.00041
TBT-002	"09:54:01"	1,263,710.3	213,351.2	58.1	8.9	49.2	47 34 28.74578	122 21 34.46864
TBT-003	"10:41:50"	1,264,058.6	213,511.1	45.6	8.6	37.0	47 34 30.39172	122 21 29.43603
TBT-004	"11:22:31"	1,263,937.3	213,698.0	48.0	7.9	40.1	47 34 32.21222	122 21 31.25884
TBT-005	"12:01:35"	1,263,436.9	213,674.8	68.0	7.0	61.0	47 34 31.88535	122 21 38.54895
TBT-006	"13:49:56"	1,263,398.5	213,927.5	62.4	3.8	58.6	47 34 34.37133	122 21 39.18205
TBT-007	"14:31:05"	1,263,680.9	213,972.7	68.8	2.6	66.2	47 34 34.87263	122 21 35.07712
TBT-008a	"15:30:10"	1,263,953.9	213,979.2	36.5	1.8	34.7	47 34 34.99019	122 21 31.09806
TBT-008b	"15:53:45"	1,263,956.6	213,978.0	39.5	1.6	37.9	47 34 34.97888	122 21 31.05834
TBT-009	"16:53:44"	1,263,961.0	214,358.0	31.5	2.3	29.2	47 34 38.72936	122 21 31.10402
FM-4	"17:05:39"	1,264,413.8	213,159.3		Positioning Check		47 34 26.98978	122 21 24.15499

Thursday, July 16th

Station Name	Time (hh:mm:ss)	State Plane Easting (ft)	Northing (ft)	Raw Depth (ft)	Tidal Ht. (ft)	MLLW Depth (ft)	Geographic Position Latitude dd mm ss.sssss	Longitude ddd mm ss.sssss
FM-4	"08:34:10"	1,264,418.7	213,154.6		Positioning Check		47 34 26.94436	122 21 24.08219
TBT-010	"08:44:12"	1,263,443.8	214,365.9	62.4	6.4	56.0	47 34 38.70608	122 21 38.64838
TBT-011	"09:18:27"	1,263,348.8	214,724.8	63.0	7.1	55.9	47 34 42.22889	122 21 40.13763
TBT-012	"10:32:30"	1,263,991.4	214,877.8	35.0	8.4	26.6	47 34 43.86440	122 21 30.81096
TBT-013a	"11:19:31"	1,263,650.1	214,994.2	68.4	8.5	59.9	47 34 44.94618	122 21 35.82178
TBT-013b	"11:41:45"	1,263,657.4	214,994.8	67.5	8.4	59.1	47 34 44.95353	122 21 35.71550
TBT-014	"13:06:39"	1,263,384.6	215,185.0	64.4	7.2	57.2	47 34 46.77689	122 21 39.74881
TBT-015	"13:50:05"	1,263,622.6	215,389.8	58.8	6.4	52.4	47 34 48.84435	122 21 36.33728
TBT-016	"14:23:45"	1,263,995.1	215,720.7	36.5	5.7	30.8	47 34 52.18238	122 21 31.00066
TBT-017	"14:59:33"	1,263,443.1	215,880.6	53.9	4.8	49.1	47 34 53.65213	122 21 39.09707
TBT-018	"15:43:34"	1,263,993.4	215,954.3	38.4	3.8	34.6	47 34 54.48708	122 21 31.09299
TBT-019a	"16:09:46"	1,263,692.8	216,343.7	54.6	3.5	51.1	47 34 58.27063	122 21 35.58952

TBT-019b	"16:26:10"	1,263,693.4	216,347.6	54.6	3.4	51.2	47 34 58.30923	122 21 35.58190
TBT-020	"17:36:58"	1,263,483.4	216,455.7	49.0	3.7	45.3	47 34 59.33478	122 21 38.67584
FM-4	"17:49:36"	1,264,416.3	213,158 1		Positioning Check		47 34 26 97843	122 21 24.11819

Friday, July 17th

Station		State Plane		Raw	Tidal	MLLW	Geographic Position	
Name	Time	Easting	Northing	Depth	Ht.	Depth	Latitude	Longitude
	(hh:mm:ss)	(ft)	(ft)	(ft)	(ft)	(ft)	dd mm ss.sssss	ddd mm ss.sssss
FM-4	"08:18:01"	1,264,421.2	213,152.8		Positioning Check		47 34 26.92737	122 21 24.04595
TBT-021	"08:31:29"	1,263,732.2	216,531.1	54.4	3.5	50.9	47 35 00.12730	122 21 35.06927
TBT-022	"08:57:53"	1,263,900.6	216,551.1	52.8	4.2	48.6	47 35 00.35800	122 21 32.61894
TBT-023	"09:40:13"	1,263,915.2	216,722.9	54.4	5.4	49.0	47 35 02.05538	122 21 32.45611
TBT-024	"10:23:00"	1,263,858.7	217,001.5	57.6	6.6	51.0	47 35 04.79369	122 21 33.36100
TBT-025	"10:48:17"	1,263,599.9	216,980.2	58.4	7.2	51.2	47 35 04.53276	122 21 37.12887
TBT-026	"11:23:39"	1,263,972.2	217,487.0	48.0	7.9	40.1	47 35 09.60663	122 21 31.84589
TBT-027	"11:54:35"	1,263,747.4	217,564.5	52.5	8.3	44.2	47 35 10.32717	122 21 35.14700
TBT-028	"12:31:23"	1,263,737.8	217,820.0	58.8	8.5	50.3	47 35 12.84633	122 21 35.36021
TBT-034	"13:16:40"	1,264,077.4	216,839.3	31.5	8.4	23.1	47 35 03.23608	122 21 30.12346
TBT-032	"13:48:27"	1,264,663.1	218,602.8	50.4	8.2	42.2	47 35 20.75216	122 21 22.09038
TBT-031	"14:29:05"	1,264,600.7	218,060.3	53.9	7.8	46.1	47 35 15.38659	122 21 22.84361
TBT-033	"15:08:01"	1,264,952.6	218,379.3	46.8	7.2	39.6	47 35 18.60318	122 21 17.80420
TBT-029	"15:48:17"	1,264,056.1	218,015.8	48.0	6.4	41.6	47 35 14.84144	122 21 30.77453
TBT-030a	"16:22:18"	1,263,752.2	218,199.1	56.0	5.8	50.2	47 35 16.59007	122 21 35.26061
TBT-030b	"16:45:11"	1,263,756.2	218,194 8	56 0	5.4	50.6	47 35 16.54814	122 21 35.20014
FM-4	"17:02:54"	1,264,418.2	213,154 8		Positioning Check		47 34 26.94614	122 21 24.08924

Appendix

West Waterway TBT Study - EVS Environment Consultants

Day: WED
Date: 7/15/98 Page 1 of 2

Navigator: Tony Petrillo
Navigation System: Trimble 4000 DS
Differential Source: CG Beacon

Survey Vessel & Scientific Party

R/V Nancy Anne
Dale Dickinson - MSS
Tony Petrillo - BWE
STEPHAN WODZICKI-EVS
LISA MILL - EVS
TIM HAMMERMEISTER - EVS

	Local Time	I.D.	Number	Predicted Tide	Boat Z	MLLW	Easting (x)	Northing (y)	Activity
	0795		A/V @	HARBOR IS		MARINA. FINISH MOB			
	0815		SAFETY MEETING						
	0830		U/W	FROM H.	I. M.				
	0840		CK PT	@ FISHERMAN	4LS	~3' TO	SW.		FISHERMILES 4
							1,264,418	213,151	
	0847		APPROX	CHECK @	TBT-004. OK				
1	0900	TBT-001	1	8.3	42.5	34.2	1,264,219	213,191	
	0917		TELEPHONE TIDE$_1$ =		8.7	PRED$_2$ = 8.4		ΔTIDE$_{1-2}$ = +0.3	
2	0954	TBT-002	1	8.5	58.1	49.2	1,263,710	213,351	
3	1041	TBT-003	1	8.1	45.6	37.0	1,264,059	213 511	
4	1122	TBT-004	1	6.7	48.0	40.3	1,263,937	213,698	
5	1201	TBT-005	1	6.6	68.0	61.0	1,263,437	213,675	
	1218		TIED	UP @	HIM	TO	OFFLOAD SAMPLES. WAIT FOR RR BRIDGE LIFT		
	1319		RR BRIDGE LIFT						
	1320		U/W	TO SITE					

TELE TIDE
8.9'
8.6'
7.9
7.0

↑ PREDICTED TIDE

SEA TIDE 749-9218

West Waterway TBT Study - EVS Environment Consultants

Day: WED
Date: 7/15/98 Page 2 of 2

Navigator: Tony Petrillo
Navigation System: Trimble 4000 DS
Differential Source: CG Beacon

Survey Vessel & Scientific Party

R/V Nancy Anne SAME
Dale Dickinson - MSS
Tony Petrillo - BWE

	Local Time	I.D.	Number	Pred Tide	Boat Z	MLLW	Easting (x)	Northing (y)	Activity	
	1339	TBT-006	N/G	3.8	62.4	58.3	LARGE TURN BUCKLE IN JAWS		~65' GSG	TELE. TOC 4.1
6	1349	TBT-006		3.5	62.4		1,263,398	213,927	~69' ESE OF TGT	3.8
			CONTAINERSHIP "WESTWOOD BELINDA" OVER PROPOSED SAMPLE SITE							
7	1431	TBT-007	1	2.6	68.8	66.2	1,263,681	213,973		2.6
	1522	TBT-008	N/G	1.7	37.5		OVERPENETRATION			1.8
8	1530	TBT-008	1	1.7	36.5	34.7	1,263,954	213,979		1.8
	1553	TBT-008	2	1.7	39.5	~~37.5~~ 37.9	1,263,957	213,978		1.6
9	1653	TBT-009	1	2.4	31.5	29.2	1,263,961	214,358		2.3
	1705		NAV CHECK @ FISCHER MILLS (FM-4). OK							
	1725		TIED UP @ H1M. OFF LOAD COOLERS							
	1750		U/W TO BWE							
	1800		A/N @ BWE							
			WEATHER: CLOUDY, INTERMITTENT RAIN, LT WIND							

West Waterway TBT Study - EVS Environment Consultants

Day: THURS
Date: 7/16/98 Page 1 of 2

Navigator: Tony Petrillo
Navigation System: Trimble 4000 DS
Differential Source: CG Beacon

Survey Vessel & Scientific Party

R/V Nancy Anne
Dale Dickinson - MSS
Tony Petrillo - BWE
LISA MILL - EVS
STEPHAN WODZICKI - EVS
DENNIS HANZLICK - EVS

	Local Time	I.D.	Number	Pred Tide	Boat Z	~~Wire~~ Z	Easting (x)	Northing (y)	Activity	
	0800		M/V @	HIM		MLLW				
	0826		V/W TO SITE							
	0834		NAV CHECK @	FM +4.			OK			TELEPHONE TIDE
1	0844	TBT-010	1	6.2'	62.4	56.0'	1,263,494	214,366		6.4'
	0913	TBT-011	REJ	6.9	63.0	~~55.0~~	TURNBUCKLE	ROD IN JAWS		7.1
2	0918	TBT-011	1	6.9	63.0	55.9	1,263,349	214,725		7.1
	0947	TBT-012	REJ	7.5	37.5	29.8	NOT ENOUGH PENETRATION.		DEBRIS IN JAWS	7.7
	0953	TBT-012	REJ	7.6	35.5	27.7	NOT ENOUGH	PENETRATION.	DEBRIS IN JAWS	7.8
	1001	TBT-012	REJ	7.8	37.1		1" THICK CRUST BUCKET EMPTY	SAND BLAST GRIT	20' NORTH OF PROPOSED LOCATION	ADD WEIGHT.
	1024	TBT-012	REJ		42.0		RUBBER GASKET IN JAWS. SAND BLAST GRIT CRUST IN BUCKET			
3	1032	TBT-012	1	8.1	35.0	26.6	1,263,991	214,878		8.4
	1105		POOR SAT CONFIG ON			THUMPER & BOAT	GPS's.			
	1114		SYSTEM UP. 5		SATS					
4	1119	TBT-013	1	8.2	68.4	59.9 ~~68.4~~	1,263,650	214,994		8.5
	1141	TBT-013	2	8.1	67.5	59.1	1,263,657	214,995		8.4

Blue Water Engineering, 4019 Phinney Avenue N., Seattle, WA 98103 (206) 633-5567

1220 BREAK FOR LUNCH

1250 DECON GRAB

749-9218

West Waterway TBT Study - EVS Environment Consultants

Day: THURS
Date: 7 / 16 /98 Page 2 of 2

Navigator: Tony Petrillo
Navigation System: Trimble 4000 DS
Differential Source: CG Beacon

Survey Vessel & Scientific Party

R/V Nancy Anne SAMS
Dale Dickinson - MSS
Tony Petrillo - BWE

	Local Time	I.D.	Number	Pred Tide	Boat Z	~~LL~~ Z	Easting (x)	Northing (y)	Activity	
			WEATHER: SUNNY			MLLW, WIND	10-12 KTS	N		TELEPHONE TIL
5	1306	TBT-014	1	6.9	64.4	57.2	1,263,385	215,185		7.2
6	1350	TBT-015	1	6.2	58.8	52.4	1,263,623	215,390		6.4
7	1423	TBT-016	1	5.3	36.5	30.8	1,263,995	215,721		5.7
8	1459	TBT-017	1	4.4	53.9	49.1	1,263,443	215,881		4.8
	1525		SATELLITE CONSTELLATION			DOWN. BOTH GPS'S INOPERABLE				
	1540		CONSTELLATION BACK UP.							
9	1543	TBT-018	1	3.6	38.4	34.6	1,263,993	215,954		3.8
10	1609	TBT-019	1	3.4	54.6	51.1	1,263,693	216,344		3.5
	1626	TBT-019	2	3.2	54.6	51.2	1,263,693	216,348		3.4
	1721	TBT-020	TOSS	3.4	49.7	46.3 49.9	HUNG ON CABLE ON BOTTOM.			3.4
11 1736	1736	TBT-020	1	3.5	49.0	45.3 ~~49.0~~	1,263,483	216,456		3.7
	1749		NAV CK @		FM-	4.	W/IN 3'			
	1757		TIED UP @ H.I. M.				OFFLOAD COOLERS			
	1845		U/W TO BWE							

Blue Water Engineering, 4019 Phinney Avenue N., Seattle, WA 98103 (206) 633-5567

1900 M/V BWE

West Waterway TBT Study - EVS Environment Consultants

Day: FRI
Date: 7/17/98 Page 1 of 2

Navigator: Tony Petrillo
Navigation System: Trimble 4000 DS
Differential Source: CG Beacon

Survey Vessel & Scientific Party

R/V Nancy Anne
Dale Dickinson - MSS
Tony Petrillo - BWE
STEPHAN WODZICKI - EVS
TIM HAMMERMEISTER - EVS

	Local Time	I.D.	Number	Pred Tide	Boat Z	W.L. MLLW	Easting (x)	Northing (y)	Activity	TELEPHONE TIDE
	0700		M/V@ H.I.M.							
	0810		U/W TO SITE (W/O LISA MILL)							
	0818		NAV CHECK @ FM-4. W/IN 4'							
1	0831	TBT-021	1	3.4	54.4	50.9	1,263,732	216 531		3.5
2	0857	TBT-022	1	4.2	52.8	48.6	1,263,901	216, 551		4.2
			BACK TO DOCK TO P/U ICE							
3	0940	TBT-023	1	5.3	54.4	49.0	1,263,915	216 723		5.4
	1006		TIED UP @ H.I.M.			P/U	DISTILLED WATER, LISA MILL			
	1006		U/W TO SITE							
4	1023	TBT-024	1	6.5	57.6	51.0	1,263,859	217,001		6.6
5	1048	TBT-025	1	7.1	58.4	51.2	1,263,600	216,980		7.2
6	1123	TBT-026	1	7.7	48.0	40.1	1,263,972	217,487		7.9
7	1154	TBT-027	1	8.1	44.2	52.5	1,263,747	217,565		8.3
8	1231	TBT-028	1	8.3	58.8	50.3	1,263,738	217,820		8.5
	1250		TIED UP @ TODD				FLOATING DOCK			

749-9218

West Waterway TBT Study - EVS Environment Consultants

Day: FRI
Date: 7/17/98 Page 2 of 2

Navigator: Tony Petrillo
Navigation System: Trimble 4000 DS
Differential Source: CG Beacon

Survey Vessel & Scientific Party

R/V Nancy Anne SAME W/ PETE RUDE, LANDAU
Dale Dickinson - MSS
Tony Petrillo - BWE

	Local Time	I.D.	Number	Pred Tide	Boat Z	MLLW Z	Easting (x)	Northing (y)	Activity	Telephone Tide
	1300		P/U PETE RUDE @			TODD	FLOATING	DOCK. U/W TO SITE		
9	1316	TBT-034	1	8.2	31.5	23.1	1,264,077	216,839	SCOPE 1:5	8.4
10	1348	TBT-032	1	7.9	50.4	42.2	1,264,663	218,603		8.2
	1412	TBT-031	REJ	7.6	53.2	45.2	OVERPENETRATION			8.0
11	1429	TBT-031	1	7.4	53.9	46.1	1,264,600	218,060		7.8
	1455	TBT-033	REJ	7.0	46.2	38.9	TOW CABLE IN JAWS. SAMPLE WASHED			7.3
	1502	TBT-033	REJ	6.9	46.2	38.9	CABLE IN JAWS. SAMPLE WASHED			
12	1508	TBT-033	1	6.7	46.8	39.6	1,264,953	218,379	MOVED EAST TO OBTAIN SAMPLE	7.2
	1515		PETE RUDE		DISEMBARKED.					
	1535	TBT-029	REJ		51.0	44.3	CABLE IN JAWS. SAMPLE WASHED			6.7
13	1548	TBT-029	1	6.0	48.0	41.6	1,264,056	218,016		6.4
14	1622	TBT-030	1	5.4	56.0	50.2	1,263,752	218,199		5.8
	1645	TBT-030	2	5.0	56.0	50.6	1,263,756	218,195		5.4
	1650		U/W	TO NAV CHECK						
	1702		NAV CHECK @ FM-4. W/IN 3' OF TBT							

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1723 TIED UP @ H.I.M.
1800 MV @ BWE

APPENDIX B

Sediment Chemistry Results

This appendix contains the sediment chemistry data as reported by the analytical laboratory. The data are grouped by analytical batches. Case narratives, when produced by the laboratory, are included for each batch.

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	EVS Consultants	**Service Request No.:**	K9804715
Project:	WSOU TBT Study	**Date Received:**	7/17/98
Sample Matrix:	Sediment		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for sample(s) designated for Tier III data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), Initial/Continuing Calibration Verification Standards (ICV/CCV), and Initial/Continuing Calibration Blanks (ICB/CCB).

All EPA recommended holding times have been met for analyses in this sample delivery group.

The following difficulties were experienced during analysis of this batch:

The Matrix Spike (MS) recovery of TBT for sample TBT-06-S was not calculated. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

Approved by LAH **Date** 8/5/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804715
Project:	WSOU TBT Study	**Date Collected:**	7/15/98
Sample Matrix:	Sediment	**Date Received:**	7/17/98

Total Solids

Prep Method	NONE	Units	PERCENT
Analysis Method	160 3M	Basis	Wet
Test Notes			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
TBT-01-S	K9804715-001	7/22/98	74 3	
TBT-02-S	K9804715-002	7/22/98	54 8	
TBT-35-S	K9804715-003	7/22/98	55 6	
TBT-03-S	K9804715-004	7/22/98	53 5	
TBT-04-S	K9804715-005	7/22/98	64 2	
TBT-05-S	K9804715-006	7/22/98	52 6	
TBT-06-S	K9804715-007	7/22/98	53 9	
TBT-07-S	K9804715-008	7/22/98	52.8	
TBT-36-S	K9804715-009	7/22/98	54 1	
TBT-08-S	K9804715-012	7/22/98	48 4	
TBT-09-S	K9804715-013	7/22/98	49 6	

Approved By _____ Date 7/24/98

TSOLIDS XLT_Sample/01071998a

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804715
Date Collected: 7/15/98
Date Received: 7/17/98
Date Extracted: NA
Date Analyzed: 7/28/98

Carbon, Total Organic
ASTM D4129-82M
Units PERCENT
Dry Weight Basis

Sample Name	Lab Code	MRL	Result
TBT-01-S	K9804715-001	0 05	0.58
TBT-02-S	K9804715-002	0.05	2 09
TBT-35-S	K9804715-003	0.05	1 89
TBT-03-S	K9804715-004	0 05	2 01
TBT-04-S	K9804715-005	0 05	1 10
TBT-05-S	K9804715-006	0 05	1.83
TBT-06-S	K9804715-007	0 05	1.81
TBT-07-S	K9804715-008	0.05	1.66
TBT-36-S	K9804715-009	0.05	1.71
TBT-08-S	K9804715-012	0.05	3.25
TBT-09-S	K9804715-013	0.05	2.02
Method Blank	K9804715-MB	0 05	ND

M Modified

Approved By: _____ Date: 7/31/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804715
Project:	WSOU TBT Study	**Date Collected:**	7/15/98
Sample Matrix:	Sediment	**Date Received:**	7/17/98
		Date Extracted:	7/21/98

Butyltins*
Units: ug/Kg (ppb)
Dry Weight Basis

Analyte:	**Tributyltin**
Method Reporting Limit.	1

Sample Name	**Lab Code**	**Date Analyzed**	
TBT-01-S	K9804715-001	7/29/98	31
TBT-02-S	K9804715-002	7/29/98	730
TBT-35-S	K9804715-003	8/4/98	650
TBT-03-S	K9804715-004	7/29/98	540
TBT-04-S	K9804715-005	7/29/98	330
TBT-05-S	K9804715-006	7/29/98	680
TBT-06-S	K9804715-007	7/29/98	660
TBT-07-S	K9804715-008	7/29/98	670
TBT-36-S	K9804715-009	7/29/98	970
TBT-07-FB	K9804715-010	7/29/98	<3(G)
TBT-07-CB	K9804715-011	7/29/98	ND
TBT-08-S	K9804715-012	7/29/98	400
TBT-09-S	K9804715-013	7/29/98	800
Method Blank	K980721-SB	7/29/98	ND

* Methodology based on C.A.Krone, et al , "A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound," National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA, November 1988. Butyltins are reported as the cations

G The MRL is elevated because an insufficient sample quantity was available for optimum analysis

Approved By _____ Date 8-4-98

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804715
Date Collected: 7/15/98
Date Received: 7/17/98

Duplicate Summary

Total Solids

Prep Method NONE
Analysis Method 160.3M
Test Notes:

Units PERCENT
Basis Wet

Sample Name	Lab Code	Date Analyzed	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
TBT-01-S	K9804715-001DUP	7/22/98	74.3	75.3	74.8	1	

Approved By _____ Date 7/24/98

TSOLIDS.XLT_DUP/01071998a

04715TS.ABT - DUP 7/23/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804715
Date Collected: 7/15/98
Date Received: 7/17/98
Date Analyzed: 7/28/98

Carbon, Total Organic
ASTM D4129-82M
Units PERCENT

LABORATORY CONTROL SAMPLE

		True Value	Measured Value	Percent Recovery
Source:	ERA 542 #01125	0 62	0 63	102

CALIBRATION VERIFICATION STANDARD

	True Value	Measured Value	Percent Recovery
CCV 3 Result	20.0	19 7	98
CCV 4 Result	20.0	19 7	98
CCV 5 Result	20.0	19 0	95

LABORATORY BLANK

	MRL	Blank Value
CCB 3 Result	0 05	ND
CCB 4 Result	0 05	ND
CCB 5 Result	0 05	ND

DUPLICATE ANALYSIS

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
TBT-01-S	K9804715-001D	0 05	0 58	0 69	0 64	17

MATRIX SPIKE ANALYSIS

Sample Name	Lab Code	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery
TBT-01-S	K9804715-001MS	0 05	3 66	0 58	4 26	100

Approved By _____ Date 7/31/98

COMBOQCD/042695

04715WET LJ1 - D_COMBOQC 7/31/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804715
Date Collected: 7/15/98
Date Received: 7/17/98
Date Extracted: 7/21/98
Date Analyzed: 7/29/98

Surrogate Recovery Summary
Butyltins

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-01-S	K9804715-001	68	80
TBT-02-S	K9804715-002	83	71
TBT-35-S	K9804715-003	114	93
TBT-03-S	K9804715-004	63	48
TBT-04-S	K9804715-005	80	66
TBT-05-S	K9804715-006	85	62
TBT-06-S	K9804715-007	85	80
TBT-07-S	K9804715-008	72	61
TBT-36-S	K9804715-009	94	48
TBT-07-FB	K9804715-010	63	79
TBT-07-CB	K9804715-011	65	86
TBT-08-S	K9804715-012	64	44
TBT-09-S	K9804715-013	105	85
TBT-06-S	K9804715-007MS	85	55
TBT-06-S	K9804715-007DMS	93	55
Lab Control Sample	K980721-SL	64	79
Method Blank	K980721-SB	73	93
CAS Acceptance Limits:		20-195	20-172

Approved By: _____ Date: 7-31-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804715
Project:	WSOU TBT Study	**Date Collected:**	7/15/98
Sample Matrix:	Sediment	**Date Received:**	7/17/98
		Date Extracted:	7/21/98
		Date Analyzed:	7/29/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins
Units: ug/Kg (ppb)
Dry Weight Basis

Sample Name: TBT-06-S
Lab Code: K9804715-007MS, K9804715-007DMS

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
Analyte	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**
Tributyltin	10	10	660	NA	NA	NC	NC	20-200	NC

NA Not Applicable; see case narrative.

Approved By: Jay Date: 7-31-98

DMS1SOTS/060194
04715SVG VN1 - DMS 7/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804715
Project:	WSOU TBT Study	**Date Collected:**	NA
LCS Matrix:	Sediment	**Date Received:**	NA
		Date Extracted:	7/21/98
		Date Analyzed:	7/29/98

Laboratory Control Sample Summary
Butyltins
Units ug/Kg (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	5	6	120	20-164

Approved By: _____ Date: 7-31-98

LCSOTS/121594
04715SVG VN1 - LCS 7/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804715
Calibration Date: 7/28/98
Date Analyzed: 7/29/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units. µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery
Tributyltin	500	565	113	560	112	576	115

Approved By: _____ Date 8.4.98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804715
Calibration Date: 8/1/98
Date Analyzed: 8/4/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery
Tributyltin	500	503	101	513	103

Approved By: Jay Date: 8-4-98

CCV 5-8/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804715
Calibration Date: 7/28/98
Date Analyzed: 7/29/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units µg/Kg (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result
Tributyltin	1	ND	ND	ND

Approved By: _____ Date 8-4-98

CCB4SMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804715
Calibration Date: 8/1/98
Date Analyzed: 8/4/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units µg/Kg (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result
Tributyltin	1	ND	ND

Approved By _____ Date 8-4-98

CCB4SMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	EVS Environmental Consultants	**Service Request No.:**	K9804761
Project:	WSOU TBT Study	**Date Received:**	7/18/98
Sample Matrix:	Sediemnt		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc (CAS). This report contains analytical results for sample(s) designated for Tier III data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Matrix/Duplicate Matrix Spike (MS/DMS) and Laboratory Control Sample (LCS)

All EPA recommended holding times have been met for analyses in this sample delivery group.

The following difficulties were experienced during analysis of this batch.

The surrogate recoveries for TBT in samples TBT-12, 13, 14, 37, 16 and 20 were not calculated. The analysis of this sample required a dilution which resulted in a surrogate concentration below the Method Reporting Limit (MRL). No further corrective action was taken

The Matrix Spike (MS) recovery of TBT for sample TBT-15-S was not calculated The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

Approved by VNT **Date** 8/6/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804761
Project:	WSOU TBT Study	**Date Collected:**	7/16/98
Sample Matrix:	Sediment	**Date Received:**	7/18/98

Total Solids

Prep Method	NONE	Units	PERCENT
Analysis Method	160 3M	Basis	Wet
Test Notes			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
TBT-10-S	K9804761-001	7/23/98	72 5	
TBT-11-S	K9804761-002	7/23/98	67 0	
TBT-12-S	K9804761-003	7/23/98	51 7	
TBT-13-S	K9804761-004	7/23/98	59 1	
TBT-14-S	K9804761-005	7/23/98	60 4	
TBT-37-S	K9804761-006	7/23/98	63 2	
TBT-15-S	K9804761-007	7/23/98	63 2	
TBT-16-S	K9804761-008	7/23/98	52 7	
TBT-17-S	K9804761-009	7/23/98	66 6	
TBT-18-S	K9804761-010	7/23/98	77 7	
TBT-19-S	K9804761-011	7/23/98	60 5	
TBT-20-S	K9804761-012	7/23/98	56 5	

Approved By SC Date 7/27/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804761
Date Collected: 7/16/98
Date Received: 7/18/98
Date Extracted: NA
Date Analyzed: 8/1/98

Carbon, Total Organic
ASTM D4129-82M
Units: PERCENT
Dry Weight Basis

Sample Name	Lab Code	MRL	Result
TBT-10-S	K9804761-001	0 05	0 50
TBT-11-S	K9804761-002	0.05	0 75
TBT-12-S	K9804761-003	0.05	2 30
TBT-13-S	K9804761-004	0.05	1 31
TBT-14-S	K9804761-005	0.05	1 03
TBT-37-S	K9804761-006	0 05	1.22
TBT-15-S	K9804761-007	0 05	1.35
TBT-16-S	K9804761-008	0.05	2 07
TBT-17-S	K9804761-009	0.05	0 86
TBT-18-S	K9804761-010	0.05	1 15
TBT-19-S	K9804761-011	0 05	1.22
TBT-20-S	K9804761-012	0 05	1.60
Method Blank	K9804761-MB	0 05	ND

M Modified for analysis of soil

Approved By _____ Date 8/3/98

1AMRL/102594
04761WET LJ1 - TOCS 8/3/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804761
Date Collected: 7/16/98
Date Received: 7/18/98
Date Extracted: 7/25/98

Butyltins*
Units: ug/Kg (ppb)
Dry Weight Basis

Analyte	Tributyltin
Method Reporting Limit	1

Sample Name	Lab Code	Date Analyzed	
TBT-10-S	K9804761-001	8/1/98	6
TBT-11-S	K9804761-002	8/1/98	130
TBT-12-S	K9804761-003	8/1/98	830
TBT-13-S	K9804761-004	8/1/98	1100
TBT-14-S	K9804761-005	8/1/98	1100
TBT-37-S	K9804761-006	8/1/98	1000
TBT-15-S	K9804761-007	8/1/98	530
TBT-16-S	K9804761-008	8/1/98	1200
TBT-17-S	K9804761-009	8/1/98	560
TBT-18-S	K9804761-010	8/1/98	210
TBT-19-S	K9804761-011	8/1/98	450
TBT-20-S	K9804761-012	8/1/98	3500
Method Blank	K980725-SB	8/1/98	ND

* Methodology based on C.A.Krone, et al , "A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound," National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA, November 1988 Butyltins are reported as the cations.

Approved By: _____ Date 8.4.98

3ADA/101194
04761SVG JG1 - Butyltn 8/4/98

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804761
Date Collected: 7/16/98
Date Received: 7/18/98

Duplicate Summary

Total Solids

Prep Method NONE
Analysis Method 160 3M
Test Notes:

Units PERCENT
Basis Wet

Sample Name	Lab Code	Date Analyzed	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
TBT-10-S	K9804761-001DUP	7/23/98	72 5	71 7	72 1	1	

Approved By JC Date 7/27/98

PSOLIDS XLT_DUP/0107199Ra

04761TS AB1 - DUP 7/26/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804761
Date Collected: 7/16/98
Date Received: 7/18/98
Date Analyzed: 8/1/98

Carbon, Total Organic
ASTM D4129-82M
Units PERCENT

LABORATORY CONTROL SAMPLE

		True Value	Measured Value	Percent Recovery
Source	ERA 542 Lot #01125	0.62	0 62	100

CALIBRATION VERIFICATION STANDARD

	True Value	Measured Value	Percent Recovery
CCV 1 Result	20 0	20.6	103
CCV 2 Result	20.0	19 4	97
CCV 3 Result	20 0	19 2	96
CCV 4 Result	20 0	19 8	99
CCV 5 Result	20 0	19 4	97

LABORATORY BLANK

	MRL	Blank Value
CCB 1 Result	0 05	ND
CCB 2 Result	0 05	ND
CCB 3 Result	0 05	ND
CCB 4 Result	0 05	ND
CCB 5 Result	0.05	ND

DUPLICATE ANALYSIS

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
TBT-10-S	K9804761-001D	0 05	0 50	0 45	0 48	10

MATRIX SPIKE ANALYSIS

Sample Name	Lab Code	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery
TBT-10-S	K9804761-001MS	0 05	3 30	0 50	3 82	100

Approved By _____ Date 8/3/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Sediment

Service Request: K9804761
Date Collected: 7/16/98
Date Received: 7/18/98
Date Extracted: 7/25/98
Date Analyzed: 8/1/98

Surrogate Recovery Summary
Butyltins

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-10-S	K9804761-001	73	74
TBT-11-S	K9804761-002	75	83
TBT-12-S	K9804761-003	NA	NA
TBT-13-S	K9804761-004	NA	NA
TBT-14-S	K9804761-005	NA	NA
TBT-37-S	K9804761-006	NA	NA
TBT-15-S	K9804761-007	79	60
TBT-16-S	K9804761-008	NA	NA
TBT-17-S	K9804761-009	73	69
TBT-18-S	K9804761-010	74	64
TBT-19-S	K9804761-011	70	59
TBT-20-S	K9804761-012	NA	NA
TBT-15-S	K9804761-007MS	82	70
TBT-15-S	K9804761-007DMS	79	77
Lab Control Sample	K980725-SL	81	74
Method Blank	K980725-SB	94	84
CAS Acceptance Limits:		20-195	20-172

NA Not Applicable; see case narrative

Approved By: _____ Date: 8-4-98

SUR2/102194
04761SVG JG1 - SURR 8/4/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804761
Project:	WSOU TBT Study	**Date Collected:**	7/16/98
Sample Matrix:	Sediment	**Date Received:**	7/18/98
		Date Extracted:	7/25/98
		Date Analyzed:	8/1/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins
Units. ug/Kg (ppb)
Dry Weight Basis

Sample Name: TBT-15-S
Lab Code: K9804761-007MS, K9804761-007DMS

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
Analyte	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**
Tributyltin	8	8	530	NA	NA	NC	NC	20-200	-

NA Not Applicable, see case narrative

Approved By: _____ Date: 8-4-98

DMS1SOTS/060194
04761SVG JG1 - DMS 8/4/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
LCS Matrix: Sediment

Service Request: K9804761
Date Collected: NA
Date Received: NA
Date Extracted: 7/25/98
Date Analyzed: 8/1/98

Laboratory Control Sample Summary
Butyltins
Units: ug/Kg (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	5	5	100	20-164

Approved By: _____ Date: 8-4-98

LCSOTS/121594
04761SVG JG1 - LCS 8/4/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804761
Project:	WSOU TBT Study	**Calibration Date:**	8/1/98
		Date Analyzed:	8/1/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery
Tributyltin	500	496	99	476	95

Approved By _____ Date 8-4-98

CCV 1-4/042795

04761SVG JG1 - CCV 1-4 8/4/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804761
Calibration Date: 8/1/98
Date Analyzed: 8/1/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units µg/Kg (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result
Tributyltin	1	ND	ND

Approved By _____ Date 8-4-98

CCB4SMRL/120594

04761SVG JG1 - CCB 1 4 8/4/98

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	EVS Environmental Consultants	**Service Request No.:**	K9804795
Project:	WSOU TBT Study	**Date Received:**	7/21/98
Sample Matrix:	Soil, Wipe		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for sample(s) designated for Tier III data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), Initial/Continuing Calibration Verification Standards (ICV/CCV), and Initial/Continuing Calibration Blanks (ICB/CCB).

All EPA recommended holding times have been met for analyses in this sample delivery group.

The following difficulties were experienced during analysis of this batch.

The surrogate recoveries for TBT in all samples except TBT-25-CB were not calculated. The analysis of these samples required a dilution which resulted in a surrogate concentration below the Method Reporting Limit (MRL). No further corrective action was taken

The Tripenyltin surrogate recovery for TBT in the Method Blank (MB) was outside normal CAS control limits. The Tripropyltin surrogate recovery associated with the TBT Method Blank analysis of these samples was within normal CAS control limits, so no further corrective action was taken.

Approved by _____ **Date** 8/10/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Soil

Service Request: K9804795
Date Collected: 7/17/98
Date Received: 7/21/98

Total Solids

Prep Method: NONE
Analysis Method 160 3M
Test Notes

Units: PERCENT
Basis Wet

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
TBT-21-S	K9804795-001	7/27/98	61 1	
TBT-22-S	K9804795-002	7/27/98	64.8	
TBT-23-S	K9804795-003	7/27/98	65.5	
TBT-24-S	K9804795-004	7/27/98	60 0	
TBT-25-S	K9804795-005	7/27/98	63 6	
TBT-26-S	K9804795-007	7/27/98	60 0	
TBT-27-S	K9804795-008	7/27/98	63 4	
TBT-28-S	K9804795-009	7/27/98	60 0	
TBT-38-S	K9804795-010	7/27/98	61 3	
TBT-34-S	K9804795-011	7/27/98	51 6	
TBT-32-S	K9804795-012	7/27/98	61 8	
TBT-31-S	K9804795-013	7/27/98	51 0	
TBT-33-S	K9804795-014	7/27/98	61 1	
TBT-29-S	K9804795-015	7/27/98	46 3	
TBT-30-S	K9804795-016	7/27/98	61 2	

Approved By: _____ Date 7/30/98

TSOLIDS XLT_Sample/01071998a

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Soil

Service Request: K9804795
Date Collected: 7/17/98
Date Received: 7/21/98
Date Extracted: NA
Date Analyzed: 8/1/98

Carbon, Total Organic
ASTM D4129-82M
Units PERCENT
Dry Weight Basis

Sample Name	Lab Code	MRL	Result
TBT-21-S	K9804795-001	0 05	1 23
TBT-22-S	K9804795-002	0 05	0.94
TBT-23-S	K9804795-003	0 05	0.93
TBT-24-S	K9804795-004	0 05	1 27
TBT-25-S	K9804795-005	0.05	1 12
TBT-26-S	K9804795-007	0 05	1.21
TBT-27-S	K9804795-008	0.05	1.45
TBT-28-S	K9804795-009	0.05	1 22
TBT-38-S	K9804795-010	0 05	1.40
TBT-34-S	K9804795-011	0 05	4.24
TBT-32-S	K9804795-012	0.05	0 99
TBT-31-S	K9804795-013	0 05	1.7
TBT-33-S	K9804795-014	0.05	1 25
TBT-29-S	K9804795-015	0 05	2.41
TBT-30-S	K9804795-016	0 05	1 28
Method Blank	K9804795-MB	0 05	ND

M Modified for analysis of soil

Approved By _____ Date 8/3/98

IAMRL/102594
04795WET LJ1 - TOCS 8/3/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Soil

Service Request: K9804795
Date Collected: 7/17/98
Date Received: 7/21/98
Date Extracted: 8/1/98

Butyltins*
Units ug/Kg (ppb)
Dry Weight Basis

Analyte	Tributyltin
Method Reporting Limit.	1

Sample Name	Lab Code	Date Analyzed	
TBT-21-S	K9804795-001	8/5/98	610
TBT-22-S	K9804795-002	8/5/98	350
TBT-23-S	K9804795-003	8/5/98	510
TBT-24-S	K9804795-004	8/5/98	570
TBT-25-S	K9804795-005	8/5/98	310
TBT-26-S	K9804795-007	8/5/98	1100
TBT-27-S	K9804795-008	8/5/98	730
TBT-28-S	K9804795-009	8/6/98	690
TBT-38-S	K9804795-010	8/6/98	650
TBT-34-S	K9804795-011	8/5/98	850
TBT-32-S	K9804795-012	8/6/98	2200
TBT-31-S	K9804795-013	8/6/98	6600
TBT-33-S	K9804795-014	8/6/98	1000
TBT-29-S	K9804795-015	8/6/98	6200
TBT-30-S	K9804795-016	8/6/98	310
Method Blank	K980801-SB	8/6/98	ND

* Methodology based on C.A.Krone, et al., "A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound," National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA, November 1988. Butyltins are reported as the cations

Approved By: Linda Neuneker Date: 8-7-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804795
Project:	WSOU TBT Study	**Date Collected:**	7/17/98
Sample Matrix:	Wipe	**Date Received:**	7/21/98
		Date Extracted:	8/1/98

Butyltins*
ug/WIPE

Analyte:	**Tributyltin**
Method Reporting Limit	0.01

Sample Name	**Lab Code**	**Date Analyzed**	
TBT-25-CB	K9804795-006	8/6/98	ND
Method Blank	K980801-SB	8/6/98	ND

* Methodology based on C A.Krone, et al , "A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound," National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA, November 1988. Butyltins are reported as the cations.

Approved By: Wanda Neuneker Date 8-7-98

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Soil

Service Request: K9804795
Date Collected: 7/17/98
Date Received: 7/21/98

Duplicate Summary

Total Solids

Prep Method. NONE
Analysis Method 160 3M
Test Notes.

Units PERCENT
Basis Wet

Sample Name	Lab Code	Date Analyzed	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
TBT-21-S	K9804795-001DUP	7/27/98	61 1	60.7	60 9	<1	

Approved By. _____ Date: 7/30/98

TSOLIDS XLT_DUP/0107199Sa

04795TS AB1 - DUP 7/28/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Soil

Service Request: K9804795
Date Collected: 7/17/98
Date Received: 7/21/98
Date Analyzed: 8/1/98

Carbon, Total Organic
ASTM D4129-82M
Units: PERCENT

LABORATORY CONTROL SAMPLE

		True Value	Measured Value	Percent Recovery
Source:	ERA Cat# 542 Lot# 01125	0.62	0.62	100

CALIBRATION VERIFICATION STANDARD

	True Value	Measured Value	Percent Recovery
CCV 3 Result	20.0	19.8	99
CCV 4 Result	20.0	19.4	97
CCV 5 Result	20.0	19.6	98
CCV 6 Result	20.0	19.7	98

LABORATORY BLANK

	MRL	Blank Value
CCB 3 Result	0.05	ND
CCB 4 Result	0 05	ND
CCB 5 Result	0.05	ND
CCB 6 Result	0.05	ND

DUPLICATE ANALYSIS

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
TBT-21-S	K9804795-001	0.05	1 23	1.17	1.20	5

MATRIX SPIKE ANALYSIS

Sample Name	Lab Code	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery
TBT-21-S	K9804795-001	0 05	6.22	1 23	7.15	95

Approved By: _____ Date: 8/10/98

00010

COMBOQCD/042695

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Soil, Wipe

Service Request: K9804795
Date Collected: 7/17/98
Date Received: 7/21/98
Date Extracted: 8/1/98
Date Analyzed: 8/5-6/98

Surrogate Recovery Summary
Butyltins

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-21-S	K9804795-001	NA	NA
TBT-22-S	K9804795-002	NA	NA
TBT-23-S	K9804795-003	NA	NA
TBT-24-S	K9804795-004	NA	NA
TBT-25-S	K9804795-005	NA	NA
TBT-25-CB	K9804795-006	70	73
TBT-26-S	K9804795-007	NA	NA
TBT-27-S	K9804795-008	NA	NA
TBT-28-S	K9804795-009	NA	NA
TBT-38-S	K9804795-010	NA	NA
TBT-34-S	K9804795-011	NA	NA
TBT-32-S	K9804795-012	NA	NA
TBT-31-S	K9804795-013	NA	NA
TBT-33-S	K9804795-014	NA	NA
TBT-29-S	K9804795-015	NA	NA
TBT-30-S	K9804795-016	NA	NA
Lab Control Sample	K980801-SL	75	77
Method Blank	K980801-SB	40	17(A)
	CAS Acceptance Limits.	20-195	20-172

A Outside acceptance limits; see case narrative
NA Not Applicable; see case narrative.

Approved By: Wanda Neuneker Date: 8-7-98

SUR2/102194
04795SVG JG1 - SURR 8/7/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804795
Project:	WSOU TBT Study	**Date Collected:**	NA
LCS Matrix:	Soil	**Date Received:**	NA
		Date Extracted:	8/1/98
		Date Analyzed:	8/6/98

Laboratory Control Sample Summary
Butyltins
Units ug/Kg (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	5	4	80	20-164

Approved By: Linda Neuneker Date: 8-7-98

LCSOTS/121594
04795SVG JG1 - LCS 8/7/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804795
Calibration Date: 8/1/98
Date Analyzed: 8/5-6/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tributyltin	500	489	98	504	101	517	103	509	102

Approved By: Wanda Neuneker Date: 8-7-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804795
Calibration Date: 8/1/98
Date Analyzed: 8/6/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units. µg/L (ppb)

Analyte	True Value	CCV5 Result	Percent Recovery
Tributyltin	500	466	93

Approved By: Wanda Mennekes Date: 8-7-98

CCV 5-8/042795
04795SVG JG1 - CCV 5-8 8/7/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804795
Calibration Date: 8/1/98
Date Analyzed: 8/5-6/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units: µg/Kg (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tributyltin	1	ND	ND	ND	ND

Approved By: Wanda Neuneker Date 8-7-98

CCB4SMRI/120594
04795SVG JG1 - CCB 1-4 (2) 8/7/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804795
Calibration Date: 8/1/98
Date Analyzed: 8/6/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units µg/Kg (ppb)

Analyte	MRL	CCB5 Result
Tributyltin	1	ND

Approved By: Wanda M Deuneke Date 8-7-98

CCB4SMRL/120594
04795SVG JG1 - CCB 1-4 (3) 8/7/98

CHAIN-OF-CUSTODY/TEST REQUEST FORM FOR SEDIMENT AND WATER SAMPLE(S)*

Study ~~Client~~ Name: WSOU TBT Study

Contact Name: Tim HAMMERMEISTER

Sampled By: Tim HAMMERMEISTER, Lisa Mill, Steve Wodzicki, Tony Petrillo, Dale Dickenson

Ship to: C.A.S. 1317 S. 13th Ave [98047]15
Kelso, WA 98626

Attn: Lynda Huckestein

Shipping Date: 07-16-98

00018

Sample Collection Date (d/m/y)	Time (am/pm)	Sample Identification	Volume of Sample/# of Containers	Test(s) Requested (check test(s) required)							Comments/Instructions
				Bulk TBT	TOC						
7/15/98	0902	TBT-01-S	16oz/1	X	X						#4001
"	0955	TBT-02-S	"	X	X						#4006
"	"	TBT-35-S	"	X	X						#4011
"	1045	TBT-03-S	"	X	X						#4014
"	1124	TBT-04-S	"	X	X						#4019
"	1205	TBT-05-S	"	X	X						#4024
"	1355	TBT-06-S	"	X	X						#4029
"	1435	TBT-07-S	"	X	X						#4034
"	1435	TBT-36-S	"	X	X						#4039
"	"	TBT-07-FB	"	X							#4042

1) Released by: [signature] Date/Time: 7/16/98 1330	2) Released by: Juliana Viveros Date/Time: 7-16-98 1345	3) Released by: Date/Time	To be completed by EVS Laboratory upon sample receipt. EVS Project # / EVS W O. #
1) Rec'd by: Juliana Viveros Date/Time: 7-16-98 1350	2) Rec'd by: [signature] Date/Time 7/17/98 0800	3) Rec'd by Date/Time	Date of Receipt / Time of receipt; Condition Upon Receipt. / Received by.

* Instructions for completion of Chain-of-Custody/Test Request Form on back
* Distribution White and yellow copies accompany shipment, pink-consignor's copy, white-consignee return with results; yellow-consignee's copy

EVS ENVIRONMENT CONSULTANTS

- 195 Pemberton Avenue
  North Vancouver, B.C.
  Canada, V7P 2R4
  Tel: (604) 986-4331
  Fax (604) 662-8548
- 200 West Mercer Street
  Suite 403
  Seattle, WA 98119
  Tel: (206) 217-9337
  Fax (206) 217-9343

CHAIN-OF-CUSTODY/TEST REQUEST FORM FOR SEDIMENT AND WATER SAMPLE(S)*

E980715

Study
~~Client~~ Name. WSDU TBT Study

Contact Name: Tom Hammermeister

Sampled By: T. Hammermeister, C. Mill, S Wodzicki, T. Petrille, D. Dickenson

Ship to: C.A.S. 1317 S. 13th Ave
Kelso, WA 98626

Attn: Lynda Huckestein

Shipping Date: 07-16-98

00019

Sample Collection Date (d/m/y)	Time (am/pm)	Sample Identification	Volume of Sample/# of Containers	Test(s) Requested (check test(s) required)							Comments/Instructions
				Bulk TBT	TOC						
7/15/98	~~1435~~ 1440 T.H.	TBT-07-CB	1602/1	X							#4043
"	1535	TBT-08-S	"	X	X						#4044
"	1655	TBT-09-S	"	X	X						4057

1) Released by: [signature]	2) Released by: Juliana Viveros	3) Released by.	To be completed by EVS Laboratory upon sample receipt.
Date/Time: 7/16/98 1330	Date/Time: 7-16 98 1345	Date/Time	EVS Project # / EVS W O. #
1) Rec'd by: Juliana Viveros	2) Rec'd by: [signature]	3) Rec'd by.	Date of Receipt / Time of receipt:
Date/Time: 7-16 98 1330	Date/Time: 7/17/98 1000	Date/Time.	Condition Upon Receipt: / Received by:

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  Fax: (206) 217-9343

CHAIN-OF-CUSTODY/TEST REQUEST FORM FOR SEDIMENT AND WATER SAMPLE(S)*

Client Name. WSOU TBT Study
Contact Name Dennis Hanglick
Sampled By: D. Hanglick, S. Wodzicki, L. Mills

Ship to: Columbia Analytical Services
1317 South 13th AVE Kelso, WA
Attn: Lynda Fuckesteen
Shipping Date. 7-17-98

Sample Collection Date (d/m/y)	Time (am/pm)	Sample Identification	Volume of Sample/# of Containers	Test(s) Requested (check test(s) required) TBT/TOC							Comments/Instructions
07-16-98	0845	TBT-10-S	16oz/1	X							4062
"	0920	TBT-11-S	"	X							4067
	1035	TBT-12-S	16oz/1	X							4072
	1120	TBT-13-S	16oz/1	X							4077
	1310	TBT-14-S	"	X							4090
	1320	TBT-37-S	"	X							4093
	1355	TBT-15-S	"	X							4098
	1430	TBT-16-S	"	X							4103
	1500	TBT-17-S	"	X							4108
	1545	TBT-18-S	"	X							4113

1) Released by: Dennis Hanglick	2) Released by: [illegible]	3) Released by.	To be completed by EVS Laboratory upon sample receipt:
Date/Time: 7-17-98 1030	Date/Time 07-17-98 1430	Date/Time	EVS Project # / EVS W O #
1) Rec'd by [illegible]	2) Rec'd by: [illegible]	3) Rec'd by.	Date of Receipt: / Time of receipt
Date/Time: 07-17-98 1430	Date/Time: CAS-K 18 JUL-98	Date/Time:	Condition Upon Receipt: / Received by

* Instructions for completion of Chain-of-Custody/Test Request Form on back
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9001 6

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Tel: (206) 217-9337
Fax. (206) 217-9343

CHAIN-OF-CUSTODY/TEST REQUEST FORM FOR SEDIMENT AND WATER SAMPLE(S)*

Client Name: WSOU TBT Study
Contact Name: Dennis Hemplick
Sampled By: D. Hemplick, D. Wodzicki, L. Mill

Ship to: Columbia Analytical Services
Attn: Lynda Huckestein
Shipping Date: 7-17-98

Sample Collection Date (d/m/y)	Time (am/pm)	Sample Identification	Volume of Sample/# of Containers	Test(s) Requested (check test(s) required) TBT/TOC							Comments/Instructions
				TBT/TOC							DFW
7-16-98	1645	TBT-19-S	16oz/1	X							~~2123~~ 4123
7-16-98	1730	TBT-20-S	"	X							~~2131~~ 4131

1) Released by: Dennis Hemplick Date/Time: 7-17-98 1030	2) Released by Date/Time	3) Released by. Date/Time.	To be completed by EVS Laboratory upon sample receipt EVS Project # / EVS W O #
1) Rec'd by. Juliana Viveiros Date/Time: 07-17-98 1030	2) Rec'd by: [signature] Date/Time. CAS 18 JUL 98	3) Rec'd by. Date/Time:	Date of Receipt: / Time of receipt. Condition Upon Receipt: / Received by

* Instructions for completion of Chain-of-Custody/Test Request Form on back
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  Fax: (206) 217-9343

CHAIN-OF-CUSTODY/TEST REQUEST FORM FOR SEDIMENT AND WATER SAMPLE(S)*

00018

Study ~~Client~~ Name: WSOU TBT Study
Contact Name: Tim HAMMERMEISTER
Sampled By: T. Hammermeister, S. Wodzicki, C. Mill, T. Petrillo, D. Dickenson

Ship to: Columbia Analytical Services
1317 S. 13th Ave Kelso, WA 98626
Attn: Lynda Hinkelstein
Shipping Date:

Sample Collection Date (d/m/y)	Time (am/pm)	Sample Identification	Volume of Sample/# of Containers	Test(s) Requested (check test(s) required) TBT	TOC						Comments/Instructions
7/17/98	1316	TBT-34-S	1602/1	X	X						#4180
"	1351	TBT-32-S	"	X	X						#4184
"	1429	TBT-31-S	"	X	X						#4187
"	1508	TBT-33-S	"	X	X						#4190
"	1548	TBT-29-S	"	X	X						#4193
"	1622	TBT-30-S	"	X	X						#4198

1) Released by:	2) Released by:	3) Released by:	To be completed by EVS Laboratory upon sample receipt.	
Date/Time: 7/20/98 1130	Date/Time	Date/Time:	EVS Project #	EVS W.O. #
1) Rec'd by: L Bayda	2) Rec'd by:	3) Rec'd by:	Date of Receipt.	Time of receipt
Date/Time: 7/21/98 1:30pm	Date/Time:	Date/Time:	Condition Upon Receipt:	Received by

* Instructions for completion of Chain-of-Custody/Test Request Form on back
* Distribution White and yellow copies accompany shipment, pink-consignor's copy, white-consignee return with results, yellow-consignee's copy

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CHAIN-OF-CUSTODY/TEST REQUEST FORM FOR SEDIMENT AND WATER SAMPLE(S)*

00019

Study ~~Client~~ Name: WSDOT TBT Study
Contact Name: Jim Hammermeister
Sampled By: J. Hammermeister, S. Wodzicki, L. Mill, T. Petrillo, D. Dickenson

Ship to: Columbia Analytical Services
1317 S 13th Ave. Kelso, WA 98626
Attn: Lynda Huckestein
Shipping Date:

Sample Collection Date (d/m/y)	Time (am/pm)	Sample Identification	Volume of Sample/# of Containers	Test(s) Requested (check test(s) required) TBT	TOC						Comments/Instructions
7/17/98	0831	TBT-21-S	1602/1	X	X						#4136
"	0857	TBT-22-S	"	X	X						#4141
"	0940	TBT-23-S	"	X	X						#4146
"	1023	TBT-24-S	"	X	X						#4151
"	1048	TBT-25-S	"	X	X						#4156
"	"	TBT-25-CB	"	X							#4161
"	1123	TBT-26-S	"	X	X						#4162
"	1154	TBT-27-S	"	X	X						#4167
"	1231	TBT-28-S	"	X	X						#4172
"	"	TBT-38-S	"	X	X						#4177

1) Released by: [signature] Date/Time: 7/20/98 1130	2) Released by. Date/Time.	3) Released by Date/Time	To be completed by EVS Laboratory upon sample receipt: EVS Project # / EVS W O #
1) Rec'd by: L. Bojicki Date/Time: 7/21/98 1:30pm	2) Rec'd by Date/Time	3) Rec'd by Date/Time	Date of Receipt. / Time of receipt. Condition Upon Receipt / Received by

* Instructions for completion of Chain-of-Custody/Test Request Form on back
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Rosa Environmental Geotechnical Laboratory, LLC

EVS Consultants
Project. WSOU TBT Study

Table 1 Apparent Grain Size Distribution Summary
Percent Finer Than Indicated Size

Sample No	Gravel			Very Coarse Sand	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt				Clay	
Phi Size	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Sieve Size (microns)	3/8"	#4	#10 (2000)	#18 (1000)	#35 (500)	#60 (250)	#120 (125)	#230 (62)	31 00	15 60	7 80	3.90	2.00	1.00
TBT-01-S	100 0	89 0	88 2	86 6	82 3	53 5	14 1	10 2	8 9	7 2	5 7	3 7	2 7	1 8
TBT-02-S	100 0	100.0	99 8	99 1	98 0	94.2	80 9	66 3	54 6	42.2	29 1	20 6	13 2	10.1
TBT-03-S	100 0	97 9	94.6	93 1	91 1	85 0	73 8	63 7	57 7	46 4	34 8	23.9	16 5	11 5
TBT-04-S	100 0	99.6	98 9	98.3	92 5	66 8	48 4	40 5	35 8	29 4	21 7	15.2	10.8	7 6
TBT-05-S	100.0	100.0	100 0	99 9	98 0	88.3	77 4	67 4	58 4	46 6	33 8	23.4	16 5	11.3
TBT-06-S	100 0	100.0	99 9	99 7	98 1	88 1	74.1	64 8	57.4	45.4	33 3	23.6	16 5	11.7
TBT-07-S	100 0	100.0	99 8	99.1	96.8	87.6	74 4	61.7	52 3	40.6	27.5	19 6	14 4	9.5
TBT-08-S	100 0	97 8	95 8	92 5	87.4	75 7	64 6	56 0	41 9	34.7	28 0	20 5	14 6	9.6
TBT-09-S	100 0	100.0	98 6	97 0	94 4	89.5	81.5	71 4	62 5	50.0	36.7	24 8	18 0	12 1
TBT-10-S	100 0	99 5	99 3	98 2	92 9	62 3	30 4	23 4	18.3	11.7	7 7	5.2	3.4	2.3
TBT-11-S	100 0	100 0	99 3	97 7	92 3	68 6	41 2	29.2	20 8	14.5	10 4	7.2	5.2	3.6
TBT-12-S	100.0	99 4	97.5	95 9	94.1	90.7	85 6	77.2	68 0	54.4	40.4	28 1	19 3	13 3
TBT-13-S	100 0	100 0	97 9	96 1	91 7	76 7	59 1	45.6	36 4	29.5	22.4	16.2	11 8	7 9
TBT-13-S-2	100 0	98 3	96.8	95 1	89 8	75 5	57 8	44 4	37 6	28 8	21 6	15 2	10 9	7.1
TBT-13-S-3	100 0	100 0	98 4	96 7	92.3	76 8	58 7	44 5	36 9	29.2	21.9	15.7	11 5	7 8
TBT-14-S	100 0	93.4	91 3	89 6	85 6	69.8	50.2	38 8	33.1	25 7	19.3	13.6	9 9	6 8
TBT-15-S	100.0	97.4	94.6	91 6	83 4	60 5	45.8	38.6	34 1	26.3	17 5	12.2	8 7	5 9
TBT-16-S	100 0	99 6	99 3	97 2	93 3	86 7	75.2	61 4	32.3	43.7	33 4	24.2	16.4	11 6
TBT-17-S	100 0	100 0	99 9	99 6	96 4	74 2	47.4	28 5	15.1	12.8	9 1	6 4	4 4	3.0
TBT-18-S	100 0	100 0	99 3	98 8	95 4	72 3	40.0	28 6	21.3	16.3	13 0	10.2	6 7	4.5
TBT-19-S	100 0	99 7	97 7	96 1	90 8	76 4	64.1	53.2	42 0	31.1	22.2	15 5	10 7	7.2
TBT-20-S	100 0	97.6	96 6	95 4	93.3	86 8	69 6	52.1	43.8	34.1	26 3	18 8	12 8	9 0
TBT-21-S	100.0	100.0	98 8	97.2	91.2	76 9	60 4	46 6	35.9	25.3	18.2	12 8	9 4	6.2
TBT-22-S	100 0	100.0	99 9	99 4	98.2	85 6	59 0	38 3	26 3	19.2	14 4	10.5	7 8	5.2
TBT-23-S	100 0	100 0	100.0	99.6	98 2	89 6	66 6	38.3	26 6	19 3	14.9	10.6	7 4	5 0
TBT-24-S	100 0	100 0	99 9	99 1	97 2	87 5	68 8	49.0	36 7	26.8	20 1	14 4	10 3	6 8
TBT-25-S	100 0	100 0	99 1	96 3	90 8	79 2	66 6	54 4	38 7	24 6	17.0	12 0	8 6	6 3
TBT-26-S	100 0	99 9	98 9	96 8	90 2	65 0	42 2	28 3	22 2	17 1	12 9	9.2	6 7	4 6
TBT-27-S	100 0	90 6	89 5	87 4	80 8	64 6	48 6	35 4	27 5	20 3	15 1	10 8	7 7	5.3
TBT-28-S	100 0	100 0	99 9	99 0	96 2	85 3	67.1	47 9	34 1	23 8	17 2	12.4	8 7	6 3
TBT-28-S-2	100 0	100 0	100 0	99 4	95 9	85 6	67 4	48 3	33 8	23 7	17 6	12 4	9 1	6 6
TBT-28-S-3	100 0	100.0	99 8	99 0	95 9	85.2	67 2	48.2	34 0	23 9	17.3	12.5	9.2	6 4
TBT-29-S	100 0	99 5	98.8	98 0	95 4	88 8	67.5	45.3	34 5	27 4	20 6	14 6	10 8	7 4
TBT-30-S	100 0	99 4	98 8	98 5	96 3	88 0	74 1	56.2	39.9	27 5	20 3	14 2	10 2	7.3
TBT-31-S	100.0	96.9	94 9	89 8	76 8	60 0	44 5	36.2	31 4	24.0	15 6	11 1	8 5	6 0
TBT-32-S	100 0	100 0	99 7	99 1	96 8	84 1	52 7	32 1	22 3	16 6	13 0	10 1	7 2	4 9
TBT-32-S [2]	100.0	99 5	99 2	98 7	96.4	83 5	51 1	29 3	21.4	16.2	12.6	9 5	6 9	4 8
TBT-33-S	100.0	99 7	99 4	98 8	93 2	64 6	33.2	18.5	13 5	9.8	7.6	5.7	4 1	2 7
TBT-34-S	100.0	94 3	72.7	62 7	55 7	46 0	36 3	29.9	25 0	20.8	15 7	11.2	7.9	5 4
TBT-35-S	100 0	100.0	100 0	100 0	99 0	94 8	81.6	66 8	56 3	44 0	31.5	21.9	16 0	10.6
TBT-36-S	100 0	100.0	99 5	98 7	96 6	86 8	72.8	59 3	50 4	40 6	28.2	19 6	14 0	9.3
TBT-37-S	100.0	93.3	90 3	88.5	84 7	69 8	50.5	39.2	33.8	25.7	19 0	13.3	9.5	6.3
TBT-38-S	100.0	100 0	99 5	98 4	94.8	84.9	66.9	48.2	32.9	23.2	17.2	12 1	8 5	5.8

Notes to the Testing

1. Apparent grain size distributions according to PSEP protocols

Rosa Environmental and Geotechnical Laboratory, LLC

QA SUMMARY

PROJECT	EVS Consultants	Project .	WSOU TBT Study
REGL Tnplicate Sample ID	98671	Batch No	1022-001-01
Client Tnplicate Sample ID	TBT-28-S	Page·	1 of 1

Relative Standard Deviation, By Phi Size

Sample ID	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
TBT-28-S	-	100 0	99.9	99 0	96 2	85 3	67.1	47 9	34.1	23 8	17.2	12 4	8.7	6 3
TBT-28-S-2	-	100 0	100 0	99.4	95 9	85 6	67 4	48.3	33.8	23 7	17 6	12.4	9 1	6 6
TBT-28-S-3	-	100.0	99.8	99 0	95 9	85.2	67.2	48.2	34 0	23.9	17.3	12.5	9 2	6.4
AVE	NA	100 00	99.89	99.15	95 98	85.37	67.20	48.14	33.99	23.80	17.39	12.45	9.01	6.42
STDEV	NA	0.00	0.10	0.21	0 20	0.19	0.17	0.18	0.14	0.11	0.20	0 07	0.28	0.14
%RSD	NA	0.00	0.10	0.21	0.20	0.22	0.25	0 37	0.43	0.47	1.14	0.56	3 10	2.23

Duplicate Analysis, By Phi Size

Sample ID	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
TBT-32-S	100 0	100.0	99 7	99 1	96 8	84.1	52 7	32 1	22 3	16 6	13 0	10 1	7 2	4.9
TBT-32-S [2]	100 0	99 5	99.2	98 7	96 4	83 5	51.1	29.3	21 4	16.2	12 6	9 5	6 9	4.8
AVE	NA	99.74	99 44	98 87	96 63	83.79	51 90	30.72	21 81	16.40	12.82	9.81	7 04	4.83

The Tnplicate Applies To The Following Samples

REGL ID	Client ID	Date Sampled	Date Extracted	Date Complete	QA*
98607	TBT-01-S	7/15/98	7/23/98	7/25/98	1 00
98611	TBT-05-S	7/15/98	7/23/98	7/25/98	1 01
98647	TBT-06-S	7/15/98	7/23/98	7/25/98	1.00
98652	TBT-10-S	7/16/98	7/23/98	7/25/98	1 02
98656	TBT-14-S	7/16/98	7/23/98	7/25/98	0.99
98659	TBT-16-S	7/16/98	7/23/98	7/25/98	1.01
98660	TBT-17-S	7/16/98	7/23/98	7/25/98	1.03
98664	TBT-21-S	7/17/98	7/23/98	7/25/98	1 00
98667	TBT-24-S	7/17/98	7/23/98	7/25/98	1.01
98668	TBT-25-S	7/17/98	7/23/98	7/25/98	1 02
98669	TBT-26-S	7/17/98	7/23/98	7/25/98	1.00
98671	TBT-28-S	7/17/98	7/23/98	7/25/98	1.02
98676	TBT-29-S	7/17/98	7/23/98	7/25/98	1 01
98677	TBT-30-S	7/17/98	7/23/98	7/25/98	1.04
98674	TBT-31-S	7/17/98	7/23/98	7/25/98	1 00
98673	TBT-32-S	7/17/98	7/23/98	7/25/98	1 02
98675	TBT-33-S	7/17/98	7/23/98	7/25/98	1 00
98672	TBT-34-S	7/17/98	7/23/98	7/25/98	1.02
98612	TBT-35-S	7/15/98	7/23/98	7/25/98	1 00

* QA limits = 95-105%

Notes to the Testing

1 Sample TBT-32-S was accidentally extracted and run twice The resulting data is reported above

Rosa Environmental and Geotechnical Laboratory, LLC

QA SUMMARY

PROJECT	EVS Consultants	Project :	WSOU TBT Study
REGL Triplicate Sample ID:	98655	Batch No.:	1022-001-02
Client Triplicate Sample ID:	TBT-13-S	Page:	1 of 1

Relative Standard Deviation, By Phi Size

Sample ID	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
TBT-13-S	100.0	100.0	97.9	96.1	91.7	76.7	59.1	45.6	36.4	29.5	22.4	16.2	11.8	7.9
TBT-13-S-2	100.0	98.3	96.8	95.1	89.8	75.5	57.8	44.4	37.6	28.8	21.6	15.2	10.9	7.1
TBT-13-S-3	100.0	100.0	98.4	96.7	92.3	76.8	58.7	44.5	36.9	29.2	21.9	15.7	11.5	7.8
AVE	NA	99.43	97.71	95.95	91.23	76.32	58.51	44.83	36.95	29.19	21.95	15.69	11.38	7.58
STDEV	NA	0.99	0.82	0.81	1.28	0.69	0.63	0.64	0.63	0.38	0.40	0.47	0.45	0.46
%RSD	NA	1.00	0.84	0.84	1.40	0.90	1.08	1.42	1.69	1.29	1.84	2.97	3.91	6.02

The Triplicate Applies To The Following Samples

REGL ID	Client ID	Date Sampled	Date Extracted	Date Complete	QA*
98608	TBT-02-S	7/15/98	7/24/98	7/26/98	0.98
98609	TBT-03-S	7/15/98	7/24/98	7/26/98	0.99
98610	TBT-04-S	7/15/98	7/24/98	7/26/98	1.00
98648	TBT-07-S	7/15/98	7/24/98	7/26/98	1.00
98650	TBT-08-S	7/15/98	7/24/98	7/26/98	1.16
98651	TBT-09-S	7/15/98	7/24/98	7/26/98	1.00
98653	TBT-11-S	7/16/98	7/24/98	7/26/98	1.02
98654	TBT-12-S	7/16/98	7/24/98	7/26/98	1.00
98655	TBT-13-S	7/16/98	7/24/98	7/26/98	1.02
98658	TBT-15-S	7/16/98	7/24/98	7/26/98	1.00
98661	TBT-18-S	7/16/98	7/24/98	7/26/98	1.02
98662	TBT-19-S	7/16/98	7/24/98	7/26/98	1.00
98663	TBT-20-S	7/16/98	7/24/98	7/26/98	1.00
98665	TBT-22-S	7/17/98	7/24/98	7/26/98	1.01
98666	TBT-23-S	7/17/98	7/24/98	7/26/98	1.04
98670	TBT-27-S	7/17/98	7/24/98	7/26/98	0.98
98649	TBT-36-S	7/15/98	7/24/98	7/26/98	1.02
98657	TBT-37-S	7/16/98	7/24/98	7/26/98	0.97
98678	TBT-38-S	7/17/98	7/24/98	7/26/98	1.03

* QA limits = 95-105%

APPENDIX C

Porewater Chemistry Results

This appendix contains the porewater chemistry data as reported by the analytical laboratory. The data are grouped by analytical batches. Case narratives, when produced by the laboratory, are included for each batch. The last letters of the porewater sample IDs indicate the extraction method, where -PT represents unfiltered porewater and -PD represents filtered porewater.

REG Lab WMBE
Rosa Environmental & Geotechnical Laboratory, LLC

400 Ninth Avenue N., Suite B
Seattle, WA 98109-5187
(206) 287-9122

Client: EVS Consultants, Inc.	REGL Project No.: 1022-001
Client Project : WSOU TBT Study	Sample Batch Nos.: 1022-001-01 and 02

Case Narrative

1. Samples for pore water extraction and grain size analysis were received as follows; eleven received July, 15, twelve received July, 16 , and fifteen received July, 17, 1998. The samples consisted of one, 2 gallon bucket, and one, 16 oz jar. The bucket samples had been packed in coolers for shipment. Two pieces of duct tape were fixed to the outer side of each bucket's lid. When lifted, each piece of tape revealed a hole approximately 1/4 inch in diameter. Duct tape can be permeable to oxygen. Being exposed to the atmosphere may have effected the quality of the samples in the buckets.
2. The samples were extracted starting on July 16, 1998, for the TBT portion of the project. The extraction was performed under anaerobic conditions in a nitrogen atmosphere. The buckets were opened, centrifuge bottles packed and decanted all under nitrogen. Sediment was placed in 1,000 ml polycarbonate centrifuge bottles. The bottles were placed in a centrifuge maintained at 4 C. The bottles were spun at 3,000 rpm for 30 minutes. They were then removed from the centrifuge and the free water was pipetted into 500 ml polycarbonate centrifuge bottles. The bottles were placed in a second centrifuge maintained at 4 C. The bottles were spun at 9,000 rpm for 30 minutes. In some cases where an odd number of centrifuge bottles were packed with sediment, a centrifuge bottle was spun twice in order to provide a balance for the odd bottle. Half the sample was pipetted un-filtered into HCl preserved polycarbonate bottles, the other half was filtered over .45 micron silver membranes. The filtered portion was sent in HCl preserved polycarbonate bottles as well.
3. A separate extraction for TOC and DOC was performed. The extraction for TOC and DOC was conducted under anaerobic conditions in a nitrogen atmosphere, beginning July 20, 1998. The extraction procedure was exactly as for TBT extraction, except the filtered and un-filtered portions were sent in Sulfuric Acid preserved 4 ounce amber glass bottles.
4. Re-extraction for TBT analysis began July 28, 1998, on request. Samples TBT-15-S, TBT-16-S, TBT-17-S, TBT-18-S, TBT-19-S, and TBT-20-S were re-extracted as per the original procedure. Due to the drier nature of sample TBT-17-S, a larger volume was required; this was obtained from Battelle July 28, 1998. Sample TBT-12-S was also re-extracted as a QC duplicate.
5. A blank was prepared on July 16, 1998 from deionized water and was run through the entire extraction process. The blank was assigned REG number 98626.
6. A laboratory control sample was prepared on July 19, 1998 from deionized water. It was spiked with 50 ul of TBT solution #660-02, prepared with 4.35 ug/ml TBT. This sample was run through the entire extraction process, and was labeled according to the SOW.
7. Enough pore water was extracted for the laboratory to prepare MS/MSDs on TBT-17-S, TBT-32-S and TBT-34-S
8 Pore water extraction was initiated within the 48 hour holding time on all samples.
9. Sample TBT-08-S had large quantities of 1x2 mm oval shaped, black objects in it, many of which floated. The objects appeared to be seeds of some sort. They were not seen in any other sample.
10. Samples TBT-25-S and TBT-27-S had several Sea Cucumbers buried in the sediment. They ranged from 1 to 4 inches in length.

11. The grain size analysis was started on July 23, 1998. The samples were tested for grain size distribution according to PSEP methods. The samples were run in two batches. A triplicate was run on one sample in each batch, and is reported in the attached QA summary. Sample TBT-32-S was accidentally extracted twice, and was run as part of the first batch, results are reported in the attached QA summary as well.

Approved by: Harold Berry Date: 8/7/98
Title: Laboratory Manager

Rosa Environmental and Geotechnical Laboratory, LLC

QA Summary, TBT Extractions

Sample No.	Date/Time Sampled	Date/Time Extracted
TBT-01-S	7/15/98 9:02	7/15/98 14:50
TBT-02-S	7/15/98 9:55	7/15/98 14:25
TBT-03-S	7/15/98 10:45	7/16/98 10:50
TBT-04-S	7/15/98 11:24	7/16/98 13:10
TBT-O5-S	7/15/98 12:05	7/16/98 13:50
TBT-06-S	7/15/98 13:55	7/16/98 17:20
TBT-07-S	7/15/98 14:35	7/16/98 18:45
TBT-08-S	7/15/98 15:35	7/16/98 17:00
TBT-09-S	7/15/98 16:55	7/17/98 8:35
TBT-10-S	7/16/98 8:45	7/17/98 9:15
TBT-11-S	7/16/98 9:20	7/17/98 10:25
TBT-12-S	7/16/98 10:35	7/17/98 12:50
TBT-13-S	7/16/98 11:40	7/17/98 13:25
TBT-14-S	7/16/98 13:10	7/17/98 16:40
TBT-15-S	7/16/98 13:55	7/17/98 17:00
TBT-16-S	7/16/98 14:30	7/17/98 20:50
TBT-17-S	7/16/98 15:00	7/17/98 19:30
TBT-18-S	7/16/98 15:45	7/18/98 9:40
TBT-19-S	7/16/98 16:45	7/17/98 20:15
TBT-20-S	7/16/98 16:45	7/17/98 10:50
TBT-21-S	7/17/98 8:31	7/18/98 8:55
TBT-22-S	7/17/98 8:57	7/18/98 10:00
TBT-23-S	7/17/98 9:40	7/18/98 12:00
TBT-24-S	7/17/98 10:23	7/18/98 13:30
TBT-25-S	7/17/98 10:48	7/18/98 16:00
TBT-26-S	7/17/98 11:23	7/18/98 16:45
TBT-27-S	7/17/98 11:54	7/18/98 16:10
TBT-28-S	7/17/98 12:31	7/18/98 16:10
TBT-29-S	7/17/98 15:48	7/19/98 9:45
TBT-30-S	7/17/98 16:22	7/19/98 8:20
TBT-31-S	7/17/98 14:29	7/19/98 13:00
TBT-32-S	7/17/98 13:51	7/19/98 11:30
TBT-33-S	7/17/98 15:08	7/19/98 13:50
TBT-34-S	7/17/98 13:16	7/19/98 11:50
TBT-35-S	7/15/98 9:55	7/16/98 8:25
TBT-36-S	7/15/98 14:35	7/16/98 17:30
TBT-37-S	7/16/98 13:20	7/17/98 15:55
TBT-38-S	7/17/98 12:30	7/19/98 12:10

Notes: All samples extracted within 48 hours of sampling.

Rosa Environmental and Geotechnical Laboratory, LLC

QA Summary, TOC/DOC Extractions

Sample No.	Date/Time Sampled	Date/Time Extracted
TBT-01-S	7/15/98 9:02	7/21/98 9:10
TBT-02-S	7/15/98 9:55	7/21/98 10:25
TBT-03-S	7/15/98 10:45	7/21/98 9:45
TBT-04-S	7/15/98 11:24	7/21/98 10:20
TBT-O5-S	7/15/98 12:05	7/21/98 10:35
TBT-06-S	7/15/98 13:55	7/21/98 11:00
TBT-07-S	7/15/98 14:35	7/21/98 10:10
TBT-08-S	7/15/98 15:35	7/21/98 9:30
TBT-09-S	7/15/98 16:55	7/21/98 10:50
TBT-10-S	7/16/98 8:45	7/21/98 9:45
TBT-11-S	7/16/98 9:20	7/21/98 8:55
TBT-12-S	7/16/98 10:35	7/21/98 8:30
TBT-13-S	7/16/98 11:40	7/21/98 8:35
TBT-14-S	7/16/98 13:10	7/21/98 10:45
TBT-15-S	7/16/98 13:55	7/21/98 8:45
TBT-16-S	7/16/98 14:30	7/21/98 8:40
TBT-17-S	7/16/98 15:00	7/20/98 11:35
TBT-18-S	7/16/98 15:45	7/21/98 10:45
TBT-19-S	7/16/98 16:45	7/21/98 9:00
TBT-20-S	7/16/98 16:45	7/21/98 10:45
TBT-21-S	7/17/98 8:31	7/22/98 9:20
TBT-22-S	7/17/98 8:57	7/22/98 9:10
TBT-23-S	7/17/98 9:40	7/22/98 9:00
TBT-24-S	7/17/98 10:23	7/22/98 9:20
TBT-25-S	7/17/98 10:48	7/22/98 8:45
TBT-26-S	7/17/98 11.23	7/22/98 8:50
TBT-27-S	7/17/98 11:54	7/22/98 9:20
TBT-28-S	7/17/98 12:31	7/22/98 9:40
TBT-29-S	7/17/98 15:48	7/22/98 10:20
TBT-30-S	7/17/98 16:22	7/22/98 8:30
TBT-31-S	7/17/98 14:29	7/22/98 9:40
TBT-32-S	7/17/98 13:51	7/21/98 12:20
TBT-33-S	7/17/98 15:08	7/20/98 15:45
TBT-34-S	7/17/98 13:16	7/20/98 15:15
TBT-35-S	7/15/98 9:55	7/20/98 11:05
TBT-36-S	7/15/98 14:35	7/22/98 10:40
TBT-37-S	7/16/98 13:20	7/22/98 10:20
TBT-38-S	7/17/98 12:30	7/22/98 8:35

Rosa Environmental and Geotechnical Laboratory, LLC

QA Summary, TBT Re-extractions

Sample No.	Date/Time Sampled	Date/Time Extracted
TBT-12-S	7/16/98 10:35	7/30/98 9:20
TBT-15-S	7/16/98 13:55	7/28/98 12:55
TBT-16-S	7/16/98 14:30	7/28/98 14:10
TBT-17-S	7/16/98 15:00	7/29/98 14:50
TBT-18-S	7/16/98 15:45	7/29/98 10:20
TBT-19-S	7/16/98 16:45	7/29/98 9:45
TBT-20-S	7/16/98 16:45	7/29/98 14:00

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	7/15/98
Sample Matrix:	Water	**Date Received:**	7/18/98
		Date Extracted:	7/21/98
		Date Analyzed:	7/28/98

Butyltins in Porewater
Units ug/L (ppb)

	Analyte	**Tributyltin**
	Method Reporting Limit	0 01
Sample Name	**Lab Code**	
TBT-01-PD	K9804760-001	0 02
98626	K9804760-002	ND
TBT-02-PT	K9804760-003	0.48
TBT-36-PD	K9804760-004	0.19
TBT-35-PD	K9804760-005	0 15
TBT-08-PT	K9804760-006	0 38
TBT-02-PD	K9804760-007	0.38
TBT-08-PD	K9804760-008	0.21
Method Blank	K980721-WB	ND

Approved By: Jay Date 8-3-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	7/16/98
Sample Matrix:	Water	**Date Received:**	7/18/98
		Date Extracted:	7/22/98
		Date Analyzed:	7/29/98

Butyltins in Porewater
Units ug/L (ppb)

	Analyte	**Tributyltin**
	Method Reporting Limit	0 01
Sample Name	**Lab Code**	
TBT-35-PT	K9804760-009	0.28
TBT-01-PT	K9804760-010	0.06
TBT-36-PT	K9804760-011	0.26
TBT-03-PD	K9804760-012	0.45
TBT-05-PD	K9804760-013	0.16
TBT-04-PD	K9804760-014	0.15
TBT-05-PT	K9804760-015	0.22
TBT-04-PT	K9804760-016	0.29
TBT-03-PT	K9804760-017	0.51
Method Blank	K980722-WB	ND

Approved By. _____ Date 8-3-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	7/17/98
Sample Matrix:	Water	**Date Received:**	7/18/98
		Date Extracted:	7/23/98
		Date Analyzed:	7/29/98

Butyltins in Porewater
Units ug/L (ppb)

	Analyte:	**Tributyltin**
	Method Reporting Limit:	0 01
Sample Name	**Lab Code**	
TBT-06-PT	K9804760-018	0.30
TBT-06-PD	K9804760-019	0.11
TBT-07-PT	K9804760-020	0.16
TBT-07-PD	K9804760-021	0.13
TBT-09-PT	K9804760-022	0.27
TBT-09-PD	K9804760-023	0.21
TBT-10-PT	K9804760-024	0 01
TBT-10-PD	K9804760-025	0 01
Method Blank	K980723-WB	ND

Approved By: _____ Date 8-3-98

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804760
Date Collected: 7/15/98
Date Received: 7/18/98
Date Extracted: 7/21/98
Date Analyzed: 7/28/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-01-PD	K9804760-001	53	60
98626	K9804760-002	61	75
TBT-02-PT	K9804760-003	57	47
TBT-36-PD	K9804760-004	64	75
TBT-35-PD	K9804760-005	57	58
TBT-08-PT	K9804760-006	61	47
TBT-02-PD	K9804760-007	54	50
TBT-08-PD	K9804760-008	63	52
TBT-35-PD	K9804760-005MS	62	60
TBT-35-PD	K9804760-005DMS	65	60
Lab Control Sample	K980721-WL	55	62
Method Blank	K980721-WB	50	65
CAS Acceptance Limits:		20-113	20-133

Approved By: _____ Date: 8-3-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	7/16/98
Sample Matrix:	Water	**Date Received:**	7/18/98
		Date Extracted:	7/22/98
		Date Analyzed:	7/28-29/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-35-PT	K9804760-009	64	71
TBT-01-PT	K9804760-010	109	104
TBT-36-PT	K9804760-011	75	65
TBT-03-PD	K9804760-012	77	56
TBT-05-PD	K9804760-013	81	69
TBT-04-PD	K9804760-014	81	62
TBT-05-PT	K9804760-015	80	62
TBT-04-PT	K9804760-016	81	72
TBT-03-PT	K9804760-017	73	48
Lab Control Sample	K980722-WL	87	73
Lab Control Sample	K980722-WL2	86	75
Method Blank	K980722-WB	83	99
CAS Acceptance Limits:		20-113	20-133

Approved By: _____ Date: 8-3-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804760
Date Collected: 7/17/98
Date Received: 7/18/98
Date Extracted: 7/23/98
Date Analyzed: 7/29/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-06-PT	K9804760-018	52	62
TBT-06-PD	K9804760-019	33	57
TBT-07-PT	K9804760-020	56	70
TBT-07-PD	K9804760-021	54	55
TBT-09-PT	K9804760-022	60	55
TBT-09-PD	K9804760-023	78	61
TBT-10-PT	K9804760-024	58	58
TBT-10-PD	K9804760-025	60	60
Lab Control Sample	K980723-WL	52	68
Lab Control Sample	K980723-WL2	49	70
Method Blank	K980723-WB	47	61
CAS Acceptance Limits.		20-113	20-133

Approved By: _____ Date. 8-3-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	7/15/98
Sample Matrix:	Water	**Date Received:**	7/18/98
		Date Extracted:	7/21/98
		Date Analyzed:	7/28/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins in Porewater
Units ug/L (ppb)

Sample Name. TBT-35-PD
Lab Code: K9804760-005

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
Analyte	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**
Tributyltin	0.25	0 25	0.15	0.40	0.47(A)	100	128	23-127	16

A Outside acceptance limits, see case narrative

Approved By _____ Date: 8-3-98

DMS1SOTS/060194
04760SVG VN1 - dms 7/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	7/21/98
		Date Analyzed:	7/28/98

Laboratory Control Sample Summary
Butyltins in Porewater
Units: ug/L (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	0.25	0.18	72	20-138

Approved By. _____ Date. 8.3.98

LCSOTS/060194
04760SVG VN1 - LCS 7/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	7/22/98
		Date Analyzed:	7/28/98

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
Butyltins in Porewater
Units: ug/L (ppb)

	True Value		Result		Percent Recovery			
Analyte	LCS	DLCS	LCS	DLCS	LCS	DLCS	CAS Acceptance Limits	**Relative Percent Difference**
Tributyltin	0.25	0.25	0.23	0.23	92	92	20-138	<1

Approved By: _____ Date. 8-3-98

DLCS/032395
04760SVG VN2 - DLCS 7/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804760
Project:	WSOU TBT Study	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	7/23/98
		Date Analyzed:	7/29/98

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
Butyltins in Porewater
Units. ug/L (ppb)

	True Value		Result		Percent Recovery			
Analyte	LCS	DLCS	LCS	DLCS	LCS	DLCS	CAS Acceptance Limits	**Relative Percent Difference**
Tributyltin	0.25	0 25	0.17	0.18	68	72	20-138	6

Approved By. _____ Date 8.3.98

DLCS/032395
04760SVG VN3 - DLCS 7/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804760
Calibration Date: 7/28/98
Date Analyzed: 7/28-29/98

Continuing Calibration Verification (CCV) Summary
Butyltins in Porewater
Butyltins-GC
Units. µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tributyltin	500	536	107	572	114	571	114	584	117

Approved By: _____ Date: 8-3-98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804760
Calibration Date: 7/28/98
Date Analyzed: 7/28-29/98

Continuing Calibration Blank (CCB) Summary
Butyltins in Porewater
Butyltins-GC
Units: µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tributyltin	0.01	ND	ND	ND	ND

Approved By: _____ Date: 8-3-98

I&CCBMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	EVS Environmental Consultants	**Service Request No.:**	K9804815
Project:	WSOU TBT Study	**Date Received:**	7/21/98
Sample Matrix:	Water		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for sample(s) designated for Tier III data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), Initial/Continuing Calibration Verification Standards (ICV/CCV), and Initial/Continuing Calibration Blanks (ICB/CCB).

All EPA recommended holding times have been met for analyses in this sample delivery group.

The following difficulties were experienced during analysis of this batch:

Due to an error during the sample preparation steps for the TBT analysis of samples TBT-15, 16, 17, 18, 19 and 20, the sample extracts were lost. Additional pore waters were received for these samples on 7/31/98 and will be reported under separate cover (K9805084).

The Matrix Spike (MS) recoveries of TBT for samples TBT-34-PT and TBT-32-PT were outside the normal CAS control limits because of suspected matrix interference. Recovery of TBT in the LCS was acceptable and all surrogate recoveries were within control limits indicating that the analysis was within control. No further corrective action was taken.

Approved by CAH **Date** 8/6/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804815
Project:	WSOU TBT Study	**Date Collected:**	7/17/98
Sample Matrix:	Water	**Date Received:**	7/21/98
		Date Extracted:	7/23/98
		Date Analyzed:	7/29/98

Butyltins in Porewater
Units ug/L (ppb)

		Analyte	**Tributyltin**
		Method Reporting Limit.	0 01
Sample Name	**Lab Code**		
TBT-11-PT	K9804815-001		0.10
TBT-11-PD	K9804815-002		0.07
TBT-12-PT	K9804815-003		0 51
TBT-12-PD	K9804815-004		0 24
TBT-13-PT	K9804815-005		0.47
TBT-13-PD	K9804815-006		0.37
TBT-14-PT	K9804815-007		0.58
TBT-14-PD	K9804815-008		0 31
TBT-37-PT	K9804815-009		0.85
TBT-37-PD	K9804815-010		0 58
Method Blank	K980723-SB		ND

Approved By: Wanda Neuneker Date. 8-5-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804815
Project:	WSOU TBT Study	**Date Collected:**	7/18/98
Sample Matrix:	Water	**Date Received:**	7/21/98
		Date Extracted:	7/24/98
		Date Analyzed:	7/30/98

Butyltins in Porewater
Units: ug/L (ppb)

	Analyte:	**Tributyltin**
	Method Reporting Limit	0.01
Sample Name	**Lab Code**	
TBT-21-PT	K9804815-023	0.51
TBT-21-PD	K9804815-024	0.38
TBT-22-PT	K9804815-025	0.29
TBT-22-PD	K9804815-026	0.09
TBT-23-PT	K9804815-027	0.24
TBT-23-PD	K9804815-028	0.14
TBT-24-PT	K9804815-029	0.33
TBT-24-PD	K9804815-030	0.14
Method Blank	K980724-SB	ND

Approved By _____ Date: 8-5-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804815
Project:	WSOU TBT Study	**Date Collected:**	7/19/98
Sample Matrix:	Water	**Date Received:**	7/21/98
		Date Extracted:	7/25/98
		Date Analyzed:	7/30/98

Butyltins in Porewater
Units: ug/L (ppb)

	Analyte:	**Tributyltin**
	Method Reporting Limit:	0 01
Sample Name	**Lab Code**	
TBT-25-PT	K9804815-031	0.44
TBT-25-PD	K9804815-032	0.26
TBT-26-PT	K9804815-033	0.17
TBT-26-PD	K9804815-034	0 13
TBT-27-PT	K9804815-035	0.97
TBT-27-PD	K9804815-036	0.71
TBT-28-PT	K9804815-037	0 74
TBT-28-PD	K9804815-038	0 64
TBT-34-PT	K9804815-039	0.19
TBT-34-PD	K9804815-040	0 14
TBT-32-PD	K9804815-042	0 28
TBT-31-PT	K9804815-043	1 50
TBT-31-PD	K9804815-044	1.49
TBT-33-PT	K9804815-045	0.11
TBT-33-PD	K9804815-046	0.09
TBT-29-PT	K9804815-047	1.87
Method Blank	K980725-SB	ND

Approved By _____ Date: 8-5-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9804815
Project:	WSOU TBT Study	**Date Collected:**	7/19/98
Sample Matrix:	Water	**Date Received:**	7/21/98
		Date Extracted:	7/26/98
		Date Analyzed:	7/30-31/98

Butyltins in Porewater
Units: ug/L (ppb)

	Analyte:	**Tributyltin**
	Method Reporting Limit:	0 01
Sample Name	**Lab Code**	
TBT-32-PT	K9804815-041	0.35
TBT-29-PD	K9804815-048	1.29
TBT-30-PT	K9804815-049	0.90
TBT-30-PD	K9804815-050	0.76
TBT-38-PT	K9804815-051	0.64
TBT-38-PD	K9804815-052	0.51
TBT-LCS-PT	K9804815-053	0.12
TBT-LCS-PD	K9804815-054	0.11
Method Blank	K980726-SB	ND

Approved By: _____ Date: 8-5-98

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804815
Date Collected: 7/17/98
Date Received: 7/21/98
Date Extracted: 7/23/98
Date Analyzed: 7/29/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-11-PT	K9804815-001	71	65
TBT-11-PD	K9804815-002	62	60
TBT-12-PT	K9804815-003	63	53
TBT-12-PD	K9804815-004	60	65
TBT-13-PT	K9804815-005	56	53
TBT-13-PD	K9804815-006	58	47
TBT-14-PT	K9804815-007	59	52
TBT-14-PD	K9804815-008	52	52
TBT-37-PT	K9804815-009	58	47
TBT-37-PD	K9804815-010	79	71
Lab Control Sample	K980723-SL	52	68
Lab Control Sample	K980723-SL2	49	70
Method Blank	K980723-SB	47	61
CAS Acceptance Limits:		20-113	20-133

Approved By: Linda Neuneker Date: 8-5-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804815
Date Collected: 7/18/98
Date Received: 7/21/98
Date Extracted: 7/24/98
Date Analyzed: 7/30/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-21-PT	K9804815-023	84	72
TBT-21-PD	K9804815-024	83	82
TBT-22-PT	K9804815-025	74	74
TBT-22-PD	K9804815-026	70	76
TBT-23-PT	K9804815-027	70	72
TBT-23-PD	K9804815-028	64	73
TBT-24-PT	K9804815-029	74	66
TBT-24-PD	K9804815-030	86	79
Lab Control Sample	K980724-SL	63	81
Method Blank	K980724-SB	70	73
CAS Acceptance Limits.		20-113	20-133

Approved By: _____ Date: 8-5-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804815
Date Collected: 7/19/98
Date Received: 7/21/98
Date Extracted: 7/25/98
Date Analyzed: 7/30/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-25-PT	K9804815-031	87	56
TBT-25-PD	K9804815-032	41	51
TBT-26-PT	K9804815-033	59	63
TBT-26-PD	K9804815-034	62	66
TBT-27-PT	K9804815-035	91	59
TBT-27-PD	K9804815-036	67	59
TBT-28-PT	K9804815-037	83	56
TBT-28-PD	K9804815-038	94	64
TBT-34-PT	K9804815-039	77	67
TBT-34-PD	K9804815-040	53	61
TBT-32-PD	K9804815-042	83	75
TBT-31-PT	K9804815-043	84	69
TBT-31-PD	K9804815-044	91	86
TBT-33-PT	K9804815-045	97	90
TBT-33-PD	K9804815-046	91	89
TBT-29-PT	K9804815-047	77	80
TBT-34-PT	K9804815-039MS	70	90
TBT-34-PT	K9804815-039DMS	68	75
Lab Control Sample	K980725-SL	63	84
Method Blank	K980725-SB	46	60
	CAS Acceptance Limits	20-113	20-133

Approved By: _____ Date 8-5-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804815
Date Collected: 7/19/98
Date Received: 7/21/98
Date Extracted: 7/26/98
Date Analyzed: 7/30-31/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-32-PT	K9804815-041	68	65
TBT-29-PD	K9804815-048	64	72
TBT-30-PT	K9804815-049	72	67
TBT-30-PD	K9804815-050	70	59
TBT-38-PT	K9804815-051	77	60
TBT-38-PD	K9804815-052	93	61
TBT-LCS-PT	K9804815-053	82	50
TBT-LCS-PD	K9804815-054	74	70
TBT-32-PT	K9804815-041MS	72	81
TBT-32-PT	K9804815-041DMS	70	80
Lab Control Sample	K980726-SL	47	57
Method Blank	K980726-SB	76	70
CAS Acceptance Limits		20-113	20-133

Approved By: _____ Date: 8-5-98

SUR2/102194
04815SVG VN3 - sur 8/5/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804815
Date Collected: 7/19/98
Date Received: 7/21/98
Date Extracted: 7/25/98
Date Analyzed: 7/30/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins in Porewater
Units: ug/L (ppb)

Sample Name: TBT-34-PT
Lab Code: K9804815-039

Analyte	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference
Tributyltin	0.29	0.29	0.19	0.68	0.78	169(A)	203(A)	23-127	14

A Outside acceptance limits; see case narrative

Approved By. _____ Date: 8-5-98

DMS1SOTS/060194
04815SVG VN2 - dms 8/5/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804815
Project:	WSOU TBT Study	**Date Collected:**	7/19/98
Sample Matrix:	Water	**Date Received:**	7/21/98
		Date Extracted:	7/26/98
		Date Analyzed:	7/31/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins in Porewater
Units ug/L (ppb)

Sample Name: TBT-32-PT
Lab Code K9804815-041

	Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent
Analyte	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**
Tributyltin	0.37	0.37	0.35	0.95	0 86	162(A)	138(A)	23-127	10

A Outside acceptance limits, see case narrative

Approved By. _____ Date: 8-5-98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
LCS Matrix: Water

Service Request: K9804815
Date Collected: NA
Date Received: NA
Date Extracted: 7/23/98
Date Analyzed: 7/29/98

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
Butyltins in Porewater
Units: ug/L (ppb)

Analyte	True Value		Result		Percent Recovery		CAS Acceptance Limits	Relative Percent Difference
	LCS	DLCS	LCS	DLCS	LCS	DLCS		
Tributyltin	0.25	0.25	0.17	0.18	68	72	20-138	6

Approved By: Wanda Neuneker Date: 8-5-98

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DLCS/032395
04815SVG JGI - DLCS 7/29/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804815
Project:	WSOU TBT Study	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Extracted:	7/24/98
		Date Analyzed:	7/30/98

Laboratory Control Sample Summary
Butyltins in Porewater
Units: ug/L (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	0.25	0.19	76	20-138

Approved By: _____ Date: 8-5-98

LCSOTS/060194
04815SVG VN1 - LCS 8/5/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
LCS Matrix: Water

Service Request: K9804815
Date Collected: NA
Date Received: NA
Date Extracted: 7/25/98
Date Analyzed: 7/30/98

Laboratory Control Sample Summary
Butyltins in Porewater
Units ug/L (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	0.25	0.21	84	20-138

Approved By: _____ Date: 8-5-98

LCSOTS/060194
04815SVG VN2 - LCS 8/5/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
LCS Matrix: Water

Service Request: K9804815
Date Collected: NA
Date Received: NA
Date Extracted: 7/26/98
Date Analyzed: 7/30/98

Laboratory Control Sample Summary
Butyltins in Porewater
Units: ug/L (ppb)

Analyte	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Tributyltin	0 25	0.12	48	20-138

Approved By: _____ Date: 8-5-98

LCSOTS/060194
04815SVG VN3 - LCS 8/5/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804815
Calibration Date: 7/28/98
Date Analyzed: 7/29/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Butyltins-GC
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tri-n-butyltin	500	561	112	571	114	584	117	565	113

Approved By: Wanda Neuneker Date: 8-5-98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804815
Calibration Date: 7/28/98
Date Analyzed: 7/29/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Butyltins-GC
Units: µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tributyltin	0 01	ND	ND	ND	ND

Approved By Sonda Neuneker Date 8-5-98

I&CCBMRL/120594

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804815
Calibration Date: 7/28/98
Date Analyzed: 7/30/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Butyltins-GC
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tributyltin	500	568	114	601	120	611	122	598	120

Approved By: _____ Date: 8-5-98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804815
Calibration Date: 7/28/98
Date Analyzed: 7/31/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Butyltins-GC
Units. µg/L (ppb)

Analyte	True Value	CCV5 Result	Percent Recovery	CCV6 Result	Percent Recovery
Tributyltin	500	616	123	638	128

Approved By: _____ Date 8-5-98

CCV 5-8/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study

Service Request: K9804815
Calibration Date: 7/28/98
Date Analyzed: 7/30/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Butyltins-GC
Units µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tributyltin	0.01	ND	ND	ND	ND

Approved By _____ Date. 8-5-98

I&CCBMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9804815
Project:	WSOU TBT Study	**Calibration Date:**	7/28/98
		Date Analyzed:	7/31/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Butyltins-GC
Units µg/L (ppb)

Analyte	MRL	CCB5 Result	CCB6 Result
Tributyltin	0 01	ND	ND

Approved By _____ Date: 8-5-98

I&CCBMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804937
Date Collected: 7/20-22/98
Date Received: 7/24/98
Date Extracted: NA
Date Analyzed: 8/4/98

Carbon, Total Organic (TOC)
EPA Method 415.1
Units mg/L (ppm)

Sample Name	Lab Code	MRL	Result
TBT-01-TOC	K9804937-001	0.5	13 8
TBT-02-TOC	K9804937-003	0.5	10 5
TBT-03-TOC	K9804937-005	0 5	24.7
TBT-04-TOC	K9804937-007	0 5	19 6
TBT-05-TOC	K9804937-010	0 5	14 8
TBT-06-TOC	K9804937-011	0 5	15.9
TBT-07-TOC	K9804937-013	0 5	11.0
TBT-08-TOC	K9804937-015	0 5	15 2
TBT-09-TOC	K9804937-017	0 5	12 6
TBT-10-TOC	K9804937-019	0 5	7 8
TBT-11-TOC	K9804937-021	0.5	21.2
TBT-12-TOC	K9804937-023	0.5	18.9
TBT-13-TOC	K9804937-025	0.5	8.8
TBT-14-TOC	K9804937-027	0 5	16 9
TBT-15-TOC	K9804937-029	0 5	13 3
TBT-16-TOC	K9804937-031	0 5	15 0
TBT-17-TOC	K9804937-033	0 5	8 4
TBT-18-TOC	K9804937-035	0 5	15 4
TBT-19-TOC	K9804937-037	0 5	8 5
TBT-20-TOC	K9804937-039	0.5	16 6
TBT-21-TOC	K9804937-041	0 5	15.7
TBT-22-TOC	K9804937-043	0 5	32 7
TBT-23-TOC	K9804937-045	0 5	14 6
TBT-24-TOC	K9804937-047	0 5	18.7
TBT-25-TOC	K9804937-049	0.5	39 9

Approved By: _____ Date: 8/10/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804937
Date Collected: 7/20-22/98
Date Received: 7/24/98
Date Extracted: NA
Date Analyzed: 8/4/98

Carbon, Total Organic (TOC)
EPA Method 415 1
Units mg/L (ppm)

Sample Name	Lab Code	MRL	Result
TBT-26-TOC	K9804937-051	0.5	13 3
TBT-27-TOC	K9804937-053	0.5	14 3
TBT-28-TOC	K9804937-055	0.5	18 5
TBT-29-TOC	K9804937-057	0.5	10 7
TBT-30-TOC	K9804937-059	0.5	22 4
TBT-31-TOC	K9804937-061	0.5	15 1
TBT-32-TOC	K9804937-063	0.5	18 7
TBT-33-TOC	K9804937-065	0 5	8 0
TBT-34-TOC	K9804937-067	0 5	18 6
TBT-35-TOC	K9804937-069	0 5	24 0
TBT-36-TOC	K9804937-071	0 5	11 2
TBT-37-TOC	K9804937-073	0.5	24 3
TBT-38-TOC	K9804937-075	0 5	28 0
Method Blank-unfiltered	K9804937-078	0 5	1 8
Method Blank	K9804937-MB	0 5	ND

Approved By _____ Date 8/10/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804937
Date Collected: 7/20-22/98
Date Received: 7/24/98
Date Extracted: NA
Date Analyzed: 8/4/98

Carbon, Dissolved Organic (DOC)
EPA Method 415 1
Units mg/L (ppm)

Sample Name	Lab Code	MRL	Result
TBT-01-DOC	K9804937-002	0.5	10.2
TBT-02-DOC	K9804937-004	0 5	8 7
TBT-03-DOC	K9804937-006	0 5	19 7
TBT-04-DOC	K9804937-008	0.5	17 2
TBT-05-DOC	K9804937-009	0 5	12.9
TBT-06-DOC	K9804937-012	0.5	14 0
TBT-07-DOC	K9804937-014	0.5	12.5
TBT-08-DOC	K9804937-016	0 5	14.3
TBT-09-DOC	K9804937-018	0 5	12.7
TBT-10-DOC	K9804937-020	0 5	7 6
TBT-11-DOC	K9804937-022	0 5	12.2
TBT-12-DOC	K9804937-024	0.5	17.4
TBT-13-DOC	K9804937-026	0 5	7 4
TBT-14-DOC	K9804937-028	0 5	16 3
TBT-15-DOC	K9804937-030	0 5	11 4
TBT-16-DOC	K9804937-032	0 5	15 3
TBT-17-DOC	K9804937-034	0 5	8 9
TBT-18-DOC	K9804937-036	0 5	14 6
TBT-19-DOC	K9804937-038	0 5	7.7
TBT-20-DOC	K9804937-040	0 5	14.3
TBT-21-DOC	K9804937-042	0 5	13.8
TBT-22-DOC	K9804937-044	0 5	24.7
TBT-23-DOC	K9804937-046	0 5	14 1
TBT-24-DOC	K9804937-048	0.5	17 0
TBT-25-DOC	K9804937-050	0 5	32.9

Approved By _____ Date. 8/16/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804937
Date Collected: 7/20-22/98
Date Received: 7/24/98
Date Extracted: NA
Date Analyzed: 8/4/98

Carbon, Dissolved Organic (DOC)
EPA Method 415 1
Units mg/L (ppm)

Sample Name	Lab Code	MRL	Result
TBT-26-DOC	K9804937-052	0 5	13 1
TBT-27-DOC	K9804937-054	0 5	29 6
TBT-28-DOC	K9804937-056	0 5	17 4
TBT-29-DOC	K9804937-058	0 5	9 4
TBT-30-DOC	K9804937-060	0 5	30 0
TBT-31-DOC	K9804937-062	0 5	14 5
TBT-32-DOC	K9804937-064	0 5	16 4
TBT-33-DOC	K9804937-066	0 5	6 3
TBT-34-DOC	K9804937-068	0 5	14 4
TBT-35-DOC	K9804937-070	0 5	18 6
TBT-36-DOC	K9804937-072	0 5	11 1
TBT-37-DOC	K9804937-074	0 5	19 8
TBT-38-DOC	K9804937-076	0 5	22 4
Method Blank-filtered	K9804937-077	0 5	1 6
Method Blank	K9804937-MB	0 5	ND

Approved By _____ Date 8/10/98

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804937
Date Collected: 7/22/98
Date Received: 7/24/98
Date Analyzed: 8/4/98

Carbon, Total Organic (TOC)
EPA Method 415.1
Units mg/L (ppm)

LABORATORY CONTROL SAMPLE

		True Value	Measured Value	Percent Recovery
Source:	APG 1075 Lot #19321	48 0	48 4	101
	APG 1075 Lot #19321	48.0	49.3	103
	APG 1075 Lot #19321	48 0	49 6	103

CALIBRATION VERIFICATION STANDARD

	True Value	Measured Value	Percent Recovery
CCV 1 Result	25.0	24.5	98
CCV 2 Result	25 0	24.9	100
CCV 3 Result	25.0	24.9	100
CCV 4 Result	25 0	24 7	99
CCV 5 Result	25 0	25 2	101
CCV 6 Result	25 0	24.8	99

LABORATORY BLANK

	MRL	Blank Value
CCB 1 Result	0 5	ND
CCB 2 Result	0 5	ND
CCB 3 Result	0 5	ND
CCB 4 Result	0 5	ND
CCB 5 Result	0 5	ND
CCB 6 Result	0 5	ND

DUPLICATE ANALYSIS

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
TBT-03-TOC	K9804937-005D	0 5	24 7	24.8	24.8	< 1
TBT-20-TOC	K9804937-039D	0 5	16.6	16 1	16 4	3
TBT-33-TOC	K9804937-065D	0 5	8 0	7 7	7 8	4

MATRIX SPIKE ANALYSIS

Sample Name	Lab Code	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery
TBT-03-TOC	K9804937-005MS	0 5	125	24 7	155	104
TBT-20-TOC	K9804937-039MS	0 5	125	16.6	144	102
TBT-33-TOC	K9804937-065MS	0 5	50 0	8 0	60.2	104

Approved By _____ Date 8/10/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study
Sample Matrix: Water

Service Request: K9804937
Date Collected: 7/22/98
Date Received: 7/24/98
Date Analyzed: 8/4/98

Carbon, Dissolved Organic (DOC)
EPA Method 415 1
Units mg/L (ppm)

LABORATORY CONTROL SAMPLE

		True Value	Measured Value	Percent Recovery
Source.	APG 1075 Lot #19321	48 0	48.1	100
	APG 1075 Lot #19321	48 0	49.7	104
	APG 1075 Lot #19321	48 0	49 1	102

CALIBRATION VERIFICATION STANDARD

	True Value	Measured Value	Percent Recovery
CCV 8 Result	25 0	25 3	101
CCV 9 Result	25 0	24 5	98
CCV 10 Result	25 0	25.1	100
CCV 11 Result	25 0	25 0	100
CCV 12 Result	25 0	25 2	101
CCV 13 Result	25 0	24.8	99

LABORATORY BLANK

	MRL	Blank Value
CCB 8 Result	0 5	ND
CCB 9 Result	0 5	ND
CCB 10 Result	0 5	ND
CCB 11 Result	0 5	ND
CCB 12 Result	0 5	ND
CCB 13 Result	0 5	ND

DUPLICATE ANALYSIS

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
TBT-02-DOC	K9804937-004D	0 5	8 7	9 0	8 8	3
TBT-28-DOC	K9804937-056D	0 5	17 4	17 9	17 6	3
TBT-33-DOC	K9804937-066D	0 5	6 3	6 2	6 2	2

MATRIX SPIKE ANALYSIS

Sample Name	Lab Code	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery
TBT-02-DOC	K9804937-004MS	0 5	125	8 7	138	103
TBT-28-DOC	K9804937-056MS	0 5	50 0	17 4	69 4	104
TBT-33-DOC	K9804937-066MS	0 5	50 0	6 3	58 6	105

Approved By _____ Date: 8/14/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: WSOU TBT Study/1022-001
Sample Matrix: Water

Service Request: K9805084
Date Collected: 7/28/98
Date Received: 7/31/98
Date Extracted: 8/4/98
Date Analyzed: 8/8-9/98

Butyltins in Porewater
Units ug/L (ppb)

	Analyte.	**Tributyltin**
	Method Reporting Limit:	0 01
Sample Name	**Lab Code**	
TBT-15-PT/Re-Extract	K9805084-001	0 24
TBT-15-PD/Re-Extract	K9805084-002	0.13
TBT-16-PT/Re-Extract	K9805084-003	0.36
TBT-16-PD/Re-Extract	K9805084-004	0.44
TBT-17-PT/Re-Extract	K9805084-005	0.02
TBT-17-PD/Re-Extract	K9805084-006	0 02
TBT-18-PD/Re-Extract	K9805084-007	0 06
TBT-18-PT/Re-Extract	K9805084-008	0.08
TBT-19-PT/Re-Extract	K9805084-009	0.08
TBT-19-PD/Re-Extract	K9805084-010	0.06
TBT-20-PT/Re-Extract	K9805084-011	1 01
TBT-20-PD/Re-Extract	K9805084-012	0 41
TBT-12-PT/Re-Extract	K9805084-013	0 46
TBT-12-PD/Re-Extract	K9805084-014	0 37
Method Blank	K980804-SB	ND

Approved By: _____ Date: 8/12/98

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study/1022-001
Sample Matrix: Water

Service Request: K9805084
Date Collected: 7/28/98
Date Received: 7/31/98
Date Extracted: 8/4/98
Date Analyzed: 8/8-9/98

Surrogate Recovery Summary
Butyltins in Porewater

Sample Name	Lab Code	Percent Recovery Tripropyltin	Percent Recovery Tripentyltin
TBT-15-PT/Re-Extract	K9805084-001	80	68
TBT-15-PD/Re-Extract	K9805084-002	74	64
TBT-16-PT/Re-Extract	K9805084-003	75	62
TBT-16-PD/Re-Extract	K9805084-004	78	58
TBT-17-PT/Re-Extract	K9805084-005	80	80
TBT-17-PD/Re-Extract	K9805084-006	81	78
TBT-18-PD/Re-Extract	K9805084-007	84	74
TBT-18-PT/Re-Extract	K9805084-008	84	66
TBT-19-PT/Re-Extract	K9805084-009	84	72
TBT-19-PD/Re-Extract	K9805084-010	78	65
TBT-20-PT/Re-Extract	K9805084-011	81	94
TBT-20-PD/Re-Extract	K9805084-012	84	71
TBT-12-PT/Re-Extract	K9805084-013	82	71
TBT-12-PD/Re-Extract	K9805084-014	76	68
Lab Control Sample	K980804-LCS	93	72
Lab Control Sample	K980804-DLCS	87	84
Method Blank	K980804-SB	93	78
CAS Acceptance Limits.		20-113	20-133

Approved By: _____ Date: 8/12/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study/1022-001
LCS Matrix: Water

Service Request: K9805084
Date Collected: NA
Date Received: NA
Date Extracted: 8/4/98
Date Analyzed: 8/8/98

Laboratory Control Sample/Duplicate Laboratory Control Sample Summary
Butyltins in Porewater
Units: ug/L (ppb)

Analyte	True Value		Result		Percent Recovery		CAS Acceptance Limits	Relative Percent Difference
	LCS	DLCS	LCS	DLCS	LCS	DLCS		
Tributyltin	0.25	0.25	0 20	0 24	80	96	20-138	18

Approved By: _____ Date: 8/12/98

DLCS/032395
05084SVG JG1 - DLCS 8/12/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: WSOU TBT Study/1022-001

Service Request: K9805084
Calibration Date: 8/1/98
Date Analyzed: 8/8-9/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Butyltins-GC
Units: µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result
Tributyltin	0.01	ND	ND	ND

Approved By _____ Date 8/12/98

I&CCBMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9805084
Project:	WSOU TBT Study/1022-001	**Calibration Date:**	8/1/98
		Date Analyzed:	8/8-9/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Butyltins-GC
Units. µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery
Tributyltin	500	533	107	531	106	530	106

Approved By: _____ Date 8/12/98

CCV 1-4/042795

05084SVG JG1 - CCV 1-4 8/12/98

CHAIN OF CUSTODY RECORD & LABORATORY ANALYSIS REQUEST

Date: 7/17/98 Page: 1 of: ____

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

2 of 2 1000

Client Company: EVS Consultants
Address: 200 W Mercer St. suite 403 Seattle Wa 98119
CONTACT: Tim Hammecmeister
Phone: (206) 217-9337
Project Name. WSDOT TBT Study
Project Number: PO#

Sample receipt
Shipped by: ____
Number of coolers in shipment: ____
Custody seals present/intact: ____
Cooler temperatures: ____
Bottle seals present/intact: ____
Client contact w/discrepancies: ____

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservative (HCl)
1	TBT-01-PD	7/15/98	7:50pm	Pore Water	1		X	7ml
2	98626	7/16/98	10:08pm	Pore Water	1		X	7ml
3	TBT-02-PT	7/15/98	5:52pm	Pore Water	1		X	4ml
4	TBT-36-PD	7/16/98	11:30pm	Pore Water	1		X	7ml
5	TBT-35-PD	7/16/98	1:50pm	Pore Water	1		X	4ml
6	TBT-08-PT	7/16/98	8:02pm	Pore Water	1		X	2ml
7	TBT-02-PD	7/15/98	8:00pm	Pore Water	1		X	8ml
8	TBT-08-PD	7/16/98	11:35pm	Pore Water	1		X	7ml
9	TBT-35-PT	7/16/98	1:50pm	Pore Water	1		X	1ml
10	TBT-01-PT	7/15/98	7:40pm	Pore Water	1		X	2ml

Turnaround requested:
Known hazardous content/rating:
Special instructions/comments:
Volume preservative Listed in last column

Relinquished by:	Relinquished by	Relinquished by
Printed name: Carmen Guerra	Printed name	Printed name.
Company: REGL	Company.	Company
Date: 7/17/98 Time:	Date: Time:	Date. Time:
Received by:	Received by:	Received by.
Printed name. lori k. Hamm	Printed name:	Printed name:
Company: CAS	Company:	Company:
Date. 18 JUL 98 Time: 1000	Date: Time:	Date: Time.

CHAIN OF CUSTODY RECORD & LABORATORY ANALYSIS REQUEST

Date: 07/17/98 Page: 2 of: 3

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

001018

Client Company: EVS Consultants
Address: 200 W Mercer St, Suite 403
Seattle, Wa 98119

CONTACT Tim Nanniermeister
Phone: (206) 217-9337
Project Name: WSOU TBT Study
Project Number: PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservative (HCL)
1	TBT-36-PT	07/16/98	11:10pm	Pore Water	1		X	2ml
2	TBT-03-PD	07/16/98	3:00pm	Pore Water	1		X	4ml
3	TBT-05-PD	07/16/98	11:20pm	Pore Water	1		X	2ml
4	TBT-04-PD	07/16/98	4:00pm	Pore Water	1		X	4ml
5	TBT-05-PT	07/16/98	8:15pm	Pore Water	1		X	2ml
6	TBT-04-PT	07/16/98	3:45pm	Pore Water	1		X	1ml
7	TBT-03-PT	07/16/98	2:25pm	Pore Water	1		X	1ml
8	TBT-06-PT	07/17/98	13:25	Pore Water	1		X	1ml
9	TBT-06-PD	07/17/98	13:20	Pore Water	1		X	4ml
10	TBT-07-PT	07/17/98	13:25	Pore Water	1		X	1ml

Turnaround requested:
Known hazardous content/rating:
Special instructions/comments:
Volume preservative listed in last column

Relinquished by	Relinquished by	Relinquished by
Printed name: SD DUNWOOD	Printed name	Printed name
Company: REGL	Company	Company
Date: 07/17/98 Time:	Date: Time:	Date: Time
Received by:	Received by:	Received by:
Printed name: Eric K. Hawn	Printed name	Printed name
Company: CAS-K	Company	Company
Date: 18-Jul 98 Time: 1000	Date Time	Date: Time

CHAIN OF CUSTODY RECORD &
LABORATORY ANALYSIS REQUEST

Date: 07/17/98 Page: 3 of: 3

REGL Job ID 1022-051

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

6000

Client Company: EVS Consultants
Address: 200 W Mercer St. suite 403
Seattle, Wa 98119

CONTACT: Tim Hammermeister
Phone: (206) 217-9337
Project Name: WSDOT TBT Study
Project Number: PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservative (HCL)
1	TBT-07-PD	07/17/98	13:30	Pore water	1		X	4 ml
2	TBT-09-PT		14:10		1		X	1 ml
3	TBT-09-PD		14:30		1		X	4 ml
4	TBT-10-PT		14:10		1		X	1 ml
5	TBT-10-PD		14:15		1		X	5 ml
6								
7								
8								
9								
10								

Turnaround requested:
Known hazardous content/rating.

Special instructions/comments:
Volume Preservative listed in last Column

Relinquished by:	Relinquished by	Relinquished by:
Printed name: Carmen Guerra	Printed name	Printed name:
Company: REGL	Company	Company
Date: 7/17/98 Time:	Date: Time.	Date. Time.
Received by:	Received by	Received by:
Printed name: Lan K. Hawn	Printed name:	Printed name:
Company: CAS-K	Company:	Company:
Date: 20 JUL 98 Time: 1000	Date. Time.	Date: Time:

(K4811)

HAIN OF CUSTODY RECORD & ABORATORY ANALYSIS REQUEST

ate: 07/20/98 Page: 1 of: 6

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

ient Company. EVS Consultants
ddress 200 W Mercer Street
Suite 403
Seattle, WA 98119
ONTACT Tim Hammermeister
hone (206) 217-2337
oject Name. WSOU TBT Study
oject Number: PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies.

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservative (HCl)
1	TBT-11-PT	07/19/98	16.00	Porewater	1		X	HCl
2	TBT-11-PD		16:05				X	HCl
3	TBT-12-PT		18 10				X	HCl
4	TBT-12-PD		18.30				X	HCl
5	TBT-13-PT		18 10				X	HCl
6	TBT-13-PD		18-30				X	HCl
7	TBT-14-PT	07/19/98	12:00				X	HCl
8	TBT-14-PD		12:00				X	HCl
9	TBT-37-PT		13:05				X	HCl
10	TBT-37-PD		13.05				X	HCl

urnaround requested
nown hazardous content/rating

pecial instructions/comments:
Cooler = 1.1

02000

Relinquished by	Relinquished by	Relinquished by
Printed name: J DUNNIGAN	Printed name	Printed name
Company: REGL	Company	Company:
Date: 07/20/98 Time: 15:20	Date Time	Date Time
Received by:	Received by:	Received by:
Printed name: Tom K. Hamm	Printed name	Printed name
Company: CAS-K	Company	Company
Date: 21 JUL 98 Time: 1000	Date Time	Date Time

Limits of Liability: REGL will perform requested services in accordance with appropriate methodology following Standard Operating Procedures, REGL Quality Assurance Program or REGL approved Project Quality Assurance Plans The total liability of REGL, its members, employees or successors arising out of or in connection with the requested services shall not exceed the invoiced amount of said services The acceptance by the CLIENT of a proposal for services by REGL releases REGL from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order, or co-signed agreement between REGL and the CLIENT

HAIN OF CUSTODY RECORD & ABORATORY ANALYSIS REQUEST

ate: 07/20/98 Page: 2 of: 6

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

ient Company: EVS Consultants
ddress:
ONTACT: Tim Hammermeister
hone:
oject Name. WSOU TBT Study
oject Number: PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservation: HCL
1	TBT-15-PT	07/18/98	13.10	PoreWater	1		X	1ml
2	TBT-15-PD		13:10				X	4ml
3	TBT-16-PT		14:00				X	1ml
4	TBT-16-PD		14:00				X	4ml
5	TBT-17-PT		12:20				X	1ml
6	TBT-17-PD		12.20		3		X (MS/MSD done 07/20/98 15:30)	4ml
7	TBT-18-PT		14:00		1		X	1ml
8	TBT-18-PD		14:00				X	4ml
9	TBT-19-PT		14:55				X	1ml
10	TBT-19-PD		14:55				X	4ml

urnaround requested:
nown hazardous content/rating:
pecial instructions/comments:
cooler = 0.7

2000

Relinquished by:	Relinquished by:	Relinquished by
Printed name: S DUNNIHOO	Printed name:	Printed name:
Company: REGL	Company:	Company:
Date: 07/20/98 Time: 15:20	Date: Time:	Date: Time:
Received by:	Received by:	Received by:
Printed name: Mark. Hamm	Printed name:	Printed name:
Company: PAS-K	Company:	Company:
Date: 21 JULY 98 Time: 1000	Date: Time:	Date: Time:

HAIN OF CUSTODY RECORD & ABORATORY ANALYSIS REQUEST

ate: 07/20/98 Page: 3 of: 6

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

ient Company: EVS Consultants
ddress:
ONTACT: Tim Hammermeister
hone
oject Name: WSDOT TBT Study
oject Number: PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservative (HCl)
1	TBT-20-PT	7/17/98	1620	Pore Water	1		X	1ml
2	TBT-20 PD	7/17/98	1650	"	1		X	4ml
3	TBT-21-PT	7/18/98	1505	"	1		X	4ml
4	TBT-21-PD	7/18/98	1505	"	1		X	4ml
5	TBT-22-PT	7/19/98	755	"	1		X	2ml
6	TBT-22-PD	7/19/98	8:20	"	1		X	8ml
7	TBT-23-PT	7/19/98	8:55	"	1		X	2ml
8	TBT-23-PD	7/19/98	9:05	"	1		X	8ml
9	TBT-24-PT	7/19/98	910	"	1		X	2ml
10	TBT-24-PD	7/19/98	11:00	"	1		X	8ml

urnaround requested:
nown hazardous content/rating.

pecial instructions/comments.

ooler = 1.1

82000

Relinquished by:	Relinquished by	Relinquished by
Printed name: S D DUNNIHOO	Printed name	Printed name.
Company: REGL	Company:	Company:
Date: 07/20/98 Time: 15:20	Date: Time:	Date Time:
Received by:	Received by:	Received by:
Printed name: Lori K. Hamm	Printed name:	Printed name:
Company: CAS-K	Company:	Company:
Date: 21 JUL 98 Time: 1000	Date: Time:	Date: Time

Limits of Liability: REGL will perform requested services in accordance with appropriate methodology following Standard Operating Procedures, REGL Quality Assurance Program or REGL approved Project Quality Assurance Plans. The total liability of REGL, its members, employees or successors arising out of or in connection with the requested services shall not exceed the invoiced amount of said services. The acceptance by the CLIENT of a proposal for services by REGL releases REGL from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order, or co-signed agreement between REGL and the CLIENT.

HAIN OF CUSTODY RECORD &
ABORATORY ANALYSIS REQUEST

ate: 07/20/98 Page: 4 of: 6

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

lient Company. EVS Consultants
ddress:
ONTACT: Tim Hammermeister
hone
oject Name: WSOU TBT Study
oject Number PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT		HOL
1	TBT-25-PT	07/19/98	8.40	Porewater	1		X		2wd
2	TBT-25-PD		8:40				X		8wd
3	TBT-26-PT		13:00				X		2wd
4	TBT-26-PD		13:10				X		8wd
5	TBT-27-PT		14:15				X		2wd
6	TBT-27-PD		14:25				X		8wd
7	TBT-28-PT		13:10				X		2wd
8	TBT-28-PD		13:30				X		8wd
9	TBT-34-PT		16:05				X	(MS/MSD fraction shipping 07/21/98)	2wd
10	TBT-34-PD		16:15		1		X		8wd

urnaround requested:
nown hazardous content/rating:
pecial instructions/comments:
Cooler = 1.1

Relinquished by:	Relinquished by	Relinquished by
Printed name: S. DUNNIHOO	Printed name.	Printed name.
Company REGL	Company	Company:
Date. 07/20/98 Time 15:20	Date: Time:	Date Time
Received by:	Received by:	Received by:
Printed name: Lori K. Hamm	Printed name.	Printed name:
Company LAS-K	Company:	Company:
Date. 21 JULY 98 Time: 1000	Date. Time:	Date. Time.

00029

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CHAIN OF CUSTODY RECORD & LABORATORY ANALYSIS REQUEST

Date: 07/20/98 Page: 5 of: 6

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

Client Company: EVS Consultants
Address:
CONTACT: Tim Hammermeister
Phone
Project Name: WSDOT TBT Study
Project Number: PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservative (HCl)
1	TBT-32-PT	07/19/98	~~16:45~~ Rejected	Porewater	1		X	2 mL
2	TBT-32-PD		17:00				X	5 mL
3	TBT-31-PT		17:10				X	2 mL
4	TBT-31-PD		17:30				X	5 mL
5	TBT-33-PT		17:45				X	2 mL
6	TBT-33-PD		18:00				X	5 mL
7	TBT-29-PT		18:01				X	2 mL
8	TBT-29-PD		18:10				X	5 mL
9	TBT-30-PT		15:15				X	2 mL
10	TBT-30-PD	"	15:20	"	1		X	5 mL

Turnaround requested:
Known hazardous content/rating.

Special instructions/comments:
Cooler= -0.1

	Relinquished by	Relinquished by	Relinquished by
Printed name	S DUNNIGAN	Printed name	Printed name:
Company:	REGL	Company:	Company:
Date / Time	07/20/98 15:20	Date: Time:	Date Time
Received by:		Received by:	Received by:
Printed name:	Lori K. Hamm	Printed name:	Printed name
Company:	CAS-K	Company.	Company:
Date. Time.	21 JULY 98 1000	Date Time	Date: Time:

00030

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HAIN OF CUSTODY RECORD &
ABORATORY ANALYSIS REQUEST

ate: 07/20/98 Page: 6 of: 6

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

lient Company: EVS Consultants
ddress:
ONTACT: Tim Hammermeister
none.
roject Name: WSOU TBT Study
roject Number PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Preservative (HCl)
1	TBT-38-PT	07/19/98	14:40	Porewater	1		X	
2	TBT-38-PD	"	14.50	↓	1		X	
3	TBT-LCS-PT	7/20/98	11:00		1		X	
4	TBT-LCS-PD	"	11:00		1		X	
5	TBT-35-PD	7/20/98	14:00	↓	2		X	(MS/MSD Fraction. Sample shipped earlier)
6								
7								
8								
9								
10								

urnaround requested:
nown hazardous content/rating.

pecial instructions/comments:

TBT-33-PT MS/MSD Fraction will be comp 07/21/98 (ship date)

0033

Relinquished by	Relinquished by	Relinquished by
Printed name: SDUNNIGAN	Printed name.	Printed name:
Company. REGL	Company:	Company:
Date 07/20/98 Time 15:20	Date: Time:	Date Time
Received by:	Received by.	Received by.
Printed name: Lori K. Hawn	Printed name.	Printed name:
Company: CAS	Company.	Company:
Date 21 JULY 98 Time. 1000	Date Time.	Date. Time.

Limits of Liability: REGL will perform requested services in accordance with appropriate methodology following Standard Operating Procedures, REGL Quality Assurance Program or REGL approved Project Quality Assurance Plans The total liability of REGL, its members, employees or successors arising out of or in connection with the requested services shall not exceed the invoiced amount of said services The acceptance by the CLIENT of a proposal for services by REGL releases REGL from any liability in excess thereof, not withstanding any provision to the [redacted] between REGL and the CLIENT

CHAIN OF CUSTODY RECORD & LABORATORY ANALYSIS REQUEST

Date: 7/21/98 Page: 1 of: 1

REGL Job ID 1022-001 (K4812)

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

Client Company. EVS Consultants
Address 2200 W Mercer St. Suite 403
Seattle, Wa. 98119
CONTACT Tim Hammermeister
Phone (206) 217-9337
Project Name WSCU TBT Study
Project Number PO#

Sample receipt
Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT	Analysis Requested: NWTPH-Dx
1	TBT-32-PT	7/21/98		Pore Water	12	-	X	X
2	TBT-34-PT	7/21/98	9:30	Pore Water	2	-	X	X
3								
4								
5								
6								
7								
8								
9								
10								

Turnaround requested
Known hazardous content/rating
Special instructions/comments:

Relinquished by	Relinquished by	Relinquished by
Printed name: H. Benny	Printed name	Printed name.
Company: REGL	Company	Company
Date: 7/21/98 Time: 1615	Date Time	Date Time
Received by:	Received by.	Received by:
Printed name: Lan K. Ham	Printed name:	Printed name
Company: CAS-K	Company.	Company:
Date: 22 JUL 98 Time: 1000	Date. Time:	Date Time.

2000

CHAIN OF CUSTODY RECORD &
LABORATORY ANALYSIS REQUEST

Date: 7/31/98 Page: 1 of: 2

REGL Job ID 1022-001

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

V980584

Client Company	EVS Consultants
Address:	200 W. Mercer St, Suite 403
	Seattle WA 98119
CONTACT	Tim Hammermeister
Phone:	(206) 217-9337
Project Name:	WSDOT TBT Study
Project Number:	PO# ~

Sample receipt

Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT									000310	Volume HCl Preservative
1	TBT-15-PT / Re-extract	7/28/98	16:30	Rinsewater	1	—	X										1mL
2	TBT-15-PD " "	7/28/98	16:30	" "	1	—	X										4mL
3	TBT-16-PT " "	7/28/98	16:30	" "	1	—	X										1mL
4	TBT-16-PD " "	7/28/98	17:00	" "	1	—	X										4mL
5	TBT-17-PT " "	7/29/98	17:10	" "	1	—	X										1mL
6	TBT-17-PD " "	7/29/98	17:30	" "	1	—	X										4mL
7	TBT-18-PD " "	7/29/98	13:40	" "	1	—	X										4mL
8	TBT-18-PT " "	7/29/98	13:40	" "	1	—	X										1mL
9	TBT-19-PT " "	7/29/98	13:40	" "	1	—	X										1mL
10	TBT-19-PD " "	7/29/98	14:30	" "	1	—	X										4mL

Turnaround requested:
Known hazardous content/rating
Special instructions/comments

Relinquished by	Relinquished by	Relinquished by
Printed name: Eileen Parnell	Printed name.	Printed name
Company: REGL	Company	Company
Date: 7/30/98 Time: 11.45	Date Time	Date Time
Received by:	Received by	Received by
Printed name.	Printed name	Printed name:
Company:	Company	Company
Date: 7/31/98 Time: 1000	Date: Time:	Date. Time.

CHAIN OF CUSTODY RECORD & LABORATORY ANALYSIS REQUEST

Date: 7/30/98 Page: 2 of: 2

REGL Job ID 1022-CD1

Rosa Environmental & Geotechnical Laboratory, LLC
400 Ninth Avenue North, Suite B. Seattle, WA 98109
PH (206) 287-9122 FAX (206) 654-0540

C980584

Client Company:	EVS Consultants
Address:	200 W Mercer St, Suite 403 Seattle, WA 98119
CONTACT:	Tim Hammermeister
Phone:	(206) 217-9337
Project Name:	Lusom TBT Study
Project Number:	PO#

Sample receipt

Shipped by:
Number of coolers in shipment:
Custody seals present/intact:
Cooler temperatures:
Bottle seals present/intact:
Client contact w/discrepancies:

	Sample ID	Date	Time	Matrix	#Cont	LAB#	Analysis Requested: TBT									00011	Volume-H Co. Preservative
1	TBT 10-PT/Re-extract	7/29/98	17:00	Porewater	1		X										1mL
2	TBT-20-PD " "	7/29/98	17 SD	" "	1		X										4mL
3	TBT-12-PT " "	7/30/98	11:25	" "	1		X										1mL
4	TBT-12-PD " "	7/30/98	11:25	" "	1		X										4mL
5																	
6																	
7																	
8																	
9																	
10																	

Turnaround requested

Known hazardous content/rating

Special instructions/comments.

Relinquished by:	Eileen Parnell	Relinquished by	Relinquished by.
Printed name.	Eileen Parnell	Printed name	Printed name
Company	REGL	Company	Company
Date.	7/30/98 Time: 11:45	Date Time.	Date. Time
Received by:	Tim Hammermeister	Received by	Received by
Printed name:	Tim Hammermeister	Printed name	Printed name:
Company.	EVS	Company:	Company
Date.	7/31/98 Time: 1000	Date: Time:	Date: Time:

APPENDIX D

Bioaccumulation Results

Battelle
Pacific Northwest Division

Marine Sciences Laboratory
1529 West Sequim Bay Road
Sequim, Washington 98382-9099
Telephone (206) 683-4151
Facsimile (206) 681-3699

November 23, 1998

Tim Hammermeister
Solutions Inc.
200 West Mercer Street
Suite 403
Seattle, WA 98119

Dear Tim:

Enclosed are the test results for the work performed under the TBT Bioaccumulation Testing project. Included are termination results of the sediment tests performed with the marine bivalve *Macoma nasuta* and marine polychaete, *Nephtys caecoides*, the daily observations, and water quality data. A brief description of the project, the methods used, and a summary of test results follows. Also included in this packet is a copy of the raw data sheets, reference toxicant curves, and an electronic copy of the test data (IBM Excel 97).

Project Plan

The *M nasuta/N. caecoides* bioaccumulation test was used to estimate the TBT bioaccumulation potential of 17 marine sediments from Todd Shipyard in Elliot Bay, Washington. Three Puget Sound reference sediments were tested concurrently with the test sediments. The bioaccumulation test is typically performed as a 28-d exposure (EPA/USACE 1991). However, because TBT may not reach equilibrium in tissues within 28 days, the test period was extended to 45 days.

Methods

Sediment samples were collected from the Todd Shipyard by EVS Environmental Consultants personnel and delivered to the Battelle/Marine Sciences Laboratory (MSL) between July 15 and July 17, 1998. Macoma native control sediment was collected from Sequim Bay, Washington by MSL personnel. Nephtys native control sediment was collected from Dillon Beach, California by Brezina and Associates. Native control sediment was pressed-seived through 1.0-mm Nytex mesh to remove large debris and potential competitors. All samples were received in good condition and were placed in a 4°C cold room until they were needed for testing.

The 45-d bioaccumulation test followed procedures outlined in Battelle SOP MSL-065-00 and EPA (1989) Tests were initiated on August 25, 1998 and included three Puget Sound reference sediments, a native sediment (negative) control and reference toxicant tests with copper (positive control).

The bivalve *M. nasuta* and the polychaete *N. caecoides* were used to evaluate the potential bioaccumulation of contaminants from dredged material. *N. caecoides* were supplied by John Brezina and Associates, Dillon Beach, California Upon receipt at the laboratory, *N. caecoides* were placed in holding trays of control sediment, and the trays were partially submerged on a holding table supplied with temperature-controlled seawater at approximately 15°C and 30‰. No temperature or salinity acclimation was necessary, since water quality at receipt was similar to test conditions. *N. caecoides* were held for 15 days before test initiation. *M. nasuta* were collected and held in flowing Discovery Bay seawater by Johnston and Gunstone, Port Townsend, Washington. Water quality (temperature, dissolved oxygen, pH, and salinity) was monitored throughout the holding period and test organisms were allowed to feed on sediment detritus during the holding period.

The bioaccumulation tests were 45-d flow-through exposures to sediment, followed by a 24-h depuration period that allowed the organisms to void their digestive tracts of sediment. *M. nasuta* and *N. caecoides* were tested together in 10-gal flow-through aquaria. Animals were exposed to one replicate of each sediment treatment, with the exception of three randomly selected treatments, as well as the native controls, were tested with five replicates. Each chamber contained 30 *M nasuta* and 45 *N. caecoides*. Water quality parameters (temperature, DO, pH, and salinity) were measured in all replicates at test initiation, in at least one replicate per treatment daily, and in all replicates at test termination. Water quality parameters for the two species were:

	M. nasuta/N. caecoides
Temperature	15°C±2°C
DO	> 60% saturation (5.0 mg/L @ 15°C, 30‰)
pH	7.8±0.5
Salinity	30‰±2l
Flow Rate	125±10 mL/min

Aeration was provided to all test chambers to maintain consistency in DO concentrations among test chambers. Water quality, organism behavior (e.g., burrowing activity, feeding), and organism mortality were recorded daily. Dead organisms were removed daily. Flow rates were measured daily in all chambers. Once weekly, 175-mL of test or control sediment was added to each respective test chamber. The purpose of these supplements was to maintain potential contaminant doses and to provide additional nutrients during the 45-day test.

At the end of the 45-day testing period, *M. nasuta* and *N caecoides* were placed in clean, flowing seawater for 24 h, after which the tissues were transferred into the appropriate chemistry jars for analyses. All tissue samples were frozen immediately and stored at <-20°C.

Water-only reference toxicant tests (96-h) were also performed using copper sulfate in six geometrically increasing concentrations plus control seawater. The exposures were conducted using a test volume of 5 L in static 9.5-L (2.5-gal) aquaria. One replicate of each concentration was tested, each containing 10 organisms. Water quality parameters were monitored at the same frequency and maintained within the same limits as the 45-d test, except that there were no flow rates. The *M. nasuta* reference toxicant test was conducted with treatments of 0, 0.31, 0.63, 1.25, 2.5, 5.0, and 10.0 mg/L Cu; the *N. caecoides* test was conducted with treatments of 0, 0.05, 0.075, 0.10, 0.20, 0.30, and 0.40 mg/L Cu.

Results

A summary of TBT Bioaccumulation Study test results and water quality observations are presented in Tables 1, 2, and 3. Termination results by replicate and daily observations are presented in Appendixes A and B. Reference toxicant test results and water quality observations are presented in Appendixes C and D.

Survival in the native-sediment controls for *M. nasuta* was 95%. Although there are no acceptability criteria for bioaccumulation-test controls, the control survival observed suggests that the test organisms were in good health throughout the test. Macoma survival was greater than 90% in all test treatments.

Mean survival in the *N. caecoides* native-control sediment was 66%. However, mean survival in the test treatments was generally greater than 80%. Thus, we feel that the *N. caecoides* the test treatments were in good health and that the poor survival observed in the native sediment was isolated to the controls.

The reduced mean survival in the controls may be due in part to poor survival in one replicate (Replicate 1: 33% survival). If this replicate is considered an outlier, mean control survival was 74%. However, survival in replicates 2 and 5 was 60% and 53%, respectively, suggesting that another factor may have influenced control survival. TOC quantity and quality in the native control sediment, combined with the extended exposure period, may have affected control survival. The native control sediment used in this study was a sandy sediment with a TOC content of 0.07%. Previous TOC-spiked sediment studies at the MSL (Pinza et al. 1996) determined a minimum optimal-TOC level for *N. caecoides* of 0.75% TOC. Below this value, survival was reduced (Figure 1). The TOC-content for the native control was well below the 0.75% threshold and was maintained for a longer exposure duration (45 days vs. 28 days). It is important to note that sufficient tissues for all treatments were obtained from the bioaccumulation exposures.

All water quality parameters were within acceptable ranges throughout the test. The water-only reference toxicant tests with copper resulted in an LC_{50} of 2.05 mg/L Cu for *M. nasuta,* which was within the controls limits established at the MSL (0.28 mg/L -2.8 mg/L Cu). The copper LC_{50} for *N. caecoides* was 0.10 mg/L Cu, which was similar to reported values [0.09 mg/L to 0.16 mg/L Cu (EPA 1984)].

If you have any further questions about this data report, please call me at (360) 681-3661.

Sincerely,

William W. Gardiner
Research Scientist
Marine Sciences Laboratory

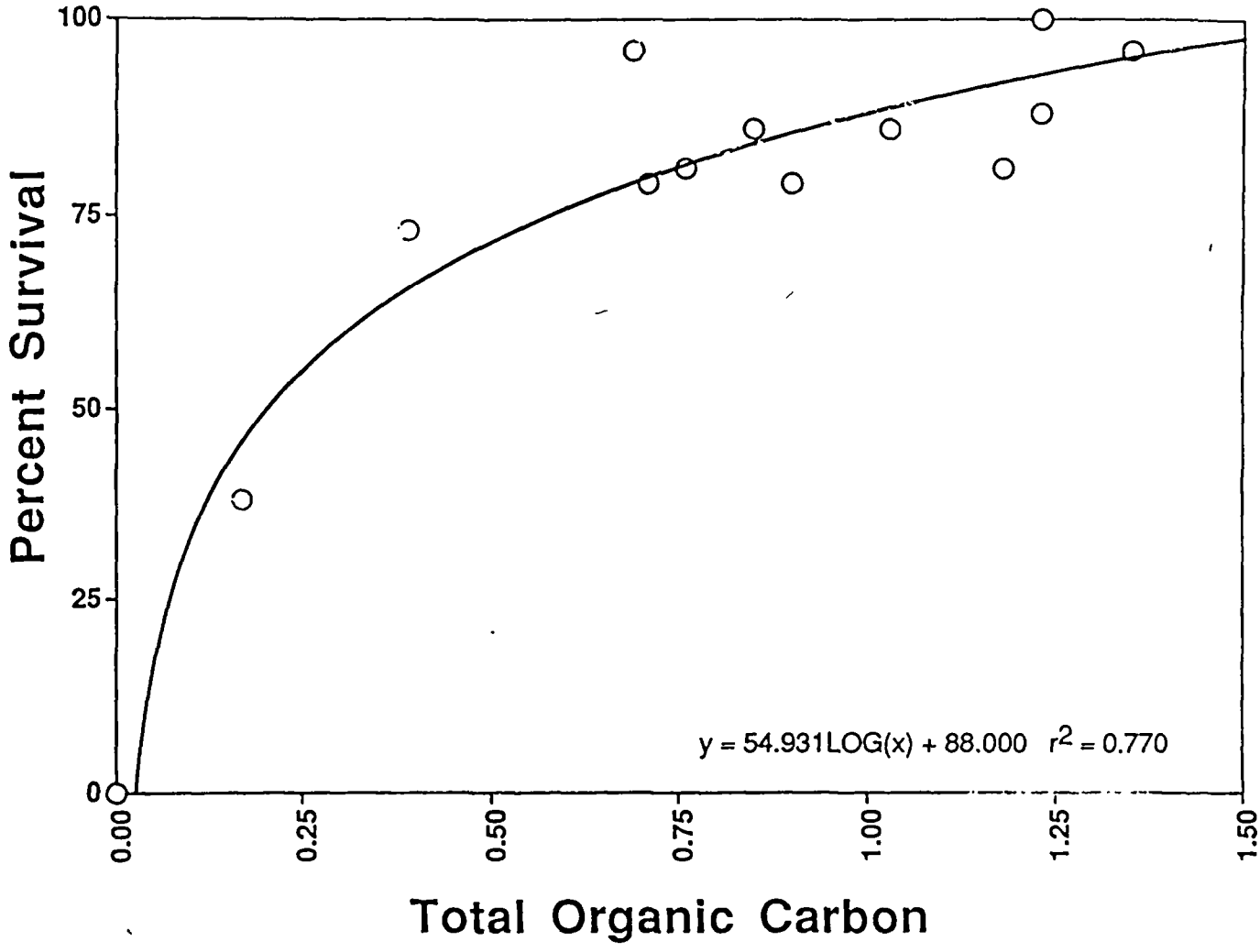

Figure 1. *Nephthys caecoides* survival in control sediment spiked with varying concentrations of TOC.

Table 1. Summary of Survival of *Macoma nasuta* During 45-d TBT-Bioaccumulation Test

Treatment	Mean Percent Survival	SD
Macoma Control	95.3	4.5
TBT-2	100.0	NA
TBT-4	96.7	NA
TBT-5	96.7	NA
TBT-7	96.7	NA
TBT-8	100.0	NA
TBT-9	100.0	NA
TBT-11	100.0	NA
TBT-12	93.3	NA
TBT-13	93.3	7.8
TBT-14	96.7	NA
TBT-15	96.7	NA
TBT-18	96.7	NA
TBT-19	98.0	3.0
TBT-20	96.7	NA
TBT-21	93.3	NA
TBT-22	93.3	NA
TBT-24	100.0	NA
TBT-26	100.0	NA
TBT-28	96.7	NA
TBT-30	96.7	5.8

NA: Not applicable, one replicate.

Table 2. Summary of Survival of *Nephtys caecoides* During 45-d TBT-Bioaccumulation Test

Treatment	Mean Percent Survival	SD
Nephtys Control	65.8	25.1
TBT-2	95.6	NA
TBT-4	88.9	NA
TBT-5	88.9	NA
TBT-7	88.9	NA
TBT-8	68.9	NA
TBT-9	86.7	NA
TBT-11	82.2	NA
TBT-12	88.9	NA
TBT-13	87.1	7.4
TBT-14	88.9	NA
TBT-15	64.4	NA
TBT-18	88.9	NA
TBT-19	87.6	8.0
TBT-20	68.9	NA
TBT-21	77.8	NA
TBT-22	64.4	NA
TBT-24	91.1	NA
TBT-26	91.1	NA
TBT-28	91.1	NA
TBT-30	88.9	4.2

Not applicable. One replicate.

Table 3. Water Quality Summary for *M. nasuta* and *N. caecoides* 45-d TBT-Bioaccumulation Test

Treatment	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13°C	17°C	7.30	8.30	>4.0	NA	28.0	32.0
Macoma Control	14.3	15.8	7.68	8.07	6.1	7.9	32.0	32.0
Nephtys Control	14.4	15.7	7.70	8.09	6.3	8.3	32.0	32.0
TBT-2	14.4	16.1	7.73	8.05	6.4	7.7	32.0	32.0
TBT-4	14.4	15.7	7.70	8.06	6.0	8.0	32.0	32.0
TBT-5	14.5	16.0	7.67	8.04	6.1	7.7	32.0	32.0
TBT-7	14.4	15.8	7.70	8.06	6.3	8.0	32.0	32.0
TBT-8	14.4	15.8	7.67	8.08	6.0	8.1	32.0	32.0
TBT-9	14.5	15.9	7.74	8.06	6.4	7.7	32.0	32.0
TBT-11	14.3	15.7	7.72	8.06	5.5	7.9	32.0	32.0
TBT-12	14.3	15.9	7.70	8.06	6.0	7.8	32.0	32.0
TBT-13	14.4	15.8	7.68	8.06	6.1	7.8	32.0	32.0
TBT-14	14.4	15.7	7.70	8.05	6.8	7.8	32.0	32.0
TBT-15	14.3	15.6	7.66	8.06	6.4	7.9	32.0	32.0
TBT-18	14.4	15.9	7.70	8.06	6.6	7.8	32.0	32.0
TBT-19	14.4	16.2	7.67	8.06	5.5	7.8	32.0	32.0
TBT-20	14.4	15.6	7.68	8.06	6.4	7.9	32.0	32.0
TBT-21	14.4	15.7	7.71	8.06	6.3	7.9	32.0	32.0
TBT-22	14.4	15.7	7.67	8.07	6.2	8.1	32.0	32.0
TBT-24	14.4	15.7	7.68	8.06	6.3	8.0	32.0	32.0
TBT-26	14.4	15.8	7.69	8.06	6.3	7.8	32.0	32.0
TBT-28	14.4	15.8	7.68	8.06	6.2	7.9	32.0	32.0
TBT-30	14.3	15.9	7.70	8.06	6.3	7.9	32.0	32.0

Appendix A1. Survival of *Macoma nasuta* During 45-d TBT-Bioaccumulation Test

Treatment	MSL Code	Replicate	Position	Number Surviving	Number Dead	Number Missing	Percent Survival	Mean Percent Survival	SD
Control	17	1	16	30	0	0	100.0		
Control	17	2	39	30	0	0	100.0		
Control	17	3	40	28	2	0	93.3		
Control	17	4	35	28	0	2	93.3		
Control	17	5	1	27	2	1	90.0	95.3	4.5
2	22	1	31	30	0	0	100.0	100.0	NA
4	18	1	19	29	1	0	96.7	96 7	NA
5	21	1	15	29	1	0	96.7	96.7	NA
7	2	1	27	29	0	1	96.7	96 7	NA
8	16	1	17	30	0	0	100.0	100.0	NA
9	7	1	30	30	0	0	100.0	100.0	NA
11	20	1	18	30	0	0	100.0	100.0	NA
12	1	1	13	28	0	2	93.3	93.3	NA
13	12	1	28	30	0	0	100.0		
13	12	2	22	24	1	5	80.0		
13	12	3	25	28	1	1	93.3		
13	12	4	2	29	1	0	96.7		
13	12	5	36	29	0	1	96.7	93.3	7.8
14	9	1	38	29	1	0	96.7	96.7	NA
15	13	1	3	29	1	0	96.7	96.7	NA
18	6	1	42	29	0	1	96.7	96.7	NA
19	14	1	10	30	0	0	100 0		
19	14	2	14	30	0	0	100 0		
19	14	3	29	28	1	1	93.3		
19	14	4	34	30	0	0	100 0		
19	14	5	32	29	0	1	96.7	98.0	3.0
20	10	1	4	29	1	0	96.7	96.7	NA
21	8	1	5	28	0	2	93.3	93.3	NA
22	15	1	7	28	0	2	93.3	93.3	NA
24	19	1	8	30	0	0	100.0	100.0	NA
26	3	1	37	30	0	0	100.0	100.0	NA
28	4	1	9	29	1	0	96.7	96.7	NA
30	5	1	11	30	0	0	100 0		
30	5	2	12	29	0	1	96.7		
30	5	3	23	30	0	0	100 0		
30	5	4	26	30	0	0	100.0		
30	5	5	20	26	1	3	86.7	96.7	5.8

Appendix B1. Survival of *Nephtys caecoides* During 45-d TBT-Bioaccumulation Test

Treatment	MSL Code	Replicate	Position	Number Surviving	Number Dead	Number Missing	Percent Survival	Mean Percent Survival	SD
Control	11	1	6	15	0	30	33.3		
Control	11	2	33	27	0	18	60.0		
Control	11	3	24	41	0	4	91.1		
Control	11	4	21	41	0	4	91 1		
Control	11	5	41	24	0	21	53 3	65.8	25 1
2	22	1	31	43	0	2	95 6	95 6	NA
4	18	1	19	40	1	4	88.9	88.9	NA
5	21	1	15	40	0	5	88.9	88.9	NA
7	2	1	27	40	0	5	88.9	88.9	NA
8	16	1	17	31	3	11	68.9	68.9	NA
9	7	1	30	39	0	6	86.7	86.7	NA
11	20	1	18	37	0	8	82.2	82.2	NA
12	1	1	13	40	0	5	88.9	88.9	NA
13	12	1	28	39	0	6	86.7		
13	12	2	22	43	0	2	95.6		
13	12	3	25	41	0	4	91.1		
13	12	4	2	34	0	11	75.6		
13	12	5	36	39	0	6	86.7	87.1	7.4
14	9	1	38	40	0	5	88.9	88.9	NA
15	13	1	3	29	0	16	64.4	64 4	NA
18	6	1	42	40	0	5	88.9	88 9	NA
19	14	1	10	42	0	3	93.3		
19	14	2	14	35	0	10	77.8		
19	14	3	29	42	0	3	93.3		
19	14	4	34	42	0	3	93.3		
19	14	5	32	36	0	9	80.0	87.6	8.0
20	10	1	4	31	0	14	68.9	68.9	NA
21	8	1	5	35	0	10	77.8	77 8	NA
22	15	1	7	29	0	16	64.4	64.4	NA
24	19	1	8	41	0	4	91.1	91 1	NA
26	3	1	37	41	0	4	91.1	91.1	NA
28	4	1	9	41	0	4	91.1	91.1	NA
30	5	1	11	39	0	6	86.7		
30	5	2	12	42	0	3	93.3		
30	5	3	23	39	0	6	86.7		
30	5	4	26	42	0	3	93.3		
30	5	5	20	38	0	7	84.4	88.9	4.2

NA. Not applicable, only one replicate

Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 0							
31	2	Sed - 22	1	15.7	7.80	6.4	32.0
19	4	Sed - 18	1	15.6	7.77	6.0	32.0
15	5	Sed - 21	1	15.6	7.77	6.1	32.0
27	7	Sed - 2	1	15.5	7.80	6.5	32.0
17	8	Sed - 16	1	15.6	7.82	6.0	32.0
30	9	Sed - 7	1	15.6	7.81	6.4	32.0
18	11	Sed - 20	1	15.6	7.77	6.3	32.0
13	12	Sed - 1	1	15.6	7.80	6.0	32.0
28	13	Sed - 12	1	15.6	7.80	6.4	32.0
22	13	Sed - 12	2	15.7	7.77	6.3	32.0
25	13	Sed - 12	3	15.5	7.81	6.6	32.0
2	13	Sed - 12	4	15.5	7.77	6.3	32.0
36	13	Sed - 12	5	15.6	7.79	6.1	32.0
38	14	Sed - 9	1	15.7	7.80	6.2	32.0
3	15	Sed - 13	1	15.5	7 77	6.4	32.0
42	18	Sed - 6	1	15.6	7.82	6.6	32.0
10	19	Sed - 14	1	15.6	7.74	6.3	32.0
14	19	Sed - 14	2	15.6	7.71	5.5	32.0
29	19	Sed - 14	3	15.6	7.79	6.4	32.0
32	19	Sed - 14	5	15.6	7.79	6.5	32.0
34	19	Sed - 14	4	15.8	7.75	6.2	32.0
4	20	Sed - 10	1	15.6	7.77	6.4	32.0
5	21	Sed - 8	1	15.6	7.76	6.3	32.0
7	22	Sed - 15	1	15.5	7.78	6.3	32.0
8	24	Sed - 19	1	15.6	7.77	6.3	32.0
37	26	Sed - 3	1	15.7	7.82	6.3	32.0
9	28	Sed - 4	1	15.7	7.77	6.2	32 0
11	30	Sed - 5	1	15.5	7.79	6.3	32.0
12	30	Sed - 5	2	15.5	7.79	6.6	32.0
23	30	Sed - 5	3	15.6	7.81	6.6	32.0
26	30	Sed - 5	4	15.5	7.81	6.5	32.0
20	30	Sed - 5	5	15.7	7.80	6.4	32.0
16	Macoma Control	Sed - 17	1	15.6	7.80	6.2	32.0
39	Macoma Control	Sed - 17	2	15.7	7.82	6.3	32.0
40	Macoma Control	Sed - 17	3	15.6	7.83	6.5	32.0
35	Macoma Control	Sed - 17	4	15.6	7.81	6.1	32.0
1	Macoma Control	Sed - 17	5	15.5	7.74	6.2	32.0
6	Neanthes Control	Sed - 11	1	15.5	7.78	6.3	32.0
21	Neanthes Control	Sed - 11	4	15.7	7.81	6.3	32.0
24	Neanthes Control	Sed - 11	3	15.5	7.82	6.6	32.0
33	Neanthes Control	Sed - 11	2	15.6	7.82	6.3	32.0
41	Neanthes Control	Sed - 11	5	15.6	7 82	6.5	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 1							
31	2	Sed - 22	1	15.5	7.75	6.4	32.0
19	4	Sed - 18	1	15.3	7.73	6.3	32.0
15	5	Sed - 21	1	15.4	7.73	6.6	32.0
27	7	Sed - 2	1	15.4	7.74	6 6	32.0
17	8	Sed - 16	1	15.4	7.77	6 7	32.0
30	9	Sed - 7	1	15.3	7.78	6 9	32.0
18	11	Sed - 20	1	15.3	7.73	6.2	32.0
13	12	Sed - 1	1	15.3	7.76	6.6	32.0
28	13	Sed - 12	1	15.3	7.77	6.9	32.0
38	14	Sed - 9	1	15.3	7.76	6.8	32.0
3	15	Sed - 13	1	15.2	7.72	6.8	32.0
42	18	Sed - 6	1	15.3	7.77	6.9	32.0
10	19	Sed - 14	1	15.3	7.74	6.4	32 0
4	20	Sed - 10	1	15.2	7.75	6.9	32 0
5	21	Sed - 8	1	15.3	7.74	6.6	32.0
7	22	Sed - 15	1	15.3	7.74	6.2	32.0
8	24	Sed - 19	1	15.4	7.75	6.5	32.0
37	26	Sed - 3	1	15.3	7.77	6.7	32.0
9	28	Sed - 4	1	15.4	7.75	6.3	32.0
11	30	Sed - 5	1	15.4	7.75	6.5	32.0
16	Macoma Control	Sed - 17	1	15.4	7.76	6.7	32.0
6	Neanthes Control	Sed - 11	1	15.3	7.79	6.9	32.0
Day 2							
31	2	Sed - 22	1	15.3	7.78	6.7	32.0
15	5	Sed - 21	1	15.2	7.78	6.7	32.0
19	5	Sed - 21	1	15.1	7.77	6.4	32.0
27	7	Sed - 2	1	15.2	7.78	6.7	32 0
17	8	Sed - 16	1	15.3	7.80	6.8	32 0
30	9	Sed - 7	1	15.2	7.81	6.9	32 0
18	11	Sed - 20	1	15.1	7.77	6.5	32.0
13	12	Sed - 1	1	15.1	7.79	6.7	32.0
22	13	Sed - 12	2	15.2	7.79	6.6	32.0
38	14	Sed - 9	1	15.2	7.80	6.7	32.0
3	15	Sed - 13	1	15.2	7.77	6.8	32.0
42	18	Sed - 6	1	15.2	7.81	6 8	32 0
14	19	Sed - 14	2	15.1	7.80	6.9	32.0
4	20	Sed - 10	1	15.1	7.78	7.0	32.0
5	21	Sed - 8	1	15.2	7.78	6.9	32.0
7	22	Sed - 15	1	15.2	7.77	6.3	32.0
8	24	Sed - 19	1	15.2	7.80	6.7	32.0
37	26	Sed - 3	1	15.2	7.81	6.9	32.0
9	28	Sed - 4	1	15.2	7.78	6.4	32.0
12	30	Sed - 5	2	15.2	7.80	6.5	32.0
39	Macoma Control	Sed - 17	2	15.2	7.81	6.8	32.0
33	Neanthes Control	Sed - 11	2	15.1	7.85	7.0	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 3							
31	2	Sed - 22	1	15.3	7.80	6.6	32.0
19	4	Sed - 18	1	15.0	7.80	6.4	32.0
15	5	Sed - 21	1	15.1	7.81	6.8	32.0
27	7	Sed - 2	1	15.1	7.83	6.9	32.0
17	8	Sed - 16	1	15.1	7.82	6.8	32.0
30	9	Sed - 7	1	15.2	7.81	6.5	32.0
18	11	Sed - 20	1	14.9	7.73	5.5	32.0
13	12	Sed - 1	1	15.1	7.82	7.0	32.0
25	13	Sed - 12	3	15.0	7.81	6.8	32 0
38	14	Sed - 9	1	15.0	7.81	6.6	32.0
3	15	Sed - 13	1	15.1	7.76	6.7	32.0
42	18	Sed - 6	1	15.0	7.83	7.0	32.0
29	19	Sed - 14	3	15.2	7.84	7.0	32.0
4	20	Sed - 10	1	15.0	7.80	7.0	32.0
5	21	Sed - 8	1	14.9	7.80	6.8	32.0
7	22	Sed - 15	1	15.0	7.80	6.5	32.0
8	24	Sed - 19	1	15.1	7.80	6.6	32.0
37	26	Sed - 3	1	15.1	7.83	6.7	32.0
9	28	Sed - 4	1	15.1	7.80	6.4	32.0
23	30	Sed - 5	3	15.1	7.83	6.9	32.0
40	Macoma Control	Sed - 17	3	15.0	7.84	6.9	32.0
24	Neanthes Control	Sed - 11	3	15.1	7.87	7.2	32.0
Day 4							
31	2	Sed - 22	1	15.2	7.81	7.0	32.0
19	4	Sed - 18	1	15.1	7.80	6.9	32.0
27	7	Sed - 2	1	15.0	7.81	7 1	32.0
15	8	Sed - 21	1	15.1	7.80	7 1	32.0
17	8	Sed - 16	1	15 1	7.82	7.2	32 0
30	9	Sed - 7	1	15 2	7.83	7.2	32.0
18	11	Sed - 20	1	15.1	7.81	7.2	32.0
13	12	Sed - 1	1	15.1	7.82	7.0	32.0
2	13	Sed - 12	4	15.1	7.79	6.9	32.0
38	14	Sed - 9	1	15.1	7.82	7.2	32.0
3	15	Sed - 13	1	15.0	7.81	7.2	32.0
42	18	Sed - 6	1	15.1	7.82	7.2	32.0
34	19	Sed - 14	4	15.2	7.84	7.2	32.0
4	20	Sed - 10	1	15.0	7.82	7.3	32.0
5	21	Sed - 8	1	15.0	7.80	7.0	32.0
7	22	Sed - 15	1	15.1	7.81	7.1	32.0
8	24	Sed - 19	1	15.1	7.81	6.9	32.0
37	26	Sed - 3	1	15.1	7.82	7.1	32.0
9	28	Sed - 4	1	15.2	7.82	6.9	32.0
26	30	Sed - 5	4	15.0	7.83	7 3	32.0
35	Macoma Control	Sed - 17	4	15.2	7.83	7.0	32.0
21	Neanthes Control	Sed - 11	4	15.0	7.86	7.2	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 5							
31	2	Sed - 22	1	15.2	7.81	7.0	32 0
19	4	Sed - 18	1	15.1	7.80	6.8	32.0
15	5	Sed - 21	1	15.2	7.81	7.0	32.0
27	7	Sed - 2	1	15.1	7.81	7.0	32 0
17	8	Sed - 16	1	15.2	7.83	7.1	32.0
30	9	Sed - 7	1	15.2	7.82	7.2	32.0
18	11	Sed - 20	1	15.1	7.81	7.0	32.0
13	12	Sed - 1	1	15.2	7.82	7.0	32.0
36	13	Sed - 12	5	15.3	7.81	7.2	32.0
38	14	Sed - 9	1	15.2	7.82	7.1	32.0
3	15	Sed - 13	1	15.1	7.83	7.2	32.0
42	18	Sed - 6	1	15.1	7.83	7.2	32.0
32	19	Sed - 14	5	15.2	7.82	7.1	32.0
4	20	Sed - 10	1	15.1	7.83	7.3	32.0
5	21	Sed - 8	1	15.1	7.82	7.1	32.0
7	22	Sed - 15	1	15.1	7.83	7.1	32.0
8	24	Sed - 19	1	15.1	7.82	6.9	32.0
37	26	Sed - 3	1	15.3	7.82	7.1	32.0
9	28	Sed - 4	1	15.1	7.83	6.7	32.0
20	30	Sed - 5	5	15.1	7.84	7.2	32.0
1	Macoma Control	Sed - 17	5	15.0	7.83	7.0	32.0
41	Neanthes Control	Sed - 11	5	15.2	7.86	7.5	32.0
Day 6							
31	2	Sed - 22	1	15.2	7.85	7.1	32.0
19	4	Sed - 18	1	15.1	7.85	7.1	32.0
15	5	Sed - 21	1	15.2	7.85	7.2	32.0
27	7	Sed - 2	1	15.0	7.85	7.1	32.0
17	8	Sed - 16	1	15 1	7.87	7.3	32.0
10	9	Sed - 14	1	15.2	7.85	7.3	32.0
30	9	Sed - 7	1	15.1	7.87	7.3	32.0
18	11	Sed - 20	1	15.1	7.85	7.2	32.0
13	12	Sed - 1	1	15.2	7.86	7.3	32.0
28	13	Sed - 12	1	15.1	7.87	7.3	32.0
38	14	Sed - 9	1	15.1	7.85	7.0	32.0
3	15	Sed - 13	1	15.1	7.83	7.3	32.0
42	18	Sed - 6	1	15.1	7.85	7.2	32.0
4	20	Sed - 10	1	15.0	7.85	7.5	32.0
5	21	Sed - 8	1	15.0	7.85	7.3	32.0
7	22	Sed - 15	1	15.0	7.85	7.0	32 0
8	24	Sed - 19	1	15.1	7.85	7.1	32.0
37	26	Sed - 3	1	15.3	7.85	7.3	32.0
9	28	Sed - 4	1	15.2	7.86	7.3	32.0
11	30	Sed - 5	1	15.2	7.86	7.4	32.0
16	Macoma Control	Sed - 17	1	15.1	7.85	7.2	32.0
6	Neanthes Control	Sed - 11	1	15.1	7.88	7.5	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 7							
31	2	Sed - 22	1	15.4	7.92	7.4	32.0
19	4	Sed - 18	1	15.0	7.92	7.2	32.0
15	5	Sed - 21	1	15.2	7.91	7.1	32.0
27	7	Sed - 2	1	15.1	7.92	7.3	32.0
17	8	Sed - 16	1	15.1	7.93	7.3	32.0
30	9	Sed - 7	1	15.2	7.93	7.3	32.0
18	11	Sed - 20	1	15.0	7.92	7.2	32.0
13	12	Sed - 1	1	15.2	7.92	7 3	32.0
22	13	Sed - 12	2	15.1	7.93	7.3	32.0
38	14	Sed - 9	1	15.1	7.92	7.4	32.0
3	15	Sed - 13	1	15.2	7.95	7.5	32.0
42	18	Sed - 6	1	15.1	7.92	7.3	32.0
14	19	Sed - 14	2	15.3	7.94	7.3	32.0
4	20	Sed - 10	1	15.0	7.93	7.5	32.0
5	21	Sed - 8	1	15.0	7.94	7.5	32.0
7	22	Sed - 15	1	15.1	7.95	7.4	32.0
8	24	Sed - 19	1	15.1	7.93	7.3	32.0
37	26	Sed - 3	1	15.3	7.92	7.4	32.0
9	28	Sed - 4	1	15.2	7.94	7.4	32.0
12	30	Sed - 5	2	15.3	7.92	7.1	32.0
39	Macoma Control	Sed - 17	2	15.2	7.94	7.3	32.0
33	Neanthes Control	Sed - 11	2	15.3	7.98	7.7	32.0
Day 8							
31	2	Sed - 22	1	15.2	7.93	7.3	32.0
19	4	Sed - 18	1	15.0	7.93	7.3	32.0
15	5	Sed - 21	1	15.1	7.92	7.3	32.0
27	7	Sed - 2	1	15.1	7.93	7.3	32 0
17	8	Sed - 16	1	15 1	7.94	7.5	32.0
30	9	Sed - 7	1	15.2	7.94	7.5	32.0
18	11	Sed - 20	1	15.1	7.94	7.5	32.0
13	12	Sed - 1	1	15.1	7.94	7.4	32.0
25	13	Sed - 12	3	15.1	7.94	7.5	32.0
38	14	Sed - 9	1	15.1	7.92	7.4	32.0
3	15	Sed - 13	1	15.1	7.95	7.5	32.0
42	18	Sed - 6	1	15.1	7.93	7.5	32.0
29	19	Sed - 14	3	15.1	7.94	7.5	32.0
4	20	Sed - 10	1	14.9	7.95	7.6	32.0
5	21	Sed - 8	1	14.9	7.95	7.5	32.0
7	22	Sed - 15	1	15.0	7.94	7.3	32.0
8	24	Sed - 19	1	15.1	7.94	7.5	32.0
37	26	Sed - 3	1	15.2	7.93	7.4	32.0
9	28	Sed - 4	1	15.1	7.94	7.4	32 0
23	30	Sed - 5	3	15.1	7.95	7.9	32.0
40	Macoma Control	Sed - 17	3	15.1	7.94	7.6	32 0
24	Neanthes Control	Sed - 11	3	15.1	7.98	7.8	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 9							
31	2	Sed - 22	1	16.1	7.97	7.7	32.0
19	4	Sed - 18	1	15.7	7.97	8.0	32.0
15	5	Sed - 21	1	16.0	7.96	7.7	32.0
27	7	Sed - 2	1	15.8	7.99	8.0	32.0
17	8	Sed - 16	1	15.8	7.98	7.7	32.0
30	9	Sed - 7	1	15.9	7.97	7.7	32.0
18	11	Sed - 20	1	15.7	7.99	7.9	32.0
13	12	Sed - 1	1	15.9	7.97	7.8	32.0
2	13	Sed - 12	4	15.8	7.97	7.3	32.0
38	14	Sed - 9	1	15.7	7.97	7.8	32.0
3	15	Sed - 13	1	15.6	7.98	7.7	32.0
42	18	Sed - 6	1	15.9	7.97	7.8	32.0
34	19	Sed - 14	4	16.2	7.97	7.8	32.0
4	20	Sed - 10	1	15.6	7.97	7.7	32.0
5	21	Sed - 8	1	15.7	7.98	7.9	32.0
7	22	Sed - 15	1	15.7	8.00	8.1	32.0
8	24	Sed - 19	1	15.7	7.98	8.0	32.0
37	26	Sed - 3	1	15.8	7.97	7.8	32.0
9	28	Sed - 4	1	15.8	7.99	7.9	32.0
26	30	Sed - 5	4	15.9	7.98	7.9	32.0
35	Macoma Control	Sed - 17	4	15.8	7.99	7.9	32.0
21	Neanthes Control	Sed - 11	4	15.7	8.02	8.3	32.0
Day 10							
31	2	Sed - 22	1	15.1	8.01	7.5	32.0
19	4	Sed - 18	1	15.0	8.00	7.5	32 0
15	5	Sed - 21	1	15.1	8.00	7.5	32.0
27	7	Sed - 2	1	15 0	8 01	7 5	32 0
17	8	Sed - 16	1	15.0	8.02	7.5	32.0
30	9	Sed - 7	1	15 0	8.01	7.6	32.0
18	11	Sed - 20	1	15.0	8.01	7.5	32.0
13	12	Sed - 1	1	15.0	8.02	7.5	32.0
36	13	Sed - 12	5	15.2	8.01	7.8	32.0
38	14	Sed - 9	1	15.1	8.00	7.5	32.0
3	15	Sed - 13	1	14.9	8.01	7.6	32.0
42	18	Sed - 6	1	15.0	8.01	7.8	32.0
32	19	Sed - 14	5	15.2	8.01	7.6	32.0
4	20	Sed - 10	1	14.9	8.01	7.5	32.0
5	21	Sed - 8	1	14.9	8.01	7.7	32.0
7	22	Sed - 15	1	14.9	8.01	7.6	32.0
8	24	Sed - 19	1	15.0	8.02	7.7	32.0
37	26	Sed - 3	1	15.1	8.01	7.7	32.0
9	28	Sed - 4	1	15.0	8.01	7 5	32.0
20	30	Sed - 5	5	15.0	8.02	7.6	32.0
1	Macoma Control	Sed - 17	5	14.8	8.02	7.4	32.0
41	Neanthes Control	Sed - 11	5	15.0	8.05	7.9	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 11							
31	2	Sed - 22	1	14.9	8.05	7.6	32.0
19	4	Sed - 18	1	14.8	8.06	7.7	32.0
15	5	Sed - 21	1	14.9	8.04	7.6	32.0
27	7	Sed - 2	1	14.8	8.06	7.8	32 0
17	8	Sed - 16	1	14.8	8.08	7.7	32.0
30	9	Sed - 7	1	14.9	8.06	7.7	32.0
18	11	Sed - 20	1	14.8	8.06	7.8	32.0
13	12	Sed - 1	1	14.9	8.06	7.8	32.0
28	13	Sed - 12	1	14.8	8.06	7.8	32.0
38	14	Sed - 9	1	14.9	8.05	7.7	32.0
3	15	Sed - 13	1	14.7	8.06	7.9	32.0
42	18	Sed - 6	1	14.8	8.06	7.8	32.0
10	19	Sed - 14	1	14.8	8.06	7.8	32.0
4	20	Sed - 10	1	14 7	8.06	7.9	32.0
5	21	Sed - 8	1	14.7	8.06	7.9	32.0
7	22	Sed - 15	1	14.8	8.07	8.0	32.0
8	24	Sed - 19	1	14.8	8.06	7.9	32.0
37	26	Sed - 3	1	14.8	8.06	7.8	32.0
9	28	Sed - 4	1	14.8	8.06	7.9	32.0
11	30	Sed - 5	1	14.9	8.06	7.8	32.0
16	Macoma Control	Sed - 17	1	14.8	8.07	7.8	32.0
6	Neanthes Control	Sed - 11	1	14 8	8.09	8 1	32.0
Day 12							
31	2	Sed - 22	1	15.0	7.98	7.7	32.0
19	4	Sed - 18	1	14.9	7.97	7.4	32.0
15	5	Sed - 21	1	14.9	7.97	7.4	32.0
27	7	Sed - 2	1	15.0	7.97	7 4	32.0
17	8	Sed - 16	1	14.9	7.99	7 5	32.0
30	9	Sed - 7	1	15.0	7.98	7.6	32.0
18	11	Sed - 20	1	14.9	7.98	7.5	32.0
13	12	Sed - 1	1	14.8	7.99	7.6	32.0
22	13	Sed - 12	2	14.9	7.97	7.5	32.0
38	14	Sed - 9	1	14.9	7.97	7.6	32.0
3	15	Sed - 13	1	14.8	7.98	7.6	32.0
42	18	Sed - 6	1	14.9	7.97	7.6	32.0
14	19	Sed - 14	2	14.8	7.98	7.7	32.0
4	20	Sed - 10	1	14.8	7.98	7 6	32.0
5	21	Sed - 8	1	14.8	7.98	7.6	32.0
7	22	Sed - 15	1	14 8	7.98	7.6	32.0
8	24	Sed - 19	1	14.8	7.97	7.5	32.0
37	26	Sed - 3	1	15.0	7.98	7.6	32.0
9	28	Sed - 4	1	14.9	7.98	7 5	32.0
12	30	Sed - 5	2	14.8	7.97	7.5	32.0
39	Macoma Control	Sed - 17	2	14.9	7.97	7.5	32.0
33	Neanthes Control	Sed - 11	2	15.0	8.01	8.0	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 13							
31	2	Sed - 22	1	15.2	7.96	7.5	32.0
19	4	Sed - 18	1	15.0	7.95	7.2	32.0
15	5	Sed - 21	1	15.1	7.95	7 2	32.0
27	7	Sed - 2	1	15.0	7 95	7.2	32.0
17	8	Sed - 16	1	15.1	7.97	7.2	32.0
30	9	Sed - 7	1	15.1	7.97	7.5	32.0
18	10	Sed - 20	1	15.0	7.95	7.2	32.0
13	12	Sed - 1	1	15.2	7.96	7.4	32.0
25	13	Sed - 12	3	15.0	7.95	7.3	32.0
38	14	Sed - 9	1	15.1	7.97	7.6	32.0
3	15	Sed - 13	1	15.0	7.96	7.4	32.0
42	18	Sed - 6	1	15.1	7.95	7.6	32.0
29	19	Sed - 14	3	15.1	7.96	7.4	32.0
4	20	Sed - 10	1	15.0	7.95	7.3	32.0
5	21	Sed - 8	1	15.0	7.95	7.4	32.0
7	22	Sed - 15	1	15.0	7.95	7.2	32.0
8	24	Sed - 19	1	15.1	7.95	7.3	32.0
37	26	Sed - 3	1	15.2	7.94	7.1	32.0
9	28	Sed - 4	1	15.1	7.95	7.2	32.0
23	30	Sed - 5	3	15.2	7.96	7.5	32.0
40	Macoma Control	Sed - 17	3	15.1	7.96	7.4	32.0
24	Neanthes Control	Sed - 11	3	15.1	7.98	7.6	32.0
Day 14							
31	2	Sed -22	1	15.0	7.88	7.1	32.0
19	4	Sed - 18	1	14.8	7.85	6.7	32.0
15	5	Sed - 21	1	14.9	7.87	6.9	32.0
27	7	Sed - 2	1	14.9	7.86	6.5	32.0
17	8	Sed - 16	1	14.9	7.89	7.0	32.0
30	9	Sed - 7	1	15.0	7.90	7.3	32.0
18	11	Sed - 20	1	14.9	7.86	6.8	32.0
13	12	Sed - 1	1	14.9	7.89	7.1	32.0
2	13	Sed - 12	4	14.6	7.87	7.0	32 0
38	14	Sed - 9	1	14.8	7.87	7.0	32.0
3	15	Sed - 13	1	14.6	7.87	7.1	32.0
42	18	Sed - 6	1	14.8	7.87	7.0	32.0
34	19	Sed - 14	4	15.0	7.89	7.3	32.0
4	20	Sed - 10	1	14.7	7.88	7.3	32.0
5	21	Sed - 8	1	14.8	7.87	7.1	32.0
7	22	Sed - 15	1	14.8	7 86	6.9	32.0
8	24	Sed - 19	1	14.9	7.85	6.8	32.0
37	26	Sed - 3	1	14.8	7.87	6.9	32.0
9	28	Sed - 4	1	14.8	7.85	6.7	32.0
26	30	Sed - 5	4	14.8	7.87	7.0	32.0
35	Macoma Control	Sed - 17	4	15.0	7.87	6.3	32.0
21	Neanthes Control	Sed - 11	4	14.9	7.89	7.0	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 15							
32	2	Sed - 22	5	14.9	7.88	7.2	32.0
19	4	Sed - 18	1	14.7	7.86	6.7	32.0
15	5	Sed - 21	1	14.8	7.86	7.0	32.0
30	7	Sed - 2	1	14.8	7.86	6 8	32.0
17	8	Sed - 16	1	14.8	7.87	7.0	32 0
31	9	Sed - 7	1	14.9	7.87	7.3	32.0
18	11	Sed - 20	1	14.7	7.87	6.9	32.0
13	12	Sed - 1	1	14.9	7.88	7.0	32.0
1	13	Sed - 12	5	14.8	7.85	6.3	32.0
41	14	Sed - 9	5	14.8	7.90	7.5	32.0
3	15	Sed - 13	1	14.7	7.88	7.0	32.0
42	18	Sed - 6	1	14.8	7.88	7.3	32.0
36	19	Sed - 14	5	14.9	7.87	7.1	32.0
4	20	Sed - 10	1	14.7	7.89	7.3	32.0
5	21	Sed - 8	1	14.7	7.88	7.0	32.0
7	22	Sed - 15	1	14.8	7.87	6.7	32.0
8	24	Sed - 19	1	14.8	7.87	6.9	32.0
38	26	Sed - 3	1	14.8	7.87	7.0	32.0
9	28	Sed - 4	1	14.8	7.87	6.7	32.0
27	30	Sed - 5	1	14.8	7.90	7.2	32.0
37	Macoma Control	Sed - 17	1	14.8	7.87	7.1	32.0
20	Neanthes Control	Sed - 11	5	14.7	7.88	7.0	32.0
Day 16							
31	2	Sed - 22	1	15.0	7.86	6.9	32.0
19	4	Sed - 18	1	14.9	7.85	6.7	32.0
15	5	Sed - 21	1	15.0	7.86	7.1	32.0
27	7	Sed - 2	1	14 9	7.85	6.7	32.0
17	8	Sed - 16	1	14.9	7.88	6.8	32.0
30	9	Sed - 7	1	15 0	7.88	7.2	32.0
18	11	Sed - 20	1	14.9	7.86	6.9	32.0
13	12	Sed - 1	1	15.0	7.88	7.0	32.0
28	13	Sed -12	1	15.0	7.88	7.1	32.0
38	14	Sed - 9	1	15.0	7.86	7.0	32.0
3	15	Sed - 13	1	14.8	7.87	6.8	32.0
42	18	Sed - 6	1	15.0	7.88	7.0	32.0
10	19	Sed - 14	1	15.0	7.85	6.8	32.0
4	20	Sed - 10	1	14.9	7.88	7.1	32.0
5	21	Sed - 8	1	14.9	7.87	6.9	32.0
7	22	Sed - 15	1	15.0	7.86	6.8	32.0
8	24	Sed - 19	1	15.0	7.86	6.8	32.0
37	26	Sed - 3	1	15.0	7.86	6 9	32.0
9	28	Sed - 4	1	15.0	7.86	6 9	32.0
11	30	Sed - 5	1	15.1	7.87	7.1	32.0
16	Macoma Control	Sed - 17	1	15.0	7 87	6.9	32.0
6	Neanthes Control	Sed -11	1	14.9	7 91	7.2	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 17							
31	2	Sed -22	1	14.9	7.85	7.0	32.0
19	4	Sed - 18	1	14.9	7.84	6.6	32.0
15	5	Sed - 21	1	14.8	7 87	6.8	32.0
27	7	Sed - 2	1	14.8	7.84	6.6	32.0
17	8	Sed - 16	1	14.9	7.84	6.7	32.0
30	9	Sed - 7	1	14.9	7.87	7.1	32 0
18	11	Sed - 20	1	14.9	7.85	6.7	32.0
13	12	Sed - 1	1	14.8	7.87	6.9	32.0
22	13	Sed - 12	2	14.9	7.84	6.8	32.0
38	14	Sed - 9	1	14.8	7.86	7.0	32.0
3	15	Sed - 13	1	15.0	7.86	6.8	32.0
42	18	Sed - 6	1	14.8	7.86	7.2	32.0
14	19	Sed - 14	2	14.8	7.86	7.1	32.0
4	20	Sed - 10	1	14.8	7.87	7.0	32.0
5	21	Sed - 8	1	14.8	7.85	7.0	32.0
7	22	Sed -15	1	14.9	7.84	6.5	32.0
8	24	Sed - 19	1	14.8	7.84	6.7	32.0
37	26	Sed - 3	1	15.0	7.85	6.9	32.0
9	28	Sed - 4	1	14.9	7.79	6.2	32.0
12	30	Sed - 5	2	15.0	7.84	6.4	32.0
39	Macoma Control	Sed - 17	2	14.9	7.87	7.1	32.0
33	Neanthes Control	Sed -11	2	15.0	7.89	7.2	32.0
Day 18							
31	2	Sed - 22	1	15.0	7.86	7.1	32.0
19	4	Sed - 18	1	14.9	7.85	6.9	32.0
15	5	Sed - 21	1	14 9	7.86	6 9	32 0
27	7	Sed - 2	1	14.9	7.84	6.3	32.0
17	8	Sed - 16	1	15.0	7.87	6.9	32.0
29	9	Sed - 14	3	14.9	7.86	7.1	32.0
30	9	Sed - 7	1	15.0	7.88	7.3	32.0
18	11	Sed - 20	1	14.9	7.87	7.2	32.0
13	12	Sed - 1	1	14.9	7.87	7.1	32.0
25	13	Sed - 12	3	14.8	7.86	6.9	32.0
38	14	Sed - 9	1	14.9	7.86	7 0	32.0
3	15	Sed - 13	1	15.1	7.87	7.1	32.0
42	18	Sed - 6	1	14.8	7.86	7.2	32.0
4	20	Sed - 10	1	15.0	7.88	7.3	32.0
5	21	Sed - 8	1	15.0	7.86	7.2	32.0
7	22	Sed -15	1	14.9	7.83	6 4	32.0
8	24	Sed - 19	1	14.9	7.84	6.8	32.0
37	26	Sed - 3	1	14.9	7.86	7.1	32.0
9	28	Sed - 4	1	14 9	7.84	6.4	32.0
23	30	Sed - 5	3	14 9	7.87	7.4	32.0
40	Macoma Control	Sed - 17	3	14.9	7.88	7.4	32.0
24	Neanthes Control	Sed - 11	3	14.9	7.87	7 0	32 0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 19							
31	2	Sed - 22	1	15.0	7.84	7.1	32.0
19	4	Sed - 18	1	14.8	7.82	6.8	32.0
15	5	Sed - 21	1	14.9	7.83	7.0	32.0
27	7	Sed - 2	1	14.8	7.84	7.2	32.0
17	8	Sed - 16	1	14.8	7.84	6.9	32.0
30	9	Sed - 7	1	14.9	7.85	7.3	32 0
18	11	Sed - 20	1	14 8	7.84	7.3	32.0
13	12	Sed - 1	1	14.9	7.84	7.2	32 0
2	13	Sed - 12	4	14.7	7.81	7.1	32 0
38	14	Sed - 9	1	14.9	7.84	7.1	32.0
3	15	Sed - 13	1	14.8	7.82	7.2	32.0
42	18	Sed - 6	1	14.9	7.84	7.2	32.0
34	19	Sed - 14	4	15.0	7.84	7.2	32.0
4	20	Sed - 10	1	14.8	7.82	7.3	32.0
5	21	Sed - 8	1	14.8	7.82	7.1	32.0
7	22	Sed - 15	1	14.9	7.83	7.2	32.0
8	24	Sed - 19	1	14.9	7.82	6.9	32.0
37	26	Sed - 3	1	14.8	7.83	7.0	32.0
9	28	Sed - 4	1	14.9	7.82	7.0	32.0
26	30	Sed - 5	4	14.8	7.84	7.1	32.0
35	Macoma Control	Sed - 17	4	14.9	7.82	6 4	32.0
21	Neanthes Control	Sed - 11	4	14.9	7.85	7.2	32.0
Day 20							
31	2	Sed - 22	1	15.0	7.75	6.9	32.0
19	4	Sed - 18	1	14.8	7.73	6.7	32.0
15	5	Sed - 21	1	14.9	7.74	6.9	32.0
27	7	Sed - 2	1	14.9	7.74	7.0	32 0
17	8	Sed - 16	1	14.9	7.76	6.9	32 0
30	9	Sed - 7	1	15.0	7.78	7.3	32.0
18	11	Sed - 20	1	14.9	7.76	7.2	32.0
13	12	Sed - 1	1	14.9	7.75	7.0	32.0
36	13	Sed - 12	5	14.9	7.74	7.0	32.0
38	14	Sed - 9	1	14.9	7.74	6.9	32.0
3	15	Sed - 13	1	14.8	7.74	6.9	32.0
42	18	Sed - 6	1	14.9	7.74	7.1	32.0
32	19	Sed - 14	5	15.0	7.75	7.2	32.0
4	20	Sed - 10	1	14.8	7.76	7.2	32.0
5	21	Sed - 8	1	14.8	7.74	7.0	32.0
7	22	Sed - 15	1	14.8	7.74	6 9	32.0
8	24	Sed - 19	1	14.9	7.73	6.8	32.0
37	26	Sed - 3	1	15.0	7.74	7.0	32.0
9	28	Sed - 4	1	15.0	7.71	6.8	32.0
20	30	Sed - 5	5	14.9	7.74	7 1	32.0
1	Macoma Control	Sed - 17	5	14.9	7.77	7.1	32 0
41	Neanthes Control	Sed - 11	5	14.9	7.77	7 2	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 21							
31	2	Sed - 22	1	14.8	7.85	7.2	32.0
19	4	Sed - 18	1	14.7	7.83	6.9	32.0
15	5	Sed - 21	1	14.7	7.83	7.1	32.0
27	7	Sed - 2	1	14.8	7.84	7.1	32.0
17	8	Sed - 16	1	14.7	7.85	7.0	32.0
30	9	Sed - 7	1	14.8	7.87	7.4	32.0
18	11	Sed - 20	1	14.6	7.85	7.2	32.0
13	12	Sed - 1	1	14.6	7.86	7.4	32.0
28	13	Sed - 12	1	14.8	7.86	7.3	32.0
38	14	Sed - 9	1	14.7	7.84	7.2	32.0
3	15	Sed - 13	1	14.8	7.84	7.1	32.0
42	18	Sed - 6	1	14.7	7.83	7.2	32.0
10	19	Sed - 14	1	14.7	7.83	7.1	32.0
4	20	Sed - 10	1	14.7	7.86	7.3	32.0
5	21	Sed - 8	1	14.6	7.84	7.2	32.0
7	22	Sed - 15	1	14.8	7.84	7.2	32.0
8	24	Sed - 19	1	14.8	7.84	7.3	32.0
37	26	Sed - 3	1	14.8	7.83	7.2	32.0
9	28	Sed - 4	1	14.8	7.83	7.1	32.0
11	30	Sed - 5	1	14.7	7.84	7.2	32.0
16	Macoma Control	Sed - 17	1	14.8	7.83	6.9	32.0
6	Neanthes Control	Sed - 11	1	14.7	7.87	7.4	32.0
Day 22							
31	2	Sed - 22	1	14.8	7.83	7.3	32.0
19	4	Sed - 18	1	14.7	7.82	7.2	32.0
15	5	Sed - 21	1	14.8	7.81	7.2	32 0
27	7	Sed - 2	1	14.8	7.83	7 3	32.0
17	8	Sed - 16	1	14.8	7.83	7 2	32.0
30	9	Sed - 7	1	14.8	7.85	7.5	32.0
18	11	Sed - 20	1	14.7	7.85	7.4	32.0
13	12	Sed - 1	1	14.7	7.83	7.2	32.0
22	13	Sed - 12	2	14.8	7.83	7.1	32.0
38	14	Sed - 9	1	14.8	7.83	7.2	32.0
3	15	Sed - 13	1	14.7	7.85	7.2	32.0
42	18	Sed - 6	1	14.8	7.84	7.2	32.0
14	19	Sed - 14	2	14.7	7.83	7.3	32.0
4	20	Sed - 10	1	14.7	7.86	7.5	32.0
5	21	Sed - 8	1	14.8	7.85	7.4	32.0
7	22	Sed - 15	1	14.7	7.85	7.4	32.0
8	24	Sed - 19	1	14.8	7.85	7.3	32.0
37	26	Sed - 3	1	14.9	7.84	7.3	32.0
9	28	Sed - 4	1	14.8	7.85	7.4	32.0
12	30	Sed - 5	2	14.8	7.85	7 4	32.0
39	Macoma Control	Sed - 17	2	14.8	7.85	7.2	32.0
33	Neanthes Control	Sed -11	2	14.9	7.87	7.5	32 0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 23							
31	2	Sed - 22	1	14.9	7.84	7.2	32.0
19	4	Sed - 18	1	14.7	7.85	7.2	32.0
15	5	Sed - 21	1	14.8	7.83	7.2	32.0
27	7	Sed - 2	1	14.8	7.84	7.2	32.0
17	8	Sed - 16	1	14.8	7.86	7.2	32.0
30	9	Sed - 7	1	14.9	7.87	7 5	32.0
18	11	Sed - 20	1	14.8	7.86	7.4	32.0
13	12	Sed - 1	1	14.8	7.85	7.4	32.0
25	13	Sed - 12	3	14 7	7.85	7.3	32.0
38	14	Sed - 9	1	14.8	7.85	7.2	32.0
3	15	Sed - 13	1	14.7	7.86	7.4	32.0
42	18	Sed - 6	1	14.8	7.85	7.3	32.0
29	19	Sed - 14	3	14.8	7.85	7.5	32.0
4	20	Sed - 10	1	14.7	7.85	7.5	32.0
5	21	Sed - 8	1	14.8	7.84	7.3	32.0
7	22	Sed - 15	1	14.8	7.84	7.4	32.0
8	24	Sed - 19	1	14.8	7.84	7.3	32.0
37	26	Sed - 3	1	14.8	7.84	7.2	32.0
9	28	Sed - 4	1	14.8	7.84	7.4	32.0
23	30	Sed - 5	3	14.7	7.86	7.6	32.0
40	Macoma Control	Sed - 17	3	14.8	7.87	7.4	32 0
24	Neanthes Control	Sed - 11	3	14.8	7.90	7.8	32.0
Day 24							
31	2	Sed - 22	1	14.8	7.82	7.1	32 0
19	4	Sed - 18	1	14.6	7.82	6 9	32.0
15	5	Sed - 21	1	14.7	7.81	7.1	32.0
27	7	Sed - 2	1	14 7	7.82	7.1	32.0
17	8	Sed - 16	1	14 6	7.85	7.0	32.0
30	9	Sed - 7	1	14.7	7.85	7.2	32.0
18	11	Sed - 20	1	14.7	7.84	7.4	32.0
13	12	Sed - 1	1	14.7	7.83	7 3	32.0
2	13	Sed - 12	4	14.7	7.83	7.2	32.0
38	14	Sed - 9	1	14.7	7.82	7.0	32.0
3	15	Sed - 13	1	14.6	7.83	7.1	32.0
42	18	Sed - 6	1	14.8	7.83	7.2	32.0
34	19	Sed - 14	4	14.7	7.83	7.4	32.0
4	20	Sed - 10	1	14.7	7.84	7.3	32.0
5	21	Sed - 8	1	14.6	7.83	7.2	32.0
7	22	Sed - 15	1	14.7	7.83	7.2	32.0
8	24	Sed - 19	1	14.7	7.83	7.1	32.0
37	26	Sed - 3	1	14.7	7.82	7.1	32.0
9	30	Sed - 5	1	14.8	7.83	7.1	32.0
26	30	Sed - 5	4	14.7	7.82	7.3	32.0
35	Macoma Control	Sed - 17	4	14.7	7.83	7.3	32.0
21	Neanthes Control	Sed - 11	4	14.7	7.84	7.2	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 25							
31	2	Sed - 22	1	14.7	7.79	7.2	32.0
19	4	Sed - 18	1	14.6	7.77	6.8	32.0
15	5	Sed - 21	1	14.7	7.77	6.9	32.0
27	7	Sed - 2	1	14.6	7.78	7.0	32.0
17	8	Sed - 16	1	14.7	7.80	7.0	32.0
30	9	Sed - 7	1	14.7	7.81	7.3	32.0
18	11	Sed - 20	1	14.6	7.80	7.2	32.0
13	12	Sed - 1	1	14 5	7.78	7 2	32.0
36	13	Sed - 12	5	14.7	7.79	7.2	32.0
38	14	Sed - 9	1	14.7	7.78	7.0	32.0
3	15	Sed - 13	1	14.6	7.77	7.0	32.0
42	18	Sed - 6	1	14.7	7.79	7.1	32.0
32	19	Sed - 14	5	14.7	7.79	7.3	32.0
4	20	Sed - 10	1	14.5	7.79	7.3	32.0
5	21	Sed - 8	1	14.6	7.78	7.2	32.0
7	22	Sed - 15	1	14.6	7.78	7.1	32.0
8	24	Sed - 19	1	14.7	7.78	7.1	32.0
37	26	Sed - 3	1	14.7	7.78	7.0	32.0
9	28	Sed - 4	1	14.5	7.79	7.2	32.0
20	30	Sed - 5	5	14.6	7.79	7.3	32.0
1	Macoma Control	Sed - 17	5	14.6	7.78	7.0	32.0
41	Neanthes Control	Sed - 11	5	14.7	7.81	7.3	32.0
Day 26							
31	2	Sed - 22	1	14.7	7.79	7.2	32.0
19	4	Sed - 18	1	14.6	7.78	7.1	32 0
15	5	Sed - 21	1	14.5	7.80	7 1	32.0
27	7	Sed - 2	1	14.6	7.78	7.2	32.0
17	8	Sed - 16	1	14.6	7 81	7.1	32.0
30	9	Sed - 7	1	14 7	7.82	7 4	32 0
18	11	Sed - 20	1	14.5	7.81	7.3	32.0
13	12	Sed - 1	1	14.4	7.79	7.2	32.0
28	13	Sed - 12	1	14.6	7.81	7.4	32.0
38	14	Sed - 9	1	14.5	7.79	7.1	32.0
3	15	Sed - 13	1	14.6	7.78	7.2	32.0
42	18	Sed - 6	1	14.6	7.79	7.3	32.0
10	19	Sed - 14	1	14.5	7.78	7.0	32.0
4	20	Sed - 10	1	14.5	7.80	7.3	32.0
5	21	Sed - 8	1	14.4	7.78	7.2	32 0
7	22	Sed - 15	1	14.5	7.79	7.2	32 0
8	24	Sed - 19	1	14.6	7.78	7.2	32.0
37	26	Sed - 3	1	14.6	7.78	7.3	32.0
9	28	Sed - 4	1	14.6	7.79	7.1	32.0
11	30	Sed - 5	1	14 5	7.79	7.3	32.0
16	Macoma Control	Sed - 17	1	14.6	7.78	6.9	32.0
6	Neanthes Control	Sed - 11	1	14.5	7.82	7.5	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 27							
31	2	Sed - 22	1	14.6	7.81	7.2	32.0
19	4	Sed - 18	1	14.4	7.79	6.8	32.0
15	5	Sed - 21	1	14.6	7.80	7.1	32.0
27	7	Sed - 2	1	14.5	7.80	7 0	32 0
17	8	Sed - 16	1	14.6	7.82	7.0	32.0
30	9	Sed - 7	1	14.6	7.84	7.3	32.0
18	11	Sed - 20	1	14.5	7.82	7.4	32.0
13	12	Sed - 1	1	14.4	7.81	7 2	32 0
22	13	Sed - 12	2	14.5	7.78	6.8	32.0
38	14	Sed - 9	1	14.5	7.79	6.9	32 0
3	15	Sed - 13	1	14.4	7.81	6.9	32.0
42	18	Sed - 6	1	14.5	7.81	7.2	32.0
14	19	Sed - 14	2	14.5	7.81	7.2	32 0
4	20	Sed - 10	1	14.5	7.82	7.1	32.0
5	21	Sed - 8	1	14.5	7.81	7.2	32.0
7	22	Sed - 15	1	14.5	7.81	7.0	32.0
8	24	Sed - 19	1	14.5	7.80	7.1	32.0
37	26	Sed - 3	1	14.4	7.80	7.2	32.0
9	28	Sed - 4	1	14.5	7.80	7.1	32.0
12	30	Sed - 5	2	14.4	7.80	7.1	32.0
39	Macoma Control	Sed - 17	2	14.5	7.81	7.1	32.0
33	Neanthes Control	Sed - 11	2	14.4	7.83	7.3	32 0
Day 28							
31	2	Sed - 22	1	14.7	7.75	7.1	32 0
15	5	Sed - 21	1	14.6	7.74	6.9	32.0
19	6	Sed - 18	1	14.6	7.73	6 7	32 0
27	7	Sed - 2	1	14.6	7.74	6 9	32.0
17	8	Sed - 16	1	14 6	7.77	6.8	32 0
30	9	Sed - 7	1	14 7	7.78	7 3	32 0
18	11	Sed - 20	1	14.6	7.77	7.1	32.0
13	12	Sed - 1	1	14.7	7.76	7.1	32.0
25	13	Sed - 12	3	14.6	7.75	7.0	32 0
38	14	Sed - 9	1	14.6	7.74	6.8	32.0
3	15	Sed - 13	1	14.6	7.74	7.0	32.0
42	18	Sed - 6	1	14.6	7.75	7.0	32.0
29	19	Sed - 14	3	14.6	7.75	7.1	32.0
4	20	Sed - 10	1	14.5	7.76	7.2	32.0
5	21	Sed - 8	1	14.5	7.75	7.1	32 0
7	22	Sed - 15	1	14.6	7.74	7.0	32 0
8	24	Sed - 19	1	14.5	7.74	7.0	32.0
37	26	Sed - 3	1	14.6	7.75	7.0	32.0
9	28	Sed - 4	1	14.6	7.74	6 9	32 0
23	30	Sed - 5	3	14 5	7.75	7 2	32.0
40	Macoma Control	Sed - 17	3	14.5	7.77	7 3	32.0
24	Neanthes Control	Sed - 11	3	14.5	7.79	7.4	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				**13°C-17°C**	**7.30-8.30**	**>4.0 mg/L**	**28-32 ppt**
Day 29							
31	2	Sed - 22	1	14.4	7.76	7.1	32.0
19	4	Sed - 18	1	14.4	7.74	6.7	32.0
15	5	Sed - 21	1	14.5	7.74	6.9	32.0
27	7	Sed - 2	1	14.5	7.76	6.9	32 0
17	8	Sed - 16	1	14.4	7.77	6.9	32.0
30	9	Sed - 7	1	14.5	7.79	7.2	32.0
18	11	Sed - 20	1	14.3	7.79	7.2	32.0
13	12	Sed - 1	1	14.3	7.77	7.1	32.0
2	13	Sed - 12	4	14.4	7.73	6.9	32 0
38	14	Sed - 9	1	14.4	7.75	6.8	32.0
3	15	Sed - 13	1	14.4	7.76	7.1	32.0
42	18	Sed - 6	1	14.4	7.76	6.9	32.0
34	19	Sed - 14	4	14.5	7.75	7.2	32.0
4	20	Sed - 10	1	14.4	7.77	7.3	32.0
5	21	Sed - 8	1	14.4	7.77	7.2	32.0
7	22	Sed - 15	1	14.4	7.77	7.1	32.0
8	24	Sed - 19	1	14.4	7.76	7.1	32.0
37	26	Sed - 3	1	14.4	7.75	7.0	32.0
9	28	Sed - 4	1	14.5	7.76	7.0	32.0
26	30	Sed - 5	4	14.3	7.76	6.8	32.0
35	Macoma Control	Sed - 17	4	14.4	7.77	7.1	32.0
21	Neanthes Control	Sed - 11	4	14.4	7.78	6.9	32.0
Day 30							
31	2	Sed - 22	1	14.7	7.75	7.1	32.0
19	4	Sed - 18	1	14.6	7.74	6.8	32.0
15	5	Sed - 21	1	14.6	7.73	6.9	32.0
27	7	Sed - 2	1	14.6	7.75	7.1	32 0
17	8	Sed - 16	1	14.6	7.77	6 8	32.0
30	9	Sed - 7	1	14.7	7.79	7.3	32.0
18	11	Sed - 20	1	14.6	7.77	7.3	32.0
13	12	Sed - 1	1	14.5	7.76	7.2	32.0
7	13	Sed - 15	1	14.6	7.75	6.9	32.0
36	13	Sed - 12	5	14.6	7.75	7.0	32.0
38	14	Sed - 9	1	14.5	7.75	6.8	32.0
3	15	Sed - 13	1	14.5	7.74	7.0	32.0
42	18	Sed - 6	1	14.6	7.76	7.0	32.0
32	19	Sed - 14	5	14.7	7.76	7.1	32.0
4	20	Sed - 10	1	14.5	7.76	7.2	32.0
5	21	Sed - 8	1	14.4	7.75	7.1	32.0
8	24	Sed - 19	1	14.6	7.75	6.9	32.0
37	26	Sed - 3	1	14.6	7.75	6.9	32.0
9	28	Sed - 4	1	14.6	7.75	6.9	32.0
20	30	Sed - 5	5	14.6	7.76	7.2	32.0
1	Macoma Control	Sed - 17	5	14.6	7.75	7.1	32.0
41	Neanthes Control	Sed - 11	5	14.6	7.79	7.3	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 31							
31	2	Sed - 22	1	14.7	7.74	6.8	32.0
19	4	Sed - 18	1	14.5	7.70	6.5	32.0
15	5	Sed - 21	1	14.7	7.67	6.4	32.0
27	7	Sed - 2	1	14 6	7.70	6.4	32 0
17	8	Sed - 16	1	14.6	7.72	6.6	32.0
30	9	Sed - 7	1	14.7	7.74	7.1	32.0
18	11	Sed - 20	1	14.5	7.72	6.9	32.0
13	12	Sed - 1	1	14.5	7.70	6.8	32.0
28	13	Sed - 12	1	14.7	7.72	6.9	32.0
38	14	Sed - 9	1	14.6	7.70	6.6	32.0
3	15	Sed - 13	1	14.6	7.66	6.8	32.0
42	18	Sed - 6	1	14.5	7.70	6.7	32.0
10	19	Sed - 14	1	14.5	7.67	6.6	32.0
4	20	Sed - 10	1	14.5	7.68	7.1	32.0
5	21	Sed - 8	1	14.5	7.76	6.9	32.0
7	22	Sed - 15	1	14.6	7.67	6.7	32.0
8	24	Sed - 19	1	14.6	7.68	6.8	32.0
37	26	Sed - 3	1	14.6	7.69	6.7	32.0
9	28	Sed - 4	1	14.6	7.68	6.7	32.0
11	30	Sed - 5	1	14.6	7.70	6.9	32.0
16	Macoma Control	Sed - 17	1	14.6	7.68	6.5	32.0
6	Neanthes Control	Sed - 11	1	14.5	7.70	7.1	32.0
Day 32							
31	2	Sed - 22	1	14.5	7.78	6.9	32.0
19	4	Sed - 18	1	14.4	7.76	6.6	32.0
15	5	Sed - 21	1	14.5	7.76	6.8	32.0
27	7	Sed - 2	1	14.5	7.77	6.9	32.0
17	8	Sed - 16	1	14.5	7.79	6 7	32 0
30	9	Sed - 7	1	14.5	7.82	7.2	32.0
18	11	Sed - 20	1	14.4	7.80	7.2	32.0
13	12	Sed - 1	1	14.3	7.78	6.9	32.0
22	13	Sed - 12	2	14.4	7.77	6.7	32.0
38	14	Sed - 9	1	14.4	7.77	6.7	32.0
3	15	Sed - 13	1	14.4	7.74	6.9	32.0
42	18	Sed - 6	1	14.5	7.78	6.9	32.0
14	19	Sed - 14	2	14.4	7.79	7.2	32.0
4	20	Sed - 10	1	14.4	7.77	7.2	32.0
5	21	Sed - 8	1	14.4	7.76	7.0	32.0
7	22	Sed - 15	1	14.4	7.78	7.1	32.0
8	24	Sed - 19	1	14.4	7.76	7.1	32.0
37	26	Sed - 3	1	14.4	7.77	6.9	32.0
9	28	Sed - 4	1	14.4	7.77	6.8	32.0
12	30	Sed - 5	2	14.3	7.77	7.0	32.0
39	Macoma Control	Sed - 17	2	14.5	7.79	6.9	32.0
33	Neanthes Control	Sed - 11	2	14.4	7.80	7.1	32 0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				**13°C-17°C**	**7.30-8.30**	**>4.0 mg/L**	**28-32 ppt**
Day 33							
31	2	Sed - 22	1	14.6	7.77	6.9	32.0
19	4	Sed - 18	1	14.5	7.75	6.8	32.0
15	5	Sed - 21	1	14 6	7.74	6.7	32.0
27	7	Sed - 2	1	14.4	7.76	6.9	32 0
17	8	Sed - 16	1	14.5	7 80	6.8	32.0
30	9	Sed - 7	1	14.5	7.81	7.2	32.0
18	11	Sed - 20	1	14.4	7.78	7.2	32.0
13	12	Sed - 1	1	14.3	7.77	7 0	32.0
25	13	Sed - 12	3	14.4	7.78	6.9	32.0
38	14	Sed - 9	1	14.4	7.76	6.8	32.0
3	15	Sed - 13	1	14.3	7.73	6.9	32 0
42	18	Sed - 6	1	14.4	7.78	7.0	32.0
29	19	Sed - 14	3	14.5	7.79	7.3	32.0
4	20	Sed - 10	1	14.4	7.76	7.2	32.0
5	21	Sed - 8	1	14.4	7.75	7.1	32.0
7	22	Sed - 15	1	14.4	7.75	7.0	32.0
8	24	Sed - 19	1	14.5	7.75	6.9	32.0
37	26	Sed - 3	1	14.4	7.78	6.9	32.0
9	28	Sed - 4	1	14.5	7.76	6.9	32.0
23	30	Sed - 5	3	14.5	7.78	7.2	32.0
40	Macoma Control	Sed - 17	3	14.3	7.79	7.1	32.0
24	Neanthes Control	Sed - 11	3	14.5	7.81	7.5	32.0
Day 34							
31	2	Sed - 22	1	14.5	7.80	7.0	32.0
19	4	Sed - 18	1	14.5	7.78	6.9	32.0
15	5	Sed - 21	1	14.6	7.78	7 0	32.0
27	7	Sed - 2	1	14.5	7 78	7.0	32 0
17	8	Sed - 16	1	14.5	7.82	6 9	32 0
30	9	Sed - 7	1	14.5	7.83	7.3	32.0
18	11	Sed - 20	1	14.5	7.81	7 2	32.0
13	12	Sed - 1	1	14.4	7.79	6 8	32 0
2	13	Sed - 12	4	14.4	7.77	6.8	32.0
38	14	Sed - 9	1	14.4	7.78	6.7	32.0
3	15	Sed - 13	1	14.4	7.77	6 9	32.0
42	18	Sed - 6	1	14.5	7.79	6.9	32.0
34	19	Sed - 14	4	14.4	7.81	7.0	32.0
4	20	Sed - 10	1	14.4	7.79	7.1	32.0
5	21	Sed - 8	1	14.4	7.78	7.1	32.0
7	22	Sed - 15	1	14.4	7.78	6.9	32.0
8	24	Sed - 19	1	14.4	7.78	6.9	32.0
37	26	Sed - 3	1	14.5	7.79	7.0	32.0
9	28	Sed - 4	1	14.5	7.78	7 0	32.0
26	30	Sed - 5	4	14.5	7.78	6 9	32.0
35	Macoma Control	Sed - 17	4	14.5	7.80	6.8	32.0
21	Neanthes Control	Sed - 11	4	14.4	7.80	7.0	32 0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 35							
31	2	Sed - 22	1	15.2	7.77	6.9	32.0
19	4	Sed - 18	1	14.9	7.76	6.8	32.0
15	5	Sed - 21	1	14.9	7.74	6.6	32 0
27	7	Sed - 2	1	15.0	7.77	6.8	32 0
17	8	Sed - 16	1	14.9	7.80	6.7	32.0
30	9	Sed -7	1	15.1	7.80	7.1	32.0
18	11	Sed - 20	1	14.9	7.79	7.1	32 0
13	12	Sed - 1	1	14.9	7.78	6.9	32 0
36	13	Sed - 12	5	15.2	7.77	6.9	32 0
38	14	Sed - 9	1	15.0	7.77	6.6	32.0
3	15	Sed - 13	1	14.9	7.72	6.9	32.0
42	18	Sed - 6	1	15.1	7.78	6.9	32 0
32	19	Sed - 14	5	15.3	7.76	6.8	32.0
4	20	Sed - 10	1	14.9	7.76	7 2	32 0
5	21	Sed - 8	1	14.9	7.75	7 0	32.0
7	22	Sed - 15	1	14.8	7.75	6.8	32 0
8	24	Sed - 19	1	14.8	7.75	6.8	32.0
37	26	Sed - 3	1	15.1	7.77	6.8	32.0
9	28	Sed - 4	1	14.8	7.76	6.9	32.0
20	30	Sed - 5	5	14.9	7.78	7.1	32.0
1	Macoma Control	Sed - 17	5	14.9	7.72	7.1	32 0
41	Neanthes Control	Sed - 11	5	15.0	7.80	7.1	32 0
Day 36							
31	2	Sed - 22	1	14.9	7.79	7.3	32.0
19	4	Sed - 18	1	14.7	7.78	6 8	32 0
15	5	Sed - 21	1	14.8	7.76	6 8	32 0
27	7	Sed - 2	1	14 7	7.78	7.0	32 0
17	8	Sed - 16	1	14.7	7.79	6.9	32.0
30	9	Sed - 7	1	14.8	7.81	7.4	32 0
18	11	Sed - 20	1	14.7	7.81	7.2	32.0
13	12	Sed - 1	1	14.8	7.78	7.1	32.0
28	13	Sed - 12	1	14.7	7.80	7.3	32.0
38	14	Sed - 9	1	14.7	7.78	6.8	32.0
3	15	Sed - 13	1	14.7	7.76	6.9	32.0
42	18	Sed - 6	1	14.7	7.79	6.9	32.0
10	19	Sed - 14	1	14.8	7.77	6.9	32 0
4	20	Sed - 10	1	14.8	7.78	7.3	32.0
5	21	Sed - 8	1	14.7	7.78	7.4	32.0
7	22	Sed - 15	1	14.7	7.78	7.1	32.0
8	24	Sed - 19	1	14.8	7.78	7.2	32.0
37	26	Sed - 3	1	14.7	7.78	7.2	32 0
9	28	Sed - 4	1	14 8	7.78	7.1	32.0
11	30	Sed - 5	1	14.8	7.79	7 1	32 0
16	Macoma Control	Sed - 17	1	14.7	7.78	6 6	32 0
6	Neanthes Control	Sed - 11	1	14.7	7.80	7 3	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				**13°C-17°C**	**7.30-8.30**	**>4.0 mg/L**	**28-32 ppt**
Day 37							
31	2	Sed - 22	1	15.2	7.79	6.7	32.0
19	4	Sed - 18	1	15.0	7.79	6.8	32.0
15	5	Sed - 21	1	15.1	7.79	6.9	32.0
27	7	Sed - 2	1	15.0	7.79	6.6	32.0
17	8	Sed - 16	1	15.0	7.83	6.7	32.0
14	9	Sed - 14	2	15.0	7.80	7.0	32.0
30	9	Sed - 7	1	15.1	7.83	7.1	32.0
18	11	Sed - 20	1	15.0	7.82	7.1	32.0
13	12	Sed - 1	1	15.1	7.79	6.9	32.0
22	13	Sed - 12	2	15.0	7.78	6.7	32.0
38	14	Sed - 9	1	15.1	7.78	6.5	32.0
3	15	Sed - 13	1	14.9	7.76	7.1	32.0
42	18	Sed - 6	1	15.0	7.80	6.7	32.0
4	20	Sed - 10	1	15.0	7.79	7 2	32.0
5	21	Sed - 8	1	14.9	7.78	7.1	32 0
7	22	Sed - 15	1	15.0	7.79	6.8	32.0
8	24	Sed - 19	1	15.0	7.79	6.9	32.0
37	26	Sed - 3	1	15.0	7.79	6.8	32.0
9	28	Sed - 4	1	15.0	7.79	6.8	32.0
12	30	Sed - 5	2	15.1	7.79	6.9	32.0
39	Macoma Control	Sed - 17	2	15.0	7.78	6.3	32.0
33	Neanthes Control	Sed - 11	2	15.2	7.82	7.2	32.0
Day 38							
31	2	Sed - 22	1	14.6	7.79	6.9	32.0
19	4	Sed - 18	1	14.6	7.77	6.7	32.0
15	5	Sed - 21	1	14.6	7.77	6 9	32.0
27	7	Sed - 2	1	14 5	7.79	6.8	32.0
17	8	Sed - 16	1	14.6	7.82	6.8	32.0
30	9	Sed - 7	1	14.7	7.83	7.2	32.0
18	11	Sed - 20	1	14.6	7.81	7.2	32.0
13	12	Sed - 1	1	14.5	7.79	6 8	32 0
25	13	Sed - 12	3	14.6	7.79	7.0	32.0
38	14	Sed - 9	1	14.6	7.78	6.7	32.0
3	15	Sed - 13	1	14.6	7.75	6.9	32.0
42	18	Sed - 6	1	14.6	7.80	6.9	32.0
29	19	Sed - 14	3	14.6	7.82	7.3	32.0
4	20	Sed - 10	1	14.6	7.78	7.1	32.0
5	21	Sed - 8	1	14.6	7.77	6.9	32.0
7	22	Sed - 15	1	14.6	7.77	6.8	32.0
8	24	Sed - 19	1	14.6	7.78	6.8	32.0
37	26	Sed - 3	1	14.6	7.79	6.9	32.0
9	28	Sed - 4	1	14.6	7.78	6.7	32.0
23	30	Sed - 5	3	14.6	7.81	7.3	32.0
40	Macoma Control	Sed - 17	3	14 6	7.82	7 2	32 0
24	Neanthes Control	Sed - 11	3	14.6	7.85	7.6	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 39							
31	2	Sed - 22	1	14.8	7.78	7.0	32.0
19	4	Sed - 18	1	14.7	7.77	6.7	32.0
15	5	Sed - 21	1	14.7	7.76	6.7	32.0
27	7	Sed - 2	1	14.6	7.78	6.8	32 0
17	8	Sed - 16	1	14.7	7.82	6.8	32.0
30	9	Sed - 7	1	14.7	7.83	7.2	32.0
34	9	Sed - 14	4	14.8	7.81	7.3	32.0
18	11	Sed - 20	1	14.6	7.81	7.1	32.0
13	12	Sed - 1	1	14.7	7.79	6.8	32.0
2	13	Sed - 12	4	14.6	7.78	7.0	32.0
38	14	Sed - 9	1	14.7	7.78	6.7	32.0
3	15	Sed - 13	1	14.6	7.78	6.9	32.0
42	18	Sed - 6	1	14.6	7.90	6.9	32.0
4	20	Sed - 10	1	14.6	7.80	7.1	32 0
5	21	Sed - 8	1	14.6	7.78	7.1	32 0
7	22	Sed - 15	1	14.7	7.78	6.8	32.0
8	24	Sed - 19	1	14.7	7.78	6.9	32.0
37	26	Sed - 3	1	14.7	7.78	6.9	32.0
9	28	Sed - 4	1	14.6	7.77	6.8	32.0
26	30	Sed - 5	4	14.6	7.78	6.7	32.0
35	Macoma Control	Sed - 17	4	14.7	7.78	6.9	32.0
21	Neanthes Control	Sed - 11	4	14.6	7.79	6.9	32.0
Day 40							
31	2	Sed - 22	1	14.8	7.76	6.9	32.0
19	4	Sed - 18	1	14.6	7.73	6.6	32 0
15	5	Sed - 21	1	14.6	7 74	7.0	32 0
27	7	Sed - 2	1	14.6	7.75	6.8	32 0
17	8	Sed - 16	1	14.7	7.77	6 7	32 0
30	9	Sed - 7	1	14.8	7.79	7.1	32.0
18	11	Sed - 20	1	14 6	7.77	7.1	32.0
13	12	Sed - 11	1	14.6	7.76	6.9	32 0
36	13	Sed - 12	5	14.7	7.76	7.0	32.0
38	14	Sed - 9	1	14.6	7.74	6.6	32.0
3	15	Sed - 13	1	14.5	7.72	6.8	32.0
42	18	Sed - 6	1	14.7	7.76	6.8	32.0
32	19	Sed - 14	5	14.8	7.75	6.8	32.0
4	20	Sed - 10	1	14.6	7.75	7.1	32.0
5	21	Sed - 8	1	14.6	7.73	6.9	32 0
7	22	Sed - 15	1	14.7	7.73	6.9	32.0
8	24	Sed - 19	1	14.7	7.73	6.8	32.0
37	26	Sed - 3	1	14.6	7.75	6.8	32.0
9	28	Sed - 4	1	14 7	7 73	6 8	32.0
20	30	Sed - 5	5	14.5	7.76	7.2	32 0
1	Macoma Control	Sed - 17	5	14.5	7.71	6 9	32.0
41	Neanthes Control	Sed - 11	5	14.6	7.78	7 0	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				**13°C-17°C**	**7.30-8.30**	**>4.0 mg/L**	**28-32 ppt**
Day 41							
31	2	Sed - 22	1	15.0	7.74	6.8	32.0
19	4	Sed - 18	1	14.8	7.72	6.6	32.0
15	5	Sed - 21	1	14.8	7.71	6.4	32.0
27	7	Sed - 2	1	14.9	7.73	6.6	32.0
17	8	Sed - 16	1	14.8	7.76	6.6	32.0
30	9	Sed - 7	1	14.9	7.78	7.1	32.0
18	11	Sed - 20	1	14.8	7.77	7.0	32.0
13	12	Sed - 1	1	14.8	7.75	6 8	32.0
28	13	Sed - 12	1	14.8	7.75	6.9	32.0
38	14	Sed - 9	1	14.8	7.73	6.4	32.0
3	15	Sed - 13	1	14.9	7.69	6.8	32.0
42	18	Sed - 6	1	14.9	7.74	6.7	32.0
10	19	Sed - 14	1	15.0	7.72	6.6	32.0
4	20	Sed - 10	1	14.8	7.73	7.1	32 0
5	21	Sed - 8	1	14.9	7.71	6.8	32 0
7	22	Sed - 15	1	14.9	7.71	6.7	32.0
8	24	Sed - 19	1	14.9	7.71	6.6	32.0
37	26	Sed - 3	1	14.9	7.74	6.7	32.0
9	28	Sed - 4	1	15.0	7.72	6.6	32.0
11	30	Sed - 5	1	15.0	7.73	6.7	32.0
16	Macoma Control	Sed - 17	1	14.9	7.71	6.3	32.0
6	Neanthes Control	Sed - 11	1	14.8	7.74	7.1	32.0
Day 42							
31	2	Sed - 22	1	14.8	7.74	6.7	32.0
19	4	Sed - 18	1	14.6	7.71	6.5	32 0
15	5	Sed - 21	1	14.7	7.71	6.5	32 0
27	7	Sed - 2	1	14.6	7.72	6.6	32 0
17	8	Sed - 16	1	14.7	7.75	6 6	32.0
30	9	Sed - 7	1	14.8	7.77	7.0	32.0
18	11	Sed - 20	1	14.6	7.75	7.1	32.0
13	12	Sed - 1	1	14.7	7.73	6.8	32.0
22	13	Sed - 12	2	14.6	7.71	6.3	32.0
38	14	Sed - 9	1	14.6	7.72	6.5	32.0
3	15	Sed - 13	1	14.5	7.70	6.6	32.0
42	18	Sed - 6	1	14.6	7.74	6.9	32.0
14	19	Sed - 14	2	14.6	7.73	6.8	32.0
4	20	Sed - 10	1	14.4	7.73	6.9	32 0
5	21	Sed - 8	1	14.5	7.71	6.7	32.0
7	22	Sed - 15	1	14.6	7.71	6.6	32.0
8	24	Sed - 19	1	14.6	7.71	6.6	32.0
37	26	Sed - 3	1	14.6	7.73	6.7	32 0
9	28	Sed - 4	1	14.7	7.72	6.5	32.0
12	30	Sed - 5	2	14.7	7.71	6 7	32.0
39	Macoma Control	Sed - 17	2	14.6	7.76	7.2	32.0
33	Neanthes Control	Sed - 11	2	14.8	7.75	6.8	32 0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 43							
31	2	Sed - 22	1	15.0	7.74	7.0	32.0
19	4	Sed - 18	1	14.7	7.73	7.3	32.0
15	5	Sed - 21	1	14.8	7.71	6.8	32.0
27	7	Sed - 2	1	14.8	7.74	7.0	32.0
17	8	Sed - 16	1	14.8	7 73	7.0	32.0
30	9	Sed - 7	1	14.9	7.78	7.5	32.0
18	11	Sed - 20	1	14.7	7.76	7.2	32.0
13	12	Sed - 1	1	14.8	7 71	6.8	32.0
25	13	Sed - 12	3	14.8	7.74	6.8	32.0
38	14	Sed - 9	1	14.8	7.73	6.8	32.0
3	15	Sed - 13	1	14.7	7.71	7.3	32.0
42	18	Sed - 6	1	14.8	7.75	7.2	32.0
29	19	Sed - 14	3	14.8	7.77	7.5	32.0
4	20	Sed - 10	1	14.7	7.74	7.4	32.0
5	21	Sed - 8	1	14.7	7.73	7.3	32.0
7	22	Sed - 15	1	14.7	7.73	7.3	32.0
8	24	Sed - 19	1	14.8	7.73	7.2	32.0
37	26	Sed - 3	1	14.8	7.74	7.1	32.0
9	28	Sed - 4	1	14.8	7.74	7.2	32.0
23	30	Sed - 5	3	14.9	7.76	7.5	32.0
40	Macoma Control	Sed - 17	3	14.8	7.77	7.2	32.0
24	Neanthes Control	Sed - 11	3	14.9	7.81	7.8	32.0
Day 44							
31	2	Sed - 22	1	14.9	7.73	6.7	32.0
19	4	Sed - 18	1	14.6	7.72	6.5	32.0
15	5	Sed - 21	1	14.8	7 69	6 4	32.0
27	7	Sed - 2	1	14.8	7 72	6 6	32 0
17	8	Sed - 16	1	14.7	7.74	6.5	32.0
30	9	Sed - 7	1	14.8	7.76	6.9	32.0
18	11	Sed - 20	1	14.6	7.75	7 0	32 0
13	12	Sed - 1	1	14.7	7.71	6.6	32.0
2	13	Sed - 12	4	14.7	7.68	6.6	32.0
36	13	Sed - 12	5	14.8	7.72	6.5	32.0
38	14	Sed - 9	1	14.7	7.72	6.4	32.0
3	15	Sed - 13	1	14.6	7.69	6.5	32.0
42	18	Sed - 6	1	14.8	7.73	6.7	32.0
32	19	Sed - 14	5	14.8	7.72	6.6	32.0
34	19	Sed - 14	4	14.8	7.74	6.8	32.0
4	20	Sed - 10	1	14.6	7.72	7.0	32.0
5	21	Sed - 8	1	14.7	7.71	6.7	32.0
7	22	Sed - 15	1	14.7	7.71	6.6	32.0
8	24	Sed - 19	1	14.8	7 70	6.5	32 0
37	26	Sed - 3	1	14.8	7.72	6 4	32.0
9	28	Sed - 4	1	14.8	7 71	6 6	32.0
20	30	Sed - 5	5	14.6	7.76	7.1	32.0
26	30	Sed - 5	4	14.7	7.71	6.3	32.0
1	Macoma Control	Sed - 17	5	14.7	7.68	6.8	32.0
35	Macoma Control	Sed - 17	4	14.8	7.72	6.4	32.0
21	Neanthes Control	Sed - 11	4	14.6	7.74	6 6	32.0
41	Neanthes Control	Sed - 11	5	14.7	7 75	6.8	32.0

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Appendix C1. Water Quality Observations

Position	Treatment	MSL Code	Rep	Temperature 0.1°C	pH 0.01 units	Dissolved Oxygen 0.1 mg/L	Salinity 0.5 ppt
Acceptable Range				13°C-17°C	7.30-8.30	>4.0 mg/L	28-32 ppt
Day 45							
31	2	Sed - 22	1	14.8	7.75	6.6	32.0
19	4	Sed - 18	1	14.6	7.73	6.4	32.0
15	5	Sed - 21	1	14.8	7.72	6.4	32.0
27	7	Sed - 2	1	14.6	7.73	6.4	32.0
17	8	Sed - 16	1	14.6	7.76	6.4	32.0
30	9	Sed - 7	1	14.8	7.78	6.7	32.0
18	11	Sed - 20	1	14.6	7.77	7.0	32.0
13	12	Sed - 1	1	14.7	7.73	6.4	32.0
28	13	Sed - 12	1	14.7	7.76	6.7	32.0
22	13	Sed - 12	2	14.6	7.74	6.3	32.0
25	13	Sed - 12	3	14.7	7.75	6.7	32.0
2	13	Sed - 12	4	14.6	7.71	6.6	32.0
36	13	Sed - 12	5	14.6	7.75	6.4	32.0
38	14	Sed - 9	1	14.7	7.74	6.4	32.0
3	15	Sed - 13	1	14.6	7.72	6.5	32.0
42	18	Sed - 6	1	14.7	7.75	6.6	32.0
10	19	Sed - 14	1	14.6	7.72	6 3	32.0
14	19	Sed - 14	2	14.7	7.75	6.8	32.0
29	19	Sed - 14	3	14.7	7.76	6.8	32.0
34	19	Sed - 14	4	14.8	7.75	6.7	32.0
32	19	Sed - 14	5	14.7	7.75	6.6	32.0
4	20	Sed - 10	1	14.6	7.75	6.9	32.0
5	21	Sed - 8	1	14.6	7.73	6.7	32.0
7	22	Sed - 15	1	14.6	7.73	6.6	32.0
8	24	Sed - 19	1	14.7	7.72	6.4	32.0
37	26	Sed - 3	1	14.6	7.74	6.3	32.0
9	28	Sed - 4	1	14.7	7.72	6 5	32 0
11	30	Sed - 5	1	14.6	7.74	6.6	32 0
12	30	Sed - 5	2	14.7	7.73	6 5	32 0
23	30	Sed - 5	3	14.8	7.76	6.9	32.0
26	30	Sed - 5	4	14.7	7.73	6 3	32.0
20	30	Sed - 5	5	14.6	7.76	6.8	32.0
16	Macoma Control	Sed - 17	1	14.7	7.74	6.2	32.0
39	Macoma Control	Sed - 17	2	14.6	7.79	7.1	32 0
40	Macoma Control	Sed - 17	3	14.7	7.78	6.9	32.0
35	Macoma Control	Sed - 17	4	14.7	7.74	6.4	32 0
1	Macoma Control	Sed - 17	5	14.6	7.73	6.9	32.0
6	Neanthes Control	Sed - 11	1	14.6	7.76	7 0	32.0
33	Neanthes Control	Sed - 11	2	14.7	7.76	6.7	32.0
24	Neanthes Control	Sed - 11	3	14.8	7.81	7.2	32.0
21	Neanthes Control	Sed - 11	4	14.6	7.75	6.6	32.0
41	Neanthes Control	Sed - 11	5	14.7	7.77	6 8	32.0

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Appendix C.2. Daily Observations for *M. nasuta*, Dead and Removed During 45-Day Test

Position	TEST DAY: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
25	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
42	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NA - Not Applicable This replicate contained Nephtys only

Appendix C.2.

Position	TEST DAY																				
	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NA - Not Applicable: This replicate contained Nephtys only.

Appendix C.3. Daily Observations for *N. caecoides*, Dead and Removed During 45-Day Test

Position	TEST DAY																								
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	0	0	0	2	0	2	1	0	1	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0
3	0	0	0	3	0	1	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	2	0	2	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	2	2	3	1	0	0	0	1	0	2	0	3	1	1	3	1	0	0	0	2	0	0
7	0	0	0	3	0	1	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2	0	0	2	0	1	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
36	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
42	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NA - Not Applicable This replicate contained Macoma only

Appendix C.3.

Position	TEST DAY																			
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
41	0	0	1	0	0	0	0	1	0	0	0	0	2	0	2	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NA - Not Applicable. This replicate contained Macoma only.

TABLE D1. Test Results for 96-Hour *M. nasuta* Copper Reference Toxicant Test

Copper Concentration (mg/L)	Live(a)	Dead or Missing	Proportion Surviving
0	10	0	1.00
0.312	10	0	1.00
0.625	10	0	1.00
1.25	10	0	1.00
2.5	3	7	0.30
5 0	3	7	0.30
10.0	3	7	0.30

(a) Survival based on initial exposure of 10 organisms per replicate

TABLE D2 Water Quality Summary for 96-Hour *M nasuta* Copper Reference Toxicant Test

Copper Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13 0	17 0	7 3	8.3	5 0	NA (a)	28 0	32 0
0	15 2	15 4	7 76	8 01	7 2	8.1	32 0	32 0
0 312	15 1	15 4	7 77	8 02	7 4	8 0	32 0	32 0
0 625	15 1	15 4	7 69	8 02	6 9	8 2	32 0	32 0
1 25	16 0	16 3	7 77	7 91	7 1	8 3	32 0	32 0
2 5	16 0	16 3	7 53	7.91	7 4	8 3	32 0	32 0
5 0	15 1	15 5	7 52	8 04	5 9	8 3	32 0	32 0
10 0	15 9	16 3	7 51	8 04	5 4	8 2	32 0	32 0

(a) NA Not applicable
(b) Data point out of range

TABLE D3 Test Results for 96-Hour *N. caecoides* Copper Reference Toxicant Test

Copper Concentration (mg/L)	Live(a)	Dead or Missing	Proportion Surviving
0 000	10	0	1 00
0 050	9	1	0 90
0 075	10	0	1 00
0 100	4	6	0 40
0 200	0	10	0 00
0 300	0	10	0 00
0 400	0	10	0 00

(a) Survival based on initial exposure of 10 organisms per replicate

TABLE D4. Water Quality Summary for 96-Hour *N. caecoides* Copper Reference Toxicant Test

Copper Concentration (mg/L)	Temperature (°C)		pH		Dissolved Oxygen (mg/L)		Salinity (o/oo)	
	Min	Max	Min	Max	Min	Max	Min	Max
Acceptable Range	13.0	17.0	7.3	8.3	5.0	NA (a)	28.0	32.0
0.000	15.1	15.5	7.80	8.06	7.6	8.0	32.0	32.0
0 050	15.1	15.4	7.80	8.04	7.4	8.1	32.0	32 0
0 075	15.1	15.4	7.80	8.03	7.5	8.2	32.0	32 0
0 100	15 1	15 4	7.82	8.07	7.7	8.2	32.0	32 0
0 200	15.1	15.6	7.81	8.04	6 9	8.0	32.0	32 0
0.300	15.1	15.4	7.82	8 06	6 0	8.2	32.0	30 0
0 400	15 1	15 3	7.70	8.06	5 3	8.1	32 0	30 0

(a) NA Not applicable

APPENDIX E

Tissue Chemistry Results

This appendix contains the tissue chemistry data as reported by the analytical laboratory. The data are grouped by analytical batches. Case narratives, when produced by the laboratory, are included for each batch. It is important to note that the tissue sample IDs do not correspond to the station IDs where the initial sediment was collected for testing. The table on the following page provides the conversion key. The numbers under the column "Position" were used for tissue sample IDs, whereas the corresponding numbers under the "Treatment" column represents the station ID from which the sediments were collected.

Test treatment codes for TBT-Bioaccumulation Tests

Sorted by treatment

Treatment	MSL Code	Replicate	Position
Macoma Control	17	1	16
Macoma Control	17	2	39
Macoma Control	17	3	40
Macoma Control	17	4	35
Macoma Control	17	5	1
Nephtys Control	11	1	6
Nephtys Control	11	2	33
Nephtys Control	11	3	24
Nephtys Control	11	4	21
Nephtys Control	11	5	41
2	22	1	31
4	18	1	19
5	21	1	15
7	2	1	27
8	16	1	17
9	7	1	30
11	20	1	18
12	1	1	13
13	12	1	28
13	12	2	22
13	12	3	25
13	12	4	2
13	12	5	36
14	9	1	38
15	13	1	3
18	6	1	42
19	14	1	10
19	14	2	14
19	14	3	29
19	14	4	34
19	14	5	32
20	10	1	4
21	8	1	5
22	15	1	7
24	19	1	8
26	3	1	37
28	4	1	9
30	5	1	11
30	5	2	12
30	5	3	23
30	5	4	26
30	5	5	20

Sorted by position

Position	Treatment	MSL Code	Replicate
1	Macoma Control	17	5
2	13	12	4
3	15	13	1
4	20	10	1
5	21	8	1
6	Nephtys Control	11	1
7	22	15	1
8	24	19	1
9	28	4	1
10	19	14	1
11	30	5	1
12	30	5	2
13	12	1	1
14	19	14	2
15	5	21	1
16	Macoma Control	17	1
17	8	16	1
18	11	20	1
19	4	18	1
20	30	5	5
21	Nephtys Control	11	4
22	13	12	2
23	30	5	3
24	Nephtys Control	11	3
25	13	12	3
26	30	5	4
27	7	2	1
28	13	12	1
29	19	14	3
30	9	7	1
31	2	22	1
32	19	14	5
33	Nephtys Control	11	2
34	19	14	4
35	Macoma Control	17	4
36	13	12	5
37	26	3	1
38	14	9	1
39	Macoma Control	17	2
40	Macoma Control	17	3
41	Nephtys Control	11	5
42	18	6	1

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	EVS Environmental Consultants	**Service Request No.:**	K9807071
Project:	TBT Bioaccumulation	**Date Received:**	10/13/98
Sample Matrix:	Tissue		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for sample(s) designated for Tier III data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix/Duplicate Matrix Spike (MS/DMS), Laboratory Control Sample (LCS), Initial/Continuing Calibration Verification Standards (ICV/CCV), and Initial/Continuing Calibration Blanks (ICB/CCB).

All EPA recommended holding times have been met for analyses in this sample delivery group.

Results for Tri-n-butyltin have been reported as the cation.

The following difficulties were experienced during analysis of this batch:

The Tri-n-pentyltin surrogate recovery for Butyltins in the LCS was outside normal CAS control limits. The Tri-n-butyltin recovery in the LCS was low but within control limits. The surrogate recoveries in all of the samples and the recoveries in the MS/MSD were within control limits indicating that the low recoveries in the LCS were likely isolated to the LCS and did not affect the other samples in the batch. No further corrective action was taken.

The Matrix Spike (MS) recoveries of Tri-n-butyltin for samples EVS-Mac-TBT-4 and EVS-Mac-TBT-25 were not calculated. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

The surrogate recoveries for Butyltins in the DMS were low. Since the surrogate recoveries in the MS and sample were within control limits, no further corrective action was taken.

The closing CCV for Tri-n-butyltin performed on 11/14/98 was below CAS control limits. The cause of the low recovery was determined to be due to a previously run extract, from a sample unrelated to this service request, that impacted the recovery of Tri-n-butyltin in the CCV. No further corrective action taken.

Approved by _____ **Date** 11/23/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98

Total Solids (%)

Prep Method: NONE
Analysis Method Freeze Dry
Test Notes

Units PERCENT
Basis Wet

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
Rep1-EVS-TBT-Macoma Bkgd	K9807071-001	11/1/98	16 2	
Rep2-EVS-TBT-Macoma Bkgd	K9807071-002	11/1/98	16 6	
Rep3-EVS-TBT-Macoma Bkgd	K9807071-003	11/1/98	16 5	
Rep4-EVS-TBT-Macoma Bkgd	K9807071-004	11/1/98	16.7	
Rep5-EVS-TBT-Macoma Bkgd	K9807071-005	11/1/98	17 1	
EVS-Mac-TBT-2	K9807071-006	11/1/98	15 5	
EVS-Mac-TBT-3	K9807071-007	11/1/98	15 0	
EVS-Mac-TBT-4	K9807071-008	11/1/98	14 7	
EVS-Mac-TBT-5	K9807071-009	11/1/98	15 1	
EVS-Mac-TBT-7	K9807071-010	11/1/98	15 2	
EVS-Mac-TBT-8	K9807071-011	11/1/98	15 8	
EVS-Mac-TBT-9	K9807071-012	11/1/98	15 4	
EVS-Mac-TBT-10	K9807071-013	11/1/98	15 8	
EVS-Mac-TBT-11	K9807071-014	11/1/98	14 7	
EVS-Mac-TBT-12	K9807071-015	11/1/98	15 9	
EVS-Mac-TBT-13	K9807071-016	11/1/98	14 7	
EVS-Mac-TBT-14	K9807071-017	11/1/98	14 5	
EVS-Mac-TBT-15	K9807071-018	11/1/98	14 7	
EVS-Mac-TBT-17	K9807071-019	11/1/98	15 0	
EVS-Mac-TBT-18	K9807071-020	11/1/98	15 6	

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By: _____ Date: 11/2/98

1A/052595

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Total Solids (%)

Prep Method:	NONE	Units.	PERCENT
Analysis Method:	Freeze Dry	Basis	Wet
Test Notes:			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
EVS-Mac-TBT-19	K9807071-021	11/1/98	15 8	
EVS-Mac-TBT-20	K9807071-022	11/1/98	14 9	
EVS-Mac-TBT-22	K9807071-023	11/1/98	15.1	
EVS-Mac-TBT-23	K9807071-024	11/1/98	15 2	
EVS-Mac-TBT-25	K9807071-025	11/1/98	15 1	
EVS-Mac-TBT-26	K9807071-026	11/1/98	14 9	
EVS-Mac-TBT-27	K9807071-027	11/1/98	15.4	
EVS-Mac-TBT-28	K9807071-028	11/1/98	15 4	
EVS-Mac-TBT-29	K9807071-029	11/1/98	15 1	
EVS-Mac-TBT-30	K9807071-030	11/1/98	16 0	
EVS-Mac-TBT-31	K9807071-031	11/1/98	16 3	
EVS-Mac-TBT-32	K9807071-032	11/1/98	15 0	
EVS-Mac-TBT-34	K9807071-033	11/1/98	15 8	
EVS-Mac-TBT-36	K9807071-034	11/1/98	15 0	
EVS-Mac-TBT-37	K9807071-035	11/1/98	15 5	
EVS-Mac-TBT-38	K9807071-036	11/1/98	16 6	
EVS-Mac-TBT-42	K9807071-037	11/1/98	15 9	
EVS-NEP-TBT-2	K9807071-038	11/1/98	17 3	
EVS-NEP-TBT-3	K9807071-039	11/1/98	17.2	
EVS-NEP-TBT-4	K9807071-040	11/1/98	16 5	

Data Validated-EPA Level I

Quality by Design

TD 12/21/98

Approved By: _____ Date 11/2/98

1A/052595

070711CP JC2 - Sample 11/2/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Total Solids (%)

Prep Method:	NONE	Units	PERCENT
Analysis Method	Freeze Dry	Basis	Wet
Test Notes.			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
EVS-NEP-TBT-5	K9807071-041	11/1/98	14 4	
EVS-NEP-TBT-7	K9807071-042	11/1/98	16 9	
EVS-NEP-TBT-8	K9807071-043	11/1/98	19.3	
EVS-NEP-TBT-9	K9807071-044	11/1/98	14.5	
EVS-NEP-TBT-10	K9807071-045	11/1/98	18 9	
EVS-NEP-TBT-11	K9807071-046	11/1/98	17.7	
EVS-NEP-TBT-12	K9807071-047	11/1/98	16 6	
EVS-NEP-TBT-13	K9807071-048	11/1/98	16 5	
EVS-NEP-TBT-14	K9807071-049	11/1/98	16 9	
EVS-NEP-TBT-15	K9807071-050	11/1/98	18.0	
EVS-NEP-TBT-17	K9807071-051	11/1/98	17 0	
EVS-NEP-TBT-18	K9807071-052	11/1/98	18 5	
EVS-NEP-TBT-19	K9807071-053	11/1/98	15 8	
EVS-NEP-TBT-20	K9807071-054	11/1/98	15 3	
EVS-NEP-TBT-22	K9807071-055	11/1/98	26 8	
EVS-NEP-TBT-23	K9807071-056	11/1/98	17 5	
EVS-NEP-TBT-25	K9807071-057	11/1/98	16 8	
EVS-NEP-TBT-26	K9807071-058	11/1/98	12 3	
EVS-NEP-TBT-27	K9807071-059	11/1/98	14 4	
EVS-NEP-TBT-28	K9807071-060	11/1/98	17 9	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date. 11/2/98

1A/052595

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Total Solids (%)

Prep Method.	NONE	Units	PERCENT
Analysis Method	Freeze Dry	Basis	Wet
Test Notes			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
EVS-NEP-TBT-29	K9807071-061	11/1/98	13 3	
EVS-NEP-TBT-30	K9807071-062	11/1/98	21 3	
EVS-NEP-TBT-31	K9807071-063	11/1/98	11 7	
EVS-NEP-TBT-32	K9807071-064	11/1/98	16 0	
EVS-NEP-TBT-34	K9807071-065	11/1/98	16 5	
EVS-NEP-TBT-36	K9807071-066	11/1/98	16 6	
EVS-NEP-TBT-37	K9807071-067	11/1/98	16 4	
EVS-NEP-TBT-38	K9807071-068	11/1/98	17 8	
EVS-NEP-TBT-42	K9807071-069	11/1/98	17 7	
Rep1-EVS-TBT-Nepthys Bkgd	K9807071-070	11/1/98	19 2	
Rep2-EVS-TBT-Nepthys Bkgd	K9807071-071	11/1/98	19 9	
Rep3-EVS-TBT-Nepthys Bkgd	K9807071-072	11/1/98	19 3	
Rep4-EVS-TBT-Nepthys Bkgd	K9807071-073	11/1/98	19 7	
Rep5-EVS-TBT-Nepthys Bkgd	K9807071-074	11/1/98	19 4	

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By: _____ Date 11/2/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98
Date Extracted: 11/3/98
Date Analyzed: 11/17/98

Lipids
Gravimetric
Units Percent (%)
As Received Basis

Sample Name	Lab Code	Result
Rep1-EVS-TBT-Macoma Bkgd	K9807071-001	0.28
Rep2-EVS-TBT-Macoma Bkgd	K9807071-002	0 04
Rep3-EVS-TBT-Macoma Bkgd	K9807071-003	0.27
Rep4-EVS-TBT-Macoma Bkgd	K9807071-004	0.03
Rep5-EVS-TBT-Macoma Bkgd	K9807071-005	0.68
EVS-Mac-TBT-2	K9807071-006	0.05
EVS-Mac-TBT-3	K9807071-007	0.13
EVS-Mac-TBT-5	K9807071-009	0.40
EVS-Mac-TBT-7	K9807071-010	<0 03
EVS-Mac-TBT-8	K9807071-011	0 12
EVS-Mac-TBT-9	K9807071-012	0.12
EVS-Mac-TBT-10	K9807071-013	0.23
EVS-Mac-TBT-11	K9807071-014	0 03
EVS-Mac-TBT-12	K9807071-015	0 08
EVS-Mac-TBT-13	K9807071-016	<0.03
EVS-Mac-TBT-14	K9807071-017	0.14
EVS-Mac-TBT-15	K9807071-018	0 10
EVS-Mac-TBT-17	K9807071-019	0 30
EVS-Mac-TBT-18	K9807071-020	0 05

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date: 11-20-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 11/5/98
Date Analyzed: 11/17/98

Lipids
Gravimetric
Units Percent (%)
As Received Basis

Sample Name	Lab Code	Result
EVS-Mac-TBT-4	K9807071-008	0 65
EVS-Mac-TBT-19	K9807071-021	0.42
EVS-Mac-TBT-20	K9807071-022	0.40
EVS-Mac-TBT-22	K9807071-023	0.52
EVS-Mac-TBT-23	K9807071-024	0.38
EVS-Mac-TBT-25	K9807071-025	0.36
EVS-Mac-TBT-26	K9807071-026	0.37
EVS-Mac-TBT-27	K9807071-027	0 25
EVS-Mac-TBT-28	K9807071-028	0 30
EVS-Mac-TBT-29	K9807071-029	0 32
EVS-Mac-TBT-30	K9807071-030	0 18
EVS-Mac-TBT-31	K9807071-031	0 25
EVS-Mac-TBT-32	K9807071-032	0 34
EVS-Mac-TBT-34	K9807071-033	0.17
EVS-Mac-TBT-36	K9807071-034	0.37
EVS-Mac-TBT-37	K9807071-035	0.48
EVS-Mac-TBT-38	K9807071-036	0 21
EVS-Mac-TBT-42	K9807071-037	0 07
EVS-NEP-TBT-2	K9807071-038	0 83
EVS-NEP-TBT-3	K9807071-039	0 61

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 11-20-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 11/10/98
Date Analyzed: 11/18/98

Lipids
Gravimetric
Units. Percent (%)
As Received Basis

Sample Name	Lab Code	Result
EVS-NEP-TBT-4	K9807071-040	0.88
EVS-NEP-TBT-5	K9807071-041	1.05
EVS-NEP-TBT-7	K9807071-042	0.74
EVS-NEP-TBT-8	K9807071-043	1.04
EVS-NEP-TBT-9	K9807071-044	1.24
EVS-NEP-TBT-10	K9807071-045	1 24
EVS-NEP-TBT-11	K9807071-046	1.02
EVS-NEP-TBT-12	K9807071-047	0.89
EVS-NEP-TBT-13	K9807071-048	0.93
EVS-NEP-TBT-14	K9807071-049	1 14
EVS-NEP-TBT-15	K9807071-050	1 20
EVS-NEP-TBT-17	K9807071-051	1 17
EVS-NEP-TBT-18	K9807071-052	1 03
EVS-NEP-TBT-19	K9807071-053	0.87
EVS-NEP-TBT-20	K9807071-054	0.96
EVS-NEP-TBT-22	K9807071-055	1 11
EVS-NEP-TBT-23	K9807071-056	1.02
EVS-NEP-TBT-25	K9807071-057	1.01
EVS-NEP-TBT-26	K9807071-058	0 79
EVS-NEP-TBT-27	K9807071-059	1.07
EVS-NEP-TBT-28	K9807071-060	1.19

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TD 12/21/98

Approved By: _____ Date: 11-20-98

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07071SVG PJ3 - TSolids 11/18/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 11/13/98
Date Analyzed: 11/19/98

Lipids
Gravimetric
Units Percent (%)
As Received Basis

Sample Name	Lab Code	Result
EVS-NEP-TBT-29	K9807071-061	0.75
EVS-NEP-TBT-30	K9807071-062	0 88
EVS-NEP-TBT-31	K9807071-063	0 96
EVS-NEP-TBT-32	K9807071-064	0 84
EVS-NEP-TBT-34	K9807071-065	1.02
EVS-NEP-TBT-36	K9807071-066	1 53
EVS-NEP-TBT-37	K9807071-067	1.00
EVS-NEP-TBT-38	K9807071-068	1 15
EVS-NEP-TBT-42	K9807071-069	1 46
Rep1-EVS-TBT-Nepthys Bkgd	K9807071-070	1 45
Rep2-EVS-TBT-Nepthys Bkgd	K9807071-071	1 08
Rep3-EVS-TBT-Nepthys Bkgd	K9807071-072	1 18

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By Jay Date. 11-20-98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep1-EVS-TBT-Macoma Bkgd	Units	ug/Kg (ppb)
Lab Code	K9807071-001	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/6/98	ND	

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Quality by Design
TD 12/21/98

Approved By _____ Date 12/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep2-EVS-TBT-Macoma Bkgd	Units	ug/Kg (ppb)
Lab Code	K9807071-002	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/6/98	ND	

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Quality by Design
TO 12/2/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep3-EVS-TBT-Macoma Bkgd	Units:	ug/Kg (ppb)
Lab Code:	K9807071-003	Basis:	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/6/98	ND	

Data Validated-EPA Level I
Quality by Design
TW 12/21/98

Approved By _____ Date 11/17/98

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070715VG BJ2 - 3 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep4-EVS-TBT-Macoma Bkgd	Units	ug/Kg (ppb)
Lab Code	K9807071-004	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/6/98	ND	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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07071SVG BJ2 4 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep5-EVS-TBT-Macoma Bkgd	Units	ug/Kg (ppb)
Lab Code	K9807071-005	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/6/98	ND	

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By _____ Date 12/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-2	Units	ug/Kg (ppb)
Lab Code	K9807071-006	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	50	

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Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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07071SVG BJ2 - 6 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-3	Units	ug/Kg (ppb)
Lab Code	K9807071-007	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	9	

Data Validated-EPA Level I

Quality by Design

TD 12/21/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-4	Units.	ug/Kg (ppb)
Lab Code	K9807071-008	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	20	10	11/5/98	11/13/98	~~380~~ 376	

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Quality by Design
12/21/98
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Approved By VAH Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-5	Units	ug/Kg (ppb)
Lab Code	K9807071-009	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	14	

Data Validated-EPA Level I

Quality by Design

TD 12/21/98

Approved By _____ Date 11/17/98

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07071SVG BJ6 - 9 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-7	Units	ug/Kg (ppb)
Lab Code	K9807071-010	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	10	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 12/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-8	Units:	ug/Kg (ppb)
Lab Code	K9807071-011	Basis:	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	11	

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Quality by Design
TD 12/24/98

Approved By _____ Date 11/17/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-9	Units	ug/Kg (ppb)
Lab Code	K9807071-012	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	43	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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07071SVG BJ6 12 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-10	Units	ug/Kg (ppb)
Lab Code	K9807071-013	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	11	

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By _____ Date 11/17/98

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07071SVG 1106 - 13 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-11	Units	ug/Kg (ppb)
Lab Code	K9807071-014	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	7	

Data Validated-EPA Level I

Quality by Design

TD 12/21/98

Approved By _____ Date 11/17/98

IS22/020597p

07071SVG BJ7 - 14 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-12	Units	ug/Kg (ppb)
Lab Code	K9807071-015	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	8	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 12/17/98

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07071SVG BJ7 - 15 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-13	Units	ug/Kg (ppb)
Lab Code	K9807071-016	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	25	

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By _____ Date 12/17/98

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07071SVG BJ7 16 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-14	Units	ug/Kg (ppb)
Lab Code	K9807071-017	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	17	

Data Validated-EPA Level I
Quality by Design
TD 12/24/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-15	Units	ug/Kg (ppb)
Lab Code	K9807071-018	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	15	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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070715VG BJ7 - 18 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-17	Units	ug/Kg (ppb)
Lab Code	K9807071-019	Basis	Wet
Test Notes.			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	4	

Data Validated-EPA Level I
Quality by Design
TD 12/24/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-18	Units	ug/Kg (ppb)
Lab Code	K9807071-020	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/7/98	13	

Data Validated-I PA Level I
Quality by Design
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Approved By _____ Date 11/17/98

1S22/020597p

07071SVG BJ7 20 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-19	Units	ug/Kg (ppb)
Lab Code	K9807071-021	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	99	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-20	Units	ug/Kg (ppb)
Lab Code	K9807071-022	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	82	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-22	Units:	ug/Kg (ppb)
Lab Code	K9807071-023	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	20	10	11/5/98	11/13/98	~~310~~	307

Data Validated-I PA Level I
Quality by Design
12/21/98

Approved By _____ Date 11/17/98

1S22/020597p

07071SVG BJI - 23 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-23	Units	ug/Kg (ppb)
Lab Code	K9807071-024	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	65	

Data Validated-EPA Level I
Quality by Design
TD/QSO 12/24/98

Approved By _____ Date 11/17/98

IS22/020597p

07071SVG BJ1 24 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-25	Units	ug/Kg (ppb)
Lab Code	K9807071-025	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	132	

Data Validated-EPA Level I

Quality by Design

TD/RBP 12/21/98

Approved By _____ Date 12/17/98

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-26	Units	ug/Kg (ppb)
Lab Code	K9807071-026	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	75	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date: 11/17/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-27	Units	ug/Kg (ppb)
Lab Code:	K9807071-027	Basis	Wet
Test Notes.			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	52	

Data Validated-EPA Level 3
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

1S22/020597p

07071SVG BJ3 27 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-28	Units	ug/Kg (ppb)
Lab Code	K9807071-028	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	145	

Data Validated-EPA Level I
Quality by Design
12/24/98

Approved By _____ Date 11/17/98

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07071SVG BJ3 28 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-29	Units	ug/Kg (ppb)
Lab Code	K9807071-029	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	51	

Data Validated-EPA Level I
Quality by Design
12/24/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-30	Units	ug/Kg (ppb)
Lab Code	K9807071-030	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	18	

Data Validated-I PA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-31	Units	ug/Kg (ppb)
Lab Code	K9807071-031	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/11/98	21	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-32	Units	ug/Kg (ppb)
Lab Code	K9807071-032	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/12/98	56	

Data Validated-LPA Level I
Quality by Design
TO 12/21/98

Approved By _____ Date 11/17/98

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07071SVG BJ4 - 32 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-34	Units:	ug/Kg (ppb)
Lab Code:	K9807071-033	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/12/98	14	

Data Validated-EPA Level I
Quality by Design
TD 12/2/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-36	Units	ug/Kg (ppb)
Lab Code	K9807071-034	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	20	10	11/5/98	11/13/98	~~260~~	253

Data Validated-EPA Level I
Quality by Design
12/21/98
TP/GBD

Approved By _____ Date 11/17/98

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-37	Units	ug/Kg (ppb)
Lab Code	K9807071-035	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/12/98	195	

Data Validated-EPA Level I
Quality by Design
TM 12/21/98

Approved By _____ Date 11/17/98

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07071SVG BJ4 35 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name.	EVS-Mac-TBT-38	Units	ug/Kg (ppb)
Lab Code	K9807071-036	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/12/98	94	

Data Validated-LPA Level I

Quality by Design

12/21/98

Approved By _____ Date: 12/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-Mac-TBT-42	Units.	ug/Kg (ppb)
Lab Code	K9807071-037	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/12/98	25	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-2	Units	ug/Kg (ppb)
Lab Code	K9807071-038	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/12/98	190	

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Quality by Design
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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name:	EVS-NEP-TBT-3	Units:	ug/Kg (ppb)
Lab Code:	K9807071-039	Basis:	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/5/98	11/12/98	131	

Data Validated-LPA Level I
Quality by Design
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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name:	Rep4-EVS-TBT-Nepthys Bkgd	Units	ug/Kg (ppb)
Lab Code:	K9807071-073	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/19/98	ND	

Data Validated-EPA Level I
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Approved By _____ Date 12/23/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep5-EVS-TBT-Nepthys Bkgd	Units	ug/Kg (ppb)
Lab Code.	K9807071-074	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/19/98	ND	

Data Validated-LPA Level I
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Approved By _____ Date 11/23/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
Sample Matrix:	Tissue	**Date Received:**	NA

Butyltins

Sample Name.	Method Blank	Units	ug/Kg (ppb)
Lab Code	K981103-MB	Basis	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/3/98	11/6/98	ND	

Data Validated-EPA Level I
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Approved By: _____ Date 11/17/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
Sample Matrix:	Tissue	**Date Received:**	NA

Butyltins

Sample Name	Method Blank	Units	ug/Kg (ppb)
Lab Code.	K981105-MB	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	20	10	11/5/98	11/11/98	ND	

Data Validated-EPA Level I
Quality by Design
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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
Sample Matrix:	Tissue	**Date Received:**	NA

Butyltins

Sample Name	Method Blank	Units	ug/Kg (ppb)
Lab Code	K981110-MB	Basis	Wet
Test Notes.			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	ND	

Data Validated-EPA Level I
Quality by Design
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Approved By _____ Date 11/19/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
Sample Matrix:	Tissue	**Date Received:**	NA

Butyltins

Sample Name:	Method Blank	Units	ug/Kg (ppb)
Lab Code:	K981113-MB	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	ND	

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APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name: EVS-Mac-TBT-15
Lab Code: K9807071-018
Test Notes:

Units: PERCENT
Basis: Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	14 7	14 8	14.8	<1	

Data Validated-EPA Level I
Quality by Design
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Approved By: _____ Date: 11/30/98

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary
Total Metals

Sample Name: EVS-Mac-TBT-15
Lab Code: K9807071-018
Test Notes:

Units: PERCENT
Basis: Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	14 7	14 8	14 8	<1	

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07071ICP JC1 - DUP 11/2/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name EVS-Mac-TBT-15
Lab Code K9807071-018
Test Notes

Units PERCENT
Basis Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	14 7	14 8	14 8	<1	

Approved By _____ Date _____

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name: EVS-Mac-TBT-26
Lab Code: K9807071-026
Test Notes:

Units: PERCENT
Basis: Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	14.9	14 7	14 8	1	

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By: _____ Date: 12/30/98

00092

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary
Total Metals

Sample Name: EVS-Mac-TBT-26
Lab Code: K9807071-026
Test Notes:

Units: PERCENT
Basis: Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	14 9	14 7	14 8	1	

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00092

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name EVS-Mac-TBT-26
Lab Code K9807071-026
Test Notes

Units PERCENT
Basis Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	14 9	14 7	14 8	1	

Approved By _____ Date _____

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name: EVS-Mac-TBT-37
Lab Code: K9807071-035
Test Notes.

Units: PERCENT
Basis: Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	15 5	15 6	15 6	<1	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

00093

Approved By: _____ Date: 11/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary
Total Metals

Sample Name EVS-Mac-TBT-37
Lab Code K9807071-035
Test Notes

Units PERCENT
Basis Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	15 5	15 6	15 6	<1	

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name EVS-Mac-TBT-37
Lab Code K9807071-035
Test Notes

Units PERCENT
Basis Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	15 5	15 6	15 6	<1	

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name EVS-NEP-TBT-38
Lab Code K9807071-068
Test Notes

Units: PERCENT
Basis: Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	17.8	18.0	17.9	1	

Data Validated-EPA Level I
Quality by Design
PP 12/21/98

Approved By: _____ Date: 11/30/98

00094

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07071ICP JC4 - DUP 11/30/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary
Total Metals

Sample Name EVS-NEP-TBT-38
Lab Code K9807071-068
Test Notes

Units: PERCENT
Basis: Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	17 8	18 0	17 9	1	

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COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: NA
Date Analyzed: 11/1/98

Duplicate Summary

Sample Name EVS-NEP-TBT-38
Lab Code K9807071-068
Test Notes

Units PERCENT
Basis Wet

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solid, Total	NA	Freeze Dry	17 8	18 0	17 9	1	

Approved By _____ Date _____

DUP/052595

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26 - 10/10/98
Date Received: 10/13/98
Date Extracted: 11/3/98
Date Analyzed: 11/6 - 7/98

Surrogate Recovery Summary
Butyltins

Prep Method Method
Analysis Method Butyltins-GC

Units PERCENT
Basis NA

Sample Name	Lab Code	Test Notes	Percent Recovery Tri-n-propyltin	Tri-n-pentyltin
Rep1-EVS-TBT-Macoma Bkgd	K9807071-001		61	67
Rep2-EVS-TBT-Macoma Bkgd	K9807071-002		88	87
Rep3-EVS-TBT-Macoma Bkgd	K9807071-003		61	66
Rep4-EVS-TBT-Macoma Bkgd	K9807071-004		63	56
Rep5-EVS-TBT-Macoma Bkgd	K9807071-005		72	65
EVS-Mac-TBT-2	K9807071-006		84	61
EVS-Mac-TBT-3	K9807071-007		58	41
EVS-Mac-TBT-5	K9807071-009		51	47
EVS-Mac-TBT-7	K9807071-010		49	47
EVS-Mac-TBT-8	K9807071-011		60	52
EVS-Mac-TBT-9	K9807071-012		66	41
EVS-Mac-TBT-10	K9807071-013		78	60
EVS-Mac-TBT-11	K9807071-014		59	57
EVS-Mac-TBT-12	K9807071-015		52	60
EVS-Mac-TBT-13	K9807071-016		62	64
EVS-Mac-TBT-14	K9807071-017		93	66
EVS-Mac-TBT-15	K9807071-018		62	53
EVS-Mac-TBT-17	K9807071-019		75	62
EVS-Mac-TBT-18	K9807071-020		44	40
EVS-Mac-TBT-4	K9807071-008MS		53	44
EVS-Mac-TBT-4	K9807071-008DMS		22	26 A
Lab Control Sample	K981103-LCS		60	49
Method Blank	K981103-MB		21	43
	CAS Acceptance Limits		13-176	32-167

A Outside acceptance limits, see case narrative

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

SUR2/111397p
07071SVG BJ2 - SUR2 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 11/5/98
Date Analyzed: 11/11 - 13/98

Surrogate Recovery Summary
Butyltins

Prep Method: Method
Analysis Method: Butyltins-GC

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery Tri-n-propyltin	Tri-n-pentyltin
EVS-Mac-TBT-4	K9807071-008		109	81
EVS-Mac-TBT-19	K9807071-021		118	82
EVS-Mac-TBT-20	K9807071-022		92	74
EVS-Mac-TBT-22	K9807071-023		118	80
EVS-Mac-TBT-23	K9807071-024		117	82
EVS-Mac-TBT-25	K9807071-025		82	67
EVS-Mac-TBT-26	K9807071-026		98	83
EVS-Mac-TBT-27	K9807071-027		85	62
EVS-Mac-TBT-28	K9807071-028		100	75
EVS-Mac-TBT-29	K9807071-029		90	72
EVS-Mac-TBT-30	K9807071-030		94	67
EVS-Mac-TBT-31	K9807071-031		83	71
EVS-Mac-TBT-32	K9807071-032		89	91
EVS-Mac-TBT-34	K9807071-033		83	67
EVS-Mac-TBT-36	K9807071-034		90	83
EVS-Mac-TBT-37	K9807071-035		82	67
EVS-Mac-TBT-38	K9807071-036		107	80
EVS-Mac-TBT-42	K9807071-037		102	81
EVS-NEP-TBT-2	K9807071-038		92	102
EVS-NEP-TBT-3	K9807071-039		102	111
EVS-Mac-TBT-25	K9807071-025MS		103	86
EVS-Mac-TBT-25	K9807071-025DMS		87	81
Lab Control Sample	K981105-LCS		69	37
Method Blank	K981105-MB		73	54
	CAS Acceptance Limits		13-176	32-167

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By _____ Date: 11/17/98

SUR2/111397p
07071SVG BJI - SUR2 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 11/10/98
Date Analyzed: #NUM!

Surrogate Recovery Summary
Butyltins

Prep Method: Method
Analysis Method: Butyltins-GC

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery Tri-n-propyltin	Tri-n-pentyltin
EVS-NEP-TBT-4	K9807071-040		115	85
EVS-NEP-TBT-5	K9807071-041		123	108
EVS-NEP-TBT-7	K9807071-042		125	93
EVS-NEP-TBT-8	K9807071-043		127	100
EVS-NEP-TBT-9	K9807071-044		127	94
EVS-NEP-TBT-10	K9807071-045		104	87
EVS-NEP-TBT-11	K9807071-046		110	97
EVS-NEP-TBT-12	K9807071-047		118	92
EVS-NEP-TBT-13	K9807071-048		115	95
EVS-NEP-TBT-14	K9807071-049		109	94
EVS-NEP-TBT-15	K9807071-050		131	100
EVS-NEP-TBT-17	K9807071-051		111	89
EVS-NEP-TBT-18	K9807071-052		109	87
EVS-NEP-TBT-19	K9807071-053		113	103
EVS-NEP-TBT-20	K9807071-054		123	101
EVS-NEP-TBT-22	K9807071-055		110	88
EVS-NEP-TBT-23	K9807071-056		117	91
EVS-NEP-TBT-25	K9807071-057		118	87
EVS-NEP-TBT-26	K9807071-058		119	89
EVS-NEP-TBT-27	K9807071-059		117	89
EVS-NEP-TBT-28	K9807071-060		107	80
EVS-NEP-TBT-12	K9807071-047MS		94	84
EVS-NEP-TBT-12	K9807071-047DMS		110	81
Lab Control Sample	K981110-LCS		51	11 A
Method Blank	K981110-MB		106	108
	CAS Acceptance Limits		13-176	32-167

A Outside acceptance limits, see case narrative

Data Validated-EPA Level I
Quality by Design
TD ~~12/2/98~~ 12/21/98

Approved By: _____ Date: 11/19/98

SUR2/111397p
07071SVG JG1 - SUR2 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26 - 10/10/98
Date Received: 10/13/98
Date Extracted: 11/13/98
Date Analyzed: 11/18 - 19/98

Surrogate Recovery Summary
Butyltins

Prep Method: Method
Analysis Method: Butyltins-GC

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery Tri-n-propyltin	Tri-n-pentyltin
EVS-NEP-TBT-29	K9807071-061		105	99
EVS-NEP-TBT-30	K9807071-062		141	113
EVS-NEP-TBT-31	K9807071-063		119	113
EVS-NEP-TBT-32	K9807071-064		112	105
EVS-NEP-TBT-34	K9807071-065		130	117
EVS-NEP-TBT-36	K9807071-066		115	97
EVS-NEP-TBT-37	K9807071-067		123	98
EVS-NEP-TBT-38	K9807071-068		145	114
EVS-NEP-TBT-42	K9807071-069		118	104
Rep1-EVS-TBT-Nepthys Bkgd	K9807071-070		119	114
Rep2-EVS-TBT-Nepthys Bkgd	K9807071-071		127	117
Rep3-EVS-TBT-Nepthys Bkgd	K9807071-072		123	107
Rep4-EVS-TBT-Nepthys Bkgd	K9807071-073		117	115
Rep5-EVS-TBT-Nepthys Bkgd	K9807071-074		117	117
EVS-NEP-TBT-37	K9807071-067MS		200	87
EVS-NEP-TBT-37	K9807071-067DMS		107	79
Lab Control Sample	K981113-LCS		65	32
Method Blank	K981113-MB		102	92
CAS Acceptance Limits			13-176	32-167

Data Validated-EPA Level I
Quality by Design
TV 12/28/98
12/21/99

Approved By _____ Date 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98
		Date Extracted:	11/3/98
		Date Analyzed:	11/7/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins

Sample Name	EVS-Mac-TBT-4	Units.	ug/Kg (ppb)
Lab Code	K9807071-008MS, K9807071-008DMS	Basis.	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	50	50	380	81	101	NC	NC	10-206	-	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By. _____ Date 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98
		Date Extracted:	11/5/98
		Date Analyzed:	11/11/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins

Sample Name:	EVS-Mac-TBT-25	Units:	ug/Kg (ppb)
Lab Code.	K9807071-025MS, K9807071-025DMS	Basis.	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	20	49	49	132	130	183	NC	NC	10-206	-	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By. _____ Date 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98
		Date Extracted:	11/10/98
		Date Analyzed:	11/14/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins

Sample Name:	EVS-NEP-TBT-12	Units:	ug/Kg (ppb)
Lab Code:	K9807071-047MS, K9807071-047DMS	Basis:	Wet
Test Notes			

				Spike Level		Sample	Spike Result		Percent Recovery				
Analyte	**Prep Method**	**Analysis Method**	**MRL**	MS	DMS	**Result**	MS	DMS	MS	DMS	CAS Acceptance Limits	**Relative Percent Difference**	**Result Notes**
Tri-n-butyltin	Method	Butyltins-GC	2	88	130	71	151	178	91	82	10-206	10	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 11/30/98

00101

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98
		Date Extracted:	11/13/98
		Date Analyzed:	11/18-19/98

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins

Sample Name	EVS-NEP-TBT-37	Units	ug/Kg (ppb)
Lab Code	K9807071-067MS, K9807071-067DMS	Basis	Wet
Test Notes			

				Spike Level		Sample	Spike Result		Percent Recovery		CAS Acceptance	Relative Percent	
Analyte	**Prep Method**	**Analysis Method**	**MRL**	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**	**Result Notes**
Tri-n-butyltin	Method	Butyltins-GC	2	410	410	359	768	750	100	95	10-206	2	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/20/98

DMS/020597B7071SVG JJT DMS 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/3/98
		Date Analyzed:	11/6/98

Laboratory Control Sample Summary
Butyltins

Sample Name	Lab Control Sample	Units	ug/Kg (ppb)
Lab Code	K981103-LCS	Basis.	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	63	37	59	17-185	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/17/98

LCS/080797p
07071SVG BJ2 - LCS 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/5/98
		Date Analyzed:	11/11/98

Laboratory Control Sample Summary
Butyltins

Sample Name:	Lab Control Sample	Units	ug/Kg (ppb)
Lab Code	K981105-LCS	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	54	27	50	17-185	

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By: _____ Date 11/17/98

LCS/080797p
07071SVG BJ1 - LCS 11/17/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
LCS Matrix: Tissue

Service Request: K9807071
Date Collected: NA
Date Received: NA
Date Extracted: 11/10/98
Date Analyzed: 11/13/98

Laboratory Control Sample Summary
Butyltins

Sample Name: Lab Control Sample
Lab Code: K981110-LCS
Test Notes:

Units: ug/Kg (ppb)
Basis: Wet

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	50	14	28	17-185	

Data Validated-LPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 11/30/98

00105

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/10/98
		Date Analyzed:	11/13/98

Laboratory Control Sample Summary
Butyltins

Sample Name	Lab Control Sample	Units	ug/Kg (ppb)
Lab Code	K981110-LCS	Basis:	Dry

Test Notes:

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	50	14	28	17-185	

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Approved By. _____ Date. 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
LCS Matrix: Tissue

Service Request: K9807071
Date Collected: NA
Date Received: NA
Date Extracted: 11/10/98
Date Analyzed: 11/13/98

Laboratory Control Sample Summary
Butyltins

Sample Name: Lab Control Sample
Lab Code: K981110-LCS
Test Notes: #REF!

Units: ug/Kg (ppb)
Basis: Wet

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	50	14	28	17-185	

Approved By _____ Date _____

LCS/080797p

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	11/13/98
		Date Analyzed:	11/18/98

Laboratory Control Sample Summary
Butyltins

Sample Name	Lab Control Sample	Units	ug/Kg (ppb)
Lab Code	K981113-LCS	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	240	147	61	17-185	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/6-7/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tri-n-butyltin	500	500	100	555	111	577	115	564	113

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 12/20/98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/11-12/1998

Continuing Calibration Verification (CCV) Summary
Butyltins
Units µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tri-n-butyltin	500	583	117	578	116	547	109	568	114

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date. 12/20/98

CCV 1-4/042795

07071SVG BJI CCV 1-4 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/13/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery
Tri-n-butyltin	500	596	119	598	120

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By: _____ Date: 12/20/98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/13-14/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tri-n-butyltin	500	556	111	582	116	578	116	326	65

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By. _____ Date. 12/20/98

CCV 1-4/042795

07071SVG JG4 - CCV 1-4 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/17/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery
Tri-n-butyltin	500	420	84	468	94

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By _____ Date 12/20/98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/18-19/98

Continuing Calibration Verification (CCV) Summary
Butyltins
Units: µg/L (ppb)

Analyte	True Value	CCV1 Result	Percent Recovery	CCV2 Result	Percent Recovery	CCV3 Result	Percent Recovery	CCV4 Result	Percent Recovery
Tri-n-butyltin	500	531	106	545	109	570	114	569	114

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By LAZ Date 11/19/98

CCV 1-4/042795

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/6-7/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tri-n-butyltin	10	ND	ND	ND	ND

Data Validated-EPA Level I
Quality by Design

TD 12/21/98

Approved By: _____ Date: 11/20/98

I&CCBMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/11-12/1998

Continuing Calibration Blank (CCB) Summary
Butyltins
Units: µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tri-n-butyltin	10	ND	ND	ND	ND

Data Validated-EPA Level I
Quality by Design
TD 12/2/98

Approved By _____ Date 12/20/98

I&CCBMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/13/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units. µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result
Tri-n-butyltin	10	ND	ND

Data Validated-EPA Level I
Quality by Design
TD 12/2/98

Approved By: _____ Date: 11/20/98

I&CCBMRL/120594

07071SVG BJI - CCBMRL (DIL) 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/13-14/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units: µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tri-n-butyltin	10	ND	ND	ND	ND

Data Validated-EPA Level I
Quality by Design
TV 12/21/98

Approved By _____ Date. 12/20/98

I&CCBMRL/120594

07071SVG JG4 - CCBMRL (1) 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/17/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units: µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result
Tri-n-butyltin	10	ND	ND

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 11/20/98

I&CCBMRL/120594

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation

Service Request: K9807071
Calibration Date: 9/17/98
Date Analyzed: 11/18-19/98

Continuing Calibration Blank (CCB) Summary
Butyltins
Units: µg/L (ppb)

Analyte	MRL	CCB1 Result	CCB2 Result	CCB3 Result	CCB4 Result
Tri-n-butyltin	10	ND	ND	ND	ND

Data Validated-EPA Level I
Quality by Design
DB 12/21/98

Approved By: _____ Date: 11/20/98

I&CCBMRL/120594

K980071

Battelle
Pacific Northwest Division
Marine Sciences Laboratory
1529 West Sequim Bay Road
Sequim, Washington 98382

SAMPLE CUSTODY RECORD

Date 10/12/98 Page 1 of 3

Project No.
Project Name EVS-TBT Bioaccumulation
Project Manager Bill Gardiner Phone 360/681-3661

Lab CAS
Address Kelso WA
Attention Lynda Huckestein

Lab No.	Sample No.	Collection Date	Matrix	Testing Parameters: TBT Analysis	No. of Containers	Observations, Instructions
1 rep1	EVS-TBT-Macoma Bkgd	10/10/98	Tissue-Clam	✓	1	
2 rep2				✓	1	
3 rep3				✓	1	
4 rep4				✓	1	
5 rep5				✓	1	
6	EVS-Mac-TBT-2	10/10/98		✓	1	
7	3			✓	1	
8	4			✓	1	
9	5			✓	1	
10	7			✓	1	
11	8			✓	1	
12	9			✓	1	
13	10			✓	1	
14	11			✓	1	
15	12			✓	1	
16	13			✓	1	
17	14			✓	1	
18	15			✓	1	
19	17			✓	1	
20	18			✓	1	
21	19			✓	1	
22	20			✓	1	
23	22			✓	1	
24	23			✓	1	

Total No. of Containers: 24

Relinquished by:
Signature — Date 10/12/98 Time 1402
L. Niewolny
Printed Name
MSL
Company

Received by:
Signature — Date 10/13/98 Time 1025
Printed Name
CAS
Company

Shipment Method:

Special Requirements or Comments:

Relinquished by:
Signature — Date — Time
Printed Name
Company

Received by:
Signature — Date — Time
Printed Name
Company

DISTRIBUTION:
1. Provide white and yellow copies to the Laboratory
2. Return pink copy to Project file or to project manager.
3. Laboratory to return signed white copy to Battelle for project file.

00120

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-4	Units:	ug/Kg (ppb)
Lab Code.	K9807071-040	Basis:	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	20	10	11/10/98	11/17/98	~~380~~ 384	

Data Validated-EPA Level I
Quality by Design
12/21/98

Approved By: _____ Date: 12/19/98

TD/BD

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name:	EVS-NEP-TBT-5	Units	ug/Kg (ppb)
Lab Code	K9807071-041	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	120	

Data Validated-EPA Level I
Quality by Design
12/2/98

Approved By _____ Date. 12/19/98

1S22/020597p

07071SVG JGI 2 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-7	Units	ug/Kg (ppb)
Lab Code.	K9807071-042	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	89	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By. _____ Date. 12/19/98

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07071SVG JGI - 3 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name:	EVS-NEP-TBT-8	Units:	ug/Kg (ppb)
Lab Code:	K9807071-043	Basis:	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	104	

Data Validated-EPA Level I
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Approved By. _____ Date 11/19/98

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07071SVG JG1 - 4 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-9	Units	ug/Kg (ppb)
Lab Code	K9807071-044	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	130	

Data Validated-EPA Level I

Quality by Design

VD 12/21/98

Approved By _____ Date 11/19/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name:	EVS-NEP-TBT-10	Units	ug/Kg (ppb)
Lab Code:	K9807071-045	Basis	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	77	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date: 11/19/98

IS22/020597p

07071SVG JG1 - 6 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name.	EVS-NEP-TBT-11	Units:	ug/Kg (ppb)
Lab Code	K9807071-046	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	54	

Data Validated-EPA Level I
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TD 12/2/98

Approved By _____ Date. 11/19/98

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07071SVG JG2 - 11 19'98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name.	EVS-NEP-TBT-12	Units	ug/Kg (ppb)
Lab Code	K9807071-047	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/13/98	71	

Data Validated-EPA Level I

Quality by Design

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Approved By _____ Date 11/19/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-13	Units	ug/Kg (ppb)
Lab Code	K9807071-048	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	134	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/19/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-14	Units	ug/Kg (ppb)
Lab Code	K9807071-049	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	72	

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TD 12/21/98

Approved By. _____ Date 11/19/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-15	Units	ug/Kg (ppb)
Lab Code	K9807071-050	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	117	

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Approved By _____ Date 11/19/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name.	EVS-NEP-TBT-17	Units	ug/Kg (ppb)
Lab Code	K9807071-051	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	15	

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Approved By _____ Date 11/19/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-18	Units	ug/Kg (ppb)
Lab Code	K9807071-052	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	101	

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Approved By _____ Date 11/19/98

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07071SVG JG3 - 1 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-19	Units	ug/Kg (ppb)
Lab Code	K9807071-053	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	92	

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Quality by Design
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Approved By _____ Date 11/19/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-20	Units	ug/Kg (ppb)
Lab Code	K9807071-054	Basis:	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	70	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/19/98

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07071SVG.JG3 - 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name.	EVS-NEP-TBT-22	Units	ug/Kg (ppb)
Lab Code	K9807071-055	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	232	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date 11/19/98

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07071SVG JG3 - 4 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-23	Units	ug/Kg (ppb)
Lab Code	K9807071-056	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	77	

Data Validated-EPA Level I
Quality by Design
TP 12/28/98

Approved By _____ Date 11/19/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-25	Units:	ug/Kg (ppb)
Lab Code	K9807071-057	Basis.	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	222	

Data Validated-EPA Level I
Quality by Design
12/21/98

Approved By. _____ Date. 11/19/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name:	EVS-NEP-TBT-26	Units:	ug/Kg (ppb)
Lab Code	K9807071-058	Basis:	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	56	

Data Validated-EPA Level
Quality by Design
TD 12/21/98

Approved By: _____ Date: 11/19/98

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07071SVG JG4 - 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-27	Units	ug/Kg (ppb)
Lab Code	K9807071-059	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	129	

Data Validated-EPA Level I

Quality by Design

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Approved By: _____ Date 11/19/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-28	Units	ug/Kg (ppb)
Lab Code	K9807071-060	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/10/98	11/14/98	197	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/19/98

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07071SVG JG4 - 3 11/19/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-29	Units.	ug/Kg (ppb)
Lab Code	K9807071-061	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	58	

Data Validated-EPA Level I
Quality by Design
TD 12/2/1998

Approved By _____ Date 11/20/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-30	Units	ug/Kg (ppb)
Lab Code	K9807071-062	Basis	Wet
Test Notes.			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	114	

Data Validated-I PA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 12/20/98

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-31	Units.	ug/Kg (ppb)
Lab Code	K9807071-063	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	118	

Data Validated-EPA Level I
Quality by Design
TD 12/24/98

Approved By: _____ Date 11/20/98

1S22/020597p

07071SVG 1JL - 63 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-32	Units	ug/Kg (ppb)
Lab Code	K9807071-064	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	66	

Data Validated-EPA Level I

Quality by Design

TD 12/21/98

Approved By: _____ Date 11/20/98

1822/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-34	Units	ug/Kg (ppb)
Lab Code	K9807071-065	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	66	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By LAX Date 11/20/98

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name.	EVS-NEP-TBT-36	Units.	ug/Kg (ppb)
Lab Code	K9807071-066	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	215	

Data Validated-EPA Level
Quality by Design
TD 12/21/98

Approved By _____ Date 11/20/98

1S22/020597p

07071SVG III 66 11/20/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-37	Units	ug/Kg (ppb)
Lab Code	K9807071-067	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/18/98	359	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/20/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-38	Units:	ug/Kg (ppb)
Lab Code:	K9807071-068	Basis	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/19/98	192	

Data Validated-LPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date 11/23/98

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	EVS-NEP-TBT-42	Units	ug/Kg (ppb)
Lab Code	K9807071-069	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/19/98	90	

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 11/23/98

IS22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep1-EVS-TBT-Nepthys Bkgd	Units	ug/Kg (ppb)
Lab Code	K9807071-070	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/19/98	ND	

Data Validated-EPA Level I

Quality by Design

TP 12/24/98

Approved By _____ Date 11/25/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name	Rep2-EVS-TBT-Nepthys Bkgd	Units	ug/Kg (ppb)
Lab Code	K9807071-071	Basis	Wet
Test Notes			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/19/98	ND	

Data Validated-EPA Level I
Quality by Design
TJ 12/21/98

Approved By _____ Date 12/23/98

1S22/020597p

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	8/26/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98

Butyltins

Sample Name:	Rep3-EVS-TBT-Nepthys Bkgd	Units.	ug/Kg (ppb)
Lab Code:	K9807071-072	Basis:	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	Method	Butyltins-GC	2	1	11/13/98	11/19/98	ND	

Data Validated-LPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 12/23/98

1S22/020597p

IC980707I

Battelle
Pacific Northwest Division
Marine Sciences Laboratory
1529 West Sequim Bay Road
Sequim, Washington 98382

SAMPLE CUSTODY RECORD

Date 10/12/98 Page 2 of 3

Project No.
Project Name EVS-TBT Bioaccumulation
Project Manager Bill Gardiner Phone 360/681-3661

Testing Parameters: TBT Analysis

Lab CAS
Address Kelso WA
Attention Lynda Huckestein

Lab No.	Sample No.	Collection Date	Matrix	No. of Containers	Observations, Instructions
25	EVS-MAc-TBT-25	10/10/98	Clam Tissue	1	
26	26			1	
27	27			1	
28	28			1	
29	29			1	
30	30			1	
31	31			1	
32	32			1	
33	34			1	
34	36			1	
35	37			1	
36	38			1	
37	42			1	
38	EVS-NEP-TBT-2		Worm Tissue	1	
39	3			1	
40	4			1	
41	5			1	
42	7			1	
43	8			1	
44	9			1	
45	10			1	
46	11			1	
47	12			1	
48	13			1	

Total No. of Containers: 24

Relinquished by: L. Niewolny — Signature — Date 10/12/98 — Time 1400
Printed Name: L. Niewolny
Company: MSL

Received by: [signature] — Date 10/13/98 — Time 1030
Printed Name:
Company:

Shipment Method:

Special Requirements or Comments:

Relinquished by:
Signature — Date — Time
Printed Name
Company

Received by:
Signature — Date — Time
Printed Name
Company

DISTRIBUTION:
1. Provide white and yellow copies to the Laboratory
2. Return pink copy to Project file or to project manager.
3. Laboratory to return signed white copy to Battelle for project files.

00121

K9807071

Battelle
Pacific Northwest Division
Marine Sciences Laboratory
1529 West Sequim Bay Road
Sequim, Washington 98382

SAMPLE CUSTODY RECORD

Date 10/12/98 Page 3 of 3

Project No.
Project Name EVS-TBT Bioaccumulation
Project Manager Bill Gardiner Phone 360/681-3601

Testing Parameters: TBT Analysis

Lab No.	Sample No.	Collection Date	Matrix	No. of Containers
49	EVS-NEP-TBT-14	10/10/98	Worm Tissue	1
50	15			1
51	17			1
52	18			1
53	19			1
54	20			1
55	22			1
56	23			1
57	24/5			1
58	26			1
59	27			1
60	28			1
61	29			1
62	30			1
63	31			1
64	32			1
65	34			1
66	36			1
67	37			1
68	38			1
69	342			1
70 repl	EVS-TBT-Neptys BKgd	8/26/98		1
71 rep2				1
72 rep3				1

Lab
Address
Attention
Observations, Instructions

Total No. of Containers 24

Relinquished by:
Signature — Date 10/12/98 Time 1400
L. Niewolny
Printed Name
MSL
Company

Received by:
Signature — Date 10/13/98 Time 1030
Printed Name
Company

Relinquished by:
Signature — Date — Time
Printed Name
Company

Received by:
Signature — Date — Time
Printed Name
Company

Shipment Method:
Special Requirements or Comments:

DISTRIBUTION:
1. Provide white and yellow copies to the Laboratory
2. Return pink copy to Project file or to project manager.
3. Laboratory to return signed white copy to Battelle for project files.

00122

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Lipids
Bligh & Dyer
Units: Percent (%)
As Received Basis

Sample Name	Lab Code	Result
Rep1-EVS-TBT-Macoma Bkgd	K9807071-001	0.77
Rep2-EVS-TBT-Macoma Bkgd	K9807071-002	0.81
Rep3-EVS-TBT-Macoma Bkgd	K9807071-003	0.75
Rep4-EVS-TBT-Macoma Bkgd	K9807071-004	0.77
Rep5-EVS-TBT-Macoma Bkgd	K9807071-005	0.77
EVS-Mac-TBT-2	K9807071-006	0.65
EVS-Mac-TBT-3	K9807071-007	0.55
EVS-Mac-TBT-4	K9807071-008	0.61
EVS-Mac-TBT-5	K9807071-009	0 62
EVS-Mac-TBT-7	K9807071-010	0.60
EVS-Mac-TBT-8	K9807071-011	0 76
EVS-Mac-TBT-9	K9807071-012	0.81
EVS-Mac-TBT-10	K9807071-013	0.67
EVS-Mac-TBT-11	K9807071-014	0.72
EVS-Mac-TBT-12	K9807071-015	0.41
EVS-Mac-TBT-13	K9807071-016	0 71
EVS-Mac-TBT-14	K9807071-017	1.12
EVS-Mac-TBT-15	K9807071-018	0.70
EVS-Mac-TBT-17	K9807071-019	0.68
EVS-Mac-TBT-18	K9807071-020	0 66
EVS-Mac-TBT-19	K9807071-021	0 68
EVS-Mac-TBT-20	K9807071-022	0 61

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By. _____ Date. 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Lipids
Bligh & Dyer
Units Percent (%)
As Received Basis

Sample Name	Lab Code	Result
EVS-Mac-TBT-22	K9807071-023	0.54
EVS-Mac-TBT-23	K9807071-024	0.72
EVS-Mac-TBT-25	K9807071-025	0.68
EVS-Mac-TBT-26	K9807071-026	0.65
EVS-Mac-TBT-27	K9807071-027	0.44
EVS-Mac-TBT-28	K9807071-028	0.52
EVS-Mac-TBT-29	K9807071-029	0.72
EVS-Mac-TBT-30	K9807071-030	0.69
EVS-Mac-TBT-31	K9807071-031	0.66
EVS-Mac-TBT-32	K9807071-032	0 73
EVS-Mac-TBT-34	K9807071-033	0 71
EVS-Mac-TBT-36	K9807071-034	0 67
EVS-Mac-TBT-37	K9807071-035	0.68
EVS-Mac-TBT-38	K9807071-036	0.81
EVS-Mac-TBT-42	K9807071-037	0.55
EVS-NEP-TBT-2	K9807071-038	1.09
EVS-NEP-TBT-3	K9807071-039	0.85
EVS-NEP-TBT-4	K9807071-040	0 94
EVS-NEP-TBT-5	K9807071-041	1 07
EVS-NEP-TBT-7	K9807071-042	1 15
EVS-NEP-TBT-8	K9807071-043	1 15
EVS-NEP-TBT-9	K9807071-044	1.16

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By. _____ Date 12/9/98

1A/102094
07071SVG PJ3 - TSobds 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Lipids
Bligh & Dyer
Units: Percent (%)
As Received Basis

Sample Name	Lab Code	Result
EVS-NEP-TBT-10	K9807071-045	1 13
EVS-NEP-TBT-11	K9807071-046	1 29
EVS-NEP-TBT-12	K9807071-047	2 37
EVS-NEP-TBT-13	K9807071-048	1.15
EVS-NEP-TBT-14	K9807071-049	1.13
EVS-NEP-TBT-15	K9807071-050	1 40
EVS-NEP-TBT-17	K9807071-051	1 12
EVS-NEP-TBT-18	K9807071-052	1.07
EVS-NEP-TBT-19	K9807071-053	1 06
EVS-NEP-TBT-20	K9807071-054	1 02
EVS-NEP-TBT-22	K9807071-055	0 98
EVS-NEP-TBT-23	K9807071-056	1 27
EVS-NEP-TBT-25	K9807071-057	1 12
EVS-NEP-TBT-26	K9807071-058	1 14
EVS-NEP-TBT-27	K9807071-059	1.27
EVS-NEP-TBT-28	K9807071-060	1 18
EVS-NEP-TBT-29	K9807071-061	0 83
EVS-NEP-TBT-30	K9807071-062	1.14
EVS-NEP-TBT-31	K9807071-063	0 71
EVS-NEP-TBT-32	K9807071-064	0 70
EVS-NEP-TBT-34	K9807071-065	0 70
EVS-NEP-TBT-36	K9807071-066	0 95

Data Validated-EPA Level I
Quality by Design
TP 12/21/98

Approved By _____ Date 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	EVS Environment Consultants	**Service Request:**	K9807071
Project:	TBT Bioaccumulation	**Date Collected:**	10/10/98
Sample Matrix:	Tissue	**Date Received:**	10/13/98
		Date Extracted:	12/7/98
		Date Analyzed:	12/8/98

Lipids
Bligh & Dyer
Units: Percent (%)
As Received Basis

Sample Name	Lab Code	Result
EVS-NEP-TBT-37	K9807071-067	0 87
EVS-NEP-TBT-38	K9807071-068	1.06
EVS-NEP-TBT-42	K9807071-069	1.03
Rep2-EVS-TBT-Nepthys Bkgd	K9807071-071	1.24

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By. _____ Date: 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Duplicate Summary
Lipids
Bligh & Dyer
Units: Percent (%)
As Received Basis

Sample Name: Rep1-EVS-TBT-Macoma Bkgd
Lab Code: K9807071-001DUP

Analyte	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lipids	0.77	0.68	0.72	12

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 8/26/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Duplicate Summary
Lipids
Bligh & Dyer
Units. Percent (%)
As Received Basis

Sample Name: EVS-Mac-TBT-9
Lab Code. K980707-012DUP

Analyte	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lipids	0 81	0.76	0 785	6

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Duplicate Summary
Lipids
Bligh & Dyer
Units: Percent (%)
As Received Basis

Sample Name. EVS-Mac-TBT-22
Lab Code: K9807071-023DUP

Analyte	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lipids	0 54	0.60	0.57	11

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: LAH Date 12/9/98

DUP1S/102194
07071SVG PJ3 - dup 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Duplicate Summary
Lipids
Bligh & Dyer
Units Percent (%)
As Received Basis

Sample Name: EVS-Mac-TBT-31
Lab Code: K9807071-031DUP

Analyte	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lipids	0 66	0.67	0 665	2

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By _____ Date 12/9/98

00010

DUP1S/102194
07071SVG PJ3 - dup (2) 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Duplicate Summary
Lipids
Bligh & Dyer
Units: Percent (%)
As Received Basis

Sample Name: EVS-NEP-TBT-10
Lab Code: K9807071-045DUP

Analyte	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lipids	1.13	1.19	1 16	5

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 12/9/98

00911

DUP1S/102194
07071SVG PJ4 - dup 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Duplicate Summary
Lipids
Bligh & Dyer
Units Percent (%)
As Received Basis

Sample Name EVS-NEP-TBT-15
Lab Code: K9807071-050DUP

Analyte	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lipids	1 40	1.13	1.265	21

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: CAL Date: 12/9/98

00912

DUP1S/102194
07071SVG PJ4 - dup (2) 12/9/98

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: EVS Environment Consultants
Project: TBT Bioaccumulation
Sample Matrix: Tissue

Service Request: K9807071
Date Collected: 10/10/98
Date Received: 10/13/98
Date Extracted: 12/7/98
Date Analyzed: 12/8/98

Duplicate Summary
Lipids
Bligh & Dyer
Units: Percent (%)
As Received Basis

Sample Name: EVS-NEP-TBT-38
Lab Code: K9807071-068DUP

Analyte	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Lipids	1.06	0.95	1.005	11

Data Validated-EPA Level I
Quality by Design
TD 12/21/98

Approved By: _____ Date: 12/9/98

APPENDIX F

Data Validation Reports

2203152009
DISK 181

Quality By Design

Laboratory Quality Assurance Consulting

97 Puhili Street
Hilo, Hawaii 96720

Phone: (808) 969-9424
Fax: (808) 969-9094

EPA LEVEL II
DATA VALIDATION REPORT

Project Name: WSOU TBT Study
Type of Samples: Sediments and Porewater
Date of Sampling: July 15-28, 1998

Prepared for:

EVS Environmental Consultants, Inc.
200 West Mercer Street, Suite 403
Seattle, WA 98119

Proposal No. 118
QBD Job No.: 133

Reviewed and Approved for Release:

Lorraine L Davis, Owner

Oct 13, 1998
Date

Prepared by:

Sherman McCutcheon

Table of Contents

This data validation report consists of the following stand alone sections, each of which is formatted to follow Functional Guidelines but which also include subsections discussing QBD contacts with the laboratory, other comments, and a summary table of data qualifiers.

A. Introduction

Laboratory Sciences, Inc., d.b.a. *Quality by Design*, has completed an EPA Level II Data Validation on the submitted data packages in accordance with QBD Proposal No. 118 and EVS Purchase Order No. 97716.

The reporting format and criteria for recommending data qualifying flags for this data set are described in USEPA *"Functional Guidelines for Evaluating Organics Analyses"*, *"Functional Guidelines for Evaluating Inorganics Analyses"*, as revised, December, 1994, and *"Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound"*, May 1997, or using criteria listed in the method referenced. Data may be qualified for any of several reasons:

1. By the laboratory prior to receipt by the reviewer;
2. Because of laboratory deviation from the designated method;
3. Because the data may not meet the criteria listed in the reference above; or
4. By the professional judgment of the reviewer.

The data set consists of seven data packages with a total of 1,206 pages from Columbia Analytical Services, Inc. in Kelso, Washington and contains data for the samples shown in Table 1.

Table 1: Sample Identification and Analysis

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-01-S	K9804715-001	X		X
TBT-02-S	K9804715-002	X		X
TBT-35-S	K9804715-003	X		X
TBT-03-S	K9804715-004	X		X
TBT-04-S	K9804715-005	X		X
TBT-05-S	K9804715-006	X		X
TBT-06-S	K9804715-007	X		X
TBT-07-S	K9804715-008	X		X
TBT-36-S	K9804715-009	X		X
TBT-07-FB	K9804715-010			X
TBT-07-CB	K9804715-011			X

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-08-S	K9804715-012	X		X
TBT-09-S	K9804715-013	X		X
TBT-01-PD	K9804760-001			X
98626	K9804760-002			X
TBT-02-PT	K9804760-003			X
TBT-36-PD	K9804760-004			X
TBT-35-PD	K9804760-005			X
TBT-35-PD	K9804760-005			X
TBT-08-PT	K9804760-006			X
TBT-02-PD	K9804760-007			X
TBT-08-PD	K9804760-008			X
TBT-35-PT	K9804760-009			X
TBT-01-PT	K9804760-010			X
TBT-36-PT	K9804760-011			X
TBT-03-PD	K9804760-012			X
TBT-05-PD	K9804760-013			X
TBT-04-PD	K9804760-014			X
TBT-05-PT	K9804760-015			X
TBT-04-PT	K9804760-016			X
TBT-03-PT	K9804760-017			X
TBT-06-PT	K9804760-018			X
TBT-06-PD	K9804760-019			X
TBT-07-PT	K9804760-020			X
TBT-07-PD	K9804760-021			X
TBT-09-PT	K9804760-022			X
TBT-09-PD	K9804760-023			X
TBT-10-PT	K9804760-024			X
TBT-10-PD	K9804760-025			X
TBT-10-S	K9804761-001	X		X
TBT-11-S	K9804761-002	X		X

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-12-S	K9804761-003	X		X
TBT-13-S	K9804761-004	X		X
TBT-14-S	K9804761-005	X		X
TBT-37-S	K9804761-006	X		X
TBT-15-S	K9804761-007	X		X
TBT-16-S	K9804761-008	X		X
TBT-17-S	K9804761-009	X		X
TBT-18-S	K9804761-010	X		X
TBT-19-S	K9804761-011	X		X
TBT-20-S	K9804761-012	X		X
TBT-32-S	K9804795- 012	X		X
TBT-21-S	K9804795-001	X		X
TBT-22-S	K9804795-002	X		X
TBT-23-S	K9804795-003	X		X
TBT-24-S	K9804795-004	X		X
TBT-25-S	K9804795-005	X		X
TBT-25-CB	K9804795-006	X		X
TBT-26-S	K9804795-007	X		X
TBT-27-S	K9804795-008	X		X
TBT-28-S	K9804795-009	X		X
TBT-38-S	K9804795-010	X		X
TBT-34-S	K9804795-011	X		X
TBT-31-S	K9804795-013	X		X
TBT-33-S	K9804795-014	X		X
TBT-29-S	K9804795-015	X		X
TBT-30-S	K9804795-016	X		X
TBT-11-PT	K9804815-001			X
TBT-11-PD	K9804815-002			X
TBT-12-PT	K9804815-003			X
TBT-12-PD	K9804815-004			X

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-13-PT	K9804815-005			X
TBT-13-PD	K9804815-006			X
TBT-14-PT	K9804815-007			X
TBT-14-PD	K9804815-008			X
TBT-37-PT	K9804815-009			X
TBT-37-PD	K9804815-010			X
TBT-21-PT	K9804815-023			X
TBT-21-PD	K9804815-024			X
TBT-22-PT	K9804815-025			X
TBT-22-PD	K9804815-026			X
TBT-23-PT	K9804815-027			X
TBT-23-PD	K9804815-028			X
TBT-24-PT	K9804815-029			X
TBT-24-PD	K9804815-030			X
TBT-25-PT	K9804815-031			X
TBT-25-PD	K9804815-032			X
TBT-26-PT	K9804815-033			X
TBT-26-PD	K9804815-034			X
TBT-27-PT	K9804815-035			X
TBT-27-PD	K9804815-036			X
TBT-28-PT	K9804815-037			X
TBT-28-PD	K9804815-038			X
TBT-34-PT	K9804815-039			X
TBT-34-PD	K9804815-040			X
TBT-32-PT	K9804815-041			X
TBT-32-PD	K9804815-042			X
TBT-31-PT	K9804815-043			X
TBT-31-PD	K9804815-044			X
TBT-33-PT	K9804815-045			X
TBT-33-PD	K9804815-046			X

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-29-PT	K9804815-047			X
TBT-29-PD	K9804815-048			X
TBT-30-PT	K9804815-049			X
TBT-30-PD	K9804815-050			X
TBT-38-PT	K9804815-051			X
TBT-38-PD	K9804815-052			X
TBT-LCS-PT	K9804815-053			X
TBT-LCS-PD	K9804815-054			X
TBT-01-TOC	K9804937-001	X		
TBT-01-DOC	K9804937-002		X	
TBT-02-TOC	K9804937-003	X		
TBT-02-DOC	K9804937-004		X	
TBT-03-TOC	K9804937-005	X		
TBT-03-DOC	K9804937-006		X	
TBT-04-TOC	K9804937-007	X		
TBT-04-DOC	K9804937-008		X	
TBT-05-DOC	K9804937-009		X	
TBT-05-TOC	K9804937-010	X		
TBT-06-TOC	K9804937-011	X		
TBT-06-DOC	K9804937-012		X	
TBT-07-TOC	K9804937-013	X		
TBT-07-DOC	K9804937-014		X	
TBT-08-TOC	K9804937-015	X		
TBT-08-DOC	K9804937-016		X	
TBT-09-TOC	K9804937-017	X		
TBT-09-DOC	K9804937-018		X	
TBT-10-TOC	K9804937-019	X		
TBT-10-DOC	K9804937-020		X	
TBT-11-TOC	K9804937-021	X		
TBT-11-DOC	K9804937-022		X	

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-12-TOC	K9804937-023	X		
TBT-12-DOC	K9804937-024		X	
TBT-13-TOC	K9804937-025	X		
TBT-13-DOC	K9804937-026		X	
TBT-14-TOC	K9804937-027	X		
TBT-14-DOC	K9804937-028		X	
TBT-15-TOC	K9804937-029	X		
TBT-15-DOC	K9804937-030		X	
TBT-16-TOC	K9804937-031	X		
TBT-16-DOC	K9804937-032		X	
TBT-17-TOC	K9804937-033	X		
TBT-17-DOC	K9804937-034		X	
TBT-18-TOC	K9804937-035	X		
TBT-18-DOC	K9804937-036		X	
TBT-19-TOC	K9804937-037	X		
TBT-19-DOC	K9804937-038		X	
TBT-20-TOC	K9804937-039	X		
TBT-20-DOC	K9804937-040		X	
TBT-21-TOC	K9804937-041	X		
TBT-21-DOC	K9804937-042		X	
TBT-22-TOC	K9804937-043	X		
TBT-22-DOC	K9804937-044		X	
TBT-23-TOC	K9804937-045	X		
TBT-23-DOC	K9804937-046		X	
TBT-24-TOC	K9804937-047	X		
TBT-24-DOC	K9804937-048		X	
TBT-25-TOC	K9804937-049	X		
TBT-25-DOC	K9804937-050		X	
TBT-26-TOC	K9804937-051	X		
TBT-26-DOC	K9804937-052		X	

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-27-TOC	K9804937-053	X		
TBT-27-DOC	K9804937-054		X	
TBT-28-TOC	K9804937-055	X		
TBT-28-DOC	K9804937-056		X	
TBT-29-TOC	K9804937-057	X		
TBT-29-DOC	K9804937-058		X	
TBT-30-TOC	K9804937-059	X		
TBT-30-DOC	K9804937-060		X	
TBT-31-TOC	K9804937-061	X		
TBT-31-DOC	K9804937-062		X	
TBT-32-TOC	K9804937-063	X		
TBT-32-DOC	K9804937-064		X	
TBT-33-TOC	K9804937-065	X		
TBT-33-DOC	K9804937-066		X	
TBT-34-TOC	K9804937-067	X		
TBT-34-DOC	K9804937-068		X	
TBT-35-TOC	K9804937-069	X		
TBT-35-DOC	K9804937-070		X	
TBT-36-TOC	K9804937-071	X		
TBT-36-DOC	K9804937-072		X	
TBT-37-TOC	K9804937-073	X		
TBT-37-DOC	K9804937-074		X	
TBT-38-TOC	K9804937-075	X		
TBT-38-DOC	K9804937-076		X	
Method Blank Filtered	K9804937-077		X	
Method Blank Unfiltered	K9804937-078	X		
TBT-15-PT-RE	K9805084-001			X
TBT-15-PD-RE	K9805084-002			X
TBT-16-PT-RE	K9805084-003			X
TBT-16-PD-RE	K9805084-004			X

Sample Identification	Laboratory Identification	TOC	DOC	TBT
TBT-17-PT-RE	K9805084-005			X
TBT-17-PD-RE	K9805084-006			X
TBT-18-PD-RE	K9805084-007			X
TBT-18-PT-RE	K9805084-008			X
TBT-19-PT-RE	K9805084-009			X
TBT-19-PD-RE	K9805084-010			X
TBT-20-PT-RE	K9805084-011			X
TBT-20-PD-RE	K9805084-012			X
TBT-12-PT-RE	K9805084-013			X
TBT-12-PD-RE	K9805084-014			X

Key:

TOC = Total Organic Carbon
DOC = Dissolved Organic Carbon
TBT = Tributyltin

Each data set includes an analytical data package for each sample, copies of the completed chain-of-custody forms, and a Quality Control (QC) Data Package. The analytical data package includes analytical results, blank sample results, both laboratory and client sample identifications, appropriate dates but not times, method reporting limits, method references, the laboratory's name and address, and the client's services manager's signature. The custody forms include the receipt of the sample but not he laboratory's internal tracking. The QC Data Package includes a tabular listing of the laboratory's sample identification, spiking concentrations, recoveries, percentage calculations, and acceptance windows.

Raw data was provided which includes chromatograms, instrument print-outs, injection logs, digestion/preparation logs, and standard logs.

B. Chain-of-Custody and Sample Receipt

The analytical plan and data packages were reviewed and compared against the Chain-of-Custody and other data. Except as noted below, no data is missing from the packages and no errors were found.

Discussion: Several anomalies were noted with regards to the Chain-of-Custody, but were resolved after contact with Columbia Analytical Services (CAS). The items listed below were not resolved.

- CAS Service Request No. **K9804760** had the following anomalies:

  The temperature of the cooler at the time of receipt ranged from 0.8° to 1.5°C which is below the acceptance criteria of 4°±2°C.

  There is no release time shown when Rosa Environmental and Geotechnical Laboratory, LLC (REGL) relinquished the samples to Columbia Analytical Services (CAS).

  The temperature of the cooler at the time of receipt was 0.5°C which is below the acceptance criteria of 4°±2°C.

- CAS Service Request No. **K9804761** had the following anomalies:

  There is no time of sample receipt listed on the Chain-of-Custody.

  Samples No. TBT-19-S and TBT-20-S were not relinquished by EVS.

- CAS Service Request No. **K9804815** had the following anomalies:

  The temperature of the coolers for samples received on July 21, 1998, at the time of receipt, ranged from –0.1°C to 1.1°C which is below the acceptance criteria of 4°±2°C.

Samples were received at temperatures below the acceptance criteria of 4°±2°C. It is in the professional opinion of the reviewer that the lower temperatures do not impact the quality of the analysis and no data qualifier flags are recommended.

Samples No. TBT-15-PT through TBT-20-PT and TBT-15-PD through TBT-20 PD were logged in under one Service Request Number but the extracts were lost. Sample re-extracts were submitted under another Service Request Number and results were reported under the new Service Request Number.

C. Review of Tributyl Tin

Krone, et. al., 1988

1. Timeliness and a Check for Errors

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. No data is missing and no errors were found.

2. Initial and Continuing Calibration

All initial and continuing calibration QC criteria were met. No Target Compound List (TCL) analytes had Percent Relative Standard Deviations greater than that allowed by the method.

Discussion: The continuing calibration verification (CCV) associated with Samples Nos. TBT-01-S, TBT-02-S, TBT-35-S, TBT-03-S, TBT-04-S, TBT-05-S, TBT-06-S and TBT-06-S MS was calculated using an average response factor whereas the sample concentration was calculated using linear regression. No data flags are recommended since the CCV calculated using linear regression falls within acceptance criteria.

3. Blanks and Checks for Contamination

Instrument and method blank analyses were performed at the required frequencies and either no analytes were detected or levels were below the reporting limit.

4. Surrogate Recovery

Except as noted below, surrogate analytes were added to all samples and blanks as required by the referenced method and all recoveries were within laboratory or method criteria.

Discussion: Surrogates were out of criteria in the blank associated with the data. No data flags are recommended because the surrogates were acceptable in the samples.

The laboratory calculated the surrogate Tripentyltin two different ways with no apparent pattern. One way was using the same calculation process used in determining the sample concentration (linear regression). On other samples, the laboratory used a "one-point" recalculation based on the daily continuing calibration verification (response factor). While this is an unacceptable practice, no data flags are recommended because in calculating the surrogate concentration using linear regression, the surrogate recoveries are within acceptance criteria.

5. Matrix Spike/Matrix Spike Duplicate

Except as noted below, matrix spikes (MS) and matrix spike duplicates (MSD) were analyzed as required by the referenced method and all percent recoveries (%Rec) and relative percent differences (RPD) were within laboratory or method criteria.

Associated Samples	TCL Compound Affected	Type of Deviation	Flag
TBT-35-PD	Tributyltin	MSD	0.15 J
TBT-34-PT	Tributyltin	MSD	0.19 J
TBT-32-PT	Tributyltin	MSD	0.35 J

Discussion: Tributyltin was out of criteria for both accuracy and precision for the MS/MSD pair. Samples No. TBT-35-PD, TBT-34-PT and TBT-32-PT have been flagged as "J" for estimated.

Matrix spike and matrix spike duplicate recoveries were out of criteria for samples associated with Sample No. TBT-06-S matrix spike due to high concentrations of analytes in the original sample. Since all other QC checks are in criteria, no data qualifier flags are recommended.

6. Field Duplicates

No field duplicates were identified with this group of samples.

7. TCL Compound Identification

All TCL Compound identifications met the criteria for retention times and peak identification of the referenced material.

8. Compound Quantitation and Reported Detection Limits

Except as noted below, quantitation was performed in accordance with the referenced method, including the correct calculations using appropriate internal standards or external standardization. Reporting limits have been correctly adjusted for dilutions and extraction amounts.

Associated Samples	TCL Compound Affected	Type of Deviation	Flag
TBT-10-S	Butyltin	Calculation Error	8

Discussion: A calculation error was found in determining the final result. The corrected value is listed in the summary table and on the laboratory final report form. The laboratory has been requested to reissue a revised report directly to EVS.

The laboratory utilized two different methods to quantitate Tributyltin. One set of sample results were calculated using a linear regression and another set of sample results were calculated using a response factor. No data flags are recommended since both methods are acceptable and both data sets were in criteria.

9. System Performance

The system performance was acceptable and had no significant problems such as baseline shifts, loss of resolution, or peak tailing.

10. Laboratory Contact

The QBD project manager faxed Lynda Huckestein at CAS Laboratory during the data validation process so that the QBD project manager could request information regarding sample receipt and laboratory quality control limits. This fax and response is appended to this validation report.

11. Other Comments

The laboratory's use of different equations in determining concentration indicates that the procedure has not been standardized at the laboratory. Although none of the calculations made the results "better," the inconsistency lends an appearance of "picking and choosing" and casts doubts on the laboratories quality policies.

12. Data Use and Overall Assessment

The data, as qualified, are acceptable for use. The analyses were generally within the requirements of the referenced method and no discrepancies were observed between raw data and reported data results. All data flags are summarized at the end of this report.

D. Review of Total and Dissolved Organic Carbon

EPA Method 415.1

1. Timeliness and a Check for Errors

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. Except as noted below, no data is missing from the packages and no errors in accuracy were found. All tests requested on the chain-of-custody were performed. All samples were analyzed within the technical holding times. There are no contractual holding time criteria that have been brought to the attention of the reviewer.

Discussion: There were several changes in raw data made without initial and dates.

The quality control page associated with Samples No. TBT-01-TOC through TBT-38-TOC and TBT-01-DOC through TBT-38-DOC was missing the Continuing Calibration Verification – 7 and Continuing Calibration Blank -7 results. The laboratory has been contacted to revise and reissue the page directly to EVS.

2. Initial and Continuing Calibration

All initial and continuing calibration Quality Control criteria were met, including the number of standards used and correlation coefficients. All continuing calibration criteria, including frequency of analysis and percent recovery were met.

3. Blanks and Checks for Contamination

Instrument and method blank analyses were performed at the required frequencies and either no analytes were detected or levels were below the reporting limit.

4. Laboratory Control Standards

A Laboratory Control Standard was analyzed at a frequency required by the referenced method and all percent recoveries were within laboratory or method criteria.

5. Precision and Accuracy

Matrix spikes (MS) and matrix spike duplicates (MSD) were analyzed as required by the referenced method and all percent recoveries (%Rec) and relative percent differences (RPD) were within laboratory or method criteria.

6. Field Duplicates

No field duplicates were identified with this group of samples.

7. Sample Result Verification

The final reports were reviewed and compared against raw instrumental data and logs to check anomalies, data reduction/calculations, transcription, linear ranges, and dilutions. No errors in accuracy were found

8. Laboratory Contact

The QBD project manager taxed Lynda Huckestein at CAS Laboratory during the data validation process so that the QBD project manager could request that the missing CCV and CCB data be added to the quality control report and the revision sent directly to EVS. A copy of the fax is appended to this validation report.

9. Other Comments

None.

10. Data Use and Overall Assessment

The data is acceptable for use. The analyses were generally within the requirements of the referenced method and no discrepancies were observed between raw data and reported data results.

E. Data Qualifier Definitions

Data Qualifier Definitions

Organics

U = The analyte was analyzed for but not detected above the numerical quantitation limit.

J = The analyte was analyzed for and was positively identified, but the associated numerical value is an estimated quantity. EPA Region X describes the data as able to be seriously considered for decision-making and useable for many purposes.

In EPA Region X, a subscript may be appended to the "J" that indicates which of the following control criteria were not met:

1 Blank contamination
2 Calibration range exceeded
3 Holding times not met
4 Other QC outside of criteria

UJ = The analyte was analyzed for but was not detected above the reporting level, but the reporting level is an estimated level.

R = The data are unusable for all purposes. The analyte was analyzed for, but the target analyte may or may not be present.

N = The analysis indicates presumptive evidence of the presence of the analyte.

NJ = The analysis indicates presumptive evidence of the presence of the analyte, but the numerical value is an estimated quantity.

In EPA Region X, a subscript may be appended to the "NJ" that indicates which of the following control criteria were not met:

1 DDT/Endrin breakdown evident
2 Interference from other sample components
3 Non-Target Compound List (TCL) compounds: Confirmation is necessary using specific methodology to accurately determine the concentration and identity of the detected compounds.
4 A confirmation analysis was missing or quality control criteria were not met for the confirmation analysis.

Inorganics

U = The analyte was analyzed for but not detected above the numerical quantitation limit. The numerical value may be either a detection limit or a quantitation limit.

J = The analyte was analyzed for and was positively identified, but the associated numerical value is an estimated quantity. EPA Region X describes the data as able to be seriously considered for decision making and useable for many purposes.

In EPA Region X, a subscript may be appended to the "J" that indicates which of the following control criteria were not met:

1 Blank contamination
2 Calibration range exceeded
3 Holding times not met
4 Other QC outside of criteria

UJ = The analyte was analyzed for but was not detected above the reporting level, but the reporting level is an estimated level.

R = The data are unusable for all purposes. The analyte was analyzed for, but the target analyte may or may not be present.

F. Data Qualification Summary

Data Qualification Summary

EVS Environmental Consultants
Project: WSOU TBT Study
Type of Samples: Sediments and Porewater
Dates of Sampling: July 15-28, 1998

Associated Samples	TCL Compound Affected	Type of Deviation	Flag
TBT-35-PD	Tributyltin	MSD	0.15 J
TBT-34-PT	Tributyltin	MSD	0.19 J
TBT-32-PT	Tributyltin	MSD	0.35 J
TBT-10-S	Butyltin	Calculation Error	8

—8203162002

Quality By Design

Laboratory Quality Assurance Consulting

97 Puhili Street
Hilo, Hawaii 96720

Phone: (808) 969-9424
Fax: (808) 969-9094

DATA VALIDATION REPORT

Project Name: Waterway Sediment Operable Unit,
Harbor Island Superfund Site
Type of Samples: Tissue
Date of Sampling: October 10, 1998
EVS Project No.: 8/203-16.2

Prepared for:

EVS Solutions, Inc.
200 West Mercer Street, Suite 403
Seattle, WA 98119

Purchase Order No. P97733
QBD Job No. 151

Reviewed and Approved,

Lorraine L. Davis 12/22/98
Lorraine L. Davis Date

Prepared by,

Thomas S. Davis 12/22/98
Thomas S. Davis Date

Table of Contents

This data validation report consists of the following stand alone sections, each of which is formatted to follow Functional Guidelines but which also include subsections discussing QBD contacts with the laboratory, other comments, and a summary table of data qualifiers.

A. Introduction

Laboratory Sciences, Inc., d.b.a. *Quality by Design*, has completed an EPA Level I Data Validation on the submitted data packages in accordance with Purchase Order No. P97733.

The reporting format and criteria for recommending data qualifying flags for this data set are described in USEPA *"Functional Guidelines for Evaluating Organics Analyses"*, *"Functional Guidelines for Evaluating Inorganics Analyses"*, as revised, December, 1994; and *"Recommended Quality Assurance and Quality Control Guidelines for the Collection of Environmental Data in Puget Sound,"* April 1997, or using criteria listed in the method referenced. Data may be qualified for any of several reasons:

1. By the laboratory prior to receipt by the reviewer;
2. Because of laboratory deviation from the designated method;
3. Because the data may not meet the criteria listed in the reference above; or
4. By the professional judgment of the reviewer.

The data set consists of two data packages, from Columbia Analytical Services, Inc. in Kelso, Washington and from Rosa Environmental and Geotechnical Laboratory in Seattle, Washington and contain data for the samples shown in Table 1.

Each data set includes an analytical data package for each sample, copies of the completed chain-of-custody forms, and a Quality Control (QC) Data Package. The analytical data package includes analytical results, blank sample results, both laboratory and client sample identifications, appropriate dates but not times, method reporting limits, method references, the laboratory's name and address, and the client's services manager's signature. The custody forms include the receipt of the sample but not he laboratory's internal tracking. The QC Data Package includes a tabular listing of the laboratory's sample identification, spiking concentrations, recoveries, percentage calculations, and acceptance windows.

Raw data was provided which includes chromatograms, instrument print-outs, injection logs, digestion/preparation logs, and standard logs.

Table 1: Sample Identification and Analysis

Sample Identification	Laboratory Identification	TBT	Total Solids	Percent Lipids	Percent Lipids *
EVS-TBT-MAC Bkgd rep 1	K9807071-1	X	X	X	X
EVS-TBT-MAC Bkgd rep 2	K9807071-2	X	X	X	X
EVS-TBT-MAC Bkgd rep 3	K9807071-3	X	X	X	X
EVS-TBT-MAC Bkgd rep 4	K9807071-4	X	X	X	X
EVS-TBT-MAC Bkgd rep 5	K9807071-5	X	X	X	X
EVS-MAC-TBT-2	K9807071-6	X	X	X	X
EVS-MAC-TBT-3	K9807071-7	X	X	X	X
EVS-MAC-TBT-4	K9807071-8	X	X	X	X
EVS-MAC-TBT-5	K9807071-9	X	X	X	X
EVS-MAC-TBT-7	K9807071-10	X	X	X	X
EVS-MAC-TBT-8	K9807071-11	X	X	X	X
EVS-MAC-TBT-9	K9807071-12	X	X	X	X
EVS-MAC-TBT-10	K9807071-13	X	X	X	X
EVS-MAC-TBT-11	K9807071-14	X	X	X	X
EVS-MAC-TBT-12	K9807071-15	X	X	X	X
EVS-MAC-TBT-13	K9807071-16	X	X	X	X
EVS-MAC-TBT-14	K9807071-17	X	X	X	X
EVS-MAC-TBT-15	K9807071-18	X	X	X	X
EVS-MAC-TBT-17	K9807071-19	X	X	X	X
EVS-MAC-TBT-18	K9807071-20	X	X	X	X
EVS-MAC-TBT-19	K9807071-21	X	X	X	X
EVS-MAC-TBT-20	K9807071-22	X	X	X	X
EVS-MAC-TBT-22	K9807071-23	X	X	X	X
EVS-MAC-TBT-23	K9807071-24	X	X	X	X
EVS-MAC-TBT-25	K9807071-25	X	X	X	X
EVS-MAC-TBT-26	K9807071-26	X	X	X	X

Sample Identification	Laboratory Identification	TBT	Total Solids	Percent Lipids	Percent Lipids *
EVS-MAC-TBT-27	K9807071-27	X	X	X	X
EVS-MAC-TBT-28	K9807071-28	X	X	X	X
EVS-MAC-TBT-29	K9807071-29	X	X	X	X
EVS-MAC-TBT-30	K9807071-30	X	X	X	X
EVS-MAC-TBT-31	K9807071-31	X	X	X	X
EVS-MAC-TBT-32	K9807071-32	X	X	X	X
EVS-MAC-TBT-34	K9807071-33	X	X	X	X
EVS-MAC-TBT-36	K9807071-34	X	X	X	X
EVS-MAC-TBT-37	K9807071-35	X	X	X	X
EVS-MAC-TBT-38	K9807071-36	X	X	X	X
EVS-MAC-TBT-42	K9807071-37	X	X	X	X
EVS-NEP-TBT-2	K9807071-38	X	X	X	X
EVS-NEP-TBT-3	K9807071-39	X	X	X	X
EVS-NEP-TBT-4	K9807071-40	X	X	X	X
EVS-NEP-TBT-5	K9807071-41	X	X	X	X
EVS-NEP-TBT-7	K9807071-42	X	X	X	X
EVS-NEP-TBT-8	K9807071-43	X	X	X	X
EVS-NEP-TBT-9	K9807071-44	X	X	X	X
EVS-NEP-TBT-10	K9807071-45	X	X	X	X
EVS-NEP-TBT-11	K9807071-46	X	X	X	X
EVS-NEP-TBT-12	K9807071-47	X	X	X	X
EVS-NEP-TBT-13	K9807071-48	X	X	X	X
EVS-NEP-TBT-14	K9807071-49	X	X	X	X
EVS-NEP-TBT-15	K9807071-50	X	X	X	X
EVS-NEP-TBT-17	K9807071-51	X	X	X	X
EVS-NEP-TBT-18	K9807071-52	X	X	X	X
EVS-NEP-TBT-19	K9807071-53	X	X	X	X
EVS-NEP-TBT-20	K9807071-54	X	X	X	X
EVS-NEP-TBT-22	K9807071-55	X	X	X	X
EVS-NEP-TBT-23	K9807071-56	X	X	X	X
EVS-NEP-TBT-25	K9807071-57	X	X	X	X

Sample Identification	Laboratory Identification	TBT	Total Solids	Percent Lipids	Percent Lipids *
EVS-NEP-TBT-26	K9807071-58	X	X	X	X
EVS-NEP-TBT-27	K9807071-59	X	X	X	X
EVS-NEP-TBT-28	K9807071-60	X	X	X	X
EVS-NEP-TBT-29	K9807071-61	X	X	X	X
EVS-NEP-TBT-30	K9807071-62	X	X	X	X
EVS-NEP-TBT-31	K9807071-63	X	X	X	X
EVS-NEP-TBT-32	K9807071-64	X	X	X	X
EVS-NEP-TBT-34	K9807071-65	X	X	X	X
EVS-NEP-TBT-36	K9807071-66	X	X	X	X
EVS-NEP-TBT-37	K9807071-67	X	X	X	X
EVS-NEP-TBT-38	K9807071-68	X	X	X	X
EVS-NEP-TBT-42	K9807071-69	X	X	X	X
EVS-TBT-Nepthys Bkgd rep 1	K9807071-70	X	X	X	X
EVS-TBT-Nepthys Bkgd rep 2	K9807071-71	X	X	X	X
EVS-TBT-Nepthys Bkgd rep 3	K9807071-72	X	X	X	
EVS-TBT-Nepthys Bkgd rep 4	K9807071-73	X	X	X	X
EVS-TBT-Nepthys Bkgd rep 5	K9807071-74	X	X	X	

Key:

TBT = Tributyltin
* = Reanalysis by method of Bligh and Dyer

B. Review of Tributyl Tin by Gas Chromatography
Method Krone

1. Timeliness and a Check for Errors

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. Except as noted below, no data is missing from the packages and no errors in accuracy were found. All tests requested on the chain-of-custody were performed. All samples were analyzed within the technical holding times. There are no contractual holding time criteria that have been brought to the attention of the reviewer.

Discussion: The chain-of-custody (COC) had a gap between October 12, 1998 at 1400 and October 13, 1998 at 1030, during which time the samples were shipped to Columbia Analytical Services (CAS). CAS was contacted and requested to provide a copy of the waybill and/or the waybill tracer number. CAS responded verbally that this information had not been retained. No data qualifiers are recommended because the laboratory's cooler receipt form states that a cooler was received on October 13 and opened, and that the contents were in good condition.

The final two samples, Rep 4- and Rep 5-EVS-TBT-Nepthys-Bkgd were not received from Battelle Laboratory. These samples were prepared by homogenizing Rep 1-, Rep 2- and Rep 3-EVS-TBT-Nepthys-Bkgd and then preparing five aliquots. The sample preparation log states that this was done at the request of the client, but no communication logs or change order documentation was provided. All results were non-detect. The reviewer does not recommend any data qualifier flags, but if performing a statistical analysis, the data user should consider that the background population size was three.

Supporting data for the bioaccumulation phase of the study (e.g., conductivity, pH, ammonia) was not provided for review.

The raw data package was incomplete and each extraction/analysis batch was formatted differently. For example:

- Some, but not all, instrumental sequence logs were provided with the injection logs.

- All of the extraction logs were provided at the beginning of the package but copies were also inserted into various parts of the data.
- An initial calibration data set was missing from the package but was faxed to the reviewer by the laboratory. A copy is attached to this report.
- Some reports utilized two significant figures and some three. Section 9 (Quantitation) identifies samples for which the report was changed to reflect the consistent use of significant figures.

2. Initial and Continuing Calibration

Except as noted below, all initial and continuing calibration QC criteria were met. No Target Compound List (TCL) analytes had Percent Relative Standard Deviations (%RSD) greater than that allowed by the method.

Discussion: The closing continuing calibration check for the target compound Tri-n-butyltin on November 14, 1998 had a percent difference greater than the acceptance criteria. The laboratory's case narrative stated that the low recovery was due to the sample immediately prior to the CCV and that no corrective action was performed. Since this sample was not a project sample, this statement could not be verified or denied. However, because all other quality control checks (MS/MSD, LCS, surrogate) were acceptable, no data qualifier flags are recommended.

The laboratory analyzed a pair of CCVs every ten samples but reported only one. Although in reviewing the raw data all CCVs were acceptable, this gives the appearance of picking and choosing results for acceptable quality control.

The confirmatory column was calibrated using only a single point calibration. No data qualifier flags are recommended because all results were confirmed qualitatively by retention time and quantitated within ±40% of the primary column. All quantitative results were reported from the primary column.

3. Blanks and Checks for Contamination

Except as noted below, instrument and method blank analyses were performed at the required frequencies and either no analytes were detected or levels were below the reporting limit.

Discussion: The method blank for the November 5, 1998 extraction was analyzed at a ten-fold dilution, but no documentation was provided to explain the elevated reporting limit.

4. Surrogate Recovery

Except as noted below, surrogate analytes were added to all samples and blanks as required by the referenced method and all recoveries were within laboratory criteria.

Discussion: Surrogates were out of criteria in a blank, an MSD, and a LCS. No data flags are recommended because the surrogates were acceptable in the samples.

5. Laboratory Control Standards and Blank Spikes

Laboratory Control Standards were analyzed at a frequency required by the referenced method and all percent recoveries were within laboratory or QAPP criteria.

6. Matrix Spike/Matrix Spike Duplicates

Except as noted below, matrix spikes (MS) and matrix spike duplicates (MSD) were analyzed as required by the referenced method and all percent recoveries (%Rec) and relative percent differences (RPD) were within laboratory or QAPP criteria.

Discussion: Two of four matrix spike and matrix spike duplicate pairs were out of criteria due to high concentrations of analytes in the original sample. Since all other QC checks (surrogate, LCS and the other MS/MSD pairs) are in criteria, no data qualifier flags are recommended.

7. Field Duplicates

Background replicates were identified and all were non-detects.

8. TCL Compound Identification

All TCL Compound identifications met the criteria for retention times, peak identification, and second column confirmation of the referenced method.

9. Compound Quantitation and Reported Detection Limits

Except as noted below, quantitation was performed in accordance with the referenced method, including the correct calculations using external standardization. Reporting limits have been correctly adjusted for dilutions and extraction amounts. The reporting limits meet requirements of the contract.

Associated Samples	Analyte Affected	Type of Deviation	Flag
EVS-MAC-TBT-4	Tri-n-butyltin	Significant Figures	376
EVS-MAC-TBT-22	Tri-n-butyltin	Transcription Error	307
EVS-MAC-TBT-36	Tri-n-butyltin	Transcription Error	253
EVS-NEP-TBT-4	Tri-n-butyltin	Significant Figures	384

Discussion: Several samples contained target analytes which were quantitated at levels greater than the highest standard. These were diluted and the laboratory appropriately reported only a single value for the analysis.

Transcription errors were found in determining the final result from the amount extracted. Corrected values are listed in the summary table and on the laboratory final report forms for Sample Nos. EVS-MAC-TBT-22 and -36.

Sample No. EVS-MAC-TBT-4 had been spilled in a laboratory accident during processing. The remaining extract was analyzed and the sample was also re-extracted. The results of both analyses were comparable. The laboratory reported the results of the first extraction. The reviewer concurs that this is appropriate because the surrogate recovery is higher and there are no signs of significant contamination on the chromatogram.

The laboratory reported TBT results to either three significant figures or to the decimal point. For example, the laboratory may have reported "129 µg/Kg" as three significant figures. The laboratory also may have reported "8 µg/Kg" and not "8.01 µg/Kg" by rounding to the decimal point. However, at higher values,

the laboratory inconsistently reported both 2 and 3 significant figures. Samples No. EVS-MAC-TBT-4 and EVS-NEP-TBT-4 have been revised from two to three significant figures to maintain consistently in reporting.

10. System Performance

The system performance was acceptable and had no significant problems such as baseline shifts, loss of resolution, or peak tailing.

11. Laboratory Contact

On November 30, 1998, the laboratory provided revised pages for the Duplicate Summaries for Total Solids for EVS-MAC-TBT-15, -26, -37, and –38. Revised pages were also received for the MS/MSD summary for Sample No. EVS-NEP-TBT-12 and the LCS associated with the November 10, 1998 extraction batch. The original pages of these revisions have been inserted into the data package and a copy is attached to the report.

The QBD project manager telephoned Lynda Huchestein at CAS during the data validation process so that the QBD project manager could request chromatograms for the initial calibration that was performed on September 17, 1998. This information was faxed to QBD on December 18 and 21.

12. Data Use and Overall Assessment

The data, as qualified, are acceptable for use. The analyses were generally within the requirements of the referenced method and no discrepancies were observed between raw data and reported data results. All data flags are summarized at the end of this report.

C. Review of Percent Moisture and Lipids Analyses of Tissues

1. Timeliness and a Check for Errors

The analytical plan and the data packages were reviewed and compared against the chain-of-custody and other data. No data is missing from the packages and no errors in accuracy were found. All tests requested on the chain-of-custody were performed. All samples were analyzed within the technical holding times and were preserved appropriately. There are no contractual holding time criteria that have been brought to the attention of the reviewer.

Discussion: The chain-of-custody (COC) had a gap between October 12, 1998 at 1400 and October 13, 1998 at 1030, during which time the samples were shipped to Columbia Analytical Services (CAS). CAS was contacted and requested to provide a copy of the waybill and/or the waybill tracer number. CAS responded verbally that this information had not been retained. No data qualifiers are recommended because the laboratory's cooler receipt form states that a cooler was received on October 13 and opened, and that the contents were in good condition.

The final two samples, Rep 4- and Rep 5-EVS-TBT-Nepthys-Bkgd were not received from Battelle Laboratory. These samples were prepared by homogenizing Rep 1-, Rep 2- and Rep 3-EVS-TBT-Nepthys-Bkgd and then preparing five aliquots. The sample preparation log states that this was done at the request of the client, but no communication logs or change order documentation was provided. All results were non-detect. The reviewer does not recommend any data qualifier flags, but if performing a statistical analysis, the data user should consider that the background population size was three.

The percent lipids results were questioned and the test was redone by the method of Bligh and Dyer. Results were comparable. Both sets of results were validated and included in this report.

2. Initial and Continuing Calibration

Not applicable. These are gravimetric tests.

3. Blanks and Checks for Contamination

Method blank analyses were performed at the frequencies required in the referenced method and either no target analytes were detected or levels were used as a correction factor.

4. Laboratory Control Sample (LCS) Analysis

Two Laboratory Control Standards were analyzed for the analysis of percent lipids by Bligh and Dyer and the percent recovery was within laboratory criteria. No LCS was analyzed for Total Solids or the original gravimetric Percent Lipids analysis.

5. Duplicate Sample Analysis

Duplicates were analyzed as required by the referenced methods and all relative percent differences were within laboratory or QAPP criteria.

6. Matrix Spike Analysis

No matrix spikes (MS) were analyzed.

7. Sample Result Verification

The final reports were reviewed and compared against raw data and logs to check anomalies, data reduction/calculations, transcription, and dilutions. No errors in accuracy were found.

8. Field Replicates

No field replicates were identified with this group of samples, however, an evaluation of the background samples was performed by calculating the percent relative standard deviation of each set of 3-5 samples.

	% RSD Macombs	% RSD Nepthys
Total Solids	1.9	1.5
Percent Lipids (gravimetric)	101	15.5
Percent Lipids (Bligh & Dyer)	2.8	No dup available

9. Laboratory Contact

There was no direct verbal or written communication with the laboratory during the validation of this section. Conversations, faxes, and e-mail were exchanged between EVS and QBD and between EVS and the laboratory regarding the analysis of lipids. Copies of these faxes and e-mail are attached to this report.

10. Other Comments

None.

11. Data Use and Overall Assessment

The data is acceptable for use. The analyses were generally within the requirements of the referenced method and no discrepancies were observed between raw data and reported data results.

D. Data Qualifier Definitions

Organics

U = The analyte was analyzed for but not detected above the numerical quantitation limit.

J = The analyte was analyzed for and was positively identified, but the associated numerical value is an estimated quantity. EPA Region X describes the data as able to be seriously considered for decision-making and useable for many purposes.

In EPA Region X, a subscript may be appended to the "J" that indicates which of the following control criteria were not met:

1 Blank contamination
2 Calibration range exceeded
3 Holding times not met
4 Other QC outside of criteria

UJ = The analyte was analyzed for but was not detected above the reporting level, but the reporting level is an estimated level.

R = The data are unusable for all purposes. The analyte was analyzed for, but the target analyte may or may not be present.

N = The analysis indicates presumptive evidence of the presence of the analyte.

NJ = The analysis indicates presumptive evidence of the presence of the analyte, but the numerical value is an estimated quantity.

In EPA Region X, a subscript may be appended to the "NJ" that indicates which of the following control criteria were not met:

1 DDT/Endrin breakdown evident
2 Interference from other sample components
3 Non-Target Compound List (TCL) compounds: Confirmation is necessary using specific methodology to accurately determine the concentration and identity of the detected compounds.
4 A confirmation analysis was missing or quality control criteria were not met for the confirmation analysis.

Inorganics

U = The analyte was analyzed for but not detected above the numerical quantitation limit. The numerical value may be either a detection limit or a quantitation limit.

J = The analyte was analyzed for and was positively identified, but the associated numerical value is an estimated quantity. EPA Region X describes the data as able to be seriously considered for decision making and useable for many purposes.

In EPA Region X, a subscript may be appended to the "J" that indicates which of the following control criteria were not met:

1 Blank contamination
2 Calibration range exceeded
3 Holding times not met
4 Other QC outside of criteria

UJ = The analyte was analyzed for but was not detected above the reporting level, but the reporting level is an estimated level.

R = The data are unusable for all purposes. The analyte was analyzed for, but the target analyte may or may not be present.

E. Data Qualification Summary

EVS Environmental Consultants
Project: WSOU TBT Study
Type of Samples: Tissues
Dates of Sampling: October 10, 1998

Associated Samples	Analyte Affected	Type of Deviation	Flag
EVS-MAC-TBT-4	Tri-n-butyltin	Significant Figures	376
EVS-MAC-TBT-22	Tri-n-butyltin	Transcription Error	307
EVS-MAC-TBT-36	Tri-n-butyltin	Transcription Error	253
EVS-NEP-TBT-4	Tri-n-butyltin	Significant Figures	384

APPENDIX G

Field Logs

EVS CONSULTANTS
PROJECT #: 2/203-15.2

SEDIMENT GRAB FIELD LOG

WATERWAY SEDIMENT OPERABLE UNIT TBT STUDY

SAMPLING DATES: 7/15/98 TO: 7/17/98

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-01

Survey: TBT Study Area: W. Waterway

Target Coordinates: _____ Start time: 0902

Stop time: _____

Weather: Overcast, H. rain

Crew: TJH, LAM, SAW, Tony Petrillo, DALE Dickerson

Comments: _____

Grab No: 1 Bottom depth: ~~42.5~~ 34.2 TH. Penetration depth: _____ Time: 0902

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C (M) F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-02

Survey TBT-Study Area W. Waterway

Target Coordinates _____ Start time 0955

_____ Stop time _____

Weather Overcast

Crew See pg 1

Comments: _____

Grab No: 1 Bottom depth: 49.2 Penetration depth: 9" Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-03

Survey: W500 TBT Study Area: W. Waterway

Target Coordinates: _____ Start time: 1045

Stop time: _____

Weather: Overcast

Crew: See pg 1

Comments: _____

Grab No: 1 Bottom depth: _____ Penetration depth: 10" Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit	olive drab		
paint chips			

Comments: alot of shells

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-04

Survey TBT Study Area W. Waterway

Target Coordinates _____ Start time 1124

_____ Stop time _____

Weather Overcast

Crew see pg 1

Comments: _____

Grab No: 1 Bottom depth: 48' Penetration depth: 10" Time: 1124

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Comments:

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F 2"	black	moderate	Other:
silt clay >2"	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit	sheen		
paint chips			

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Comments:

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Comments:

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-05

Survey WSOU TBT Study Area W. Waterway

Target Coordinates _____ Start time 1205

_____ Stop time _____

Weather Overcast lt. rain

Crew Sea pg 1

Comments: _____

Grab No: 1 Bottom depth: 61' Penetration depth: 10" Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-06

Survey WSOU TBT Area W. Waterway

Target Coordinates _____ Start time 1350

_____ Stop time _____

Weather Overcast

Crew See page 1

Comments: _____

Grab No: 1 Bottom depth: _____ Penetration depth: _____ Time: 1350

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

REJECT

Comments: Approximately 60' from proposed location due to ship blocking access Large foreign object in grab

---

Grab No: 2 Bottom depth: _____ Penetration depth: _____ Time: 1353

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray (with)	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	Sheen
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: Approx 69' from orig proposed location - Ship in berth

---

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-07

Survey WSDOT TBT Study Area W. Waterway

Target Coordinates _____ Start time ~~ETH~~ 1430

_____ Stop time _____

Weather Overcast

Crew See page 1

Comments: _____

Grab No: _____ Bottom depth: _____ Penetration depth: 9" Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-08

Survey LWSOU TBT Study Area W. Whitehorse

Target Coordinates _____ Start time 1535

_____ Stop time _____

Weather Overcast

Crew See pg 1

Comments: Bioaccumulation Replicate

Grab No: 1 Bottom depth: _____ Penetration depth: 8" Time: 1535

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips		Sheen		

Grab No: 2 Bottom depth: _____ Penetration depth: 11" Time: 15

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray Surface	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-09

Survey: WSOU TBT Study Area: LW Waterway

Target Coordinates: _____ Start time: 1655

Stop time: _____

Weather: Overcast

Crew: See page 1

Comments: _____

Grab No: 1 Bottom depth: _____ Penetration depth: _____ Time: 1655

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit		Sheen		
paint chips				

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

depart N.I marina @ 0825

Date: 7/16/98 Station: TBT-10

Survey WSOU TBT Study Area N. Dilworth

Target Coordinates _____ Start time 0840

_____ Stop time _____

Weather clear, 65° F

Crew D. Manglicz, L. Mills, S. Wodzicki, T. Petrillo, D. Dickerson

Comments: _____

56.0 ft MLLW

Grab No: 1 Bottom depth: ~~62.1 ft~~ Penetration depth: 9" Time: 0840

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: Good grab

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: Dennis Manglicz

10

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-11-S

Survey WSDA TBT Study Area W. Waterway

Target Coordinates _____ Start time 0910

_____ Stop time _____

Weather clear

Crew sup 10

Comments: _____

Grab No: 1 Bottom depth: 55.9 MLLW Penetration depth: _____ Time: 0915

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: 10 ft metal rod in jaws rejected

Grab No: 2 Bottom depth: _____ Penetration depth: 7" Time: 0920

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	(gray)	slight	Petroleum
sand C (M) F	(black)	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: a few 1-2" rocks on top of material

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Recorded by: DJH

EVS ENVIRONMENT CONSULTANTS

Date: 7/16/98 Station: TBT-12-S

Survey WSOU TBT Study Area W. Waterway

Target Coordinates _____ Start time 0945

_____ Stop time _____

Weather clear

Crew Sue + 10

Comments: _____

Grab No: 1 Bottom depth: _____ Penetration depth: 10 cm Time: _____

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: rejected, insufficient penetration

Grab No: 2 Bottom depth: _____ Penetration depth: 10 cm Time: _____

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: rejected, insufficient penetration

Grab No: 3 Bottom depth: _____ Penetration depth: _____ Time: 1005

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: moved 20 ft north rejected — appears thick crust of sand blast grit

---

Grab 4 — added weight to sampler Time 1025 — rejected - no penetration, very steep slope, so moving shoreward approx 10 ft, perhaps we were over a drop off. go to next page

Recorded by: DJM

EVS ENVIRONMENT CONSULTANTS

Date: 7/16/98 Station: TBT-12-S

Survey WSOU TBT Study Area W. Waterway

Target Coordinates _____ Start time 1030

_____ Stop time _____

Weather clear

Crew sep 10

Comments: ~~Pat~~ 4 failed attempts,

Grab No: 5 Bottom depth: _____ Penetration depth: 25 cm Time: 1035

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*		Comments:
cobble	D.O.	none	H_2S	~~moved approx~~
gravel	gray	(slight)	(Petroleum)	
sand C M (F)	(black)	moderate	Other:	
(silt) clay	brown	strong		
wood chips	(brown surface)	overwhelming		
sandblast grit				
paint chips				

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Recorded by: DJH

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-13

Survey: WSDOT TBT Survey Area: W. Waterway

Target Coordinates: _____ Start time: 1105

Stop time: _____

Weather: clear, warm

Crew: see p/ 10

Comments: — waiting for satellites to get good fix / broccoum replicate

---

Grab No: 1 Bottom depth: _____ Penetration depth: 25 cm Time: 1120

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
sand C M (F)	(black)	moderate	Other:
(silt) clay	brown	strong	
wood chips	(brown surface)	overwhelming	
sandblast grit			
paint chips			

Comments: 1st grab of 2 grabs for broccum replicates

Grab No: 2 Bottom depth: _____ Penetration depth: _____ Time: 1140

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
sand C M (F)	(black)	moderate	Other:
(silt) clay	brown	strong	
wood chips	(brown surface)	overwhelming	
sandblast grit			
paint chips			

Comments: 2nd grab 1 2 for broccum replicate

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: DJM

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-14

Survey WSOU TBT Study Area NW. Waterway

Target Coordinates _____ Start time 1305

_____ Stop time _____

Weather clear, warm

Crew see pg 10

Comments: Replicate TBT-37-S

Grab No: 1 Bottom depth: _____ Penetration depth: 25cm Time: 1310

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: good grab replicate TBT-37-S

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Replicate TBT-37-S at 1320

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-15

Survey WSOU TBT Study Area West Waterway

Target Coordinates _____ Start time 1350

_____ Stop time _____

Weather clear 80°

Crew see p 10

Comments: _____

Grab No: 1 D Bottom depth: _____ Penetration depth: 22 cm Time: 1355

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	(gray)	(slight)	Petroleum
sand C M (F)	(black)	moderate	Other:
(silt) clay	brown	strong	
wood chips	(brown surface)	overwhelming	
sandblast grit			
paint chips			

Comments: good grab

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Recorded by: DJR

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-16

Survey WSOU TBT study Area W. Waterway

Target Coordinates _____ Start time 1420

_____ Stop time _____

Weather 80° clear

Crew see p 10

Comments: _____

1

Grab No: 1 Bottom depth: _____ Penetration depth: 27 cm Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: good grab

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: DJ JN

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-17

Survey WSOU TBT Study Area West Waterway

Target Coordinates _____ Start time 1455

_____ Stop time _____

Weather clear 83°

Crew ME-P 10

Comments: _____

Grab No: 1 Bottom depth: _____ Penetration depth: 27 cm Time: 1500

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: good grab

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: DJH

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-18

Survey: WSOU TBT Study Area: NWest Waterway

Target Coordinates: _____ Start time: 1535

Stop time: _____

Weather: Clear 85° F

Crew: see p 10

Comments: _____

Grab No: 1 Bottom depth: _____ Penetration depth: 28 cm Time: 1545

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C (M) F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

Recorded by: DJH

EVS ENVIRONMENT CONSULTANTS

do 3rd bioaccumulation rep

Date: 7-16-98 Station: TBT-19

Survey WSOU TBT Study Area W. Waterway

Target Coordinates _____ Start time 1600

Stop time _____

Weather clear 85°F take bioaccumulation rep

Crew sea p 10

Comments: ~~TBT~~ 38 bioacc rep no DNA

1

Grab No: 1 Bottom depth: _____ Penetration depth: 27cm Time: 1615

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	(slight)	Petroleum
sand C (M) F	(black)	moderate	Other:
(silt) clay	(brown)	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: first of 2 grabs for bioacc replicate

Grab No: 2 Bottom depth: _____ Penetration depth: 26cm Time: 1626

Total Sulfides Sample: Y (N) (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	(gray)	(slight)	Petroleum
sand C (M) F	(black)	moderate	Other:
(silt) clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: 2nd of 2 grabs for bioacc replicate

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: ~~Y N~~ (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

DNA

~~TBT-38~~ bioacc rep

Recorded by: DJM

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-20

Survey: WSDA TBT Study Area: West Waterway

Target Coordinates: _____ Start time: 1710

Stop time: _____

Weather: clear, 84° F

Crew: DCA JP JO

Comments: _____

Grab No: 1 Bottom depth: _____ Penetration depth: _____ Time: 1720

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: rejected – cable from bottom was clasped in jaws

Grab No: 2 Bottom depth: _____ Penetration depth: 27 cm Time: 1740

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
sand C M (F)	(black)	moderate	Other:
(silt clay)	(brown)	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: accepted
depart for HI marina at 1740

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: _____

at HI, marina 1755

Recorded by: DJH.

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-021

Survey: NSOU TBT STUDY Area: WEST WATERWAY

Target Coordinates: _____ Start time: 0831

Stop time: _____

Weather: SUNNY, CLEAR, 65°F, WIND 10 KTS OUT OF SOUTH

Crew: TIM HAMMERMEISTER, STEPHAN WODACH, DALE DICKINSON, TONY PETRILLO

Comments: _____

Grab No: 1 Bottom depth: 50.9 MLLW Penetration depth: 10" Time: 0831

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
(sand) C M (F)	(black)	moderate	Other:
(silt) clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BWG

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-022

Survey WSOU Area WEST WATERWAY

Target Coordinates _____ Start time 0857

_____ Stop time _____

Weather SEE P622

Crew SEE P622

Comments: _____

Grab No: 1 Bottom depth: 48.6 Penetration depth: 11.5" Time: 0857

Total Sulfides Sample: Y N (circle one) NONE GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	(gray)	slight	Petroleum
(sand) C M (F)	(black)	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: TUBE WORMS

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BWS

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-023

Survey: WSOU Area: WEST WATERWAY

Target Coordinates: _____ Start time: 0940

_____ Stop time: _____

Weather: SEE PG 22

Crew: "

Comments: _____

Grab No: 1 Bottom depth: 49.0 fmm Penetration depth: 9" Time: 0940

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
(sand) C M (F)	(black)	moderate	Other:
(silt) clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: TUBE WORMS

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BLS

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-024

Survey W500 Area WESTWATERWAY

Target Coordinates _____ Start time 1023

_____ Stop time _____

Weather SEE PG 22

Crew TIM HAMMERMEISTER, LISA MILL, STEPHEN WODZICKI, DAVE DICKINSON, TONY PETRILLO

Comments: _____

Grab No: _____ Bottom depth: 51.0 Penetration depth: 10" Time: 1023

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Comments:

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	(gray)	slight	Petroleum
(sand) C M (F)	(black)	moderate	Other:
(silt) clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Comments:

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____ _____

Comments:

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Recorded by: TP/BWE

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-025

Survey WSOU Area WEST WATERWAY

Target Coordinates _____ Start time 1048

_____ Stop time _____

Weather SEE PG 22

Crew SEE PG 25

Comments: _____

Grab No: 1 Bottom depth: 51.2 Penetration depth: 10" Time: 1048

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	TUBE WORMS
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:		Comments:
cobble	D.O.	none	H_2S	
gravel	gray	slight	Petroleum	
sand C M F	black	moderate	Other:	
silt clay	brown	strong		
wood chips	brown surface	overwhelming		
sandblast grit				
paint chips				

Recorded by: TP/BWG

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-026

Survey WSOU Area WEST WATERWAY

Target Coordinates _____ Start time 1123

_____ Stop time _____

Weather BLUE SKY W/SCATTERED CLOUDS, WIND 10-12 KTS NNW 65°F

Crew SEE PG 25

Comments: _____

Grab No: 1 Bottom depth: 40.1 Penetration depth: 8.5" Time: 1123

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	ORGANIC
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BWE

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/12 Station: TBT-021

Survey WSCU Area LWR, THWY

Target Coordinates _____ Start time 1154

_____ Stop time _____

Weather SEE P627

Crew SEE P625

Comments: _____

Grab No: 1	Bottom depth: 44.2	Penetration depth: 10"	Time: 1154		
Total Sulfides Sample: Y N (circle one)				GPS Coordinates: _____ _____	
Sediment type:	*Sediment color:*	*Sediment odor:*		Comments: COPPER GROUNDING WIRE	
cobble	D.O.	(none)	H_2S	TUBE WORMS	
gravel	gray	slight	Petroleum	LOTS OF COPPER GROUNDING WIRE	
(sand) C M (F)	black	moderate	Other:		
(silt clay)	(brown)	strong			
wood chips	brown surface	overwhelming			
sandblast grit					
paint chips					

Grab No: _____	Bottom depth: _____	Penetration depth: _____	Time: _____		
Total Sulfides Sample: Y N (circle one)				GPS Coordinates: _____ _____	
Sediment type:	*Sediment color:*	*Sediment odor:*		Comments:	
cobble	D.O.	none	H_2S		
gravel	gray	slight	Petroleum		
sand C M F	black	moderate	Other:		
silt clay	brown	strong			
wood chips	brown surface	overwhelming			
sandblast grit					
paint chips					

Grab No: _____	Bottom depth: _____	Penetration depth: _____	Time: _____		
Total Sulfides Sample: Y N (circle one)				GPS Coordinates: _____ _____	
Sediment type:	*Sediment color:*	*Sediment odor:*		Comments:	
cobble	D.O.	none	H_2S		
gravel	gray	slight	Petroleum		
sand C M F	black	moderate	Other:		
silt clay	brown	strong			
wood chips	brown surface	overwhelming			
sandblast grit					
paint chips					

Recorded by: TP/BMS

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/16 Station: TBT-028

Survey WSOU Area WEST WATERWAY

Target Coordinates _____ Start time 1231

_____ Stop time _____

Weather SEE PG 27

Crew SEE PG 25

Comments: _____

Grab No: 1 Bottom depth: 50.3 Penetration depth: 10" Time: 1231

Total Sulfides Sample: Y N (circle one) NONE GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
(sand) C M (F)	(black)	moderate	Other:
(silt) clay	(brown)	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BWE

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-034

Survey: WSOU Area: WEST WATERWAY

Target Coordinates: _____ Start time: 1316

Stop time: _____

Weather: SEE P627

Crew: SEE P625 + PETE RUDE

Comments: _____

Grab No: 1 Bottom depth: 23.1 Penetration depth: 8" Time: 1316

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: SHEEN HASH; WORM TUBES; OILY SHEEN

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BWE

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-032

Survey: LOSCO Area: DRYDOCK TODD SHIPYARD

Target Coordinates: _____ Start time: 1348

Stop time: _____

Weather: SEE PG 27

Crew: SEE PG 25 + PETE RUDE

Comments: _____

Grab No: 1 Bottom depth: 42.2 Penetration depth: 9" Time: 1348

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
(sand) C M (F)	black	moderate	Other:
(silt) clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit	DRAB OLIVE		
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BWE

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-031

Survey: WSOU Area: TODD SHIPYARD

Target Coordinates: _____ Start time: 1412

Stop time: 1429

Weather: SEE PG 27

Crew: SEE PG 25 + PETE RUDE

Comments: _____

Grab No: 1 **Bottom depth:** 45.2 **Penetration depth:** — **Time:** 1412

Total Sulfides Sample: Y N (circle one) **GPS Coordinates:** _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: OVER PENETRATION

REJECT

Grab No: 2 **Bottom depth:** 46.1 **Penetration depth:** 9.5" **Time:** 1429

Total Sulfides Sample: Y N (circle one) **GPS Coordinates:** _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	(Petroleum)
(sand) C M (F)	(black) VERY	moderate	Other:
(silt clay)	brown	(strong)	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: WORM TUBES

Grab No: _____ **Bottom depth:** _____ **Penetration depth:** _____ **Time:** _____

Total Sulfides Sample: Y N (circle one) **GPS Coordinates:** _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BLUE

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-033

Survey WSOU Area TODD SHIPYARD

Target Coordinates _____ Start time 1455

_____ Stop time _____

Weather SEE PG 27

Crew SEE PG 25 + PETE RUDE

Comments: _____

Grab No: 1 Bottom depth: ~~NOT~~ 38.9 Penetration depth: _____ Time: 1455

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: TOW CABLE IN JAWS. SAMPLE WASHED. REJECT

Grab No: 2 Bottom depth: 38.9 Penetration depth: _____ Time: 1502

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	(none)	H_2S
gravel	(gray) DARK	slight	Petroleum
(sand) C (M) F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: ~~DRAB OLIVE~~ SAME REJECT

Grab No: 3 Bottom depth: 39.6 Penetration depth: 10" Time: 1508

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O	(none)	H_2S
gravel	(gray) DARK	slight	Petroleum
(sand) C (M) F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: DRAB OLIVE ON SURFACE BLACK BENEATH WORMS & WORM TUBES

Recorded by: TP/BWE

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-029

Survey: WSOU Area: WEST WATERWAY

Target Coordinates: _____ Start time: 1535

_____ Stop time: 1548

Weather: SEE PG 27

Crew: SEE PG 25

Comments: _____

Grab No: 1 **Bottom depth:** 44.3 **Penetration depth:** _____ **Time:** 1535

Total Sulfides Sample: Y N (circle one) **GPS Coordinates:** _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: CABLE IN JAWS. SAMPLE WASHED. REJECT

Grab No: 2 **Bottom depth:** 41.6 **Penetration depth:** 7" **Time:** 1548

Total Sulfides Sample: Y N (circle one) **GPS Coordinates:** _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
(sand) C M (F)	(black)	moderate	Other:
(silt clay)	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments: OLIVE DRAB ON SURFACE, BLACK BENEATH

Grab No: _____ **Bottom depth:** _____ **Penetration depth:** _____ **Time:** _____

Total Sulfides Sample: Y N (circle one) **GPS Coordinates:** _____

Sediment type:	*Sediment color:*	*Sediment odor:*	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP / BLW

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-030

Survey: WSOU Area: WEST WATERWAY

Target Coordinates: _____ Start time: 1622

Stop time: 1645

Weather: PG 27

Crew: PG 25

Comments: _____

Grab No: 1 Bottom depth: 50.2 Penetration depth: 10" Time: 1622

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
(sand) C M (F)	black	moderate	Other:
(silt clay)	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit	DRAB OLIVE		
paint chips			

Comments:

Grab No: 2 Bottom depth: 50.6 Penetration depth: 9" Time: 1645

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	(none)	H_2S
gravel	gray	slight	Petroleum
(sand) C M (F)	black	moderate	Other:
(silt clay)	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit	DRAB		
paint chips	OLIVE		

Comments:

Grab No: _____ Bottom depth: _____ Penetration depth: _____ Time: _____

Total Sulfides Sample: Y N (circle one) GPS Coordinates: _____

Sediment type:	Sediment color:	Sediment odor:	
cobble	D.O.	none	H_2S
gravel	gray	slight	Petroleum
sand C M F	black	moderate	Other:
silt clay	brown	strong	
wood chips	brown surface	overwhelming	
sandblast grit			
paint chips			

Comments:

Recorded by: TP/BWE

EVS CONSULTANTS
PROJECT #: 2/203-15.2

SAMPLE JAR FIELD LOG

WATERWAY SEDIMENT OPERABLE UNIT TBT STUDY

SAMPLING DATES: 7/15/98 TO: 7/17/98

EVS ENVIRONMENT CONSULTANTS

Survey: TBT Study Date: 7/15/98 Station: TBT-01

Area: West Waterway Time: 0902

TAG #	ID #	Analyses	Lab
4001	TBT-01-S	TBT/TOC	CAS
4002	"	Grain Size	ROSA
4003	"	Porewater Extr.	"
4004	"	Bioaccumulation	Battelle
4005	"	"	"

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Survey: TBT Study Date: 7/15/98 Station: TBT-02
Area: W. Waterway Time: 0955

TAG #	ID #	Analyses	Lab
4006	TBT-02-S	TBT/TOC	CAS
4007	"	Grain Size	ROSA
4008	"	Porewater	"
4009	"	Bioaccumulation	Battelle
4010	"	"	"
4011	TBT-35-S	TBT/TOC	CAS
4012	"	Grain Size	ROSA
4013	"	Porewater	"

Comments: Chemistry/Grain size replicate taken

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-03

Survey: WSOU TBT Study Area: W. Waterway Time: 1045

TAG #	ID #	Analyses	Lab
4014	TBT-03-S	TBT / TOC	CAS
4015	"	Grain Size	ROSA
4017	"	Porewater	"
4018	"	Bioaccumulation	Battelle
4016	"	Sed Replenish	"

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Survey: WSDOT TBT Study Date: 7/15/98 Station: TBT-04
Area: W. Waterway Time: 1124

TAG #	ID #	Analyses	Lab
4019	TBT-04-S	TBT/TOC	CAS
4020	"	Grain Size	ROSA
4022	"	Porewater Extraction	"
4023	"	Bioaccumulation	Battelle
4021	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Date: 7/13/98 Station: TBT-05
Area: W. Waterway Time: 1205

TAG #	ID #	Analyses	Lab
4024	TBT-05-S	TBT/TOC	CAS
4025	"	Grain Size	RosA
4027	"	Porewater Extraction	"
4028	"	Bioaccumulation	BATTELLE
4026	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSDOT TBT Study Date: 7/15/98 Area: W. Waterway Station: TBT-06 Time: 1355

TAG #	ID #	Analyses	Lab
4029	TBT-06-S	TBT/TOC	CAS
4030	"	Grain Size	ROSA
4032	"	Porewater Extraction	"
4033	"	Bioaccumulation	Battelle
4031	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Date: 7-15-98 Station: TBT-07

Area: W. Waterway Time: 1435

TAG #	ID #	Analyses	Lab
4034	TBT-07-S	TBT/TOC	CAS
4035	"	Grain Size	ROSA
4037	"	Porewater	"
4038	"	Bioaccumulation	Battelle
4036	"	"	"
4039	TBT-36-S	TBT/TOC	CAS
4040	"	Grain Size	ROSA
4041	"	Porewater	"
4042	TBT-07-FB	TBT	CAS
4043	TBT-07-CB	"	"

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Date: 7/15/98 Station: TBT-08

Survey: WSDU TBT Study Area: W. Waterway Time: 1535

TAG #	ID #	Analyses	Lab
4044	TBT-08-S	TBT/TOC	CAS
4045	"	Grain Size	Rosa
4046	"	Porewater	"
4047	"	Bioaccumulation	Battelle
4048	"	"	"
4049	"	"	"
4050	"	"	"
4051	"	"	"
4052	"	"	"
4053	"	"	"
4054	"	"	"
4055	"	"	"
4056	"	"	"

Comments:

Recorded by: L. [signature]

EVS ENVIRONMENT CONSULTANTS

Survey: WSDOT TBT Study Area: W Waterway Date: 7/15/98 Station: TBT-09 Time: 1655

TAG #	ID #	Analyses	Lab
4057	TBT-09-S	TBT/TOC	CAS
4058	"	Grain Size	ROSA
4060	"	Porewater	"
4059	"	Bioaccumulation	BATTELLE
4061	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-10-S

Survey: WSDU TBT Study Area: W. Waterway Time: 0845

TAG #	ID #	Analyses	Lab
4062	TBT-10-S	TBT/TOC	CAS
4063		grain size	Rosa
4066		porewater	Rosa
4064		Invertebrate	Battelle
4065		Invertebrate	Battelle

Comments:

Recorded by: DJH

EVS ENVIRONMENT CONSULTANTS

Date: 07-16-98 Station: TBT-11-S

Survey: W.SOU TBT Area: W. Waterway Time: 0920

TAG #	ID #	Analyses	Lab
4071	TBT-11-S	Arsenic	Battelle
4069		Arsenic	Battelle
4070		porewater extract	Rosa
4068		grain size	"
4067	↓	TBT/TOC	CAS

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-12-S

Survey: WSOU TBT Area: West Waterway Time: 1035

TAG #	ID #	Analyses	Lab
4072	TBT-12-S	TBT/TOC	CAS
4073	↓	grain size	Ross
4076		porewater extract	"
4074		bioassay sed sepl	Battelle
4075		bioassay	"

Comments:

Recorded by: DJN

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Date: 7-16-98 Station: TBT-13-S
Area: NN. Nisqually Time: 1140

TAG #	ID #	Analyses	Lab
4077	TBT-13-S	TBT/TOC	CAS
4078		grain size	Rosa
4084		porewater extract	"
4079		broacum sed. repl.	Battelle
4080		broacumed repl	"
4081		"	
4082		"	
4083		"	
4085		broacum	
4086		"	
4087		"	
4088		"	
4089		"	

Comments:

Recorded by: DJH

EVS ENVIRONMENT CONSULTANTS

+ replicate TBT-37-S

Date: 7-16-98 Station: TBT-14

Survey: WSOU TBT Study Area: W. Waterway Time: 1310 and 1320

TAG #	ID #	Analyses	Lab	
4090	TBT-14-S	TBT/TOC	CAS	
4091	14	grain size	Rosa	
4095		porewater extract	"	1310
4092		Broccam acid-sept.	Battelle	
4096		Broccam	"	
4093	TBT-37-S	TBT/TOC	CAS	
4094		grain size	Rosa	1320
4097		porewater extract	"	

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-15

Survey: WSOU TBT study Area: W. Waterway Time: 1355

TAG #	ID #	Analyses	Lab
4098	TBT-15-S	TBT/TOC	CAS
4099	↓	grain size	Rosa
4101		porewater extract	"
4100		bioacc sed. repl.	Battelle
4102		bioaccumulation	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-16

Survey: WSOU TBT Study Area: W. Waterway Time:

TAG #	ID #	Analyses	Lab
4103	TBT-16-S	TBT/TOC	CAS
4104		grainsize	Ross
4106		porewater extract	"
4105		bioaccum sed repl.	Battelle
4107		bioaccumulation	"

Comments:

Recorded by: DJ

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-17

Survey: WSOU TBT Survey Area: W. Waterway Time: _____

TAG #	ID #	Analyses	Lab
4108	TBT-17-S	TBT/TOC	CAS
4109		grainsize	Rosa
4111		porewater	"
4110		bioassay sed repl.	Battelle
4112		bioaccumulation	"

Comments:

Recorded by: _____

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Area: W Waterway Date: 7-16-98 Station: TBT-18 Time: 1545

TAG #	ID #	Analyses	Lab
4113	TBT-18-S	TBT/TOC	CAS
4114		grain size	Rosa
4116		porewater extract	"
4115		bioacc. sed. repl.	Battelle
4117		bioaccumulation	"

Comments:

Recorded by: DJH

DJH + biosacc rep TBT-038

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Date: 7-16-98 Station: TBT-19

Area: N. Victoria Time: 1615, 1635

collected 1645

TAG #	ID #	Analyses	Lab
4123	TBT-19-5	TBT/TOC	CAS
4124		grain size	Rosa
4125		porewater extract	"
4118		biosacc sed. repl.	Battelle
4126		bioaccumulation	"
4119	~~TBT-38-5~~	biosacc sed repl.	"
4120		"	
4121		"	
4122		"	
4127		bioaccumulation	
4128		"	
DJH ~~4129~~ 4129		"	
4130		"	

Comments: 3rd bioaccumulation replicate

Recorded by: DJH

EVS ENVIRONMENT CONSULTANTS

Date: 7-16-98 Station: TBT-20

Survey: WSOU TBT study Area: West Waterway Time:

TAG #	ID #	Analyses	Lab
4131	TBT-20-S	TBT / TOC	CAS
4132		grain size	Rosa
4134		porewater extract	"
4133		Invert sed. repl.	Battelle
4135		bioaccumulation	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Area: W. Waterway Date: 7/17/98 Station: TBT-21 Time: 0831

TAG #	ID #	Analyses	Lab
4136	TBT-21-5	TBT/TOC	CAS
4137	"	Grain Size	Rosa
4138	"	Porewater Extraction	"
4139	"	Bioaccumulation	Battelle
4140	"	"	"

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Survey: WSDOT TBT Study Area: W. Waterway Date: 7/17/98 Time: 0857 Station: TBT-22

TAG #	ID #	Analyses	Lab
T.H. ~~4041~~ 4141	TBT-22-S	TBT/TOC	CAS
T.H. ~~4042~~ 4142	"	Grain Size	Rosa
4144	"	Porewater Extraction	"
4145	"	Bioaccumulation	Battelle
4143	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-23

Survey: WSDOT TBT Study Area: W. Waterway Time: 0940

TAG #	ID #	Analyses	Lab
4146	TBT-23-5	TBT/TOC	CAS
4147	"	Grain Size	Rosa
4150 ~~4148~~ T.H.	"	Porewater Extraction	"
4149	"	Bioaccumulation	Battelle
4148 ~~4150~~ T.H	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Date: 7/17/98 Area: W. Waterway Station: TBT-24 Time: 1023

TAG #	ID #	Analyses	Lab
4151	TBT-24-S	TBT/TOC	CAS
4152	"	Grain Size	ROSA
4153	"	Porewater Extraction	"
4154	"	Bioaccumulation	Battelle
4155	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-25

Survey: WSDOT TBT Study Area: W. Waterway Time: 1048

TAG #	ID #	Analyses	Lab
4156	TBT-25-S	TBT/TOC	CAS
4157	"	Grain Size	Rosa
4158	"	Porewater Extract	"
4159	"	Bioaccumulation	Battelle
4160	"	"	"
4161	"	TBT	CAS

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Date: 7/17/98 Station: TBT-26
Area: W. Waterway Time: 1123

TAG #	ID #	Analyses	Lab
4162	TBT-26-S	TBT/TOC	CAS
4163	"	Grain Size	Rosa
4164	"	Pore Water	"
4165	"	Bioaccumulation	Battelle
4166	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-27

Survey: WSOU TBT Study Area: W. Waterway Time: 1154

TAG #	ID #	Analyses	Lab
4167	TBT-27-S	TBT/TOC	CAS
4168	"	Grain Size	ROSA
4169	"	Porewater Extraction	"
4170	"	Bioaccumulation	Battelle
4171	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSOV TBT Study Area: W. Waterway Date: 7/17/98 Station: TBT-28 Time: 1231

TAG #	ID #	Analyses	Lab
4172	TBT-28-S	TBT/TOC	CAS
4173	"	Grain Size	Rosa
4174	"	Porewater	"
4175	"	Bioaccumulation	Battelle
4176	"	"	"
4177	TBT-38-S	TBT/TOC	CAS
4178	"	Grain Size	ROSA
4179	"	Porewater	"

Comments: Chemistry Rep

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Study Area: Todd Shipyards Date: 7/17/98 Time: 1316 Station: TBT-34

TAG #	ID #	Analyses	Lab
4180	TBT-34-S	TBT / TOC	CAS
4181	"	Grain Size	ROSA
4182	"	Porewater	"

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Survey: WSDOT TBT Study Area: Todd Shipyards Date: 7/17/98 Time: 1351 Station: TBT-32

TAG #	ID #	Analyses	Lab
4184	TBT-32-S	TBT/TOC	CAS
4185	"	Grain Size	ROSA
4186	"	Porewater	"

Comments:

Recorded by: [signature]

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-31

Survey: WSDU TBT Study Area: Todd Shipyards Time: 1429

TAG #	ID #	Analyses	Lab
4187	TBT-31-S	TBT/TOC	CAS
4188	"	Grain Size	Rosa
4189	"	Porewater	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSDV TBT Study Date: 7/17/98 Station: TBT-33
Area: Todd Shipyards Time: 1508

TAG #	ID #	Analyses	Lab
4190	TBT-33-S	TBT/TOC	CAS
4191	"	Grain Size	ROSA
4192	"	Porewater Extract	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Survey: WSOU TBT Survey Date: 7/17/98 Station: TBT-29

Area: W. Waterway Time: 1548

TAG #	ID #	Analyses	Lab
4193	TBT-29-S	TBT/TOC	CAS
4194	"	Grain Size	ROSA
4195	"	Porewater Extraction	"
4196	"	Bioaccumulation	Battelle
4197	"	"	"

Comments:

Recorded by:

EVS ENVIRONMENT CONSULTANTS

Date: 7/17/98 Station: TBT-30

Survey: WSDU TBT Study Area: W. Waterway Time: 1622

TAG #	ID #	Analyses	Lab
4198	TBT-30-S	TBT / TOC	CAS
4199	"	Grain Size	ROSA
4200	"	Porewater Extraction	"
4201	"	Bioaccumulation	Battelle
4202	"	"	"
4203	"	"	"
4204	"	"	"
4205	"	"	"
4206	"	"	"
4207	"	"	"
4208	"	"	"
4209	"	"	"
4210	"	"	"

Comments:

Recorded by: