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NAS JACKSONVILLE  
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SAMPLING EVENT REPORT FOR POTENTIAL SOURCE OF CONTAMINATION 40 EAST  
SITE WASTEWATER TREATMENT PLANT DISCHARGE AREA NAS JACKSONVILLE FL  
7/1/1999  
HARDING LAWSON ASSOCIATES

**SAMPLING EVENT REPORT**

**POTENTIAL SOURCE OF CONTAMINATION 40**  
**EAST SIDE WASTEWATER TREATMENT PLANT DISCHARGE AREA**

**NAVAL AIR STATION JACKSONVILLE**  
**JACKSONVILLE, FLORIDA**

**Unit Identification Code: N00207**

**Contract No.: N62467-89-D-0317/040**

**Prepared by:**

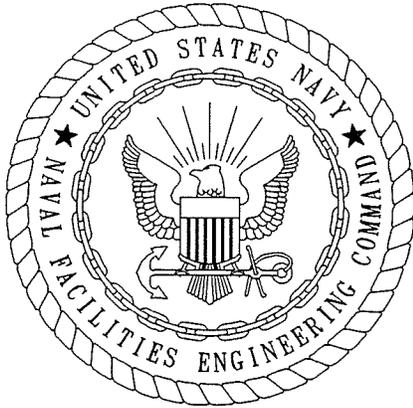
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CERTIFICATION OF TECHNICAL  
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/040 are complete and accurate and comply with all requirements of this contract.

DATE: July 5, 1999

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(DFAR 252.227-7036)

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## GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
ABS	Aquatec Biological Sciences, Inc.
B&R	Brown and Root
BHC	benzene hexachloride
CLP	Contract Laboratory Program
EDS	Environmental Data Services
EP Tox	extraction procedure toxicity
FDEP	Florida Department of Environmental Protection
HLA	Harding Lawson Associates
mg/kg	milligrams per kilogram
µg/kg	micrograms per kilogram
NAS	Naval Air Station
NFESC	Naval Facilities Engineering Service Center
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PEL	probable effect level
PSC	potential source of contamination
QA/QC	quality assurance and quality control
SDG	sample delivery group
SER	sampling event report
TAL	target analyte list
TCL	target compound list
TEL	threshold effect level
TOC	total organic carbon
USEPA	U.S. Environmental Protection Agency
WWTP	wastewater treatment plant

## 1.0 INTRODUCTION

Harding Lawson Associates (HLA) under contract to the Department of Navy (Contract No. N62467-89-D-0317, Task Order No. 040) is submitting this Sampling Event Report (SER) for Potential Source of Contamination (PSC) 40, East Side Wastewater Treatment Plant (WWTP) Discharge Area at Naval Air Station (NAS) Jacksonville, Jacksonville, Florida. The East Side WWTP Discharge Area is located on the northeast part of NAS Jacksonville, south of the east end of runway 27 (Figures 1-1, and 1-2). The East Side WWTP ceased operating in 1972, and was demolished in 1974. Effluent from the settling and skimming operations at the East Side WWTP was treated in a trickling filter, chlorinated, and discharged to the St. Johns River. Reportedly, the discharge to the river resulted in a buildup of sediment in the cove east of runway 27.

This SER summarizes the methods and the results of the field investigation and transmits the field and analytical data.

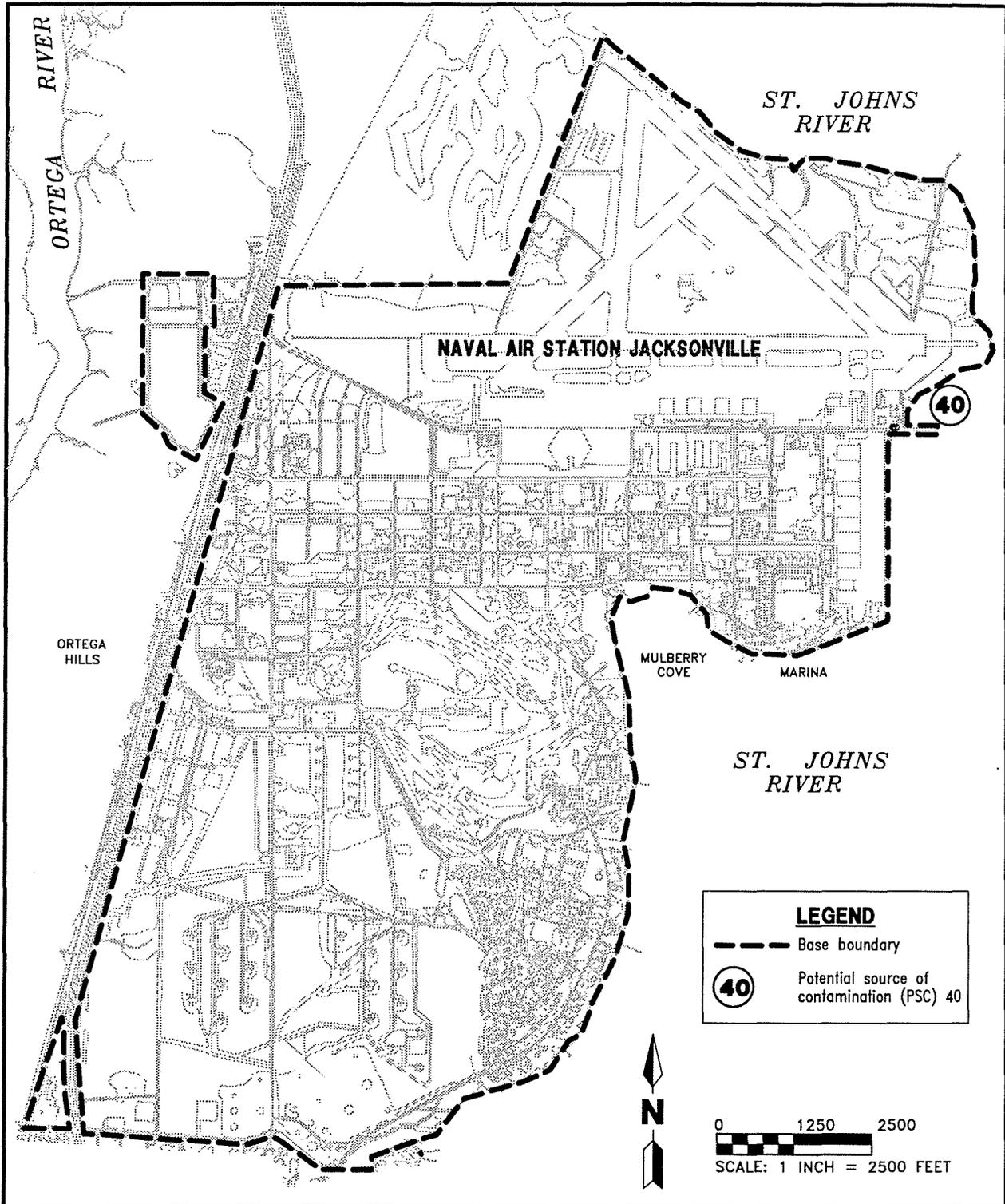
1.1 PURPOSE AND SCOPE. The purpose of the sampling event at the East Side WWTP was to gather sufficient data to support the next phase of the Remedial Response Decision System. The sampling activity included the collection and laboratory analysis of two sediment samples for U.S. Environmental Protection Agency (USEPA) Target Analyte List (TAL) inorganics, polynuclear aromatic hydrocarbons (PAHs), Target Compound List (TCL) pesticides, TCL polychlorinated biphenyls (PCBs), and total organic carbon (TOC). A sediment toxicity test using the organism *Leptocheirus plumulosus* and grain size analysis were also conducted on the sediment samples.

Field work for this sampling event was completed on March 29 and 30, 1999. The locations of the sediment samples are shown on Figure 1-2. A sample tracking log which includes sample and sample delivery group (SDG) identifiers, relevant dates, sample depths, and parameters analyzed is included in Appendix A.

1.2 SITE DESCRIPTION AND HISTORY. Based on information acquired from a former employee in March 1985, the East Side WWTP Discharge Area was added to the verification study as PSC 40 (Geraghty & Miller, Inc., 1985).

From 1940 to 1972, the East Side WWTP was located south of the east end of the main runway. The East Side WWTP treated only domestic wastewater until 1961, when the plant also began to treat industrial wastewater. When the East Side WWTP ceased operating in 1972, the waste stream was diverted to the west side plant (ABB Environmental Services, Inc. [ABB-ES], 1994). The East Side WWTP was demolished in 1974.

Industrial wastewater that reached the plant was treated by a primary clarifier that removed paint chips by settling and oils and solvents by skimming. The sludges were collected in a hopper, then periodically pumped into a truck and transported to the base landfill (PSC 26). After this disposal practice was prohibited, the sludges were transported to an offsite disposal facility. Effluent from the settling and skimming operations was treated in a trickling filter, chlorinated, and discharged to the St. Johns River. Reportedly, the discharge to the river resulted in a buildup of sediment in the cove east of



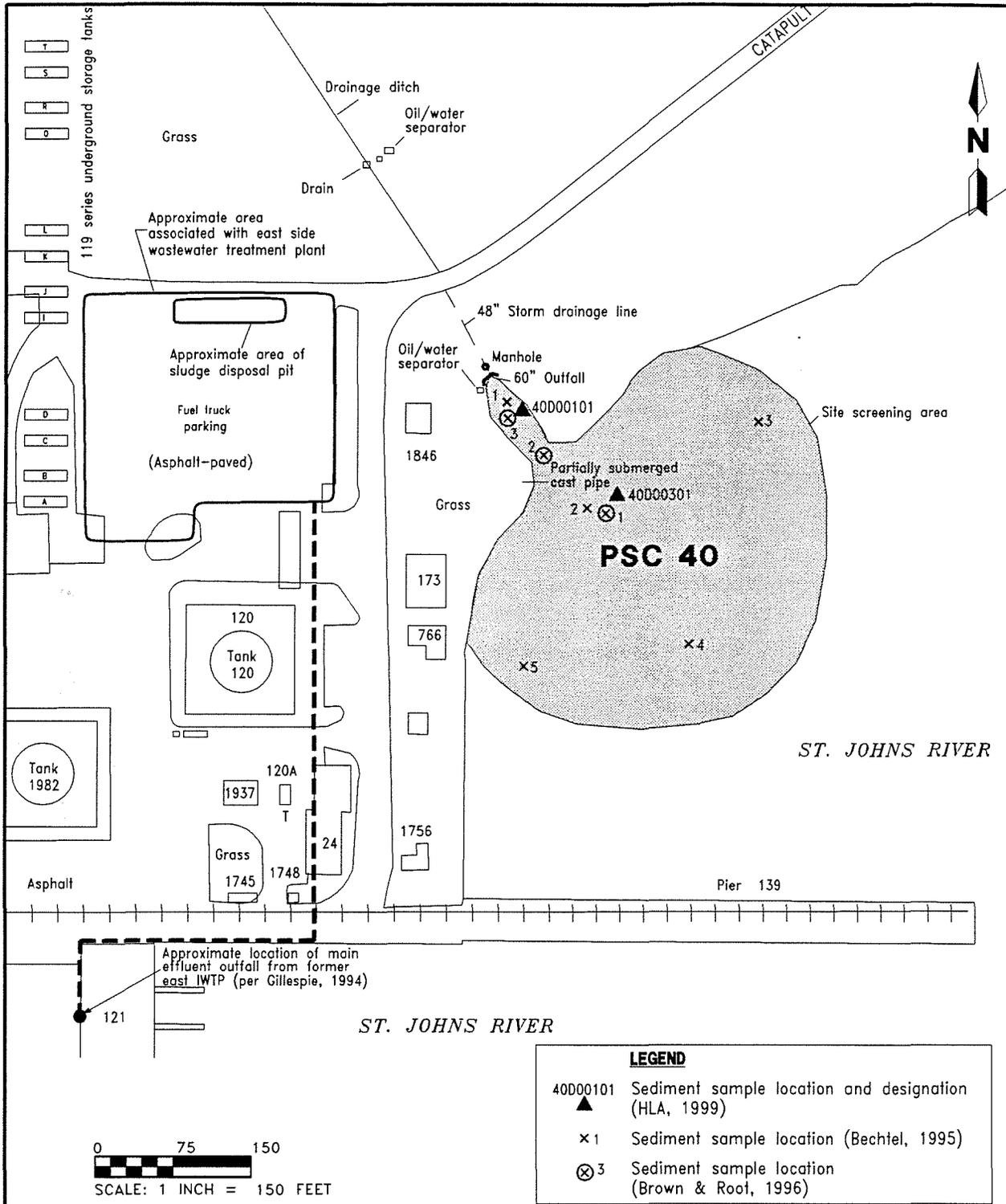
**FIGURE 1-1  
LOCATION OF PSC 40 AT  
NAVAL AIR STATION JACKSONVILLE**



**SAMPLING EVENT REPORT  
PSC 40**

**NAVAL AIR STATION JACKSONVILLE  
JACKSONVILLE, FLORIDA**

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**FIGURE 1-2  
SAMPLING LOCATIONS AT PSC 40  
EAST SIDE WASTEWATER TREATMENT  
PLANT DISCHARGE AREA**



**SAMPLING EVENT REPORT  
PSC 40**

**NAVAL AIR STATION JACKSONVILLE  
JACKSONVILLE, FLORIDA**

runway 27. In addition, it has been reported that the cove at PSC 40 turned bright yellow after heavy rains, possibly as a result of discharges of chromium. However, a former foreman of the East Side WWTP stated that the normal outfall for the plant was near the boat docks to the south (Figure 1-1); the outfall at PSC 40 was a rarely-used bypass, or overflow, line for the plant. Reportedly, the pipeline from the plant to the outfall was crushed during runway construction in 1961 and was not used after that (Gillespie, 1994).

A storm drainage map from 1981 shows a 48-inch line leading to the outfall at PSC 40. Neither the East Side WWTP nor any lines leading to the outfall at PSC 40 are evident on this map.

According to a waste handler at NAS Jacksonville, sludge drying beds were located northeast of the East Side WWTP and were probably connected to an outfall (Newman, 1994). Sludges from the domestic digesters and the sludge drying beds were dumped in a pit near the plant (Geraghty & Miller, Inc., 1985; ABB-ES, 1994). Wet and dry sludge may also have been disposed of at PSC 8.

During the verification study, four composite sediment samples were collected at PSC 40 and their leachates were analyzed for metals according to the Extraction Procedure toxicity (EP Tox) test. The analytical results of composite sample leachates were below the laboratory detection limits and EP Tox test threshold values; therefore, the sediment in this area was not classified as hazardous waste. The verification study report recommended no further action at PSC 40 (Geraghty & Miller, Inc., 1985).

In the site prioritization and events scheduling plan (Geraghty & Miller, 1990), PSC 40 was included in a no action operable unit (OU) because analyses of samples collected during the preliminary assessment (i.e., the verification study) indicated that sediment was not characteristic of hazardous waste. The Federal Facility Agreement Site Management Plan and Volume 1 of the Navy and Marine Corps Installation Restoration Program Plan recommended no further action for PSC 40 for the same reason (Southern Division, Naval Facilities Engineering Command, 1990; Geraghty & Miller, Inc., 1991). However, regulatory personnel from both the USEPA and the Florida Department of Environmental Protection (FDEP) disagreed with the no further action recommendation. It was requested that additional sampling and analysis be conducted at PSC 40.

In February 1995, Bechtel Environmental, Inc. conducted a radiological survey at PSC 40 because it was suggested that radium paint waste from the radium paint shop at the Naval Aviation Depot may have been discharged to the East Side WWTP, and residual radium may have been deposited in the sediment at PSC 40. The survey included a representative area survey, sediment sampling, and laboratory analyses. The survey area extended 200 feet from the outfall along each bank and 300 feet into the St. Johns River. The results of the survey indicated that Radium-226 activity at PSC 40 ranged from 0.297 picocuries per gram (pCi/g) to 0.401 pCi/g, which is significantly below the action level or site release criteria of 5.4 pCi/g for the station.

## 2.0 SAMPLING APPROACH AND FIELD CHANGES

The two sediment sample locations were selected based on results of the sampling performed by Brown & Root Environmental (B&R) in 1996. Analytical results from this study identified pesticides, PAHs, and metals in the sediment at the East Side WWTP Discharge Area. The results of a screening-level ecological risk assessment indicated the detected concentrations of alpha-chlordane, cadmium, and mercury in the sediment exceeded the Florida Sediment Quality Assessment Guidelines Threshold Effects Levels (TEs), indicating possible adverse effects to aquatic receptors. In addition, constituents including 4,4-dichlorodiphenyl dichloroethene, several PAHs, and lead were detected at concentrations well above their respective Probable Effects Level (PEL), which represents a concentration that is usually or always associated with adverse biological effects. Based on results of the B&R sampling, a field investigation was recommended to evaluate potential ecological risks to benthic macroinvertebrates associated with contaminants in the sediment at PSC 40.

Two sediment samples were collected by HLA on March 29, 1999 from approximately the same locations as the B&R sample locations 1 and 3, corresponding to HLA samples 40D00301 and 40D00101, respectively (Figure 1-2). The sediment samples were analyzed for TAL inorganics, PAHs, TCL pesticides, TOC, and sediment toxicity testing using the marine amphipod *Leptocheirus plumulosus*. The amphipod was evaluated for 10-day acute mortality and reburial. The subcontractor that conducted the toxicity testing also performed grain size analysis of both sediment samples. Sediment data from the background locations used for OU 3 at NAS Jacksonville (including the toxicity testing) were used as a background data set for PSC 40 (HLA, 1999).

The sediment samples collected for laboratory analysis were sent by overnight carrier to the subcontract laboratory, Quanterra, Inc., North Canton, Ohio. Toxicity testing for the sediment samples was performed by Aquatec Biological Sciences (ABS), South Burlington, Vermont. The results of the toxicity testing are presented in Appendix E.

Following the laboratory analysis all data were validated in accordance with the Naval Facilities Engineering Service Center (NFESC) Level D protocol. A summary of the detections in the sediment analytical results are presented in Appendix B. The validated analytical results are included in Appendix C.

### 3.0 QUALITY ASSURANCE AND QUALITY CONTROL

Field samples and an associated quality assurance and quality control (QA/QC) sample (rinsate blank) were collected and analyzed according to USEPA Contract Laboratory Program (CLP) and NFESC requirements by an NFESC certified laboratory, Quanterra, Inc. (North Canton, OH), following CLP analytical and deliverable requirements (for TAL metals and TCL pesticides and PCB analysis). PAH analysis was performed using USEPA SW846 Method 8310 and TOC by the Walkley-Black oxidation procedure. Toxicity tests were performed based on methods described in USEPA Method 600/R-94/025 (USEPA, 1994c).

The analytical data packages, submitted by SDGs, were independently validated by a subcontract data validation company, Environmental Data Services (EDS) of Concord, New Hampshire, in accordance with validation requirements contained in NFESC document *Navy Installation Restoration Laboratory Quality Assurance Guide*, February 1996. Other documents utilized in the data validation and review include the *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*, February 1994 and the *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, February 1994.

A detailed QA/QC evaluation can be found in the EDS validation reports dated May 1999 and included in Appendix D. The generated analytical data were found to be acceptable according to NFESC requirements, with less than five percent of the data requiring qualification as estimated concentration (J qualifier), mostly related to inorganic detections between the instrument detection limit and the contract required detection limit.

## 4.0 ANALYTICAL RESULTS

4.1 ANALYTICAL RESULTS FOR SEDIMENT SAMPLES. Appendix B presents a summary of the parameters detected in sediment samples collected at PSC 40. The complete validated analytical data are included in Appendix C.

4.1.1 Polynuclear Aromatic Hydrocarbons Ten PAHs with a total concentration of approximately 11.5 milligrams per kilogram (mg/kg) were detected in sediment sample 40D00101 located within the tiny cove approximately 50 feet from the outfall. Only three of the PAHs (benzo[a]pyrene, benzo[b]fluoranthene, and pyrene) were detected in sediment sample 40D00301, located approximately 150 feet southeast of the outfall, and these were detected at a significantly lower total PAH concentration (0.16 mg/kg). The PAH concentrations detected by HLA in 1999 did not conform with the analytical results from the sediment samples taken in 1996 by B&R at the corresponding locations. The highest PAH concentration in 1996 was found at the location approximately 150 feet southeast of the outfall (27 mg/kg total PAHs at B&R location 1), and the lower concentration was found at the location approximately 50 feet from the outfall (3 mg/kg total PAHs at B&R location 3). The pattern of contamination based on HLA data is logical if the source of PAH contamination is considered to be coming from the outfall or shoreline. Since PAHs are not typical of WWTP effluent, the more likely source of these compounds is surface water runoff from nearby paved surfaces.

4.1.2 Pesticides and Polychlorinated Biphenyls Four pesticides were detected in sample 40D00301: alpha-benzene hexachloride (BHC) at 0.97 micrograms per kilogram ( $\mu\text{g}/\text{kg}$ ), beta-BHC at 2.8  $\mu\text{g}/\text{kg}$ , gamma-Chlordane at 0.41  $\mu\text{g}/\text{kg}$  and Heptachlor at 0.75  $\mu\text{g}/\text{kg}$ . One PCB compound, Aroclor-1248, was detected at 40D00101 at 260  $\mu\text{g}/\text{kg}$ .

4.1.3 Inorganic Parameters Nineteen inorganic parameters were identified in sediment samples analyzed. All inorganics were detected in both samples, except for cobalt, mercury, and selenium, which were detected only in sample 40D00301, and cadmium, which was detected only in sample 40D00101.

4.1.4 General Chemistry Parameters TOC was measured at the two sediment sample locations at 85,000 mg/kg (40D00101) and 160,000 mg/kg (40D00301).

4.2 SEDIMENT TOXICITY TESTS. Two bulk sediment samples were collected and submitted to ABS for grain size analysis and ten-day whole sediment survival and reburial toxicity test using the marine amphipod *Leptocheirus plumulosus*.

The Toxicity Test Report, including the grain size analysis results, is included in Appendix E and discussed in Chapter 5.0.

## 5.0 RISK EVALUATION

The purpose of performing risk screening as part of the site screening evaluation is to assist in determining whether or not the existing risk at PSC 40 (1) supports a no further action decision, (2) indicates the need for an interim remedial action, or (3) requires additional investigation to make a decision.

5.1 HUMAN HEALTH RISK SCREENING. The current human exposure pathways are recreational fishing and dermal contact with and incidental ingestion of the surface water of the St. Johns River. Human health risk screening was not conducted because no surface water analytical data were collected at PSC 40. There is little potential for human exposure to contaminated sediments under the recreational or wading scenario because the area is currently off-limits to human activities.

5.2 ECOLOGICAL RISK SCREENING. This screening-level evaluation is intended to provide an assessment of potential ecological risks associated with sediment at PSC 40. The evaluation consists of an exposure pathways analysis (Subsection 5.2.1), a summary of the analytical results and comparison to applicable sediment toxicological benchmarks (Subsection 5.2.2), an evaluation of the sediment toxicity testing data (Subsection 5.2.3), and conclusions/recommendations (Subsection 5.2.4). The results of the chemical analyses and toxicity tests were used to determine if chemical concentrations in sediment at PSC 40 are associated with adverse effects to benthic invertebrates in the St. Johns River.

5.2.1 Exposure Pathway Analysis Because sediment is the media of concern, the exposure pathway most likely to occur is direct contact and indirect ingestion of contaminants in the sediment of the St. Johns River adjacent to PSC 40 by aquatic receptors. The aquatic receptors of concern include bottom-dwelling macroinvertebrates and larval stage aquatic species that may come into contact with contaminants in the sediment. Although fish ingestion of contaminated food and incidental ingestion of contaminated sediment are also potential exposure pathways, these routes of exposure were not evaluated in the screening-level evaluation due to the localized nature of potential sediment contamination adjacent to PSC 40. Population-level impacts to fish are not anticipated because the area surrounding PSC 40 is small relative to the wide range of fish foraging habitat in the St. Johns River.

5.2.2 Summary of Analytical Results Sediment data are summarized in Table 5-1. Information provided in these tables includes frequency of detection, range of detected concentrations, maximum detected concentrations, and the applicable inorganic sediment background concentrations and sediment quality guidelines from USEPA Region IV (USEPA, 1995) and FDEP (MacDonald Environmental Sciences, 1994).

Several PAHs and a PCB, Aroclor-1248, were detected at concentrations above their respective USEPA Region IV sediment screening values and FDEP sediment quality TEL and PEL values. The TEL value represents concentrations of sediment-associated contaminants that, when below that value, are not considered to represent significant hazards to aquatic organisms. Within the range of concentrations between the TEL and PEL, adverse biological effects are possible; above the PEL range, concentrations of sediment-associated contaminants are

**Table 5-1  
Summary of Analytes Detected in Sediment**

Sampling Event Report  
Potential Source of Contamination 40  
East Side Wastewater Treatment Plant Discharge Area  
Naval Air Station Jacksonville  
Jacksonville, Florida

Chemical Name	Frequency of Detections <sup>1</sup>	Range of Detects	Maximum Detected Concentration	Background Concentrations <sup>2</sup>	USEPA Region IV SSV <sup>3</sup>	FDEP Sediment TEL/PEL Guidelines <sup>4</sup>	Exceeds TEL and/or PEL?
<b>Semivolatile Organic Compounds (µg/kg)</b>							
Benzo(a)anthracene	1/2	960 to 960	960	NA	330	74.8/693	TEL / PEL
Benzo(a)pyrene	2/2	50 to 850	850	NA	330	88.8/763	TEL / PEL
Benzo(b)fluoranthene	2/2	54 to 990	990	NA	330	NA/NA	
Benzo(g,h,i)perylene	1/2	280 to 280	280	NA	330	NA/NA	
Benzo(k)fluoranthene	1/2	430 to 430	430	NA	330	NA/NA	
Chrysene	1/2	1,000 to 1,000	1000	NA	330	108/846	TEL / PEL
Dibenz(a,h)anthracene	1/2	580 to 580	580	NA	330	6.22/135	TEL / PEL
Fluoranthene	1/2	3,400 to 3,400	3400	NA	330	113/1,494	TEL / PEL
Indeno(1,2,3-cd)pyrene	1/2	760 to 760	760	NA	330	NA/NA	
Pyrene	2/2	52 to 2,300	2300	NA	330	153/1,398	TEL / PEL
<b>Pesticides and PCBs (µg/kg)</b>							
alpha-BHC	1/2	0.97 to 0.97	0.97	NA	3.3	NA/NA	
Aroclor-1248	1/2	260 to 260	260	NA	33	21.6/189	TEL / PEL
beta-BHC	1/2	2.8 to 2.8	2.8	NA	3.3	NA/NA	
gamma-Chlordane	1/2	0.41 to 0.41	0.41	NA	1.7	2.26/4.79	
Heptachlor	1/2	0.75 to 0.75	0.75	NA	1.7	NA/NA	
<b>Inorganic Analytes (mg/kg)</b>							
Aluminum	2/2	4,890 to 10,700	10,700	1,167	NA	NA/NA	
Arsenic	2/2	2.1 to 10.5	10.5	ND	7.24	7.24/41.6	TEL
Barium	2/2	36.2 to 218	218	4.8	NA	NA/NA	
Cadmium	1/2	1.5 to 1.5	1.5	ND	1.0	0.676/4.21	TEL
Calcium	2/2	11,500 to 38,100	38,100	1,914	NA	NA/NA	

See notes at end of table.

**Table 5-1 (Continued)**  
**Summary of Analytes Detected in Sediment**

Sampling Event Report  
Potential Source of Contamination 40  
East Side WWTP Discharge Area  
Naval Air Station Jacksonville  
Jacksonville, Florida

Chemical Name	Frequency of Detections <sup>1</sup>	Range of Detects	Maximum Detected Concentration	Background Concentrations <sup>2</sup>	USEPA Region IV SSV <sup>3</sup>	FDEP Sediment TEL/PEL Guidelines <sup>4</sup>	Exceeds TEL and/or PEL
<b><u>Inorganic Analytes (mg/kg) (continued)</u></b>							
Chromium	2/2	22.6 to 35.3	35.3	4.4	52.3	52.3/160	
Cobalt	1/2	3.2 to 3.2	3.2	0.6	NA	NA/NA	
Copper	2/2	12.4 to 21.2	21.2	1.8	18.7	18.7/108	TEL
Iron	2/2	5,310 to 20,500	20,500	1,530	NA	NA/NA	
Lead	2/2	39.6 to 168	168	6.1	30.2	30.2/112	TEL / PEL
Magnesium	2/2	5,180 to 5,490	5,490	353.8	NA	NA/NA	
Manganese	2/2	46.5 to 253	253	21.3	NA	NA/NA	
Mercury	1/2	0.64 to 0.64	0.64	ND	0.13	0.13/0.696	TEL
Nickel	2/2	4 to 12.3	12.3	ND	15.9	15.9/42.8	
Potassium	2/2	345 to 906	906	122.8	NA	NA/NA	
Selenium	1/2	8.2 to 8.2	8.2	1.48	NA	NA/NA	
Sodium	2/2	1,640 to 6,010	6,010	ND	NA	NA/NA	
Vanadium	2/2	16.7 to 25.7	25.7	3.65	NA	NA/NA	
Zinc	2/2	57 to 122	122	ND	124	124/271	
<b><u>General Chemistry (mg/kg)</u></b>							
Organic Carbon	2/2	85,000 to 160,000	160,000	NA	NA	NA/NA	

<sup>1</sup> Frequency of detection is equal to the number of samples in which the analyte is detected in relation to the total number of samples analyzed (excluding rejected data).

<sup>2</sup> Sediment background concentrations are from the Operable Unit 3 remedial investigation (HLA, 1999).

<sup>3</sup> USEPA Region IV, Waste Management Division, *Sediment Screening Values for Hazardous Waste Sites* (USEPA, 1995).

<sup>4</sup> TEL and PEL Sediment Quality Assessment Guidelines (MacDonald, 1994).

Notes: USEPA = U.S. Environmental Protection Agency.  
SSV = sediment screening values.  
FDEP = Florida Department of Environmental Protection.  
TEL = threshold effects limit.  
PEL = probable effects limit.  
µg/kg = micrograms per kilogram.

NA = not applicable (background) or not available.  
PCB = polychlorinated biphenyl.  
BHC = benzene hexachloride.  
mg/kg = milligrams per kilogram.  
ND = not detected.

considered to represent significant hazards to aquatic organisms. All exceedances were found in sample 40D00301, located within the tiny cove approximately 50 feet from the outfall. As previously discussed in Chapter 4.0, these compounds are not typical of WWTP effluent, and a likely source of these compounds is surface water runoff from the nearby extensive paved surfaces.

Maximum detected concentrations of inorganic analytes were all above their respective sediment background screening values. Inorganic analytes found to exceed their respective TELs but not their PELs include arsenic, cadmium, copper and mercury. Lead, with a maximum detected concentration of 168 mg/kg, exceeded both its TEL and PEL guidelines of 30.2 and 112 mg/kg, respectively.

**5.2.3 Toxicity Tests** Two bulk sediment toxicity test samples were collected from sampling locations 40D00101 and 40D00301, and submitted to ABS for toxicity tests using the marine amphipod *Leptocheirus plumulosus*. The test species, *L. plumulosus*, was chosen as the representative infaunal test species for the toxicity test because of its tolerance to a wide range of salinities from 0 to 33 parts per thousand as well as its tolerance to both coarse texture and fine grain sediment. The amphipod was evaluated for ten-day acute mortality and reburial rates. The results of the sediment toxicity tests are summarized in Table 5-2; the full laboratory report is presented in Appendix E.

**Table 5-2  
Summary of Sediment Toxicity Test Results**

Potential Source of Contamination 37  
East Side Wastewater Treatment Plant Discharge Area  
Naval Air Station Jacksonville  
Jacksonville, Florida

Sample Location	Mean Survival (Percent)	Mean Reburial (Percent)
Laboratory Control	94	94
40D00101	93	90
40D00301	96	94

Note: No significant differences in site-related samples versus laboratory control ( $p=0.05$ ),

After ten days of exposure, mean survival rates of *Leptocheirus plumulosus* in the PSC 40 sediment samples ranged from 93 to 96 percent, for 40D00101 and 40D00301, respectively, versus 94 percent in the laboratory reference sediment sample. Mean reburial rates of *Leptocheirus plumulosus* ranged from 90 to 94 percent, for 40D00101 and 40D00301, respectively, versus 94 percent in the laboratory reference sediment sample. There were no significant differences ( $P = 0.05$ ) in mean survival and reburial rates between the laboratory control and the site-related sediment samples. These results suggest that although concentrations of PAH compounds exceeded FDEP TEL and PEL guidelines, estuarine invertebrates are not adversely affected from exposure to sediment at PSC 40.

**5.2.4 Conclusions** Based on the results of the ecological screening, there appears to be no significant impact resulting from exposure of aquatic receptors to contaminants in sediment at PSC 40; therefore, it is recommended that this site be proposed for no further action.

## 6.0 REFERENCES

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6.0 REFERENCES (Continued)

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**APPENDIX A**

**OFF-SITE SAMPLE TRACKING LOG**

**Appendix A**

PSC 40  
 OFFSITE SAMPLE TRACKING LOG  
 SITE SCREENING, NAS JACKSONVILLE

SDG	SAMPLE ID	SAMP DATE	MATRIX	TAL MET	PAH/8310	TCL PESTPCB	TOC	TOXT	DRFL	TAT	DSTV	DRFV
JAX05	40D00101	3/30/99	sediment	X	X	X	X	X	5/3/99	35	5/5/99	5/15/99
JAX05	40D00301	3/29/99	sediment	X	X	X	X	X	5/3/99	35	5/5/99	5/15/99

**NOTES:**

SDG	Sample Delivery Group (group of 20 samples or less collected not more than 14 days of each other).
SAMPLE ID	Sample Identifier
SAMP DATE	Date of Sample Collection
MATRIX	Media Sampled
TAL MET	Target Analyte List Metals
PAH/8310	Polynuclear Aromatic Hydrocarbons, Method SW8310
TCL PESTPCB	Target Compound List Pesticides and Polychlorinated Biphenyls
TOC	Total Organic Carbon
TOXT	Toxicity test.
DRFL	Date Package Received from Laboratory
TAT	Turnaround Time (days)
DSTV	Date Package Sent to Validators
DRFV	Date Package Received from Validators

**APPENDIX B**

**SUMMARY OF DETECTIONS OF ANALYTICAL RESULTS**

**Appendix B**

Summary of Detections in Sediment Analytical Results,  
PAHs, TCL Pesticides/PCBs, TAL Metals, and General Chemistry  
PSC 40

Naval Air Station, Jacksonville  
Jacksonville, FL

Sample ID	40D00101	40D00301
Lab ID	A9D010139009	A9D010139008
Sampling Date	3/30/99	3/29/99
<b>Polyaromatic Hydrocarbons, ug/kg</b>		
Benzo(a)anthracene	960	
Benzo(a)pyrene	850	50 J
Benzo(b)fluoranthene	990	54
Benzo(ghi)perylene	280	
Benzo(k)fluoranthene	430	
Chrysene	1000	
Dibenzo(a,h)anthracene	580	
Fluoranthene	3400	
Indeno(1,2,3-cd)pyrene	760	
Pyrene	2300	52
<b>Pesticides/PCBs, ug/kg</b>		
alpha-BHC		0.97 J
Aroclor-1248	260 J	
beta-BHC		2.8 J
gamma-Chlordane		0.41 J
Heptachlor		0.75 J
<b>Inorganics, mg/kg</b>		
Aluminum	4890	10700
Arsenic	2.1 J	10.5 J
Barium	218	36.2 J
Cadmium	1.5 J	
Calcium	38100	11500
Chromium	22.6	35.3
Cobalt		3.2 J
Copper	12.4	21.2 J
Iron	5310	20500
Lead	168	39.6
Magnesium	5180	5490 J
Manganese	46.5	253
Mercury		0.64 J
Nickel	4 J	12.3 J
Potassium	345 J	906 J
Selenium		8.2 J
Sodium	1640 J	6010 J
Vanadium	16.7 J	25.7 J
Zinc	57	122
<b>General Chemistry</b>		
Total Organic Carbon, mg/kg	85000	160000
<b>NOTES:</b>		
Sample ID= sample identifier.		
Lab ID = laboratory identifier.		
mg/kg = milligrams per kilogram		
ug/kg = micrograms per liter.		
PCB = polychlorinated biphenyl.		
J = Reported concentration is an estimated quantity.		
Blank space indicates analyte/compound was not detected at the reporting limit.		

Appendix C

Analytical Results for Sediment  
PAHs, TCL Pesticides/PCBs, TAL Metals, and General Chemistry  
PSC 40

Naval Air Station, Jacksonville  
Jacksonville, FL

Sample ID	40D00101	40D00301
Lab ID	A9D010139009	A9D010139008
Sampling Date	3/30/99	3/29/99
<b>Polyaromatic Hydrocarbons, ug/kg</b>		
1-Methylnaphthalene	800 U	280 U
2-Methylnaphthalene	800 U	280 U
Acenaphthene	800 U	280 U
Acenaphthylene	800 U	280 U
Anthracene	120 U	42 U
Benzo(a)anthracene	960	42 U
Benzo(a)pyrene	850	50 J
Benzo(b)fluoranthene	990	54
Benzo(ghi)perylene	280	42 U
Benzo(k)fluoranthene	430	42 U
Chrysene	1000	42 U
Dibenzo(a,h)anthracene	580	42 U
Fluoranthene	3400	42 U
Fluorene	120 UJ	42 UJ
Indeno(1,2,3-cd)pyrene	760	42 U
Naphthalene	800 U	280 U
Phenanthrene	120 U	42 U
Pyrene	2300 J	52 J
<b>Pesticides/PCBs, ug/kg</b>		
4,4'-DDD	80 U	28 U
4,4'-DDE	80 U	28 U
4,4'-DDT	80 U	28 U
Aldrin	40 U	14 U
alpha-BHC	40 U	0.97 J
alpha-Chlordane	40 U	14 U
Aroclor-1016	800 U	280 U
Aroclor-1221	1600 U	560 U
Aroclor-1232	800 U	280 U
Aroclor-1242	800 U	280 U
Aroclor-1248	260 J	280 U
Aroclor-1254	800 U	280 U
Aroclor-1260	800 U	280 U
Aroclor-1262	800 U	280 U
Aroclor-1268	800 U	280 U
beta-BHC	40 U	2.8 J
delta-BHC	40 U	14 U
Dieldrin	80 U	28 U
Endosulfan I	40 U	14 U
Endosulfan II	80 U	28 U
Endosulfan sulfate	80 U	28 U
Endrin	80 U	28 U
Endrin aldehyde	80 U	28 U
Endrin ketone	80 U	28 U
gamma-BHC(Lindane)	40 U	14 U
gamma-Chlordane	40 U	0.41 J
Heptachlor	40 U	0.75 J
Heptachlor epoxide	40 U	14 U
Methoxychlor	400 U	140 U

**APPENDIX C**  
**VALIDATED ANALYTICAL RESULTS**

Appendix C

Analytical Results for Sediment  
PAHs, TCL Pesticides/PCBs, TAL Metals, and General Chemistry  
PSC 40

Naval Air Station, Jacksonville  
Jacksonville, FL

Sample ID	40D00101	40D00301
Lab ID	A9D010139009	A9D010139008
Sampling Date	3/30/99	3/29/99
Toxaphene	4000 U	1400 U
<b>Inorganics, mg/kg</b>		
Aluminum	4890	10700
Antimony	1.4 U	3.7 U
Arsenic	2.1 J	10.5 J
Barium	218	36.2 J
Beryllium	0.04 U	0.15 U
Cadmium	1.5 J	0.34 U
Calcium	38100	11500
Chromium	22.6	35.3
Cobalt	0.83 U	3.2 J
Copper	12.4	21.2 J
Iron	5310	20500
Lead	168	39.6
Magnesium	5180	5490 J
Manganese	46.5	253
Mercury	0.13 UJ	0.64 J
Nickel	4 J	12.3 J
Potassium	345 J	906 J
Selenium	1.5 U	8.2 J
Silver	0.34 U	1.3 U
Sodium	1640 J	6010 J
Thallium	1.7 U	5.9 U
Vanadium	16.7 J	25.7 J
Zinc	57	122
<b>General Chemistry</b>		
Total Organic Carbon, mg/kg	85000	160000

## Appendix C

### Notes to Sediment Analytical Results Table PSC 40

Naval Air Station, Jacksonville  
Jacksonville, FL

Sample ID = Sample Identifier  
Lab ID = Laboratory identifier

#### Units:

mg/kg milligram per kilogram  
ug/kg microgram per kilogram

The following standard validation qualifiers have the following definitions:

- U The analyte/compound was analyzed for but was not detected above the reported sample quantitation limit. The number preceding the U qualifier is the reported sample quantitation limit.
- J The analyte/compound was positively identified and the associated numerical value is an estimated concentration of the analyte/compound in the sample.  
For most detected analytes and compounds, the J qualifier is also used to indicate that the reported concentration is below the contract required detection or quantitation limit.
- UJ The analyte/compound was not detected above the reported sample quantitation limit.  
The reported quantitation limit, however, is approximate and may or may not represent the actual limit of quantitation necessary to accurately measure the analyte/compound in the sample.

**APPENDIX D**  
**DATA VALIDATION REPORTS**

# Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

## POLYNUCLEAR AROMATIC HYDROCARBONS (PAH) NFESC LEVEL D

Site: NAS Jacksonville - Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 14, 1999

Laboratory: Quanterra, North Canton, Ohio Reviewer: Nancy Weaver

Client Sample ID	Laboratory Sample ID	Matrix
37D00101	A9D010139-001	Soil
37D00201	A9D010139-002	Soil
37D00301	A9D010139-003	Soil
09S00102	A9D010139-004	Soil
09SBK101	A9D010139-005	Soil
40D00301	A9D010139-008	Soil
40D00101	A9D010139-009	Soil
JXR93740	A9D010139-010	Water

Holding Times - All samples were extracted within 7 days for water samples and 14 days for soil samples and analyzed within 40 days for all samples. No qualifications were required.

Initial Calibration - The initial calibration analyzed on 4/19/99 exhibited a high %RSD value for fluorene of 48.5%. Fluorene has been qualified (UJ) in all samples since all results are non-detect.

Continuing Calibration - The continuing calibration analyzed on 4/22/99 (1704) exhibited high %D values for pyrene and fluorene of 33.5% and 84.0%, respectively. Pyrene has been qualified (J) for positive results and (UJ) for non-detects in sample 37D00101. Fluorene has already been qualified due to the initial calibration and no further qualifications were required.

The continuing calibration analyzed on 4/22/99 (2352) exhibited high %D values for pyrene and fluorene of 32.3% and 84.0%, respectively. Pyrene has been qualified (J) for positive results and (UJ) for non-detects in samples 37D00201, 37D00301, 09S00102, 09SBK101, 40D00301, 40D00101, and JXR93740. Fluorene has already been qualified due to the initial calibration and no further qualifications were required.

Surrogates - Sample JXR93740 exhibited a low %R for S1-benzo(e)pyrene. All results for this sample have been qualified (UJ) since all results are non-detect.

MS/MSD - MS/MSD sample "LAB" exhibited acceptable %R and RPD values and no qualifications were required.

Laboratory Control Samples - LCS sample CT9JH102 exhibited acceptable %R values. No qualifications were required.

LCS/LCSD sample CT8FV102/CT8FV103 exhibited acceptable %R and RPD values. No qualifications were required.

Method Blank - Method blanks CT8FV101 (4/2/99) and CT9JH101 (4/5/99) were free of contamination. No qualifications were required.

Field, equipment blank - Rinsate blank JXR93740 was free of contamination. No qualifications were required.

Field Duplicates - Field duplicate samples were not analyzed with this data package. No action was taken on this basis.

Compound Quantitation - The laboratory flagged several results with a (P) indicating that the % difference between the original and confirmation analyses was >25%. The reviewer further qualified these results as estimated (J).

Comments - The analyses of environmental samples and quality control samples are valid within the constraints identified with the data quality flags as presented in the initial calibration, continuing calibration, surrogates, and compound quantitation sections of this report. Ten percent of the calculations in this data package were verified for the Level D validation. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, February, 1994, were used in evaluating the data in this summary report.

# Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

## PESTICIDE/PCBs NFESC LEVEL D

Site: NAS Jacksonville, Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 14, 1999

Laboratory: Quanterra, Inc., North Canton, Ohio Reviewer: Nancy Weaver

Client Sample ID	Laboratory Sample ID	Matrix
09S00102	CT7GR106	Soil
09SBK101	CT7N0104	Soil
09W00201	CT7N3101	Water
09W00301	CT7N4101	Water
37D00101	CT7GN104	Soil
37D00201	CT7GP103	Soil
37D00301	CT7GQ103	Soil
40D00101	CT7N810V	Soil
40D00301	CT7N710V	Soil
JXR93740	CT7NH101	Water

Holding Times - All samples were extracted within 7 days for water samples and 14 days for soil samples and analyzed within 40 days for all samples. No qualifications were required.

Initial Calibration - The initial calibrations analyzed on 4/12/99 exhibited acceptable %RSD values. No qualifications were required.

Calibration Verification - The calibration verification QC limits were met as specified below.

1. The %D values of the PEM and Individual Mixes were  $\leq 25\%$ .
2. The 4,4'-DDT breakdown was  $\leq 20\%$ .
3. The endrin breakdown was  $\leq 20\%$ .
4. The combined breakdown was  $\leq 30\%$ .

Resolution - Resolution criteria have been met and no action has been taken.

Method Blanks - Method blank PBLANK1 (4/2/99) exhibited alpha-BHC, beta-BHC, delta-BHC, and gamma-BHC contamination at 0.0046 ug/L, 0.013 ug/L, 0.0030 ug/L, and 0.0029 ug/L, respectively, however, all associated results are non-detect and no qualifications were required.

Method blank PBLANK2 (4/2/99) exhibited alpha-chlordane contamination at 0.0029 ug/L, however, all associated results are non-detect and no qualifications were required.

Method blank PBLANK3 (4/2/99) exhibited alpha-BHC, methoxychlor, and alpha-chlordane contamination at 0.052 ug/kg, 0.86 ug/kg, and 0.10 ug/kg, respectively. Alpha-BHC has been qualified (U) in associated sample 09SBK101. All other associated results are non-detect and no further qualifications were required.

Field, equipment blank - Rinsate blank JXR93740 was free of contamination. No qualifications were required.

Surrogates - Sample JXR93740 exhibited low %R values for surrogate compounds DCB1 and DCB2 of 8% and 8%, respectively. All results for this sample have been rejected (R).

MS/MSD - A MS/MSD sample was not analyzed with this data package.

Laboratory Control Samples - A LCS sample was not analyzed with this data package.

Field Duplicates - Field duplicate samples were not analyzed with this data package.

Compound Identification - Retention times were acceptable and no further action was taken.

Pesticide Cleanup Checks - The % recoveries were within the QC limits for the florisil cartridge cleanup and GPC cleanup. No qualifications were required.

Compound Quantitation - Several compounds in several samples exhibited high %D values (>25%) between columns and were flagged (P) by the laboratory and further qualified (J) by the reviewer.

Comments - The analyses of environmental samples and quality control samples are valid within the constraints identified with the data quality flags as presented in the method blank and compound quantitation sections of this report with the exception of all results for sample JXR93740 which have been rejected (R) due to low surrogate recoveries. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, February, 1994, were used in evaluating the data in this summary report.

# Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

## TAL METALS/MERCURY NFESC LEVEL D

Site: NAS Jacksonville - Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 13, 1999

Laboratory: Quanterra, North Canton, Ohio Reviewer: Douglas Weaver

Client Sample ID	Laboratory Sample ID	Matrix
JXR93740	CT7NH	Water
09SBK101*	CT7N0	Soil
09S00102*	CT7GR	Soil
37D00101	CT7GN	Soil
37D00101MS	CT7GNMS	Soil
37D00101MSD	CT7GNMSD	Soil
37D00201	CT7GP	Soil
37D00301	CT7GQ	Soil
40D00101	CT7N8	Soil
40D00301	CT7N7	Soil

\* - Analyzed for mercury only.

Holding Times - All samples were prepared and analyzed within the recommended holding time of 180 days for all metals and 28 days for mercury. No qualifications were required.

Initial and Continuing Calibration Verification (ICV/CCV) - All ICV and CCV %R values were acceptable. No qualifications were required.

Method and Calibration Blanks - The water preparation blank PBW (4/6/99), initial, and/or continuing calibration blanks exhibited contamination for several compounds, however, all sample results are non-detect or greater than 5X the blank concentration with the exception of the following. Barium, cadmium, calcium, cobalt, copper, iron, magnesium, manganese, and sodium have been qualified (U) in sample JXR93740.

The soil preparation blank PBS (4/6/99), initial, and/or continuing calibration blanks exhibited contamination for several compounds, however, all sample results are non-detect or greater than 5X the blank concentration with the exception of the following. Antimony has been qualified (U) in sample 40D00101. Beryllium has been qualified (U) in samples 37D00201 and 37D00301. Cadmium has been qualified (U) in sample 37D00101.

Cobalt has been qualified (U) in samples 37D00101 and 40D00101. Mercury has been qualified (U) in samples 09SBK101, 09S00102, and 40D00101. Silver has been qualified (U) in samples 37D00101, 37D00301, and 40D00301.

ICP Interference Check Sample - The ICP interference check sample %R results met the 80-120% QC criteria. No qualifications were required.

Field and equipment blank - Rinsate blank JXR93740 was free of contamination. No qualifications were required.

LCS - The water LCS exhibited acceptable %R values. No qualifications were required.

The soil LCS exhibited acceptable results within QC limits. No qualifications were required.

ICP Serial Dilution - Water ICP serial dilution sample JXR93740L exhibited acceptable %D values. No qualifications were required.

Soil ICP serial dilution sample 37D00101L exhibited acceptable %D values. No qualifications were required.

Matrix Spike - Water matrix spike sample JXR93740S exhibited acceptable %R values. No qualifications were required.

Soil matrix spike sample 37D00101S exhibited a low %R value for mercury of 62.3%. Positive mercury results have been qualified (J) in all soil samples.

Matrix Duplicate - Water matrix duplicate sample JXR93740D exhibited acceptable RPD values. No qualifications were required.

Soil matrix duplicate sample 37D00101D exhibited acceptable RPD values. No qualifications were required.

Field Duplicates - Field duplicate samples were not analyzed with this data package.

Compound Quantitation - All results between the IDL and CRDL which have been flagged with a "B" by the laboratory have been qualified as estimated "J" by the reviewer.

Comments - The analyses of environmental samples and quality control samples are valid within the constraints identified with the data quality flags as presented in the method blank, matrix spike, and compound quantitation sections of this report. Ten percent of the calculations in this data package were verified for the Level D validation. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February, 1994, were used in evaluating the data in this summary report.

# Environmental Data Services, Inc.

Specializing in Laboratory Data Validation

## TOTAL ORGANIC CARBON (TOC) NFESC LEVEL C

Site: NAS Jacksonville - Building 554 SDG #: JAX05

Client: Harding Lawson Associates ES, Inc. Date: May 14, 1999

Laboratory: Quanterra, Inc., North Canton, Ohio Reviewer: Nancy Weaver

Client Sample ID	Laboratory Sample ID	Matrix
37D00101	A9D010139-001	Soil
37D00201	A9D010139-002	Soil
37D00301	A9D010139-003	Soil
40D00301	A9D010139-008	Soil
40D00101	A9D010139-009	Soil

Holding Times - All samples were analyzed within the recommended holding time of 28 days for TOC. No qualifications were required.

Method Blanks - The method blanks were non-detect. No qualifications were required.

Field and equipment blank - Field QC samples were not associated with the samples in this data package.

LCS - The LCS samples exhibited acceptable %R values. No qualifications were required.

Matrix Spike - A MS/MSD sample was not analyzed with this data package. No qualifications were required.

Field Duplicates - Field duplicate samples were not analyzed with this data package.

Comments - The analyses of environmental samples and quality control samples are valid. The NFESC "Navy Installation Restoration Laboratory Quality Assurance Guide", February 1996, in conjunction with the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February, 1994, were used in evaluating the data in this summary report.

**APPENDIX E**  
**TOXICITY TEST REPORT**

Final  
Results of  
*Leptocheirus plumulosus* Survival and Reburial  
Toxicity Tests  
BTR 2838

Prepared for:  
Harding Lawson Associates  
2590 Executive Center, East Circle  
Tallahassee, Florida 32301



Prepared by:  
**Aquatec Biological Sciences**  
75 Green Mountain Drive  
South Burlington, Vermont

April 1999



# Aquatec Biological Sciences

 Ecology

 Environmental Toxicology

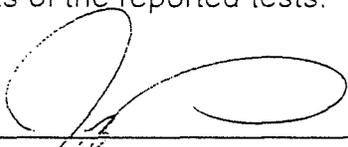
 Natural Resource Assessments

 Microbiology

BTR: 2838

PROJECT: 99020

I have reviewed this data package, which was completed under my supervision. This data package is complete, and to the best of my ability, accurately reflects the conditions and the results of the reported tests.



John W. Williams  
Toxicity Laboratory Manager

4/27/99

Date

I have reviewed and discussed this data package with the responsible laboratory manager. Based on this review, the data package was, to the best of my knowledge and belief, conducted in accordance with established company quality assurance procedures.



Philip C. Downey, Ph.D.  
Director

4/27/99

Date

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- APPENDIX B: CHAIN-OF-CUSTODY DOCUMENTATION
- APPENDIX C: LABORATORY DOCUMENTATION AND DATA ANALYSES FOR  
*Leptocheirus plumulosus* TOXICITY TESTS
- APPENDIX D: RESULTS OF STANDARD REFERENCE TOXICANT TESTS

## EXECUTIVE SUMMARY

Results of the *Leptocheirus plumulosus*  
Sediment Toxicity Tests  
Conducted March-April 1999  
NAS Jacksonville, Florida for Harding Lawson Associates

Laboratory Sample ID	Client Sample ID	Species	Mean Survival (%)	Mean Reburial (%)
8820	37D00101	<i>Leptocheirus plumulosus</i>	95	95
8821	37D00201	<i>Leptocheirus plumulosus</i>	95	95
8822	37D00301	<i>Leptocheirus plumulosus</i>	96	96
8823	40D00101	<i>Leptocheirus plumulosus</i>	93	90
8824	40D00301	<i>Leptocheirus plumulosus</i>	96	94
8827	Laboratory Control	<i>Leptocheirus plumulosus</i>	94	94

\* Statistically significantly different from the control sediment ( $p \leq 0.05$ )

## INTRODUCTION:

Samples were received for toxicity testing at Aquatec Biological Sciences of 75 Green Mountain Drive, South Burlington, Vermont. The results of the following tests are reported:

Client:	Harding Lawson Associates, Tallahassee, Florida
Permit Number:	N/A
Sites:	NAS Jacksonville, PSC 37 and PSC 40
Initial Sampling Date:	3/29/99
Tests Conducted:	<i>Leptocheirus plumulosus</i> , Survival and Reburial

## METHODS:

The procedures followed in conducting the toxicity tests were based on methods described by the USEPA (EPA 600/R-94/025). Specific test parameters for the *Leptocheirus plumulosus* toxicity test are listed in Table 1.

## PROTOCOL DEVIATIONS:

Protocol deviations were not encountered.

## RESULTS:

Tabulated summary results for the *Leptocheirus plumulosus* toxicity tests are located in Appendix A. None of the tested samples were shown to have significantly less ( $p < 0.05$ ) survival or reburial responses than the Control sample (8827) which had 94 percent survival and reburial.

## QUALITY ASSURANCE:

A standard reference toxicity test performed with *Leptocheirus plumulosus*, the resulting LC50 value was plotted on the developing control chart limit was deemed acceptable.

**Table 1. Test conditions for the amphipod (*Leptocheirus plumulosus*) 10-day whole sediment survival and reburial toxicity test.**

ASSOCIATED PROTOCOL: EPA 1994. *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Estuarine and Marine Amphipods* (EPA/600/R-94/025).

1. Test type:	Static
2. Temperature:	25 ± 1 °C
3. Light quality:	Wide-spectrum fluorescent lights
4. Light illuminance:	500 to 1000 lux (46-93 ft-c)
5. Photoperiod:	Continuous
6. Test chamber size:	1000 mL beaker
7. Sediment volume:	175 mL
8. Overlying water volume:	750 mL
9. Renewal of overlying water:	None
10. Age of test organism:	Juvenile (2-4 mm)
11. Organism Source:	Chesapeake Cultures, Hayes, Virginia
12. Number of organisms / test chamber:	20
13. Number of replicate test chambers/tested:	5
14. Feeding regime:	None
15. Aeration:	Gentle aeration with outlet positioned above sediment
16. Overlying Water:	Forty Fathoms artificial sediment (salinity 20‰ ± 2‰ )
17. Control sediment:	Natural marine sediment collected from organism source, 0.5 mm sieved

**Table 1. Test conditions for the amphipod (*Leptocheirus plumulosus*) 10-day whole sediment survival and reburial toxicity test (continued).**

---

18. Sediment preparation:	Thoroughly homogenize sediments, add 175 mL aliquots to each replicate test chamber
19. Test chamber cleaning:	None
20. Water quality monitoring:	
Temperature	Daily (overlying water)
Dissolved oxygen	Daily (overlying water)
pH	Daily (overlying water)
Salinity	Beginning of test (porewater) Daily (overlying water)
Ammonia, total	Beginning of test (pore water) Days 2 and 8 (overlying water) Beginning of test (pore water)
21. Biological monitoring/ organism behavior:	Daily, all replicates
22. Test duration:	10 days
23. Retrieval of organisms	0.5 mm sieve and repicked if recovery <90%
24. End points:	Survival and reburial
25. Reference toxicant:	Cadmium chloride 96-h acute, water only
26. Test acceptability:	Minimum mean negative control survival of $\geq 90\%$
28. Data interpretation:	Hypothesis testing versus the negative control and/or the reference site responses

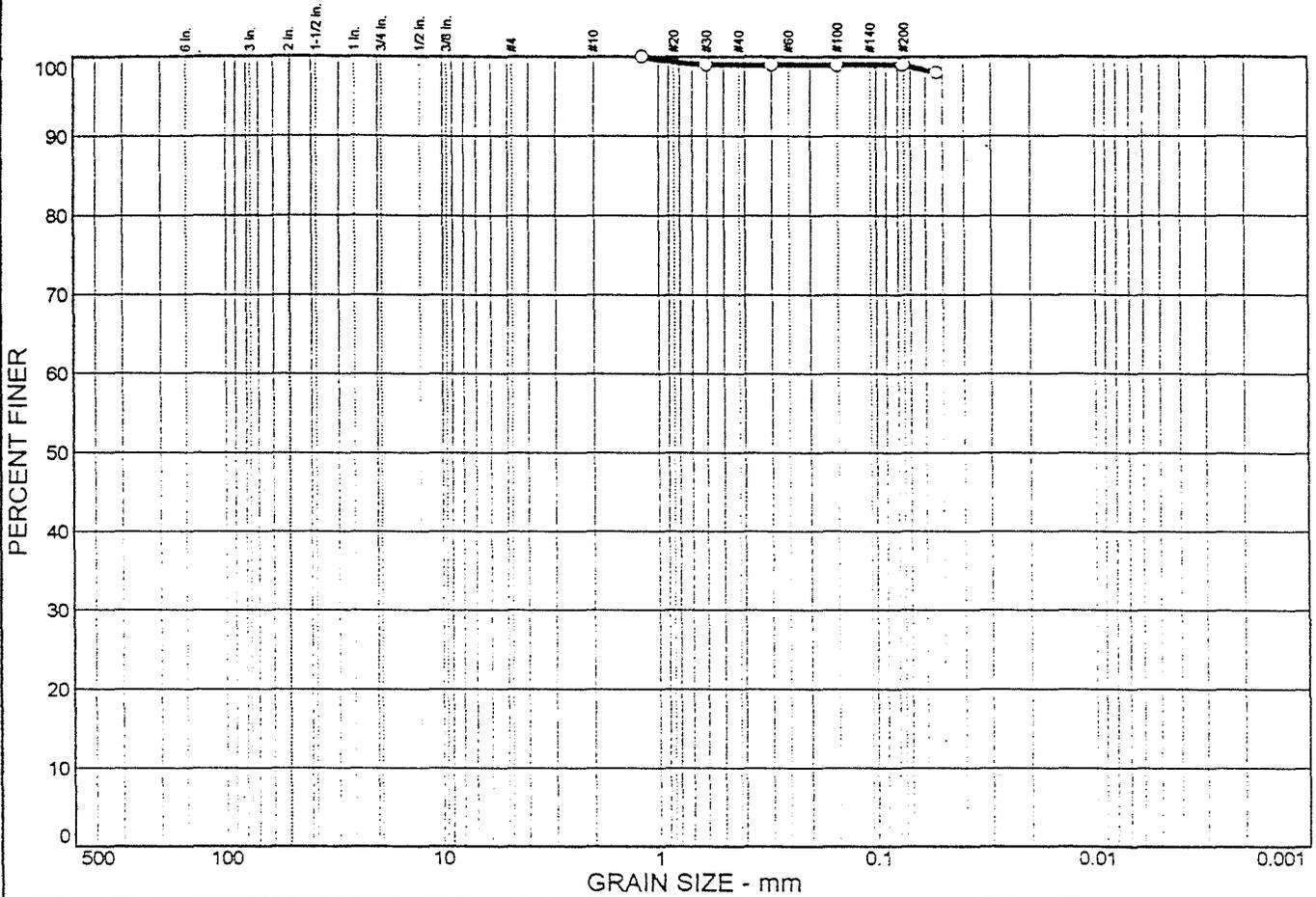
---

## Appendix A





# Grain Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0	0	1	99	.

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#16	100		
#30	99		
#50	99		
#100	99		
#200	99		
#270	98		

**Soil Description**

HLAFLA Sediment  
Sample #8821

**Atterberg Limits**

PL=                      LL=                      PI=

**Coefficients**

D<sub>85</sub>=                      D<sub>60</sub>=                      D<sub>50</sub>=  
D<sub>30</sub>=                      D<sub>15</sub>=                      D<sub>10</sub>=  
C<sub>u</sub>=                      C<sub>c</sub>=

**Classification**

USCS= ML                      AASHTO= A-4(0)

**Remarks**

Delivered By: Mail on 4-16-99  
Tested By: Peter Rixford on 4-22-99  
F.M.=0.03

\* (no specification provided)

Sample No.: 2  
Location:

Source of Sample:

Date: 4-22-99  
Elev./Depth:

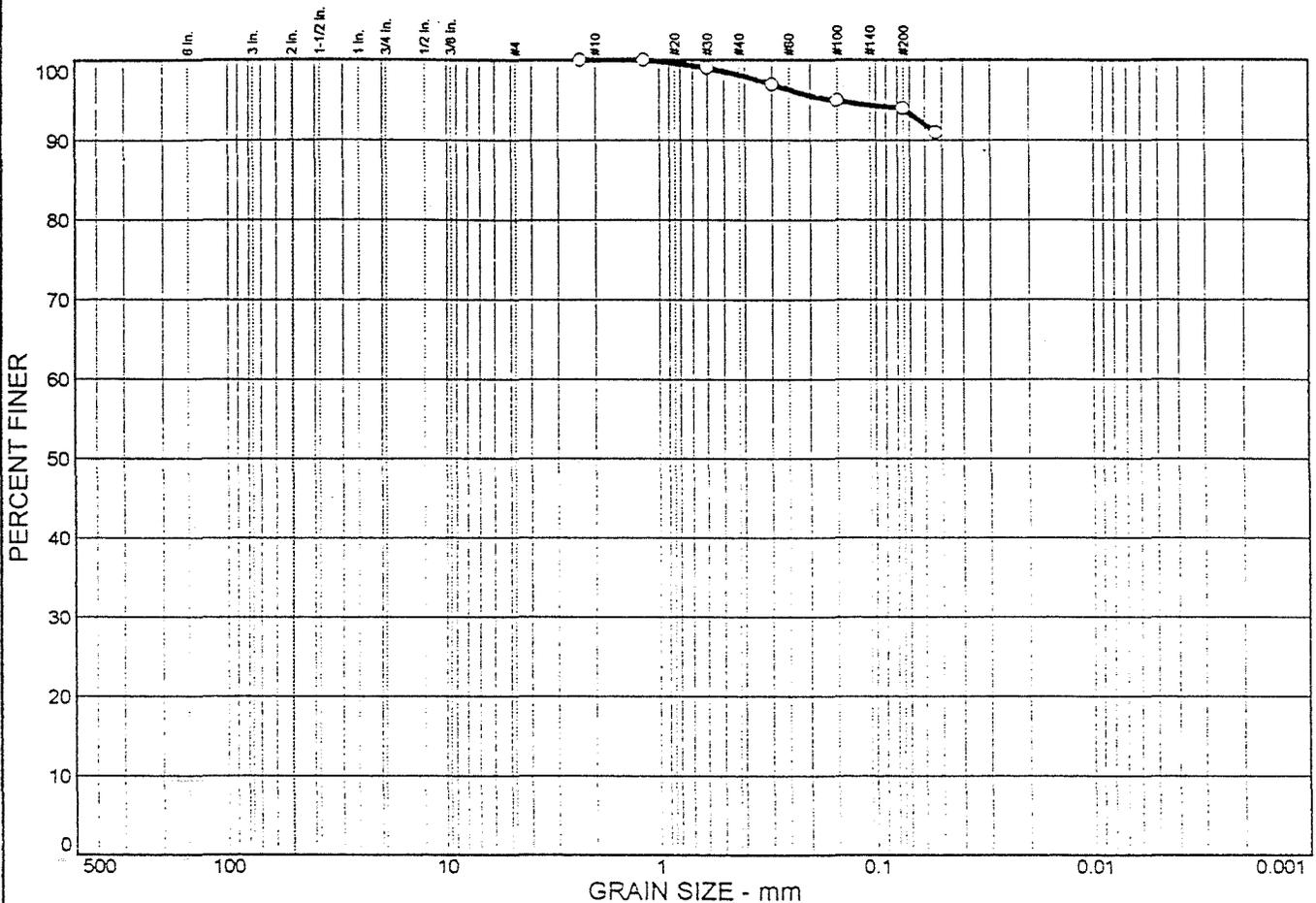
**Knight Consulting Engineers, Inc.**

Client: Aquatec Biological Services  
Project: General Testing

Project No: 99207

Page 2 of 6

# Grain Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0	0	6	94	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#8	100		
#16	100		
#30	99		
#50	97		
#100	95		
#200	94		
#70	91		

Soil Description

HLAFLA Sediment  
Sample #8822

Atterberg Limits

PL=                      LL=                      PI=

Coefficients

D<sub>85</sub>=                      D<sub>60</sub>=                      D<sub>50</sub>=  
D<sub>30</sub>=                      D<sub>15</sub>=                      D<sub>10</sub>=  
C<sub>u</sub>=                      C<sub>c</sub>=

Classification

USCS= ML                      AASHTO= A-4(0)

Remarks

Delivered By: Mail on 4-16-99  
Tested By: Peter Rixford on 4-22-99  
F.M.=0.09

\* (no specification provided)

Sample No.: 3  
Location:

Source of Sample:

Date: 4-22-99  
Elev./Depth:

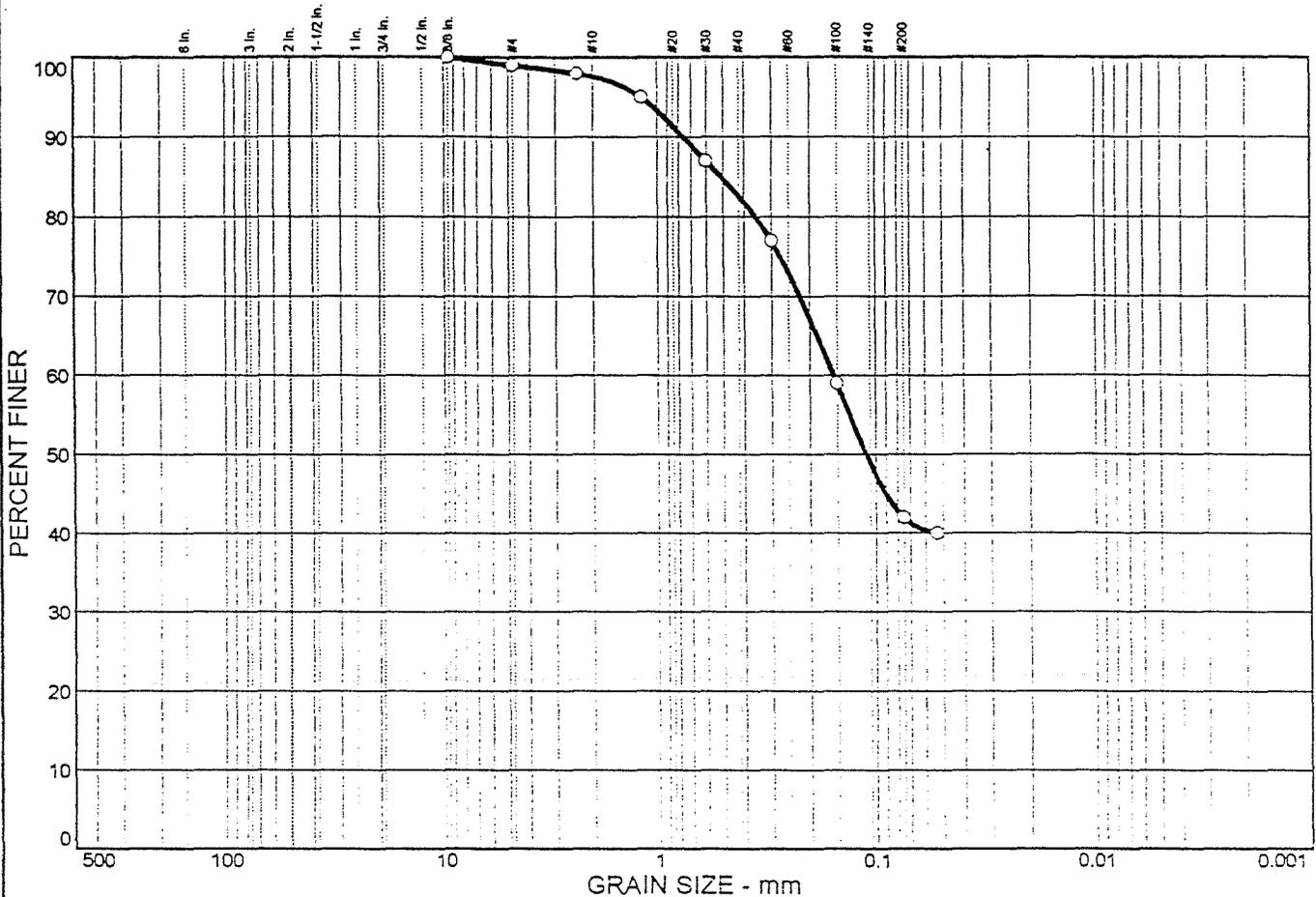
**Knight Consulting  
Engineers, Inc.**

Client: Aquatec Biological Services  
Project: General Testing

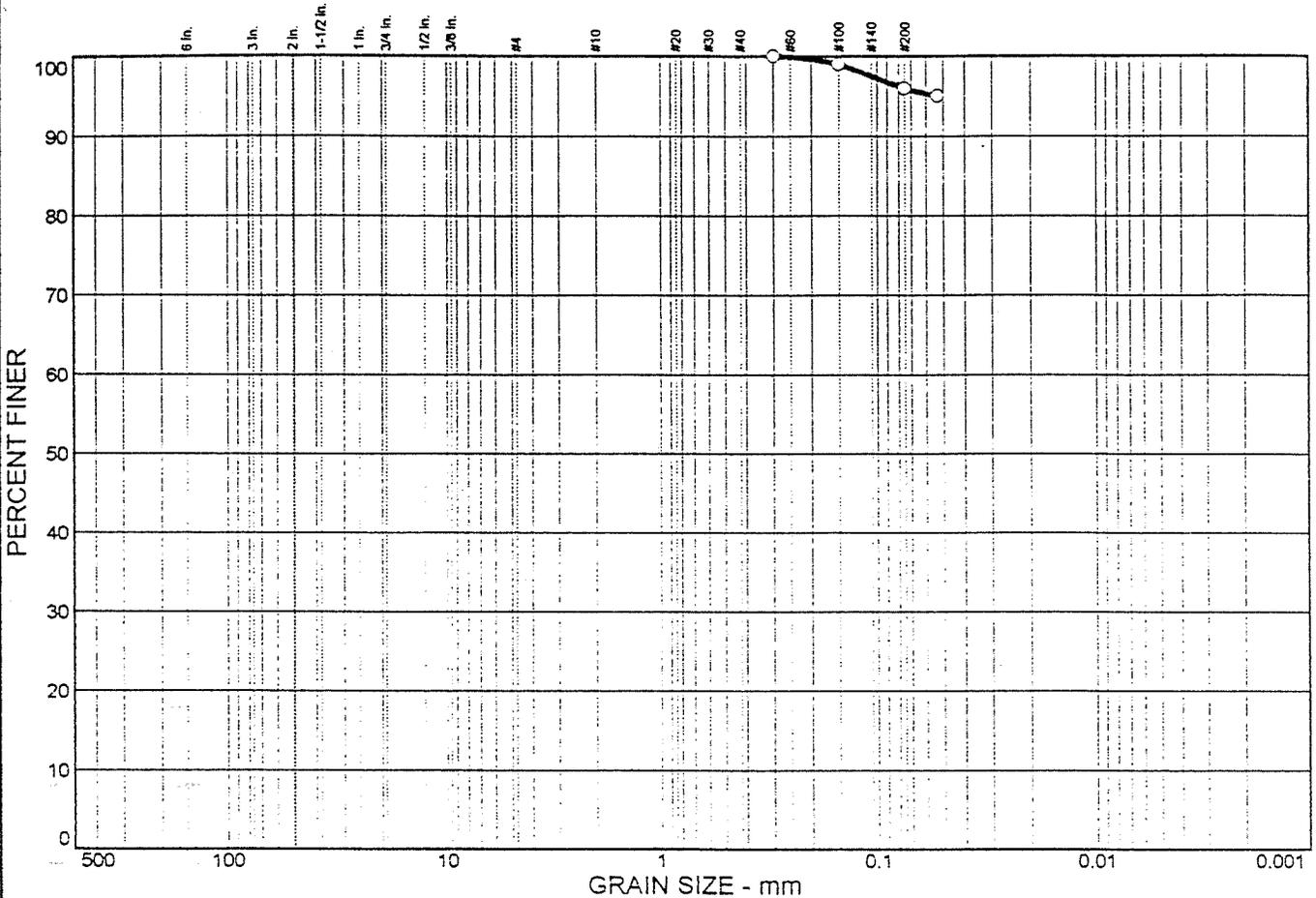
Project No: 99207

Page 3 of 6

# Grain Size Distribution Report



# Grain Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0	0	4	96	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#50	100		
#100	99		
#200	96		
#270	95		

**Soil Description**

HLAFLA Sediment  
Sample #8824

**Atterberg Limits**

PL=                      LL=                      PI=

**Coefficients**

D<sub>85</sub>=                      D<sub>60</sub>=                      D<sub>50</sub>=  
D<sub>30</sub>=                      D<sub>15</sub>=                      D<sub>10</sub>=  
C<sub>u</sub>=                      C<sub>c</sub>=

**Classification**

USCS= ML                      AASHTO= A-8

**Remarks**

Delivered By: Mail on 4-16-99  
Tested By: Matt Letourneau on 4-22-99  
F.M.=0.01

\* (no specification provided)

Sample No.: 5  
Location:

Source of Sample:

Date: 4-22-99  
Elev./Depth:

**Knight Consulting  
Engineers, Inc.**

Client: Aquatec Biological Services  
Project: General Testing

Project No: 99207



## Appendix B

**Chain of Custody Record**

ABS  
25 Green Mt. Dr.  
South Burlington, VT 05403

BTR  
2838



QUA-4124

Client <b>HARDING LAWSON Assoc</b>			Project Manager <b>LISSA MILLER</b>			Date <b>3/29/99</b>		Chain Of Custody Number <b>07279</b>		
Address <b>Building 554 NAs Jacksonville</b>			Telephone Number (Area Code)/Fax Number <b>904 772 7688 / 779 9348 Fax</b>			Lab Number		Page <b>1</b> of <b>1</b>		
City <b>Jacksonville</b>		State <b>FL</b>	Zip Code <b>32212</b>		Site Contact <b>Alex Oltis</b>			Analysis		
Project Name <b>GTO 40 RKDS 2508.09</b>			Carrier/Waybill Number <b>811233023746</b>							
Contract/Purchase Order/Quote No.										

Sample No.	Sample I.D. No. and Description	Date	Time	Sample Type	Total Volume	Containers		Preservative	Condition on Receipt	Analysis					
						Type	No.			Amphipod Toxicity Test	Earthworm Toxicity	lettuce seed germination			
3820	37 D 001 01	3/29/99	1130	SED	1 gal		1	Ice to 4°C							
8821	37 D 002 01	↓	1230	↓	↓		1	↓							
8822	37 D 003 01	↓	1300	↓	↓		1	↓							
8823	40 D 001 01	3/29/99	1130	↓	↓		1	↓							
8824	40 D 003 01	3/29/99	1515	↓	↓		1	↓							
8825	09 S 001 02	3/30/99	1400	SOIL	↓		1	↓				X		X	
8826	09 S BK 101	3/30/99	1440	SOIL	↓		1	↓				X		X	

Special Instructions

Possible Hazard Identification <input type="checkbox"/> Non-Hazard <input type="checkbox"/> Flammable <input type="checkbox"/> Skin Irritant <input type="checkbox"/> Poison B <input type="checkbox"/> Unknown				Sample Disposal <input type="checkbox"/> Return To Client <input type="checkbox"/> Disposal By Lab <input type="checkbox"/> Archive For _____ Months							
Turn Around Time Required <input type="checkbox"/> Normal <input checked="" type="checkbox"/> Rush		GC Level <input type="checkbox"/> I. <input type="checkbox"/> II. <input type="checkbox"/> III.		Project Specific (Specify)							
1. Relinquished By <b>Alexander Oltis</b>		Date <b>3/30/99</b>		Time <b>1530 H</b>		1. Received By <b>Quanterra Biological Sciences</b>		Date <b>3/31/99</b>		Time <b>10:00</b>	
2. Relinquished By		Date		Time		2. Received By		Date		Time	
3. Relinquished By		Date		Time		3. Received By		Date		Time	

Comments  
**Temperature 0.8°C on delivery 3/31/99**

DISTRIBUTION: E - Stays with Sample; CANARY - Returned to Client with Report; PINK - Field Copy

# Aquatec Biological Sciences

## Chain-of-Custody Record

75 Green Mountain Drive  
 South Burlington, VT 05403  
 TEL: (802) 860-1638  
 FAX: (802) 658-3189

COMPANY INFORMATION	COMPANY'S PROJECT INFORMATION	SHIPPING INFORMATION	VOLUME/CONTAINER TYPE/ PRESERVATIVE (NOTE 4)			
Name: <u>John Williams</u> Address: <u>Aquatec Biological Sciences</u> Telephone: <u>(802) 860-1638</u> Facsimile: <u>(802) 658-3189</u> Contact Name: <u>John Williams</u>	Project Name: <u>HLATA</u> Project Number: <u>99020</u> Sampler Name(s): <u>John Williams</u> Quote #: _____ Client Code: _____	Carrier: _____ Airbill Number: _____ Date Shipped: _____ Hand Delivered: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	—	—	—	—

SAMPLE IDENTIFICATION (NOTE 1)	COLLECTION		GRAB	COMPOSITE	MATRIX	ANALYSIS/REMARKS (NOTE 2,3)	NUMBER OF CONTAINERS			
	DATE	TIME					1	2	3	4
8820	3/29/99	11:30	X			I				
8821	3/29	11:30	X							
8822	3/29	11:30	X							
8823	3/29 <sup>30</sup>	11:30 <sup>15</sup>	X							
8824	3/29	15:45	X							
8829	3/30	—	X							

Relinquished by: (signature)	DATE	TIME	Received by: (signature)	NOTES TO SAMPLER(S): (1) Limit Sample Identification to 30 characters, if possible; (2) Indicate designated Lab Q.C. sample and type (e.g.:MS/MSD/REP) and provide sufficient sample; (3) Field duplicates are separate sample; (4) e.g.: 40 ml/glass/H <sub>2</sub> SO <sub>4</sub> Notes to Lab: _____ _____ _____
Relinquished by: (signature)	DATE	TIME	Received by: (signature)	
Relinquished by: (signature)	DATE	TIME	Received by: (signature)	

## Appendix C

Title: Leptocheirus plumulosus survival  
File: 2838lps Transform: ARC SINE(SQUARE ROOT(Y))  
Number of Groups: 6

---

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	8827	1	1.0000	1.4588
1	8827	2	0.9500	1.3453
1	8827	3	0.9500	1.3453
1	8827	4	0.9000	1.2490
1	8827	5	0.9000	1.2490
2	8820	1	0.9000	1.2490
2	8820	2	1.0000	1.4588
2	8820	3	1.0000	1.4588
2	8820	4	0.9500	1.3453
2	8820	5	0.9000	1.2490
3	8821	1	1.0000	1.4588
3	8821	2	1.0000	1.4588
3	8821	3	1.0000	1.4588
3	8821	4	0.9500	1.3453
3	8821	5	0.8000	1.1071
4	8822	1	0.9500	1.3453
4	8822	2	1.0000	1.4588
4	8822	3	1.0000	1.4588
4	8822	4	0.9500	1.3453
4	8822	5	0.9000	1.2490
5	8823	1	0.9500	1.3453
5	8823	2	0.8500	1.1731
5	8823	3	0.9500	1.3453
5	8823	4	0.9000	1.2490
5	8823	5	1.0000	1.4588
6	8824	1	0.9500	1.3453
6	8824	2	1.0000	1.4588
6	8824	3	0.9500	1.3453
6	8824	4	1.0000	1.4588
6	8824	5	0.9000	1.2490

---

T 4/26/99

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

---

D = 0.2776

W = 0.9391

Critical W = 0.9000 (alpha = 0.01 , N = 30)

W = 0.9270 (alpha = 0.05 , N = 30)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 1.9114

(p-value = 0.8613)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 15.0863 (alpha = 0.01, df = 5)

= 11.0705 (alpha = 0.05, df = 5)

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

---

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	8827	5	1.2490	1.4588	1.3295
2	8820	5	1.2490	1.4588	1.3522
3	8821	5	1.1071	1.4588	1.3657
4	8822	5	1.2490	1.4588	1.3714
5	8823	5	1.1731	1.4588	1.3143
6	8824	5	1.2490	1.4588	1.3714

---

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

---

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	8827	0.0075	0.0868	0.0388	6.5306
2	8820	0.0110	0.1049	0.0469	7.7600
3	8821	0.0233	0.1527	0.0683	11.1794
4	8822	0.0079	0.0889	0.0397	6.4809
5	8823	0.0117	0.1084	0.0485	8.2463
6	8824	0.0079	0.0889	0.0397	6.4809

---

Title: Leptocheirus plumulosus survival

File: 2838lps

Transform:

ARC SINE(SQUARE ROOT(Y))

ANOVA Table

---

SOURCE	DF	SS	MS	F
Between	5	0.0143	0.0029	0.2475
Within (Error)	24	0.2776	0.0116	
Total	29	0.2919		

---

(p-value = 0.9370)

Critical F = 3.8951 (alpha = 0.01, df = 5,24)  
          = 2.6207 (alpha = 0.05, df = 5,24)

Since  $F < \text{Critical } F$  FAIL TO REJECT  $H_0$ : All equal (alpha = 0.05)

Title: Leptocheirus plumulosus survival  
 File: 2838lps Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	8827	1.3295	0.9400		
2	8820	1.3522	0.9500	-0.3337	
3	8821	1.3657	0.9500	-0.5331	
4	8822	1.3714	0.9600	-0.6166	
5	8823	1.3143	0.9300	0.2233	
6	8824	1.3714	0.9600	-0.6166	

Dunnett critical value = 2.3600 (1 Tailed, alpha = 0.05, df = 5,24)

Title: Leptocheirus plumulosus survival  
 File: 2838lps Transform: ARC SINE(SQUARE ROOT(Y))

Dunnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	8827	5			
2	8820	5	0.0959	10.2	-0.0100
3	8821	5	0.0959	10.2	-0.0100
4	8822	5	0.0959	10.2	-0.0200
5	8823	5	0.0959	10.2	0.0100
6	8824	5	0.0959	10.2	-0.0200

Title: Leptocheirus plumulosus reburial

File: 28381pr

Transform:

ARC SINE(SQUARE ROOT(Y))

Number of Groups: 6

---

GRP	IDENTIFICATION	REP	VALUE	TRANS VALUE
1	8827	1	1.0000	1.4588
1	8827	2	0.9500	1.3453
1	8827	3	0.9500	1.3453
1	8827	4	0.9000	1.2490
1	8827	5	0.9000	1.2490
2	8820	1	0.9000	1.2490
2	8820	2	1.0000	1.4588
2	8820	3	1.0000	1.4588
2	8820	4	0.9500	1.3453
2	8820	5	0.9000	1.2490
3	8821	1	1.0000	1.4588
3	8821	2	1.0000	1.4588
3	8821	3	1.0000	1.4588
3	8821	4	0.9500	1.3453
3	8821	5	0.8000	1.1071
4	8822	1	0.9500	1.3453
4	8822	2	1.0000	1.4588
4	8822	3	1.0000	1.4588
4	8822	4	0.9500	1.3453
4	8822	5	0.9000	1.2490
5	8823	1	0.9500	1.3453
5	8823	2	0.7500	1.0472
5	8823	3	0.9500	1.3453
5	8823	4	0.8500	1.1731
5	8823	5	1.0000	1.4588
6	8824	1	0.9500	1.3453
6	8824	2	1.0000	1.4588
6	8824	3	0.9500	1.3453
6	8824	4	0.9500	1.3453
6	8824	5	0.8500	1.1731

---

4/20/99

Title: Leptocheirus plumulosus reburial

File: 2838lpr

Transform:

ARC SINE(SQUARE ROOT(Y))

Shapiro - Wilk's Test for Normality

---

D = 0.3468

W = 0.9477

Critical W = 0.9000 (alpha = 0.01 , N = 30)

W = 0.9270 (alpha = 0.05 , N = 30)

---

Data PASS normality test (alpha = 0.01). Continue analysis.

Title: Leptocheirus plumulosus reburial

File: 2838lpr

Transform:

ARC SINE(SQUARE ROOT(Y))

Bartlett's Test for Homogeneity of Variance

---

Calculated B1 statistic = 2.7912

(p-value = 0.7321)

Data PASS B1 homogeneity test at 0.01 level. Continue analysis.

---

Critical B = 15.0863 (alpha = 0.01, df = 5)

= 11.0705 (alpha = 0.05, df = 5)

Title: Leptocheirus plumulosus reburial  
File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 1 of 2

---

GRP	IDENTIFICATION	N	MIN	MAX	MEAN
1	8827	5	1.2490	1.4588	1.3295
2	8820	5	1.2490	1.4588	1.3522
3	8821	5	1.1071	1.4588	1.3657
4	8822	5	1.2490	1.4588	1.3714
5	8823	5	1.0472	1.4588	1.2739
6	8824	5	1.1731	1.4588	1.3335

---

Title: Leptocheirus plumulosus reburial  
File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Summary Statistics on Transformed Data TABLE 2 of 2

---

GRP	IDENTIFICATION	VARIANCE	SD	SEM	C.V. %
1	8827	0.0075	0.0868	0.0388	6.5306
2	8820	0.0110	0.1049	0.0469	7.7600
3	8821	0.0233	0.1527	0.0683	11.1794
4	8822	0.0079	0.0889	0.0397	6.4809
5	8823	0.0265	0.1627	0.0728	12.7737
6	8824	0.0105	0.1023	0.0457	7.6690

---

Title: Leptocheirus plumulosus reburial

File: 28381pr

Transform:

ARC SINE(SQUARE ROOT(Y))

ANOVA Table

---

SOURCE	DF	SS	MS	F
Between	5	0.0314	0.0063	0.4350
Within (Error)	24	0.3468	0.0144	
Total	29	0.3782		

---

(p-value = 0.8196)

Critical F = 3.8951 (alpha = 0.01, df = 5,24)

= 2.6207 (alpha = 0.05, df = 5,24)

Since  $F < \text{Critical } F$  FAIL TO REJECT  $H_0$ : All equal (alpha = 0.05)

Title: Leptocheirus plumulosus reburial  
 File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Dunnnett's Test - TABLE 1 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	TRANSFORMED MEAN	MEAN CALCULATED IN ORIGINAL UNITS	TRANS T STAT	SIG 0.05
1	8827	1.3295	0.9400		
2	8820	1.3522	0.9500	-0.2985	
3	8821	1.3657	0.9500	-0.4769	
4	8822	1.3714	0.9600	-0.5517	
5	8823	1.2739	0.9000	0.7308	
6	8824	1.3335	0.9400	-0.0534	

Dunnnett critical value = 2.3600 (1 Tailed, alpha = 0.05, df = 5,24)

Title: Leptocheirus plumulosus reburial  
 File: 2838lpr Transform: ARC SINE(SQUARE ROOT(Y))

Dunnnett's Test - TABLE 2 OF 2 Ho:Control<Treatment

GROUP	IDENTIFICATION	NUM OF REPS	MIN SIG DIFF (IN ORIG. UNITS)	% OF CONTROL	DIFFERENCE FROM CONTROL
1	8827	5			
2	8820	5	0.1097	11.6	-0.0100
3	8821	5	0.1097	11.6	-0.0100
4	8822	5	0.1097	11.6	-0.0200
5	8823	5	0.1097	11.6	0.0400
6	8824	5	0.1097	11.6	0.0000

Amphipod, *Leptocheirus plumulosus*, 10 Day Survival in Sediment  
Organism Survival Data

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838

Client: Harding Lawson Associates Client Project Reference: NA

Client Sample ID: NA Sample Descriptor: NA

Laboratory Water: NA Receiving Water: NA

Test ended 4/12/99

Test Initiated: 4/2/99 12:00 JJJ

Sample Number	Replicate	No. Surviving	Initials/Date	No. Recov. on Repick	Initials/Date	Total Surviving	No. Reburied*	Remarks/Comments
8820	A	18	JJJ 4/12	—	—	18	18	2 chironomids found in 8820A. (removed) JJJ
8820	B	20	JJJ 4/12	—	—	20	20	
8820	C	<del>19</del> 20	JJJ 4/12	—	—	20	20	
8820	D	19	JJJ 4/12	—	—	19	19	1 chironomid found 8820D (removed) JJJ
8820	E	18	JJJ 4/12	—	—	18	18	

8821	A	20	JJJ 4/12	—	—	20	20	
8821	B	20	JJJ 4/12	—	—	20	20	1 nematode found (small). JJJ 8821B 4/12
8821	C	20	JJJ 4/12	—	—	20	20	
8821	D	19	JJJ 4/12	—	—	<del>20</del> 19	19	1 chironomid found. JJJ 4/12 8821D
8821	E	16	JJJ 4/12	—	—	16	16	

8822	A	19	JJJ 4/12	<del>19</del>	—	19	19	2 nematodes found 8822A JJJ 4/12
8822	B	20	JJJ 4/12	—	—	20	20	
8822	C	20	JJJ 4/12	—	—	20	20	
8822	D	19	JJJ 4/12	—	—	19	19	
8822	E	18	JJJ 4/12	—	—	18	18	1 dead found 8822E JJJ 4/12

8823	A	19	JJJ 4/12	—	—	19	19	found
8823	B	17	JJJ 4/12	—	—	17	15	found 1 dead. JJJ 4/12 8823B
8823	C	19	JJJ 4/12	—	—	19	19	
8823	D	18	JJJ 4/12	—	—	18	17	
8823	E	21	JJJ 4/12	—	—	21	21	

Comments/Notes: \* # reburied = # surviving (initial count) - # not reburied; OLW = overlying water.

Reviewed By/Date: JJJ 4/26/99

Amphipod, *Leptocheirus plumulosus*, 10 Day Survival in Sediment  
Organism Survival Data

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838  
 Client: Harding Lawson Associates Client Project Reference: NA  
 Sample ID: NA Sample Descriptor: NA  
 Laboratory Water: NA Receiving Water: NA

Test ended 4/12/99

Test Initiated: 4/2/99 12:00 J

Sample Number	Replicate	No. Surviving	Initials/Date	No. Recov. on Repick	Initials/Date	Total Surviving	No. Reburied*	Remarks/Comments
8824	A	19	JJG 4/12	—		19	19	
8824	B	20	JJG 4/12	—		20	20	
8824	C	19	JJG 4/12	—		19	19	
8824	D	20	JJG 4/12	—		20	19	
8824	E	18	JJG 4/12	—		18	17	1 dead found. JJG 4/12

8827	A	20	JJG 4/12	—		20	20	
8827	B	19	JJG 4/12	—		19	19	
8827	C	19	JJG 4/12	—		19	19	
8827	D	18	JJG 4/12	—		18	18	
8827	E	18	JJG 4/12	—		18	18	

Comments/Notes: \* # reburied = # surviving (initial count) - # not reburied; OLW = overlying water.

Reviewed By/Date: J 4/26/99



Amphipod, *Leptocheirus plumulosus*, 10 Day Survival in Sediment  
Daily Biological Monitoring

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838

Client: Harding Lawson Associates Client Project Reference: NA

Exposure Water: NA Receiving Water: NA

Sample Number	Replicate	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
8820	A	AB	AB	AB	AB	AB	AB	AB	1 on surface dead?	AB	AB	Some
8820	B								AB			molt
8820	C											or
8820	D											dead
8820	E											on
8821	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	Some
8821	B			1 dead on surface								molt
8821	C			AB								or
8821	D											dead
8821	E											on
8822	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	Some
8822	B											molt
8822	C											or
8822	D											dead
8822	E											on
8823	A	AB	AB	AB	AB	AB	AB	AB	AB	AB	AB	Some
8823	B											molt
8823	C											or
8823	D											dead
8823	E											on
8824	A	AB	AB	AB	1 in room surface	AB	AB	AB	AB	AB	AB	Some
8824	B				AB				1 on surface dead?			molt
8824	C								AB			or
8824	D			1 dead on surface								dead
8824	E			AB								on

Initials:	JJG	JJG	JJG	JJG	JJG	GC	JJG	JJG	JJG	JJG	JJG	J
Date/Time:	4/2/99 13:45	4/3/99 11:15	4/4/99 14:00	4/5/99 12:15	4/6/99 10:15	4/7/99 14:40	4/8/99 11:45	4/9/99 11:15	4/10/99 12:15	4/11/99 12:00		4/12/99 09:20

Comments/Notes: Codes: AB = all burrowed; S = swimming; F = floating; AS = avoiding sediment.

Record the number exhibiting coded behaviors. Any floaters should be resubmerged.

1 Dead on surface, may be a molt: JJG

Reviewed By/Date: J 4/26/99



# Initial Sediment Characterization

Test Facility: Aquatec Biological Sciences, South Burlington, VT Project No.: 99020 BTR No.: 02838  
 Client: Harding Lawson Associates Client Project Reference: NA  
 Sample ID: NA Sample Descriptor: NA  
 Laboratory Water: NA Receiving Water: NA

Sample Number	Sediment Visual Characterization	volume wt. (g) per sediment per replicate	volume Vol. (mL) pore water	Pore Water Characterization			
				pH	Salinity	mg/L Ammonia (✓)	Sulfide (✓)
8820	blackish, silty (fine), no organisms found	200	NS <sup>300</sup> JG	7.0	1‰	29	
8821	blackish, silty (fine) no organisms found	200	NS <sup>300</sup> JG	6.9	1‰	49	
8822	blackish-brown (fine) lumpy - some clams found (removed)	200	350	6.9	2‰	49	
8823	blackish-brown (gritty). lumpy, no organisms	200	175	7.3	1‰	5	
8824	blackish, silty (fine), no organisms found	200	350	6.9	3‰	34	
8827	dark gray, fine-gritty, watery - no organisms	200	325	7.5	20‰	7.4	

Comments/Notes: ✓ = Sample preserved for subsequent analysis. NS indicates insufficient pore water for analysis.  
 SEDIMENTS were distributed to test chambers and setup with aeration. 4/1/99 JJG  
 TEST START - 4/2/99 12:00 JJG

Entered By/Date: J Reviewed By/Date: 4/26/99



**Amphipod, Leptocheirus plumulosus, 10 Day Survival in Sediment**

**Water Chemistry Data**

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT

Project No.: 99020

BTR No.: 02838

Client: Harding Lawson Associates

Client Project Reference: NA

Laboratory Water: NA

Receiving Water: NA

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8820	pH	7.9	8.1	8.1	8.0	8.0	8.0	7.9	7.8	7.7	7.7	7.6
	DO (mg/L)	7.2	7.0	7.6	7.4	7.4	7.4	7.0	7.3	7.3	7.2	7.4
	Temp (°C)	24.8	25.1	23.0	22.4	23.7	24.7	25.4	24.4	24.5	24.3	24.1
	Salinity (‰)	19	X	X	X <sup>24.0 after temp. adjustment.</sup>	X	20	X	X	X	X	21

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8821	pH	8.1	8.1	8.1	8.0	8.0	8.0	7.9	7.8	7.7	7.6	7.5
	DO (mg/L)	7.3	7.0	7.1	6.9	6.9	7.2	6.8	7.1	7.1	7.1	7.0
	Temp (°C)	24.7	24.7	25.1	24.9	25.5	25.7	25.6	25.3	25.0	24.6	24.5
	Salinity (‰)	19	X	X	X	X	20	X	X	X	X	20

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8822	pH	8.1	8.0	8.1	8.0	8.0	8.0	7.9	7.9	7.8	7.7	7.6
	DO (mg/L)	7.3	7.1	7.1	6.9	6.9	6.8	6.8	7.1	7.1	7.0	7.1
	Temp (°C)	24.8	24.8	25.3	25.3	25.8	25.8	25.7	25.6	25.4	25.1	24.9
	Salinity (‰)	20	X	X	X	X	20	X	X	X	X	20

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8823	pH	8.0	8.1	8.1	8.0	8.1	8.1	8.0	8.0	8.1	8.0	8.0
	DO (mg/L)	7.3	6.9	7.2	6.9	7.0	6.8	6.9	7.2	7.2	7.2	7.3
	Temp (°C)	25.0	25.1	25.2	24.9	25.5	25.9	25.9	25.7	25.4	25.2	25.3
	Salinity (‰)	20	X	X	X	X	20	X	X	X	X	20

Initials/Date/ Time:	JJG 4/2/99 10:30	JJG 4/3/99 11:15	JJE 4/4/99 13:50	JJG 4/5/99 13:00	JJG 4/6/99 16:15	JJG 4/7/99 14:40	JJG 4/8/99 11:30	JJG 4/9/99 11:00	JJG 4/10/99 12:15	JJG 4/11/99 11:55	JJG 4/12/99 11:00
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Comments/Note: X = no sample required. Test temperature regulated by waterbath JJG. Turned up heater for cart with 8820, 8824, 8827 ENV heaters to increase temperature of test. 4/4/99 JJG. Adjusted heater again for same cart 4/5/99 JJG.

Reviewed By/Date: J 4/26/99

Amphipod, Leptocheirus plumulosus, 10 Day Survival in Sediment

Water Chemistry Data

Sample No.: NA

Test Facility: Aquatec Biological Sciences, South Burlington, VT

Project No.: 99020

BTR No.: 02838

Client: Harding Lawson Associates

Client Project Reference: NA

Laboratory Water: NA

Receiving Water: NA

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8824	pH	7.9	8.0	8.0	8.0	8.0	7.9	7.9	7.8	7.7	7.6	7.6
	DO (mg/L)	7.1	7.0	7.4	6.9	7.0	6.8	7.0	7.0	6.9	7.0	
	Temp (°C)	24.2	25.3	23.3	23.5	24.3	25.3	26.0	25.2	25.4	25.1	24.6
	Salinity (‰)	20	X	X	X	X	20	X	X	X	X	20

24.7 after temp. adjustment.

Sample Number	Parameter	Day										
		0	1	2	3	4	5	6	7	8	9	10
8827	pH	8.1	8.1	8.0	8.0	7.9	7.9	7.9	7.8	7.9	7.9	7.8
	DO (mg/L)	7.2	7.0	7.4	7.0	7.1	6.9	7.2	7.2	7.2	7.2	
	Temp (°C)	24.9	25.5	23.3	23.5	24.2	25.2	25.7	24.9	25.0	24.7	24.4
	Salinity (‰)	20	X	X	X	X	20	X	X	X	X	21

24.5 after temp. adjustment.

Initials/Date/ Time:	JJG 4/2/99 10:30	JJG 4/3/99 11:15	JJG 4/4/99 13:50	JJG 4/5/99 12:00	JJG 4/6/99 10:15	LS 4/7/99 1442	JJG 4/8/99 11:30	JJG 4/9/99 11:00	JJG 4/10/99 12:15	JJG 4/11/99 11:55	JJG 4/12/99
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Comments/Note: X = no sample required.

Reviewed By/Date: JJG 4/26/99



### AMMONIA ANALYSIS

Client: HLAFLA	Project #: 99020	BTR: 2838
Sample Description: Day 8 overlying water BJ		

Sample Date	Sample Description	Meter Reading (ppm NH <sub>3</sub> -N)
	check std. (ext.) T.V. = 20.0	19.0
4/10/99	8820 DAY 8	1.3
4/10	8821	6.2
4/10	8822	6.4
4/10	8823	0.10
4/10	8824	2.5
4/10	8827	1.0
	check std. T.V. = 20.0	13.0
	calibration: 5.0 ppm	3.8
	50.0 ppm	37.0
	check std. (ext.) T.V. = 20.0	20.0
	BLANK	JG < 2.0, 0.2
4/10/99	8820 DAY 8	2.6
	8821	10.0
	8822	10.0
	8823	0.2
	8824	4.3
	8827 JG	2.0
	check std. (ext.) T.V. = 20.00	21.0



Analyst: JGG	Analysis Date: 4/24/99	Reviewer: J	Review Date: 4/26/99
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### Organism Holding and Acclimation

Species: <i>Leptocheirus plumulosus</i>	Date Received: 3/31/99
	No. ordered: 750
Supplier: Chesapeake Cultures	Collection Date: 3/30/99 (Cultured)
Apparent Condition: Good	Culture ID: LP33199

**Acclimation / Holding Procedures:** Daily remove 50% L of shipping water, 20 ‰ Forty Fathoms artificial seawater. Feed algal food stock supplied with organisms. Aerate lightly. Provide 8-12h dark cycle for feeding. Hold at 25°C.

**Daily Feeding:** Several mL of algal food stock

**Monitoring:** Examine over a light box daily, record apparent condition. Temperature daily; pH, D.O, salinity.

1999 Date	Fed	Temp	pH	D.O.	Conduct.	Sal.	Hard.	Alk.	Water Chg.	Condition *	Init.
3/31 <sup>1440</sup>	✓	22.6	7.8	7.8		20			1/3 ✓	OK / N	JW
4/1	✓	25.6	7.9	7.1	—	20			1/2 ✓	NORMAL	JTG
4/2	✓	25.5	7.8	6.9	—	20				NORMAL	JTG
4/3											
4/4											

\* N = normal, appear healthy. Record # dead if any observed.

Sediment test start (Date/time/Init.) J 4/2/99 SRT test start: (Date/time/init.) 4/2/99 J.

# Chesapeake Cultures

P.O. Box 507 Hayes, Va. 23072 (804) 693-4046

## Shipment Information

Species Leptocheirus plumulosus

Date 3/30/99

Age 2-4 mm

P.O. No. Verbal

Quantity 150+

Invoice No. 3070

Temperature 22°C Salinity 20‰ pH 7.94

Rec. Conditions

Temp. 18.7°C  
D.O. > 20 mg/l

Organisms active

Sal. 20‰

pH 7.3

Notes Sediment is from pristine York River Marsh, passed through

a 250 micron sieve and subsequently frozen. No water is

added during processing. Sediment provided by Chesapeake

Cultures is from the same source as sediment used at our

facility for culturing L. plumulosus. It is the responsibility  
of the recipient to determine its suitability for testing.

Biologist ST Mone

REC  
3/31/99

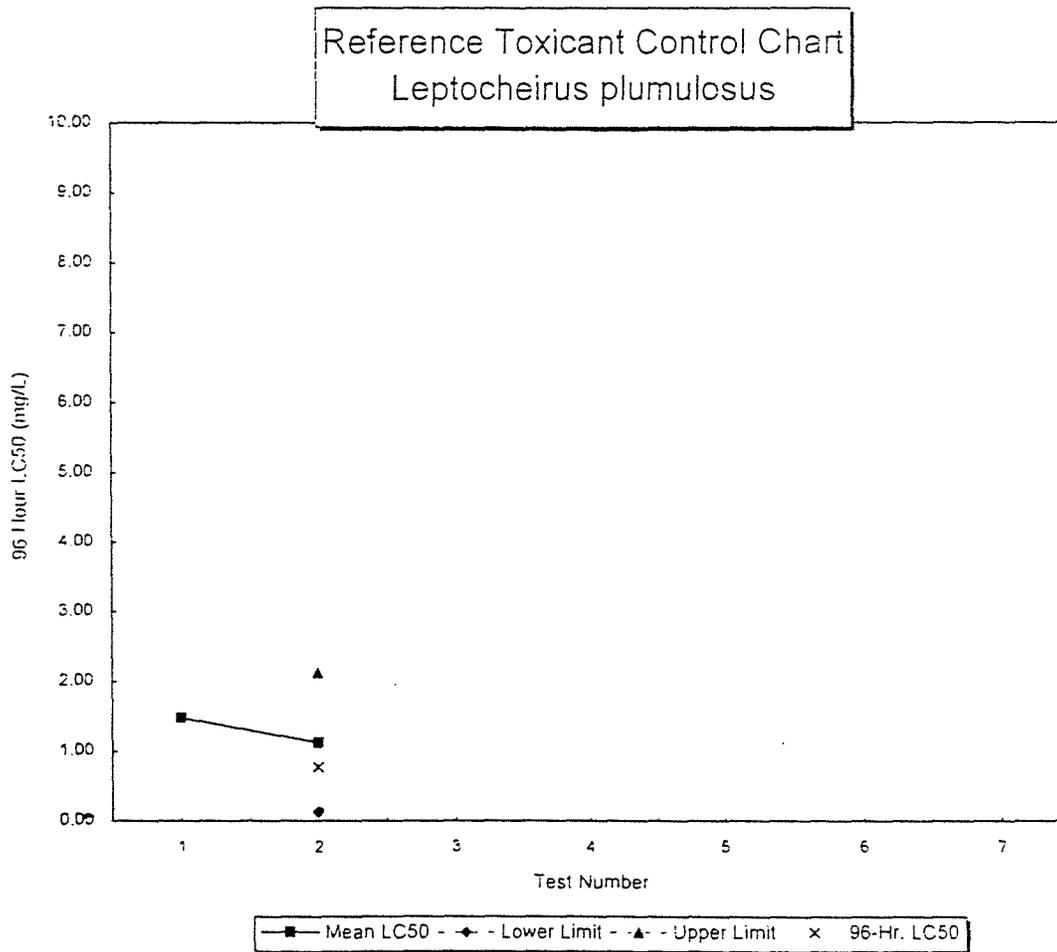
Please inspect shipment carefully upon arrival and report any problem immediately.

JW

## Appendix D

*Leptocheirus plumulosus*  
Cadmium Chloride Reference Toxicant Control Chart

TEST NUMBER	TEST DATE	96-Hr. LC50 (mg/L)	Mean LC50 (mg/L)	Lower Limit	Upper Limit	Organism Source
1	12/20/97	1.479	1.48			Chesapeake Cultures
2	04/02/99	0.772	1.13	0.13	2.13	Chesapeake Cultures
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						



KNIGHT CONSULTING ENGINEERS, INC.

P.O. BOX 29

WILLISTON, VT 05495-0029

Tele(802) 879-6343

Fax (802) 879-6376

LETTER OF TRANSMITTAL

TO: John Williams  
Aquatec Biological Services  
75 Green Mountain Drive  
South Burlington, VT 05403

DATE: April 28, 1999  
JOB NO: 99207  
RE: GENERAL TESTING

We are sending you the following items:

<u>COPIES</u>	<u>DATE</u>	<u>NO.</u>	<u>DESCRIPTION</u>
1	4-22-99	1-6	GRAIN SIZE DISTRIBUTION CURVES

REMARKS:

Signed: \_\_\_\_\_  
Robert A. Lovgren, P.E.