APPENDIX F

COLONY WHARF SEDIMENT SAMPLING REPORT

The attached investigation report was funded by the Department of Ecology. It describes the sampling and analysis of surface sediments adjacent to the Colony Wharf site along the Whatcom Waterway. The upland portion of that site is being managed as part of the Central Waterfront site cleanup. Sediments at the site are being managed as part of the Whatcom Waterway site cleanup.

DRAFT Summary of Sediment Testing

Colony Wharf
Bellingham, Washington

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February 4, 2004

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Table of Contents

List of Tables

List of Figures

List of Appendices

1 Introduction

This report presents results of the sampling and analysis of surface sediments near Colony Wharf in Bellingham, Washington (Colony Wharf). This sediment sampling collection and analysis effort was intended to characterize the Colony Wharf sediments by comparing the sediment analytical data to Washington State Sediment Management Standards (SMS [both sediment quality standards (SQS) and cleanup screening levels (CSL)]) and conventional bioassays. Results presented include chemical, physical, and biological toxicity testing data and analyses.

Sampling and analysis of the Colony Wharf sediments were conducted according to the approved Colony Wharf Sediment Sampling and Analysis Plan (RETEC, 2003). Three sample stations were located as close to the shoreline as possible along the property line of Colony Wharf in the Whatcom Waterway. Sediments were collected initially on July 24, 2003 and recollected on November 6, 2003 due to failure of *Mytilus galloprovincialis* larval bioassay control criteria. Figure 1-1 identifies the sample locations for each of the two sample collections.

This report includes the following sections:

- Introduction (Section 1)
- Sampling and Analytical Methods (Section 2)
- Results (Section 3)
- Summary (Section 4)

2 Sampling and Analytical Methods

Sampling and analysis of the Colony Wharf sediments were conducted according to the approved Colony Wharf Sediment Sampling and Analysis Plan (RETEC, 2003) (SAP). Below, the specific collection and analysis methods are presented.

2.1 Collection

Colony Wharf sediment collection included two separate sampling events on July 24 (first sample collection) and November 6, 2003 (second sample collection). Each event is described below.

2.1.1 First Sample Collection

Three surface sediment stations (CWB-1, CWB-2, and CWB-3) and one reference surface sediments station (REF-1) were collected by RETEC (see Table 2-1 and Figure 1-1) on July 24, 2003. The reference sample was collected in Samish Bay, approximately 10 miles south of Bellingham Bay.

Surface sediment stations were positioned as close as possible to the bulkheads along the Colony Wharf property during both sampling events (Figure 1-1). During the second sampling in November, the locations of the first sampling event were targeted. Each station was shifted slightly from the original sampling location due to debris or boats preventing access. This shift resulted in grain size differences between the first and second sampling at each location, as discussed in subsequent sections.

Sampling was performed with Marine Sampling Service's 26-ft *Peter R.* using a modified hydraulic Vanveen with a 1-m^2 area, which penetrated the sediments approximately 5 to 11 inches, depending on substrate composition. The boat is equipped with an electric winch and DGPS.

A grab sample of the top 12 cm was collected from each sampling station. One grab sample provided sufficient sediment for all stations for all biological and analytical parameters except at CWB-1. This station required two grab samples, which were then composited.

Sediment collection parameters are presented in Table 2-2. After collection, sediments were spooned into a decontaminated stainless steel bowl, and sample jars were filled after the mixture had been homogenized using decontaminated stainless steel spoons. Jars were filled with sediment for each sampling parameter in the field. Specifically, homogenized sediment samples were colleted for grain size (16-oz jar), conventionals (8-oz jar), metals (8-oz jar), semi-volatile organic carbon (SVOC) and polychlorinated biphenyls (PCBs) (16-oz jar), and tri-butyl tin (TBT) in porewater (2 1-L jars).

Sulfides and VOC samples were collected directly from the sediment sampler prior to homogenizing and placed in 4-oz jars. Sulfide samples were sealed with 2 ml of zinc acetate (ZnAc). Sediment samples for bioassay testing were placed in two 4-L decontaminated plastic buckets provided by AMEC, the bioassay laboratory.

Quality assurance/control samples included duplicate samples collected at station CWB-3, (sample identification CWB-103) and matrix spike and matrix spike duplicate (MS/MSD) samples collected at station CWB-2 for SVOC/PCB, porewater TBT, and grain size.

All samples were properly labeled, sealed, and placed on ice in the field. Samples were stored on ice and transported to each respective laboratory within 24 hours (analytical and bioassay). The chain of custody forms are contained in Appendix A.

2.1.2 Second Sampling Event

On November 6, 2003, a second sampling effort was conducted to collect sediment to repeat the bioassay testing (including sulfide and ammonia analyses). Sediments were collected from the same sediment stations and by the methods described above.

Again, sulfides were collected from the sampler prior to homogenization and were sealed with ZnAc. A 4-oz jar for ammonia and a 4-L plastic container for bioassays were filled following homogenization. Further, four 1-L jars of sediment were archived for potential chemical or grain size testing.

2.2 Analytical Methods

Analytical Resources, Inc. (ARI), in Tukwila, Washington (a Washington state Department of Ecology certified laboratory), performed the sediment chemical analyses (July 24, 2003 sample only). Analytical parameters and methods included semi-volatile organic carbon (SVOC) (EPA 8270), volatile organic carbon (VOC) (EPA 8260), metals (EPA 6010; EPA 7471 for mercury), porewater tri-butyltin (Krone, 1989), and conventionals (total solids, total volatile solids, ammonia, sulfide, and total organic carbon) following PSEP protocols (PSEP, 1986, 1996). Physical grain size distributions were also analyzed by ARI for sediment by PSEP protocols (PSEP, 1986).

AMEC, in Fife, Washington performed all biological testing on the sediments. Tests performed with the July 24 collected sediments included 10-day *Ampelisca abdita*[1] mortality, 10-day *Neanthes arenaceodentata* growth, and

[1] *Ampelisca abdita*, a burrowing amphipod, was selected for this test species due to its grain size insensitivity to concentrations of fines greater than 60 percent (PSDDA, 2000) – the consistency of the samples collected. Sufficient fine-grained sediment appeared to exist in all samples to allow for burrowing. Consequently, *A. abdita* was the preferred amphipod test species

48-hour *Mytilus galloprovincialis* larval survival and normality according to PSEP protocols (PSEP, 1995) and 100 percent porewater Microtox® according to Ecology's marine protocol contained in Subappendix B of the Sampling and Analysis Plan Appendix (Ecology, 2003).

The only biological test performed with the sediments collected on November 6 was the 48-hour *Mytilus galloprovincialis* sediment larval test. Again this test was rerun due to bioassay control failures in the tests conducted on the July 24 sample.

Appropriate laboratory protocols were followed including internal quality assurance and control. All samples were properly stored and analyzed within the appropriate holding time.

3 Results

Results include data from chemical, grain size, and bioassay testing. Results of each test are discussed below and include comparisons to SMS criteria and bioassay standards.

3.1 Chemical Analytical Data

Table 3-1 presents chemical analytical data[2] for the Colony Wharf sediments collected on July 24, 2003. This table also shows a comparison of the chemical data to SMS criteria for each sampling station and analytical parameter. Chemical analytes that had numeric values above the laboratory detection limit are shown in bold, and analytes that exceeded SMS criteria are shown in bold and underlined.

The only chemical analytes that exceeded SMS criteria were copper and zinc in sample CWB-3. In the duplicate sample (CWB-103), copper and fluoranthene exceeded SMS criteria.

No SMS criteria currently exist for TBT in porewater. However, the conceptual equivalent of an SQS, as cited in the Dredged Materials Management Program (DMMP)/SMS agencies' review during the 1996 Sediment Management Analysis and Review Meeting (SMARM) (Michelsen et al., 1996), was used for comparison. Based upon this value, TBT was elevated above this value in the porewater in sample CWB-3 as well as in the duplicate sample (CWB-103)

No other chemicals exceeded SMS criteria at any stations.

Conventional parameters analyzed included total solids, total volatile solids, total organic carbon, ammonia and total sulfides. SMS criteria have not been identified for these parameters. All parameters were analyzed for the July 24th samples (initial sampling), but only total solids, ammonia and total sulfides were analyzed for the November 6 samples (second sampling).

For the July 24 samples, all conventional parameters were similar in CWB-1 and CWB-2. Station CWB-3, however, had higher ammonia and sulfide concentrations than both CWB-1 and CWB-2 (for ammonia, 68 mg/kg in CWB-3 vs. 8.0 and 8.9 mg/kg in CWB-1 and CWB-2, respectively). Sulfide concentrations in CWB-3 were 7,000 mg/kg, versus 170 mg/kg each in CWB-1 and CWB-2. The duplicate sample CWB-103 compares well in all parameters to CWB-3 except total sulfides (7,000 mg/kg CWB-3 and 4,000

[2] All chemical data was validated by an independent validator, Susan Milcan of RETEC (Appendix 1). Data validation procedures are detailed in the *Data Validation Guidance Manual for Selected Sediment Variables (QA-2)* (PTI Environmental Services, 1989).

mg/kg for CWB-103). Sulfide concentrations at CWB-1 and CWB-2 were comparable to the reference station concentration (160 mg/kg).

For the November samples, station CWB-2 and CWB-3 had similar results for total sulfides (3,000 mg/kg and 3,500 mg/kg, respectively), but both were higher than the reference station (1,200 mg/kg). Sulfide concentrations measured in the November samples were higher than the results from the July 24 sampling event for CWB-1 and CWB-2. However, sulfide concentration in CWB-3 was 50 percent lower (3,500 mg/kg). The November 6 reference sample sulfide concentration was measured at 1,200 mg/kg. Ammonia was also higher in CWB-3 than the other two station samples.

3.2 Grain Size Data

Table 3-2 provides grain size results for the initial sampling of Colony Wharf sediment. Visual inspection of grain size of sediment collected during the second sampling appeared different from samples collected during the initial sampling for samples CWB-1 and CWB-2. During the initial sampling, CWB-1 was dominated by sand and gravel and CWB-2 was 75 percent gravel. Although grain size was not measured on sediment from the second sampling, CWB-1 consisted of silty sand with no gravel present, and CWB-2 consisted of silt with a trace of gravel (Table 3-1).

3.3 Bioassay Data

Biological testing control and reference criteria are listed in Table 3-3, and sediment quality decision criteria are listed in Table 3-4. Acute bioassay results are provided for *Ampelisca abdita* (Table 3-5), *Neanthes arenadeodentata* (Table 3-6), *Mytilus galloprovincialis* (Tables 3-7 and 3-8), and Microtox® (Table 3-9). Table 3-10 contains a summary and evaluation of each of the biological endpoint results compared to criteria for each station. The laboratory bioassay report is included in Appendix B. A data quality review conducted by RETEC is contained in Appendix C. The results of each specific bioassay are discussed below. As discussed previously, the *Mytilus galloprovincialis* test failed control criteria on July 24 samples and was retested with the November 6 samples.

Porewater and overlying water was tested for sulfide and ammonia more frequently than required by PSEP protocols. These data are contained in the Water Quality section of the laboratory bioassay report (Appendix B). Of these results, initial porewater sulfide concentration in the amphipod test for sample CWB-3 was high (178 mg/L) but was undetected on day 10. Results for all other samples were non-detect or slightly above the detection limit.

3.3.1 Ten-Day Amphipod Survival

Mean amphipod survival for CWB-1, 2 and 3 was 69 percent, 76 percent and 54 percent, respectively (Table 3-5). Control and reference station survival was 88 percent and 82 percent. SQS failures were noted for CWB-1 and CWB-3 due to the statistical differences when compared to reference survival and because test sediment mean mortality exceeded 25 percent. No Cleanup Screening Level (CSL) failures occurred.

Control survival for *A. abdita* was 88 percent, which did not meet the 90 percent survival criteria (Table 3-5). However, reference survival (82 percent) met performance criteria (75 percent). Because biological effects are based on statistical comparisons to reference sediment survival, the test was considered acceptable.

3.4 Twenty-Day *Neanthes* Growth

Results for the 20-day juvenile polychaete survival and growth test are presented in Table 3-6. Measurement endpoints include both mortality and growth. The mean survival for CWB-1, CWB-2 and CWB-3 were 96, 100 and 100 percent, respectively. None of the samples were statistically different (p=0.05) from the control or reference (means of 100 percent and 92 percent, respectively). Growth rates in all test samples met SQS criteria of 70 percent of reference growth rate. Therefore, all stations met SQS effects criteria.

Control survival for *N. arenaceodentata* met the control criteria of 90 percent (Table 3-6). Mean individual growth rate was 0.49 mg/ind/day, which did not meet 0.72 mg/ind/day but did meet the Puget Sound Dredge Disposal Act criteria of 0.38 mg/ind/day (PSDDA, 2000). Reference growth rate met reference criteria of 80 percent of control growth rate. Consequently, the test was deemed acceptable.

3.5 Forty-Eight Hour Larval Test

The July 24th sediment samples did not meet control survival criteria for *M. galloprovincialis*. The test was not rerun within the maximum 8-week holding time, and therefore, sediment was recollected to repreform the larval test. The results of this test are summarized in Table 3-7.

Results of the larval test for the second sampling (November 6) are summarized in Table 3-8. Mean normal survivorship of each test sample was greater than mean normal survivorship in the reference sediment. None of the test samples had normal survivorship significantly different than the reference sediment. Therefore, samples CWB-1, CWB-2, and CWB-3 passed SQS effects criteria.

Mean normal survivorship in the control sample (75 percent) met the control criteria of 70 percent. Mean normal survivorship in the reference sample met criteria of 65 percent of mean normal survivorship in the control. Consequently, this test was deemed acceptable.

3.6 Microtox®

Results of the 100 percent porewater Marine Microtox® test are contained in Table 3-9. Each test sample was run concurrently with control and reference samples. Samples CWB-2 and CWB-3 were statistically different (p=0.05) from both the reference and control samples at both I_5 and I_{15}. The mean output was less than 80 percent of both the reference and control outputs at both I_5 and I_{15}. Therefore, samples CWB-2 and CWB-3 failed to meet SQS criteria, as identified in the protocol. Sample CWB-1 met SQS criteria.

Control and reference performance met percent output requirements as defined by the protocol, as shown on Table 3-9 (Ecology, 2003). Based on these criteria, the reference was used to calculate change in light readings for CWB-1, but due to low initial mean test values, the control was used to calculate change in light readings for CWB-2 and CWB-3.

4 Summary

Table 3-10 provides a summary of all bioassay results and criteria comparison for each sediment sample collected from near Colony Wharf. No samples failed to meet SQS criteria for the juvenile polychaete or larval tests. Sample CWB-1 and CWB-3 failed to meet SQS biological criteria for the amphipod test. Samples CWB-2 and CWB-3 failed to meet SQS biological criteria for the 100 percent porewater marine Microtox® test. No sediment samples failed the CSL biological criteria.

Differences in particle size did not appear to affect any bioassay results. SQS failures were seen in both types of substrates collected: CWB-1 (gravelly sand, amphipod test) and CWB-2 (silty gravel, Microtox®). Effects were observed in the amphipod and Microtox® tests in sample CWB-3, which consisted of clayey silt.

SMS chemical criteria were exceeded only at station CWB-3 and included copper and zinc. The proposed porewater TBT criterion was also exceeded in CWB-3. The duplicate of sample CWB-3 (CWB-103) contained concentrations of copper, fluoranthene, and porewater TBT to exceed criteria. Further, sulfide and ammonia concentrations were higher in CWB-3 than the other two stations.

5 References

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Tables

Table 2-1 Colony Wharf Bioassay Sediment Station Locations

Station	Initial Sampling, July 24, 2003 (WA State Plane North, NAD27, feet) [1]		Second Sampling, November 6, 2003 (WA State Plane North, NAD27, feet) [1]	
	Northing (y axis)	Easting (x axis)	Northing (y axis)	Easting (x axis)
Test Stations				
CWB-1	642990	1601078	642984	1601083
CWB-2	643118	1601238	643088	1601221
CWB-3	643343	1601421	643342	1601419
Reference Station				
REF-1	582110	1588588	582110	1588632

Notes:

[1] Coordinates are in Washington State Plane North Zone (feet) North American Datum (NAD) 1927

Table 2-2 Visual Description of Surface Grab Samples

Sample ID	Date Collected	Sample Method	Attempts	Description	Biological	Odor	Sheen	Debris	Depth of Penetration (in)	Depth of Sample (cm)	Water Depth (ft)
CWB-1	7/24/2003	V V	2	thin layer of grayish brown SILT over dark gray GRAVELLY SAND	crab (*Cancer gracilis*)	strong sulfide	none	bark pieces, grass pieces, half cinder block, 8 in. riprap, small shells	6.5	0-12	14.6
CWB-2	7/24/2003	V V	9	thin layer of grayish brown 5mm thick over dark gray SILTY GRAVEL with trace sand	none	none	slight	none	5	0-12	19.1
CWB-3	7/24/2003	V V	1	thin light brown surface layer over very wet, soft dark gray SILT to 2 in. grading to CLAYEY SILT below 2 in.	abundant mussel shells (>70%)	very strong sulfide	slight	moderate wood fragments and sticks	5	0-12	11.0
REF-1	7/24/2003	V V	1	wet, soft grayish brown CLAYEY SILT w/ trace fine sand	none	none	none	none	9	0-12	64.4
CWB-1	11/6/2003	V V	4	thin layer of light brown SILT over black SILTY SAND	Moderate snails (*Bittium* sp.)	moderate sulfide	slight	alder and cottonwood leaves on surface	6	0-12	15.7
CWB-2	11/6/2003	V V	1	1" layer of light brown over black slightly sandy SILT with minor gravel (1")	Clam shell (*Clinocardium* sp.)	strong sulfide	slight	wood debris (6" x 2")	6	0-12	21.4
CWB-3	11/6/2003	V V	1	thin light brown surface layer over black SANDY SILT	crab (*Cancer magister*)	strong sulfide	moderate specs	moderate sticks and leaves	9	0-12	10.1
REF-1	11/6/2003	V V	1	thin light brown silt over soft, wet black slightly clayey SILT with trace sand	worm cases	slight sulfide	none	none	11	0-12	63.1

Notes:
V V – Sampled using a modified Van Veen sampler.

Table 3-1 Colony Wharf Sediment Chemical Concentrations

Parameter	SMS Criteria		CWB-1			CWB-2			CWB-3			CWB-103			REF-1		
	SQS	MCUL															
Conventionals			***Round 1***	***Round 2***		***Round 1***	***Round 2***		***Round 1***	***Round 2***		***Round 1***	***Round 2***		***Round 1***	***Round 2***	
Total Solids (%)	nv	nv	**73.8**	**80.3**		**69.5**	**41**		**42.9**	**40.9**		**36.9**	**-**		**34.3**	**33.1**	
Total Volatile Solids(%)	nv	nv	**3.0**	**-**		**3.4**	**-**		**11**	**-**		**12**	**-**		**7.5**	**-**	
Total Organic Carbon (%)	nv	nv	**4.6**	**-**		**2.9**	**-**		**4.5**	**-**		**4.8**	**-**		**1.9**	**-**	
Ammonia (mg/kg)	nv	nv	**8.9**	**2.6**		**8.0**	**21**		**68**	**33**		**64**	**-**		**12**	**15**	
Total Sulfides (mg/kg)	nv	nv	**170**	**400**		**170** E	**3,000**		**7,000**	**3,500**		**4,800**	**-**		**160**	**1,200**	
Metals	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*			*(mg/kg)*			*(mg/kg)*			*(mg/kg)*			*(mg/kg)*		
Antimony	nv	nv	<7		U	<7		U	<10		U	<10		U	<10		U
Arsenic	57	93	<7		U	<7		U	<10		U	<10		U	<10		U
Cadmium	5.1	6.7	**0.5**			**0.5**			**1.3**			**1.3**			<0.6		U
Chromium	260	270	**37**			**42.6**			**55**			**53**			**44**		
Copper	390	390	**46.9**			**48.4**			**489**			**390**			**31.1**		
Lead	450	530	**18**			**15**			**63**			**70**			**14**		
Mercury	0.41	0.59	**0.13**			**0.17**			**0.3**			**0.3**			<0.1		U
Nickel	nv	nv	**33**			**48**			**57**			**53**			**38**		
Silver	6.1	6.1	<0.4		U	<0.4		U	<0.8		U	<0.8		U	<0.9		U
Zinc	410	960	**111**			**95.8**			**990**		J	**358**		J	**81**		
Organotins (porewater)*	*(µg/L)*	*(µg/L)*	*(µg/L)*			*(µg/L)*			*(µg/L)*			*(µg/L)*			*(µg/L)*		
Monobutyl Tin	nv	nv	<0.045		UG	<0.045		UG	<0.045		UG	<0.045		UG	**0.067**		**E**
Dibutyl Tin	nv	nv	<0.045		U	<0.045		U	<0.045		U	<0.045		U	**0.054**		**E**
Tributyl Tin	0.05 *	nv	<0.022		U	<0.022		U	**0.054**			**0.072**			<0.022		U
Organotins *	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*			*(µg/kg)*			*(µg/kg)*			*(µg/kg)*			*(µg/kg)*		
Monobutyl Tin	nv	nv	-			-			-			-			<5.3		U
Dibutyl Tin	nv	nv	-			-			-			-			<5.3		UG
Tributyl Tin	nv	nv	-			-			-			-			<5.3		U
LPAH	*(ppm TOC)*	*(ppm TOC)*	*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*	
Naphthalene	99	170	**0.023**	**0.50**		<0.019	<0.66	U	**0.044**	**0.98**	J	**0.024**	**0.50**	J	<0.020	<1.05	U
Acenaphthylene	66	66	<0.019	<0.41	U	<0.019	<0.66	U	**0.039**	**0.87**	J	**0.110**	**2.29**	J	<0.020	<1.05	U
Acenaphthene	16	57	<0.019	<0.41	U	<0.019	<0.66	U	**0.026**	**0.58**		**0.029**	**0.60**		<0.020	<1.05	U
Fluorene	23	79	**0.026**	**0.57**		<0.019	<0.66	U	**0.046**	**1.02**		**0.056**	**1.17**		<0.020	<1.05	U
Phenanthrene	100	480	**0.081**	**1.76**		**0.033**	**1.14**		**0.290**	**6.44**		**0.480**	**10.00**		<0.020	<1.05	U
Anthracene	220	1200	**0.053**	**1.15**		<0.019	<0.66	U	**0.130**	**2.89**	J	**0.480**	**10.00**	J	<0.020	<1.05	U
2-Methylnaphthalene	38	64	<0.019	<0.41	U	<0.019	<0.66	U	**0.035**	**0.78**		**0.021**	**0.44**		<0.020	<1.05	U
Total LPAH	370	780	**0.2**	**5.2**		**0.1**	**5.1**		**0.6**	**13.6**		**1.2**	**25.0**		<0.020	<1.05	U
HPAH	*(ppm TOC)*	*(ppm TOC)*	*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*	
Fluoranthene	160	1200	**0.240**	**5.22**		**0.100**	**3.45**		**0.950**	**21.11**	J	**14**	**291.67**	J	<0.020	<1.05	U
Pyrene	1000	1400	**0.230**	**5.00**		**0.084**	**2.90**		**0.740**	**16.44**	J	**6.9**	**143.75**	J	<0.020	<1.05	U
Benzo(a)anthracene	110	270	**0.110**	**2.39**		**0.043**	**1.48**		**0.390**	**8.67**	J	**2.1**	**43.75**	J	<0.020	<1.05	U
Chrysene	110	460	**0.150**	**3.26**		**0.059**	**2.03**		**0.590**	**13.11**	J	**3.7**	**77.08**	J	<0.020	<1.05	U
Benzofluoranthenes	230	450	**0.194**	**4.22**		**0.082**	**2.83**		**0.740**	**16.44**	J	**2.52**	**52.50**	J	<0.040	<2.10	U
Benzo(a)pyrene	99	210	**0.079**	**1.72**		**0.031**	**1.07**		**0.340**	**7.56**	J	**0.77**	**16.04**	J	<0.020	<1.05	U
Indeno(1,2,3-cd)pyrene	34	88	**0.040**	**0.87**		<0.019	<0.66	U	**0.230**	**5.11**		**0.36**	**7.50**		<0.020	<1.05	U
Dibenzo(a,h)anthracene	12	33	<0.019	<0.41	U	<0.019	<0.66	U	**0.051**	**1.13**	J	**0.094**	**1.96**	J	<0.020	<1.05	U
Benzo(g,h,i)perylene	31	78	**0.035**	**0.76**		<0.019	<0.66	U	**0.230**	**5.11**		**0.27**	**5.63**		<0.020	<1.05	U
Total HPAH	960	5300	**1.1**	**23.4**		**0.5**	**15.7**		**4.3**	**94.7**		**30.7**	**639.9**		<0.040	<2.10	U
Chlorinated Hydrocarbons	*(ppm TOC)*	*(ppm TOC)*	*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*	
1,3-Dichlorobenzene	nv	nv	<0.001	<0.02	U	<0.001	<0.04	UG	<0.002	<0.04	UJ	<0.002	<0.04	UJ	<0.002	<0.12	U
1,4-Dichlorobenzene	3.1	9	<0.001	<0.02	U	<0.001	<0.04	UG	<0.002	<0.04	UJ	<0.002	<0.04	UJ	<0.002	<0.12	U
1,2-Dichlorobenzene	2.3	2.3	<0.001	<0.02	U	<0.001	<0.04	UG	<0.002	<0.04	UJ	<0.002	<0.04	UJ	<0.002	<0.12	U
1,2,4-Trichlorobenzene	0.81	1.8	<0.005	<0.10	U	<0.005	<0.18	UG	<0.010	<0.22	UJ	<0.009	<0.19	UJ	<0.011	<0.58	U
Hexachlorobenzene	0.38	2.3	<0.001	<0.020	U	<0.001	<0.032	U	<0.001	<0.027	Y	**0.001**	**0.025**	PE	<0.001	<0.052	U
Phthalates	*(ppm TOC)*	*(ppm TOC)*	*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*	
Dimethyl phthalate	53	53	<0.019	<0.41	U	<0.019	<0.66	U	**0.130**	**2.89**		**0.086**	**1.79**		<0.020	<1.05	U
Diethyl phthalate	61	110	<0.019	<0.41	U	<0.019	<0.66	U	**0.077**	**1.71**		<0.020	<0.42	UJ	<0.020	<1.05	U
Di-n-butyl phthalate	220	1700	**0.030**	**0.65**		<0.019	<0.66	U	**0.140**	**3.11**	J	**0.069**	**1.44**	J	<0.020	<1.05	U
Butyl benzyl phthalate	4.9	64	<0.019	<0.41	U	<0.019	<0.66	U	**0.065**	**1.44**	J	**0.110**	**2.29**	J	<0.020	<1.05	U
Bis(2-ethylhexyl)phthalate	47	78	**0.240**	**5.22**	**B**	**0.120**	**4.14**	**B**	**0.650**	**14.44**	**B**	**0.680**	**14.17**	**B**	<0.020	<1.05	U
Di-n-octyl phthalate	58	4500	<0.019	<0.41	U	<0.019	<0.66	U	<0.020	<0.44	U	<0.020	<0.42	U	<0.020	<1.05	U
Phenols	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*			*(mg/kg)*			*(mg/kg)*			*(mg/kg)*			*(mg/kg)*		
Phenol	0.42	1.2	<0.019		U	<0.019		U	**0.030**		**EM**	**0.048**		**EM**	<0.020		U
2-Methylphenol	0.063	0.063	<0.019		U	<0.019		U	<0.020		U	<0.020		U	<0.020		U
4-Methylphenol	0.67	0.67	**0.075**			<0.019		U	**0.120**			**0.091**			<0.020		U
2,4-Dimethylphenol	0.029	0.029	<0.019		U	<0.019		U	<0.020		U	<0.020		U	<0.020		U
Pentachlorophenol	0.36	0.69	<0.097		U	<0.096		U	0.100			<0.098		U	<0.099		U
Miscellaneous Extractables	*(mg/kg)*	*(mg/kg)*	*(mg/kg)*			*(mg/kg)*			*(mg/kg)*			*(mg/kg)*			*(mg/kg)*		
Benzyl alcohol	0.057	0.073	<0.019		U	<0.019		U	<0.020		U	**0.022**			<0.020		U
Benzoic acid	0.65	0.65	<0.190		U	<0.190		U	<0.200		U	<0.200		U	<0.200		U
Miscellaneous Extractables	*(ppm TOC)*	*(ppm TOC)*	*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*	
Dibenzofuran	15	58	**0.023**	**0.50**		<0.019	<0.66	U	**0.034**	**0.76**		**0.024**	**0.5**		<0.020	<1.05	U
Hexachloroethane	nv	nv	<0.019	<0.41	U	<0.019	<0.66	U	<0.020	<0.44	U	<0.020	<0.42	U	<0.020	<1.05	U
Hexachlorobutadiene	3.9	6.2	<0.001	<0.020	U	<0.001	<0.032	U	<0.001	<0.022	U	<0.001	<0.021	U	<0.001	<0.052	U
N-Nitrosodiphenylamine	11	11	<0.019	<0.41	U	<0.019	<0.66	U	<0.020	<0.44	U	<0.020	<0.42	U	<0.020	<1.05	U
Volatile Organics	*(µg/kg)*	*(µg/kg)*	*(µg/kg)*			*(µg/kg)*			*(µg/kg)*			*(µg/kg)*			*(µg/kg)*		
Trichloroethene	nv	nv	<1.0		U	<1.1		U	<1.9		UJ	<1.8		UJ	<2.3		U
Tetrachlorethene	nv	nv	<1.0		U	<1.1		UG	<1.9		U	<1.8		U	<2.3		U
Ethylbenzene	nv	nv	<1.0		U	<1.1		UG	<1.9		U	<1.8		U	<2.3		U
Total xylenes	nv	nv	<2.0		U	<2.2		UG	<3.8		U	**4.0**			<4.6		U
Pesticides	*(ppm TOC)*	*(ppm TOC)*	*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*		*(mg/kg)*	*(ppm TOC)*	
DDT	nv	nv	<0.002	<0.041	U	<0.002	<0.062	U	<0.002	<0.044	U	<0.003	<0.065	Y	<0.002	<0.105	U
Aldrin	nv	nv	<0.001	<0.020	U	<0.001	<0.032	U	<0.001	<0.022	U	<0.001	<0.021	U	<0.001	<0.052	U
alpha-chlordane	nv	nv	<0.001	<0.020	U	<0.001	<0.032	U	<0.001	<0.022	U	<0.001	<0.021	U	<0.001	<0.052	U
dieldrin	nv	nv	<0.002	<0.041	U	<0.002	<0.062	U	<0.002	<0.047	Y	<0.002	<0.046	Y	<0.002	<0.105	U
heptachlor	nv	nv	<0.001	<0.020	U	<0.001	<0.032	U	<0.001	<0.022	U	<0.001	<0.021	U	<0.001	<0.052	U
gamma-BHC (Lindane)	nv	nv	<0.001	<0.020	U	<0.001	<0.032	U	<0.001	<0.022	U	<0.001	<0.021	U	<0.001	<0.052	U
Aroclor 1016	nv	nv	<0.019	<0.41	U	<0.018	<0.62	U	<0.019	<0.42	U	<0.020	<0.42	U	<0.019	<1.00	U
Aroclor 1242	nv	nv	<0.019	<0.41	U	<0.018	<0.62	U	**0.028**	**0.62**		**0.028**	**0.58**		<0.020	<1.05	U
Aroclor 1248	nv	nv	<0.019	<0.41	U	<0.018	<0.62	U	<0.020	<0.44	U	<0.020	<0.42	U	<0.020	<1.05	U
Aroclor 1254	nv	nv	<0.019	<0.41	U	<0.018	<0.62	U	**0.030**	**0.67**		**0.035**	**0.73**		<0.020	<1.05	U
Aroclor 1260	nv	nv	<0.019	<0.41	U	<0.018	<0.62	U	<0.020	<0.44	UJ	**0.068**	**1.42**	J	<0.020	<1.05	U
Aroclor 1221	nv	nv	<0.038	<0.82	U	<0.037	<1.24	U	<0.039	<0.87	U	<0.040	<0.83	U	<0.039	<2.05	U
Aroclor 1232	nv	nv	<0.019	<0.41	U	<0.018	<0.62	U	<0.020	<0.44	U	<0.020	<0.42	U	<0.020	<1.05	U
Total PCBs ***	12	65	<0.038	<0.82	U	<0.037	<1.24	U	**0.058**	**1.29**		**0.131**	**2.73**		<0.039	<8.3	U

Notes:

Bold values at or above laboratory detection limit and underlined values exceed SMS criteria.
All data have been validated according to QA-2 protocols.
* Ecology's 1996 SMARM paper establishes 0.050 ug/L as a conceptual equivalent of an SQS for tributyl tin in porewater.
** Bulk and porewater TBT were originally reported as TBT-chloride (in ppb) and converted to TBT (in ppb) by multiplying by 0.89.
*** Total PCBs are calculated by summing detected concentrations of Aroclors.
nv - No value currently established under SMS or PSDDA.
U = Undetected
J = Estimated concentration
B = False positivite, blank contamination
Y = Raised reporting limit due to background interference
P = High RPD for dual column GC analyses
M = Estimated value but with low spectral match
E = Estimated concentration, direction of bias, if determined, is identified in the data verification report
UG = Undetected, reporting limit may be biased low

Table 3-2 Colony Wharf Surface Sediment Grain Size Data

Sample ID	Gravel	Sand						Silt					Clay			
		V. Coarse	Coarse	Med	Fine	Very Fine	**Total**	Coarse	Med	Fine	V. Fine	**Total**	8 to 9	9 to 10	<10	**Total**
CWB-1	**31.3**	20.7	19.9	10.6	2.3	1.4	**54.9**	0.9	2.2	3.2	1.9	**8.2**	1.8	3.9	0.0	**5.7**
CWB-2	**75.0**	5.0	3.3	2.4	1.5	1.3	**13.5**	0.7	2.2	2.7	1.7	**7.3**	1.0	0.3	2.9	**4.2**
CWB-3	**16.5**	3.7	3.6	4.2	8.3	8.2	**28.0**	3.0	29.7	6.4	3.2	**42.3**	2.5	2.7	8.0	**13.2**
CWB-103	**28.3**	3.6	3.0	3.9	7.6	7.7	**25.8**	2.9	28.1	3.5	1.9	**36.4**	1.7	1.4	6.3	**9.4**
REF-1	**0.0**	2.1	1.8	1.0	0.8	2.0	**7.7**	24.6	23.3	13.9	11.3	**73.1**	5.9	3.5	9.7	**19.1**

Table 3-3 Reference and Control Bioassay Performance Standards

Biological Test	Control	Reference
Amphipod	The control has a mortality of less than 10 percent	The reference has a mortality of less than 25 percent
Juvenile Polychaete	The control has a mortality of less than 10 percent and a target mean individual growth rate of 0.72 mg per individual per day. Control growth rates below 0.38 mg per individual per day will be considered a QA/QC failure (PSDDA, 2000)	The reference has a mean individual growth rate greater than or equal to 80 percent of the growth rate measured in the control
Larval	The control has a mean normal survivorship of greater than 70 percent of the initial count	The reference has a mean normal survivorship of greater than or equal to 65 percent of the mean normal survivorship measured in the control (PSDDA, 2000)
Microtox® [1]	The control final mean output should be greater than or equal to 80% of control Initial mean ouput (Ecology, 2003).	The reference final mean output should be greater than or equal to 80% of control final mean output (Ecology, 2003).

Source: (Ecology, 1998b)

[1] Marine Microtox® 100% Sediment Porewater Toxicity Assessment

Table 3-4 Biological Effects Criteria[1]

Biological Test	SQS Biological Criteria	CSL Biological Criteria
Amphipod	The test sediment has a significantly higher (t-test, $p = 0.05$) mean mortality than the reference sediment, and the test sediment mean mortality exceeds 25 percent (M_T>25%)	The test sediment has a significantly higher (t-test, $p = 0.05$) mean mortality than the reference sediment, and the test sediment mean mortality is more than 30 percent greater (M_T-M_C > 30%) than the reference sediment mean mortality
Juvenile Polychaete	The mean individual growth rate in the test sediment is less than 70 percent of the mean individual growth rate in the reference sediment ($MIG_T/MIG_R < 0.70$), and the test sediment biomass is significantly different (t-test, $p = 0.05$) from the reference sediment biomass	The mean individual growth rate in the test sediment is less than 50 percent of the mean individual growth rate in the reference sediment ($MIG_T/MIG_R < 0.50$), and the test sediment biomass is significantly different (t-test, $p = 0.05$) from the reference sediment biomass
Larval	The test sediment has a mean survivorship of normal larvae that is significantly less (t-test, $p = 0.05$) than the mean normal survivorship in the reference sediment, and the mean normal survivorship as a percentage of the reference is less than 85%	The test sediment has a mean survivorship of normal larvae that is significantly less (t-test, $p = 0.05$) than the mean normal survivorship in the reference sediment, and the mean normal survivorship as a percentage of the reference sediment is less than 70%
Microtox® [2]	The test sediment has a mean output that is significantly less (t-test, $p = 0.05$) than the reference mean output, and the mean output is less than 80% of reference mean output.	There is no CSL failure criterion in the SMS rule for marine sediments.

[1] SMS Bioassay Evaluation Endpoints - Ecology, 1998b

[2] Marine Microtox® 100% Sediment Porewater Toxicity Assessment

Table 3-5 Summary of Colony Wharf 10-Day Amphipod *(Ampelisca abdita)* Bioassay Testing – September 19, 2003

Sample Location	Replicate	Initial Count	Final Count	Survival
Control	A	20	17	85%
	B	20	17	85%
	C	20	18	90%
	D	20	18	90%
	E	20	18	90%
	Mean	20	17.6	**88%**
Reference	A	20	16	80%
	B	20	16	80%
	C	20	16	80%
	D	20	15	75%
	E	20	19	95%
	Mean	20	16.4	**82%**
CWB-1	A	20	16	80%
	B	20	12	60%
	C	20	16	80%
	D	20	11	55%
	E	20	14	70%
	Mean	20	13.8	**69%**
CWB-2	A	20	14	70%
	B	20	18	90%
	C	20	14	70%
	D	20	14	70%
	E	20	16	80%
	Mean	20	15.2	**76%**
CWB-3	A	20	12	60%
	B	20	8	40%
	C	20	16	80%
	D	20	9	45%
	E	20	9	45%
	Mean	20	10.8	**54%**

Table 3-6 Summary of Colony Wharf Neanthes Bioassay Testing – September 5, 2003

Sample Location	Replicate	Initial Count	Final Count	Percent Survival	Total Weight Per Worm (mg)	Growth Per Worm (mg)	Mean Individual Growth Rate (mg/ind/day)
Control	A	5	5	100	12.67	11.95	0.60
	B	5	5	100	9.06	8.34	0.42
	C	5	5	100	10.53	9.82	0.49
	D	5	5	100	9.81	9.09	0.45
	E	5	5	100	10.66	9.95	0.50
	Mean			100	10.55	9.83	**0.49**
Reference	A	5	5	100	11.15	10.43	0.52
	B	5	5	100	7.94	7.22	0.36
	C	5	4	80	10.95	10.23	0.51
	D	5	4	80	11.75	11.03	0.55
	E	5	5	100	8.14	7.42	0.37
	Mean			92	9.98	9.27	**0.46**
CWB-1	A	5	4	80	10.02	9.30	0.47
	B	5	5	100	14.23	13.51	0.68
	C	5	5	100	10.74	10.02	0.50
	D	5	5	100	11.71	10.99	0.55
	E	5	5	100	17.21	16.49	0.82
	Mean			96	12.78	12.06	**0.60**
CWB-2	A	5	5	100	13.47	12.76	0.64
	B	5	5	100	10.90	10.18	0.51
	C	5	5	100	17.00	16.29	0.81
	D	5	5	100	13.08	12.36	0.62
	E	5	5	100	13.36	12.65	0.63
	Mean			100	13.56	12.85	**0.64**
CWB-3	A	5	5	100	14.70	13.99	0.70
	B	5	5	100	19.91	19.20	0.96
	C	5	5	100	19.52	18.80	0.94
	D	5	5	100	12.91	12.19	0.61
	E	5	5	100	15.95	15.23	0.76
	Mean			100	16.60	15.88	**0.79**

Note: Initial organism weight estimated from 5 replicates = 0.72 mg/org.

Table 3-7 Summary of Colony Wharf Larval Bioassay Results – September 4, 2003

Site	Replicate	Initial Number of Embryos, T=0	Number Normal	Number Abnormal	Total Number	N_C/Mean Initial
Control	A	216	94	5	99	0.44
	B	216	60	6	66	0.28
	C	216	100	9	109	0.46
	D	216	79	13	92	0.37
	E	216	108	8	116	0.50
	Mean	216	88.2	8.2	96.4	**0.41**

Site	Replicate	Number Normal	Number Abnormal	Total Number	N_R/N_C
Reference	A	92	10	102	1.04
	B	107	8	115	1.21
	C	105	10	115	1.19
	D	62	15	77	0.70
	E	98	7	105	1.11
	Mean	92.8	10	102.8	**1.05**

Site	Replicate	Number Normal	Number Abnormal	Total Number	N_T/N_C	$[(N_T/N_C)/(N_R/N_C)]$	Mean $[(N_T/N_C)/(N_R/N_C)]$
CWB-1	A	103	6	109	1.17	1.11	
	B	79	11	90	0.90	0.851	
	C	96	11	107	1.09	1.03	
	D	83	15	98	0.94	0.894	
	E	47	7	54	0.53	0.5065	**0.88**
CWB-2	A	63	21	84	0.71	0.68	
	B	109	5	114	1.24	1.17	
	C	75	6	81	0.85	0.81	
	D	87	14	101	0.99	0.94	
	E	122	11	133	1.38	1.31	**0.98**
CWB-3	A	68	28	96	0.771	0.73	
	B	60	30	90	0.680	0.65	
	C	40	24	64	0.454	0.43	
	D	87	27	114	0.99	0.94	
	E	25	9	34	0.283	0.27	**0.60**

Note: All values are mean values calculated from three subsample counts.

Table 3-8 Summary of Colony Wharf Larval Bioassay Results – November 12, 2003

Site	Replicate	Initial Number of Embryos, T=0	Number Normal	Number Abnormal	Total Number	N_C/Mean Initial
Control	A	203	224	13	237	1.10
	B	203	160	35	195	0.79
	C	203	130	22	152	0.64
	D	203	143	16	159	0.70
	E	203	100	12	112	0.49
	Mean	203	151.4	19.6	171	**0.75**

Site	Replicate	Number Normal	Number Abnormal	Total Number	N_R/N_C
Reference	A	138	4	142	0.91
	B	150	5	155	0.99
	C	99	17	116	0.65
	D	131	11	142	0.87
	E	152	5	157	1.00
	Mean	134	8	142	**0.89**

Site	Replicate	Number Normal	Number Abnormal	Total Number	N_T/N_C	$[(N_T/N_C)/(N_R/N_C)]$	Mean $[(N_T/N_C)/(N_R/N_C)]$
CWB-1	A	142	2	144	0.94	1.06	
	B	187	1	188	1.24	1.40	
	C	176	2	178	1.16	1.31	
	D	167	4	171	1.10	1.25	
	E	148	5	153	0.98	1.10	**1.22**
CWB-2	A	146	9	155	0.96	1.09	
	B	156	20	176	1.03	1.16	
	C	160	24	184	1.06	1.19	
	D	148	8	156	0.98	1.10	
	E	145	11	156	0.96	1.08	**1.13**
CWB-3	A	128	16	144	0.85	0.96	
	B	116	13	129	0.77	0.87	
	C	149	6	155	0.98	1.11	
	D	137	17	154	0.90	1.02	
	E	145	4	149	0.96	1.08	**1.01**

*Compared to SMS Criteria

N_C = Normal control survival

N_T = Normal test survival

N_R = Normal reference survival

Table 3-9 Colony Wharf Microtox® Results – September 3, 2003

Site	Light Reading								Change in light readings compared to initial control	Evaluation of initial light output
		Replicate								
	Reading	1	2	3	4	5	Mean	$T_{(mean)}/R_{(mean)}$	$I_{(t)(mean)}/I_{(0)C(mean)}$	$I_{(0)(mean)}/I_{(0)C(mean)}$
Control	$I_{(0)}$	97	108	112	108	99	105			
	$I_{(5)}$	100	113	116	115	104	110		1.05	
	$I_{(15)}$	107	119	122	122	109	116		1.10	
	$C_{(5)}$	1.03	1.05	1.04	1.06	1.05	1.05			
	$C_{(15)}$	1.10	1.10	1.09	1.13	1.10	1.10			
Ref 1	$I_{(0)}$	96	102	82	98	113	98			0.94
	$I_{(5)}$	99	109	88	105	120	104		0.95	
	$I_{(15)}$	107	119	94	115	132	113		0.98	
	$R_{(5)}$	1.03	1.07	1.07	1.07	1.06	1.06			
	$R_{(15)}$	1.11	1.17	1.15	1.17	1.17	1.15			
CWB-1	$I_{(0)}$	83	89	96	74	96	88			0.84
	$I_{(5)}$	90	93	101	83	103	94			
	$I_{(15)}$	97	100	110	87	113	101			
	$T_{(5)}$	1.08	1.04	1.05	1.12	1.07	1.08	1.01		
	$T_{(15)}$	1.17	1.12	1.15	1.18	1.18	1.16	1.00		
CWB-2	$I_{(0)}$	61	73	74	58	66	66			0.63
	$I_{(5)}$	62	76	78	60	68	69			
	$I_{(15)}$	71	85	88	68	76	78			
	$T_{(5)}$	0.64	0.70	0.70	0.56	0.69	0.66	0.62		
	$T_{(15)}$	0.73	0.79	0.79	0.63	0.77	0.74	0.64		
CWB-3	$I_{(0)}$	3	2	2	3	3	3			0.025
	$I_{(5)}$	0	0	0	0	0	0			
	$I_{(15)}$	0	0	0	0	0	0			
	$T_{(5)}$	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	$T_{(15)}$	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

$I_{(0)}$ is the light reading after the initial five minute incubation period
$I_{(5)}$ is the light reading five minutes after $I_{(0)}$
$I_{(15)}$ is the light reading fifteen minutes after $I_{(0)}$

$C_{(t)}$, $R_{(t)}$, and $T_{(t)}$ are the changes in light readings from the intial reading in each sample container for the control, reference sediment and test sites, respectively. $I_{(t)}/I_{(0)}$

Quality Control Steps:

1. Is control final mean output greater than 80% control initial mean output?
   $I_{(5)}$: $F_{c(mean)}/I_{c(mean)}$=105%
   $I_{(15)}$: $F_{c(mean)}/I_{c(mean)}$=110%

Control results are acceptable

2. Does the reference final mean exceed 80% of control final mean?
   $I_{(5)}$: $F_{R(mean)}/F_{C(mean)}$=95%
   $I_{(15)}$: $F_{R(mean)}/F_{C(mean)}$=98%

Reference site results are acceptable to be used in statistical analyses.

3. Is the reference initial mean $\geq$ 80% of control initial mean?
   $I_{R(mean)}/I_{C(mean)}$=94%

Reference initial mean used to calculate change in light readings at $I_{(5)}$ and $I_{(15)}$ for reference site.

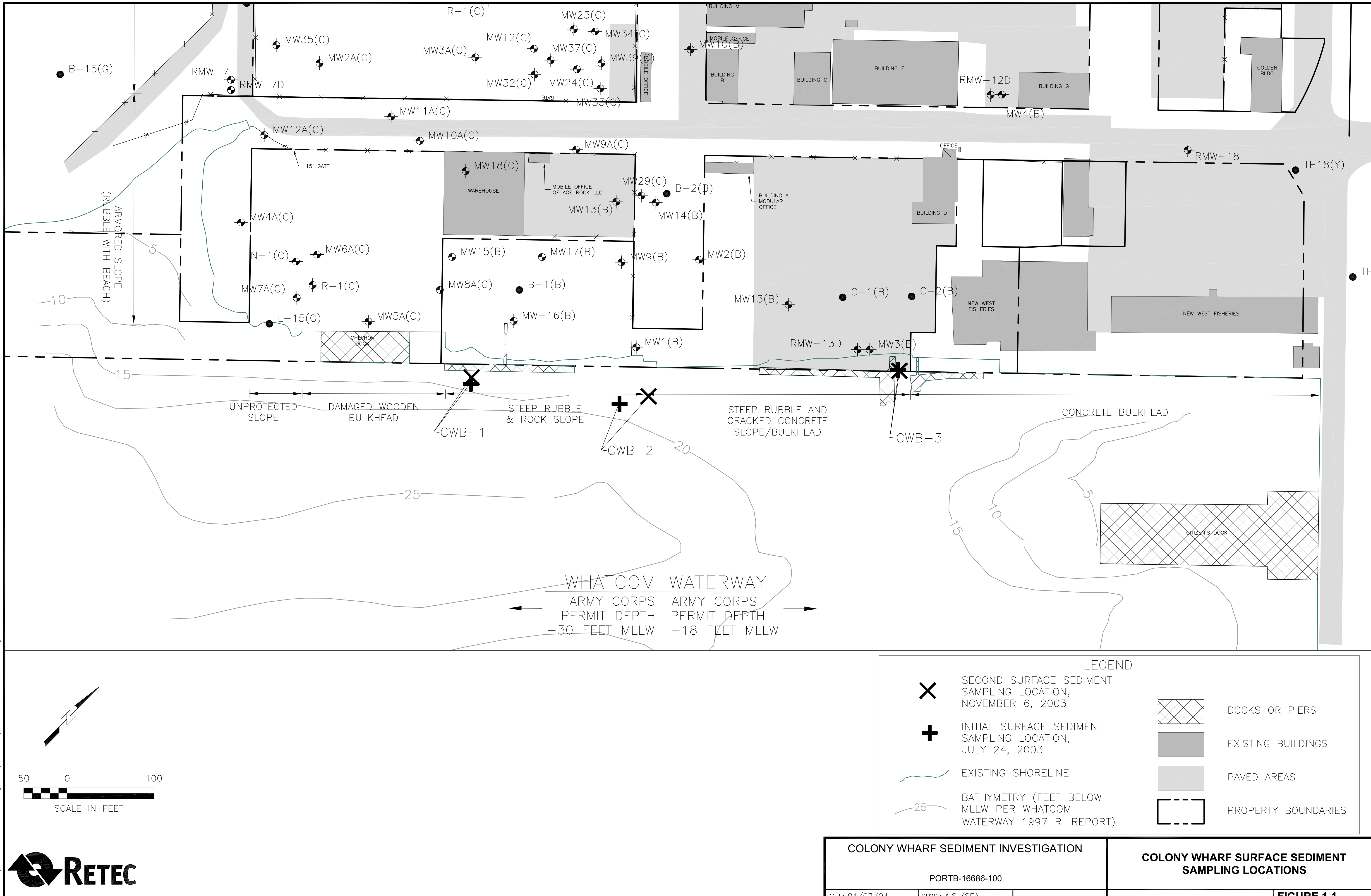
4. Are test initial mean values $\geq$ 80% of control initial mean values?
   CWB-1: $I_{T(mean)}/I_{C(mean)}$=84%, use to calculate change in light readings.
   CWB-2: $I_{T(mean)}/I_{C(mean)}$)=63%, use control initial mean readings to calculate change in light readings.
   CWB-3: $I_{T(mean)}/I_{C(mean)}$=2.5%, use control initial mean readings to calculate change in light readings.

Table 3-10 Bioassay Endpoint Evaluation

Bioassay Test	Site	Statistical Difference Present (Yes/No)	Exceeds SQS Effect Criteria (Yes/No)	Exceeds CSL Effect Criteria (Yes/No)	SQS Bioligical Criteria (Pass/Fail)	CSL Biological Criteria (Pass/Fail)
Amphipod		*t-test vs. Ref, p=0.05*	M_T > 25%, Absolute	M_T-M_R>30%		
	CWB-1	Yes	Yes	No	Fail	Pass
	CWB-2	No	No	No	Pass	Pass
	CWB-3	Yes	Yes	No	Fail	Pass
Juvenile Polychaete		*t-test, vs Ref, p=0.05*	$MIG_T/MIG_R<0.70$	$MIG_T/MIG_R<0.50$		
	CWB-1	No	No	No	Pass	Pass
	CWB-2	No	No	No	Pass	Pass
	CWB-3	No	No	No	Pass	Pass
Larval		*t-test vs Ref, p=0.05*	$(N_T/N_C)/(N_R/N_C)<0.85$	$(N_T/N_C)/(N_R/N_C)<0.70$		
	CWB-1	No	No	No	Pass	Pass
	CWB-2	No	No	No	Pass	Pass
	CWB-3	No	No	No	Pass	Pass
Microtox®		*t-test vs Ref, p=0.05*	$T_{(mean)}/R_{(mean)}<0.8$	—		
	CWB-1	No	No	—	Pass	—
	CWB-2	Yes	Yes	—	Fail	—
	CWB-3	Yes	Yes	—	Fail	—

M = mortalilty, N = normal counts, MIG = mean individual growth rate
Subscripts: R = reference sediment, T = test sediment, C = negative control

Figures



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