APPENDIX C
Water Quality and Sediment Evaluation

Water Quality and Sediment Evaluation For Inner Harbor Navigation Canal Lock Replacement Project, New Orleans, LA

Environmental Processes and Engineering Division
Environmental Laboratory
U.S. Army Engineer Research and Development Center
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Prepared for U.S. Army Engineer District, New Orleans
New Orleans, LA

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1 Introduction

1.1. Purpose

The U. S. Army Corps of Engineers, New Orleans District (CEMVN) has been authorized by Congress to replace the existing Industrial Canal Lock. A larger lock would replace the existing lock, which has been in operation since 1921, to accommodate a heavier traffic load and modern deep-draft vessels. As part of the construction project, sediment and soil from the area would be dredged to accommodate the new lock, allow ship traffic to bypass the construction site, and deepen the current channel through the Inner Harbor Navigation Canal (IHNC).

Samples of the sediment and soil that would be excavated as part of the lock replacement project have been evaluated in accordance with section 404 of the Clean Water Act. As stated in 40 Code of Federal Regulations Part 230 – *Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material*, the CEMVN must demonstrate that the proposed discharges of dredged material associated with the lock replacement project would not have unacceptable adverse impacts on the physical, chemical, and biological components of the aquatic environment. A series of tests have been performed on the proposed dredged material as described in the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual* (USEPA and USACE 1998). This document is commonly referred to as the "Inland Testing Manual" (ITM). The interpretations of the results of those tests along with an environmentally acceptable dredged material disposal plan are provided in this report.

1.2. Dredged material sampling and analysis overview

1.2.1 Dredging area

Dredging would be required to accommodate seven project features: (1) a navigable bypass channel north of the existing lock and adjacent to the new lock construction site (referred to as the “north bypass channel”), (2) the new lock construction site, (3) IHNC channel enlargement north of the new lock, (4) IHNC channel enlargement south of the new lock and north of the existing lock, (5) a navigable bypass channel adjacent to the existing lock (referred to as the “south bypass channel”), (6) existing lock demolition and IHNC channel enlargement south to the St. Claude Ave Bridge, and (7) IHNC channel enlargement south of St. Claude Ave to the Mississippi River.

Project features overlay three general sediment and soil types within the project area: (1) non-native sediment consisting of unconsolidated material that has been deposited naturally within the IHNC since it was constructed in the 1920s, (2) non-native fill consisting of material that has been placed adjacent to the IHNC for industrial development since the IHNC was constructed, and (3) native subsurface soil consisting of clays and alluvial formations at or below the depth of the original IHNC cut and underlying fill material along the banklines of the IHNC (Figure 1). In this report, project DMMU sediment and soil types (1), (2) and (3) are designated as “NN”; “F”; and “N”.

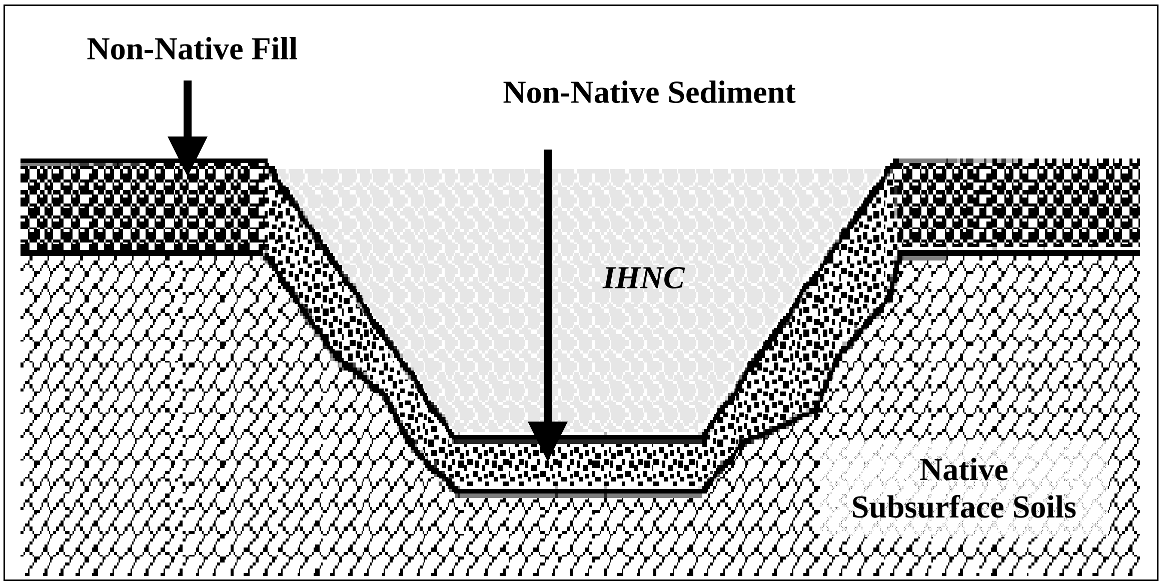


Figure 1. Conceptual cross-section of the IHNC. Vertical distribution of sediment and soil types within the IHNC Lock project area.

Project features also overlap areas impacted by industrial activities along the IHNC, including a former industrial area where contaminated soils have since been remediated. After a review of prior reports, studies, and contaminant sampling programs, suspected areas of contamination were defined within (1) a segment of the IHNC north of the Florida Ave Bridge and adjacent to a metal scrap yard, (2) a remediated industrial area, formerly known as the East Bank Industrial Area, located between the Florida and Claiborne Ave Bridges, and (3) an abandoned wharf along the west bank of the IHNC near Galvez Street. Appendix A contains a summary of contaminant reports and includes a list of suspected contaminants with analytical target detection limits developed for the IHNC Lock Replacement Project analytical program.

Based on the location and dimension of the project features and overlap with sediment types and suspected areas of contamination, the project area was divided into 11 non-native sediment dredged material management units (DMMU), four non-native fill DMMUs, and five native subsurface soil DMMUs. Two to 16 sediment samples were collected from each DMMU (depending on the size of the dredging unit) and subjected to chemical, physical, and biological tests. Table 1 details the breakdown of DMMUs into vertical and horizontal units by project feature, and Figure 2 depicts the spatial arrangement of DMMUs including individual sampling sites for each DMMU. DMMU 11 was eliminated from the sampling and analysis program after soundings determined the area was already at project depth. Results from sediment and soil tests were used to characterize each DMMU and determine acceptable disposal options for each dredging unit.

Table 1. IHNC DMMUs and associated project features.

DMMUs	Associated Project Feature
Non-Native Sediments	
DMMU 1 NN	IHNC Channel Enlargement
DMMU 2 NN	IHNC Channel Enlargement
DMMU 3 NN	New Lock Construction
DMMU 4 NN	New Lock Construction
DMMU 5 NN	New Lock Construction
DMMU 6 NN	North Bypass Channel
DMMU 7 NN	North Bypass Channel
DMMU 8 NN	IHNC Channel Enlargement
DMMU 9 NN	Lock Demolition and IHNC Channel Enlargement
DMMU 10 NN	South Bypass Channel
DMMU 11 NN	IHNC Channel Enlargement
Non-Native Fill	
DMMU 3 F	New Lock Construction
DMMU 6 F	North Bypass Channel
DMMU 7 F	North Bypass Channel
DMMU 10 F	South Bypass Channel
Native Subsurface Soils	
DMMU 3 N	New Lock Construction
DMMU 4/5 N*	New Lock Construction
DMMU 6 N	North Bypass Channel
DMMU 7 N	North Bypass Channel
DMMU 10 N	South Bypass Channel
Note that non-native sediments occur within the channel, non-native fill are located on the channel banks, and native subsurface soils underlay non-native sediments and soils. *DMMU 4/5 N underlays both DMMUs 4 NN and 5 NN.	

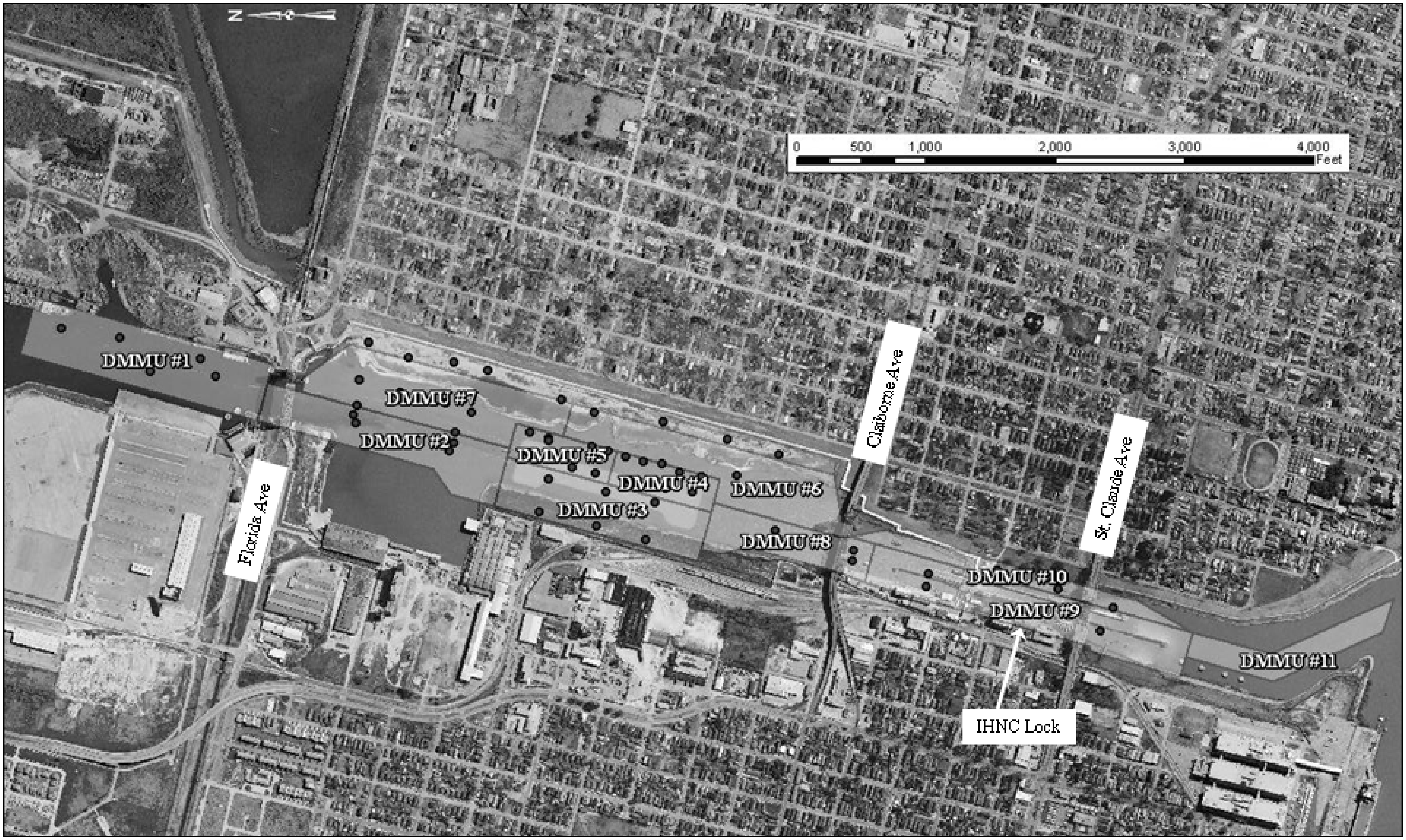


Figure 2. Plan view of the IHNC Lock Replacement Project and distribution of major DMMUs. Sediment sampling sites appear as black dots within each DMMU. Note that proposed sampling stations in DMMU 11 were below project depth, and samples were therefore not collected as part of this sediment evaluation. Native subsurface soil DMMUs (3N, 4/5N, 6N, 7N, 10N) underlay non-native sediments within the IHNC and non-native fill DMMUs on the channel banks.

1.2.2. Disposal areas

Two open-water disposal areas have been proposed for dredged material excavated as part of the lock replacement project (Figures 3 and 4). An area of deep water in the Mississippi River adjacent to the IHNC would serve as a primary disposal site. A secondary disposal site is located northeast of the IHNC in a triangular area of subsided marsh bounded by Bayou Bienvenue, an Orleans Parish sewerage treatment plant, and the 9th Ward back protection levee. Dredged material would be discharged unconfined into the Mississippi River disposal site and is expected to disperse. Material would be placed semi-confined into the secondary disposal site to create a sub-aerial platform at typical marsh elevations. It is anticipated that wetland plants would colonize this platform and that the disposal site would transform into a functioning marsh. This newly created marsh would offset or mitigate for unavoidable losses of other wetland areas associated with the lock replacement project and is therefore referred to in this report as the "mitigation site". Chemical and physical analyses were conducted on sediment and water samples representative of each disposal area to characterize the sites and for comparison to materials collected from the DMMUs. Samples were taken from within the disposal areas and from adjacent "reference" areas previously not directly impacted by dredged material placement (Mississippi River upstream of the IHNC and Saint Bernard central wetlands).

In addition, an upland confined disposal facility (CDF) has been proposed to accommodate dredged material that has either been determined by this evaluation to be unsuitable for discharge into open-water or that would be temporarily stockpiled and later utilized as backfill around the lock construction site (Figures 3 and 4). The CDF is located in an area bounded by the north bank of Bayou Bienvenue and the Chalmette Loop hurricane protection levee on the south bank of the Gulf Intracoastal Waterway (GIWW), near the intersection of the IHNC and GIWW. Discharges of effluent and runoff from the CDF would likely be routed to the GIWW or Bayou Bienvenue, and design considerations for managing these discharges have been included in this evaluation. Chemical analysis was conducted on water samples collected from the GIWW and Bayou Bienvenue to characterize potential receiving waters for effluent and runoff from the CDF. Soil samples were also collected for analysis from a reference area near the project area that was previously not directly impacted by dredged material placement (Bayou LaLoutre Ridge near Hopedale).

1.2.3. Evaluation of sediment physical and chemical properties

Physical and chemical properties of project sediments were measured to characterize and make general comparisons between DMMUs and disposal areas. Physical properties of project sediments were measured, including grain-size distribution, moisture content, and organic content. Sediments were analyzed for the presence of over 170 contaminants of concern (COC), including metals,

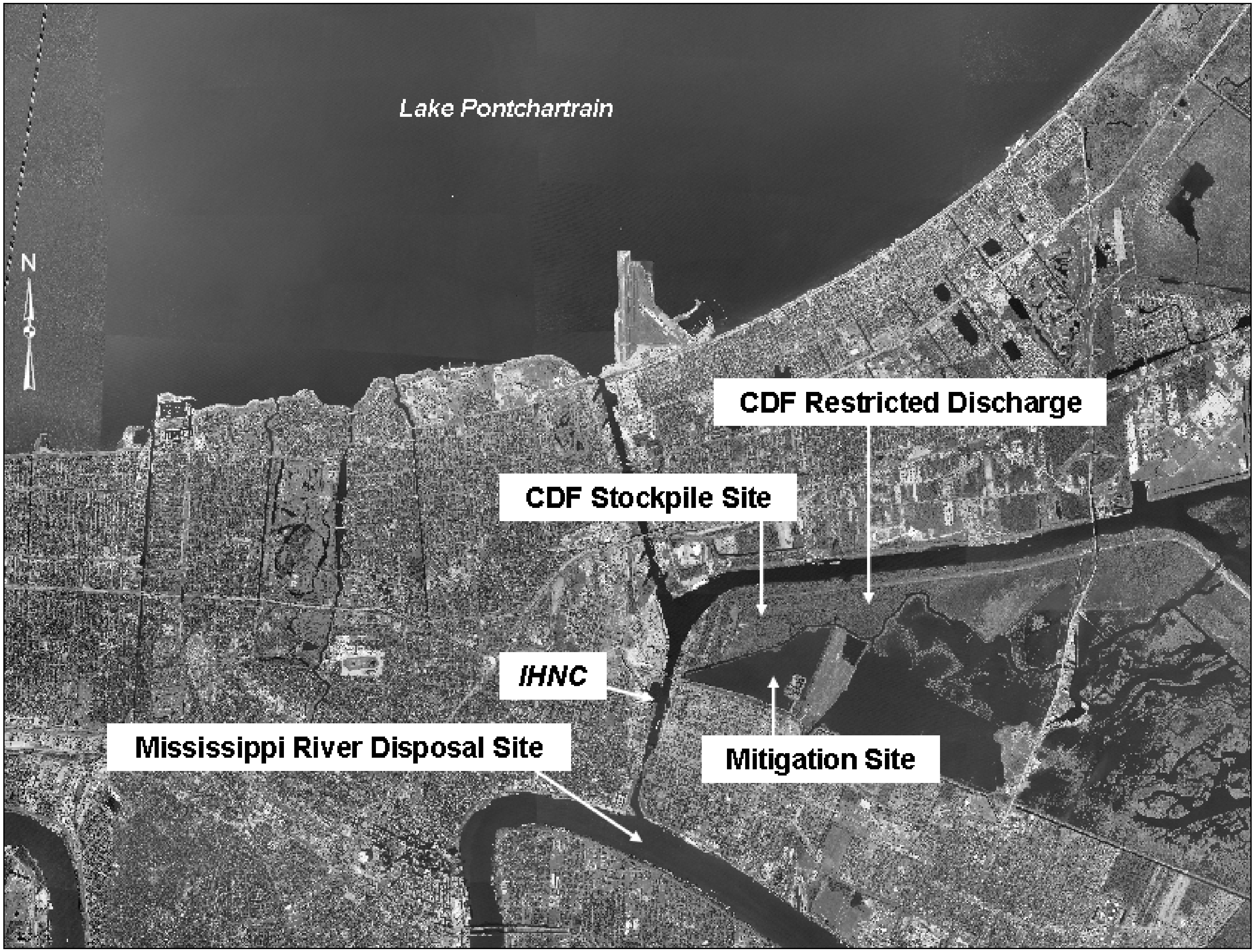


Figure 3. Proposed disposal areas.

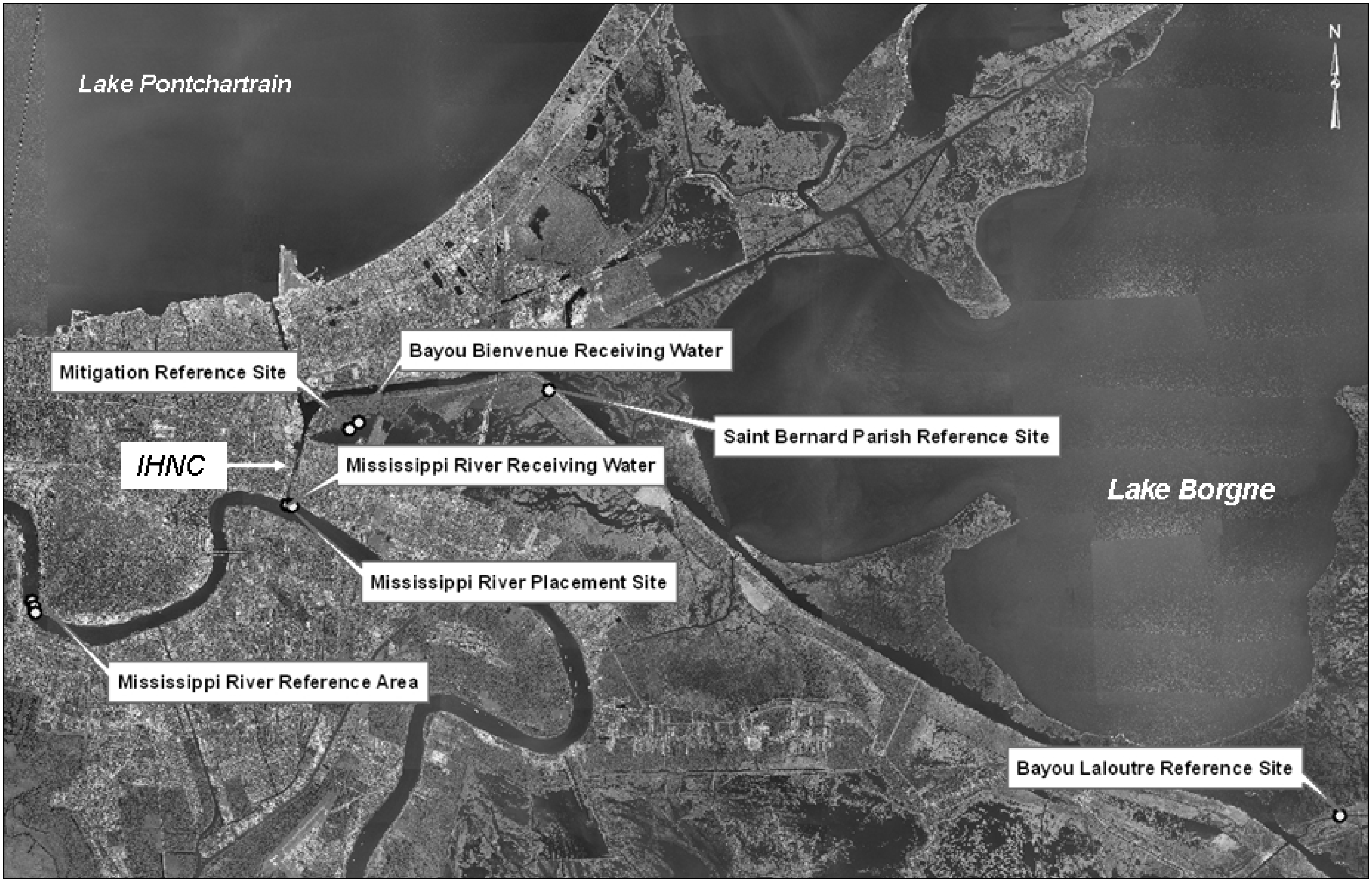


Figure 4. Disposal and reference areas sediment and water collection sites.

organotins, polychlorinated biphenyls (PCB), semi-volatiles, total petroleum hydrocarbons (TPH), pesticides, herbicides, and volatiles. Physical characterization and chemical inventories were used in the interpretation of biological tests (described below) and to identify sediment properties that may have contributed to observed adverse impacts to water column and benthic test organisms.

1.2.4. Biological evaluation

Separate freshwater and estuarine biological evaluations of water column and benthic impacts were conducted. Sediments and soils were used for the preparation of elutriates (mixture of sediment and site water representative of dredged material slurry) used in freshwater and estuarine suspended phase toxicity tests and for conducting freshwater and estuarine solid phase toxicity and bioaccumulation tests. The sediments and soils are listed and described in Table 2.

Table 2. Soils and sediments used in the biological evaluation.

Soil or Sediment	Description
DMMU 1 NN	Composite of DMMU 1 non-native sediments from 6 locations
DMMU 2 NN	Composite of DMMU 2 non-native sediments from 6 locations
DMMU 3 NN	Composite of DMMU 3 non-native sediments from 3 locations
DMMU 3 N	Composite of DMMU 3 native subsurface soils from 6 locations
DMMU 3 F	Composite of DMMU 3 non-native fill from 3 locations
DMMU 4 NN	Composite of DMMU 4 non-native sediments from 8 locations
DMMU 5 NN	Composite of DMMU 8 non-native sediments from 8 locations
DMMU 4/5 N	Composite of DMMUs 4 and 5 native subsurface soils from 15 locations
DMMU 6 NN	Composite of DMMU 6 non-native sediments from 2 locations
DMMU 6 N	Composite of DMMU 6 native subsurface soils from 6 locations
DMMU 6 F	Composite of DMMU 6 fill from 4 locations
DMMU 7 NN	Composite of DMMU 8 non-native sediments from 4 locations
DMMU 7 N	Composite of DMMU 7 native subsurface soils from 6 locations
DMMU 7 F	Composite of DMMU 7 fill from 5 locations
DMMU 8 NN	Composite of DMMU 8 non-native sediments from 4 locations
DMMU 9-1 NN	Composite of DMMU 9 non-native sediments from 1 location south of existing lock
DMMU 9-2,4 NN	Composite of DMMU 9 non-native sediments from 2 locations north of existing lock
DMMU 10 NN	DMMU 10 non-native sediments from 1 location
DMMU 10 N	Composite of DMMU 10 native subsurface soils from 2 locations
DMMU 10 F	Composite of DMMU 10 fill from 2 locations
MR	Non-native sediments from Mississippi River reference area
SB	Non-native sediments from San Bernard Parish reference area
MIT	Non-native sediments from mitigation site

1.2.5. Evaluation of water column impacts

Potential impacts to disposal area receiving waters during the placement of dredged material were assessed through comparison of elutriate concentration to water quality standards and background levels in receiving waters and through biological testing with sensitive aquatic organisms. Elutriate composites prepared for biological evaluation are listed in Table 2. Comparsion of elutriate concentration to criteria and background levels are aummarized in Appendix A of Westion Solutions (2008). Freshwater and estuarine juvenile fish were exposed to elutriates to predict any potential water column toxicity at the Mississippi River and mitigation site, respectively. Dilution requirements were determined for each elutriate COC to meet background levels, or site-specific and regulatory water quality standards. Using results from elutriate toxicity tests, site-specific dilution requirements were developed for COC that lack state or Federal water quality standards. Maximum dilution required for each DMMU to meet the above criteria at each disposal area was identified, and mixing zone models were evaluated to determine if sufficient dilution occurred within regulatory mixing zones specified by the Louisiana Department of Environmental Quality.

Elutriates from DMMUs meeting required dilutions within regulatory mixing zones were predicted not to be potentially toxic to water column organisms at a given disposal site. Typically, elutriates exceeding required dilutions beyond the mixing zone are predicted to be potentially toxic to water column organisms. When predicted, toxicity can provide a basis for eliminating disposal alternatives for a DMMU. In cases where toxicity was not observed in estuarine fish exposed to an elutriate treatment, but state or Federal water quality standards were exceeded beyond the mixing zone, DMMUs were further evaluated as a potential source of material for the mitigation site.

1.2.6. Evaluation of benthic impacts

Potential impacts to the benthos at disposal areas after placement of dredged material was assessed through direct exposure of sensitive benthic organisms to dredged material and analysis of COC bioaccumulated in tissues of organisms exposed to DMMU and disposal reference sediments. Freshwater and estuarine amphipods were exposed to DMMU and disposal area reference sediments to predict any potential benthic toxicity following dredged material placement at the Mississippi River and mitigation site. For any DMMU exposure resulting in statistically significant mortality exceeding a disposal area reference, the dredged material is predicted to be acutely toxic to benthic organisms at a given disposal site. When predicted, acute toxicity provided a basis for eliminating disposal alternatives for a DMMU. Similar statistical analysis was performed on freshwater and marine clams to compare bioaccumulation of COC in organisms exposed to DMMU and reference sediments. Where statistically significant bioaccumulation was observed, consideration was given to the concentration of the contaminant relative to U.S. Food and Drug Administration (USFDA) Action Levels (and other action or tolerance level or state advisory), the toxicological importance of the contaminant, potential for the contaminant to biomagnify, the magnitude of exceedance above the reference, and the number of COC exceeding the reference.

2 Sediment Characterization

Physical trends are presented in Table 3 and display variation in grain size, moisture content, and organic carbon content. A simple description of physical trends accompanies the table, but does not attempt to classify project sediments based on physical properties. A summary of detected COC for sediment samples is presented in Tables 4 - 19 as a range of values observed for each DMMU and individual values observed at disposal and reference areas. However, it is difficult to discern patterns in this large data set by simple review of the tables. Figures 5 - 11 display general trends among sediment and soil types within the project area and serve as a guide while reviewing sediment chemistry tables.

2.1. Physical trends

Non-native sediments can be characterized generally as fine-grained material with high moisture content. Combined clay and silt fractions were typically greater then 87%. With the exception of DMMUs 4 and 7 NN, coarse-grained material accounted for less then 12% of the sediment. DMMUs 4 and 7 NN had roughly equal proportions of sand, silt, and clay. Moisture content ranged between 37% and 58%. By weight, organic carbon content in non-native sediments was variable and ranged from 11,700 to 29,100 mg/kg of organic carbon.

Grain-size distribution in non-native fill materials was less consistent. Coarse-grained material in DMMUs 3 F and 10 F was greater then 50%, while DMMUs 6 F and 7 F had a greater percentage of fine-grained material (96% and 74%, respectively). Organic carbon content varied from 9,270 to 25,300 mg/kg for those DMMUs. Moisture content ranged between 27% and 33%. Differences in physical characteristics of fill are likely attributable to available sources of material at the time of construction or differences in construction specifications.

Native subsurface soils had fairly uniform grain size and moisture content. Combined clay and silt fractions ranged between 84% and 96%, and moisture content averaged about 38%. However, organic carbon content varied considerably (7,590 to 44,300 mg/kg). Major coarse-grained alluvial deposits were not apparent, although sand fractions were somewhat greater in DMMUs 3, 4/5, and 10 N.

There are considerable differences in physical properties of sediments in the Mississippi River and mitigation site disposal areas. Mississippi River sediments were predominantly coarse-grained (57% sand) with a lower moisture content (34%), while mitigation site sediments were predominantly fine-grained (96% clay and silt) with a high moisture content (82%). Organic carbon content was

10,300 and 164,000 mg/kg, respectively, at the Mississippi River and mitigation site.

Table 3. Physical properties of DMMUs and Reference Areas

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Moisture (%)	Organic Carbon (mg/kg)
Non-Native Sediment						
DMMU 1 NN	53.8	37.3	8.9	0	57.6	29,100
DMMU 2 NN	65.1	25.7	6	3.1	54.1	20,100
DMMU 3 NN	66.1	30.9	2.8	0.2	55.6	21,100
DMMU 4 NN	40.6	26.9	30.8	1.7	53.5	16,100
DMMU 5 NN	56	32.7	11	0.3	48.5	21,600
DMMU 6 NN	42.1	45.4	6.8	5.7	37.2	19,800
DMMU 7 NN	33.3	34.7	31.6	0.4	54	17,700
DMMU 8 NN	60.8	37.1	2.1	0	51.9	18,600
DMMU 9 NN	49.3	41.9	8.6	0.2	42.4	12,700
DMMU 10 NN	50.1	46.2	2.4	1.3	39	11,700
Non-Native Fill						
DMMU 3 F	12.4	29	57.1	1.5	26.7	10,900
DMMU 6 F	61.4	34.4	3.6	0.6	32.9	17,500
DMMU 7 F	31.6	42	16.5	9.9	29.7	25,300
DMMU 10 F	30.2	19.7	49	1.1	26.5	9,270
Native Subsurface Soil						
DMMU 3 N	43.8	40	12.2	4	35.7	33,100
DMMU 4/5 N	41.1	49	9.9	0	32.6	7,590
DMMU 6 N	59.3	36.5	3.4	0.8	39.7	26,900
DMMU 7 N	61.3	34.9	3.8	0	44.8	44,300
DMMU 10 N	46.6	43.1	10.1	0.2	34.9	12,200
Reference Areas						
Mississippi River Reference	12.4	29	57.1	1.5	33.9	10,300
Mitigation Site Reference	61.4	34.4	3.6	0.6	82	164,000

2.2. Chemical trends

2.2.1 Average concentration of metals

Sediment quality benchmarks have been developed by National Oceanic & Atmospheric Administration to serve as a quick screening tool to assess sediment quality (Buchman 1999). These benchmarks include the *Effects Range Median* (ER-M) that represents the median of chemical concentrations observed or predicted to be associated with biological effects. ER-Ms for arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc were compared to values observed at each DMMU and disposal area. Observed concentrations were standardized by the ER-M for each metal and averaged across a given DMMU or disposal area to produce an ER-M Quotient (ER-M_Q). An ER-M_Q approaching or exceeding 1.0 may potentially be associated with adverse biological effects to benthic invertebrates, while values closer to zero are expected not to be associated with adverse effects. The resulting quotients are displayed in Figure 5.
The highest ER-M_Q was observed at the mitigation site (0.47) and was influenced primarily by high concentrations of lead, mercury, silver, and zinc. There is considerable variation among non-native sediments, with ERM-$_Q$ ranging from 0.07 to 0.30. ERM-$_Q$s were above 0.2 in non-native DMMUs 2, 4, 5, and 7 NN and were influenced primarily by high concentrations of lead and zinc. ER-M_Qs were less then 0.1 for the remaining non-native and disposal reference sediments, all non-native fill material, and all native subsurface soils.

2.2.2. Chlorinated pesticides, total Aroclors, and sum PAHs

The organochlorine pesticides (DDTs), Aroclors, and semi-volatile polycyclic aromatic hydrocarbons (PAH) are classes of organic compounds that may be associated with adverse ecological effects when present in sediment at total concentrations above 7, 180, and 40,000 ppb, respectively. Sediment total organic carbon (TOC) concentration has a major influence on the bioavailability and toxicity of hydrophobic organic contaminants in sediments and soils (Rand et al. 1995). For sediments with the same bulk concentration of a hydrophobic compound, the sediment with the highest TOC content is expected to contain the lowest bioavailable fraction and lowest porewater concentration of that compound. The sediment with the higher TOC content would be associated with the lowest bioaccumulation of that compound in exposed organisms. Therefore, presentation of TOC-normalized total concentrations of hydrophobic organic contaminants in sediments provide metrics that can be used to estimate potential for bioaccumulation or potential to promote toxicity in benthic organisms exposed to these sediments. For each DMMU and reference area sediment, total concentrations of DDTs, Aroclors, and PAHs expressed as mg per kg of organic carbon are presented below (Figures 6-8).

The TOC-normalized concentration of Total-DDT (sum concentration of DDD, p,p'DDE, and p,p'DDT) in non-native sediment from DMMU 7 was about 3.5 times higher than bioavailabilty in the Mississippi River and mitigation site disposal areas. TOC-normalized concentration for all other DMMUs was comparable or below that measured for the disposal sites. Non-native sediment DMMUs 6 and 9 NN, fill DMMUs 6, 7, and 10 F, and all native DMMUs had TOC-normalized concentration of Total-DDT similar to the Saint Bernard reference sediment.

As with Total-DDT, TOC-normalized concentration of Total Aroclor in non-native sediment from DMMU 7 NN far exceeded that in the Mississippi River and mitigation site. Concentrations for non-native DMMUs 1, 2, 3, and 10 NN were 1.5 to 16 times higher then concentrations for the disposal areas. Concentrations in non-native sediment DMMUs 4, 5, 6, 8, and 9 NN, and all fill and native DMMUs were similar to that observed at the disposal areas. Aroclor concentration in non-native sediment from DMMU 5 NN and from native DMMUs 3 and 7 N were comparable to that in the Saint Bernard reference sediment.

With the exception of DMMU 6 NN, TOC-normalized concentration of Total PAHs (sum concentration of acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) was 10 to 80 times higher at non-native DMMUs compared to the Mississippi River and mitigation site. Concentrations in fill and native DMMUs were generally 1.5 to 9 times higher then in the disposal areas. Total PAH concentration for native DMMUs 3, 7, and 10 N were within ranges measured for the disposal sites and approached those for the Saint Bernard reference area.

2.2.3. Multivariate analysis

Multivariate statistical procedures are useful in identifying variation between sample sites while considering several related random variables simultaneously. Multidimensional scaling (MDS) is one such procedure that can be used to construct a two-dimensional figure depicting “distances” between sample sites based on scores for multiple variables. These distances are representative of similarities or dissimilarities between individual sample sites, with sites aligning closely on the figure having similar qualities compared to sites spaced further apart. The position of sample sites relative to the figure axes can be correlated with scores for each variable. The strength and direction of correlation provides a meaningful label for an axis, with the position of a site along an axis indicative of either a low or high score for a given variable (Manly 2000).

The MDS procedure was applied to the sediment chemistry data set to generate a table of distances between individual sampling sites, disposal areas, and reference areas based on observed concentrations of COC. Analytes that were detected or quantifiable below analytical detection limits in at least 20% of the sampling sites were selected for the analysis in an effort to minimize skewing of MDS distances by typically low and uniform values reported for non-detects. Additional standardization of COC was necessary prior to analysis to prevent analytes with larger ranges or higher overall concentrations from masking the influence of analytes typically present in lower and at less variable concentrations. The COC were grouped by contaminant class, and three separate analyses were performed to produce figures that display similarities in sites based on observed concentrations of (1) metals and cyanide, (2) semi-volatiles, and (3) PCBs, pesticides, and TPH. Figure axes were labeled based on correlation between distance coordinates for sampling sites and concentration of COC observed at the sites. Multidemensional Scaling (MDS) data and model output are given in Appendix B. For simplicity, DMMUs were grouped by sediment and soils type to focus discussion on overarching trends in the sediment chemistry data.

Figure 9 displays similarities between project sediments based on the concentration of metals and cyanide. The X-axis best describes increases in arsenic, cadmium, chromium, trivalent chromium, lead, mercury, silver, and zinc among project sediments, with correlations ranging from +0.7 to +0.9. Increases in the concentration of aluminum, beryllium, and thallium were moderately correlated (about +0.6) with the distribution of project sediments along the Y-axis. Non-native fill and native subsurface soils are clustered towards the low end of the X-axis with sediment collected from the Mississippi River disposal area and Bayou Laloutre and Saint Bernard reference areas. Two outlying fill sites set the low end of the X- and Y-axes. In contrast, there is considerable variation in the distribution of non-native sediments, with some non-native sediments clustering with native and fill materials (DMMU 6 NN) or near disposal and reference areas (DMMUs 8, 9 , and 10 NN), and others dispersed towards the high end of the X-axis. Dispersed samples with higher concentration of metals include portions of non-native DMMUs 2, 4, 5, and 7 NN. Note that sediment collected from the mitigation site sets the high end of the X-axis.

Figure 10 displays similarities between project sediments based on the concentration of semi-volatiles. Variation in the semi-volatiles data can be split into two distinct components that are highly correlated (+0.72 to +0.97) with a single axis. The X-axis is best described by increases in acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene. The Y-axis is best described by increases in 1,4-dichlorobenzene, 4-methylphenol, benzoic acid, di-n-butyl phthalate, di-n-octyl phthalate, and phenol. Non-native fill and native subsurface soils are tightly clustered towards the low end of both axes with sediment collected from the Mississippi River disposal area and Bayou Laloutre and Saint Bernard reference areas. A small cluster of outliers from two native and one fill DMMU set the low end of the scale on both axes. Similar to the metals data, there is considerable variation in the distribution of non-native sediments, but with two loosely associated clusters near the disposal and reference areas. The two non-native sediment clusters can be split along the Y-axis, with sediments from DMMUs 1, 2, 3, 5, and 8 NN having somewhat higher concentrations of semi-volatiles as compared to sediments collected from DMMUs 4, 7, 9, and 10 NN. A few outliers from non-native DMMU 4 NN set the high end of the x-axis, and sediment collected from the mitigation site sets the high end of the Y-axis.

Figure 11 displays similarities between project sediments based on the concentration of pesticides, TPH, and PCBs. The X-axis best describes increases in PCBs, DDD, DDE, DDT, and TPH-diesel, with moderate to strong correlations (+0.6 to +0.8). Increases in the concentration of gama-chlordane and DDT are moderately correlated (+0.6 and +0.5, respectively) with the distribution of project sediments along the Y-axis. Non-native fill, native subsurface soils, and non-native sediments from DMMUs 8, 9, and 10 NN form a tight cluster towards the low end of the X-axis along with sediment collected from the Mississippi River disposal area and Bayou Laloutre and Saint Bernard reference areas. There is considerable variation in the distribution of the remaining non-native sediments, with some non-native sediments associating with the cluster described above and others dispersed towards the high end of both axes. Non-native sediment from DMMUs 5 and 7 NN set the high end of the x-axis, along with sediment collected from the mitigation site. A non-native sample from DMMU 4 NN sets the high end of the Y-axis, along with sediment from the mitigation site.

Table 4. Detected metals in non-native sediments (mg/kg).

Analyte	DMMU 1 NN	DMMU 2 NN	DMMU 3 NN	DMMU 4 NN	DMMU 5 NN
Aluminum	8,200 - 13,900 (11,633)	12,400 - 15,500 (14,017)	13,600 - 20,600 (17,833)	6,050 - 16,200 (10,018)	2,190 - 16,600 (11,006)
Antimony	0.07 - 0.21 (0.14)	0.08 - 0.23 (0.13)	0.10 - 0.13 (0.12)	0.06 - 0.56 (0.18)	0.05 - 0.17 (0.11)
Arsenic	5.7 - 8.6 (7.0)	7.2 - 8.1 (7.5)	7.1 - 9.0 (8.3)	4.0 - 8.4 (6.3)	2.7 - 7.9 (6.6)
Barium	212 - 2,000 (1,211)	381 - 889 (712)	376 - 989 (752)	368 - 1,390 (1,005)	124 - 1,170 (594)
Beryllium	0.56 - 0.86 (0.75)	0.76 - 0.92 (0.87)	0.96 - 1.2 (1.1)	0.43 - 1.0 (0.67)	0.15 - 1.1 (0.75)
Cadmium	0.37 - 1.4 (0.86)	0.65 - 0.91 (0.76)	0.72 - 1.1 (0.94)	0.39 - 0.86 (0.68)	0.15 - 1.1 (0.65)
Calcium	6,530 - 8,410 (7,542)	6,400 - 23,900 (10,667)	6,280 - 10,400 (7,870)	4,190 - 10,600 (7,010)	5,850 - 10,700 (8,486)
Chromium	14.0 - 29.2 (22.1)	21.8 - 38.5 (26.5)	23.8 - 34.2 (30.7)	14.0 - 49.5 (26.7)	11.5 - 35.5 (23.0)
Copper	18.8 - 57.4 (39.2)	29.4 - 42.0 (33.9)	31.9 - 46.9 (41.6)	40.3 - 308 (100)	21.6 - 144 (59.1)
Lead	27.1 - 120 (76.6)	66.3 - 275 (128)	77.4 - 106 (92.2)	30.5 - 436 (153)	26.8 - 589 (137)
Mercury	0.06 - 0.31 (0.20)	0.16 - 0.30 (0.21)	0.16 - 0.20 (0.19)	0.05 - 0.29 (0.16)	0.04 - 0.58 (0.24)
Nickel	14.1 - 26.3 (20.5)	20.9 - 23.2 (22.4)	23.7 - 30.5 (28.2)	14.3 - 24.6 (20.2)	11.5 - 32.4 (23.2)
Selenium	1.7 - 2.6 (2.3)	2.2 - 2.5 (2.3)	1.6 - 2.0 (1.8)	0.48 - 1.4 (0.84)	0.48 - 2.2 (1.5)
Silver	0.10 - 0.41 (0.30)	0.19 - 0.25 (0.22)	0.22 - 0.38 (0.30)	0.07 - 0.33 (0.16)	0.03 - 0.25 (0.17)
Thallium	0.22 - 0.29 (0.26)	0.26 - 0.28 (0.27)	0.29 - 0.34 (0.32)	0.15 - 0.29 (0.21)	0.08 - 0.28 (0.24)
Tin	1.7 - 6.3 (3.7)	1.6 - 26.0 (6.2)	2.4 - 2.9 (2.7)	1.3 - 2.9 (2.3)	1.6 - 16.0 (4.3)
Trivalent Chromium	14.0 - 29.2 (22.1)	21.8 - 38.5 (26.5)	23.8 - 34.2 (30.7)	14.0 - 49.5 (26.7)	11.5 - 35.5 (23.0)
Zinc	56.6 - 192 (140)	99.1 - 192 (133.9)	131 - 194 (172)	130 - 284 (184)	72.6 - 577 (209)
Analyte	**DMMU 6 NN**	**DMMU 7 NN**	**DMMU 8 NN**	**DMMU 9 NN**	**DMMU 10 NN**
Aluminum	8,240 - 11,300 (9,825)	6,550 - 10,500 (8,536)	15,000 - 16,200 (15,500)	8,850 - 12,300	8,020
Antimony	0.06 - 0.11 (0.09)	0.09 - 0.13 (0.11)	0.10 - 0.14 (0.11)	0.04 - 0.07	0.09
Arsenic	4.7 - 8.2 (6.4)	3.9 - 6.4 (5.5)	6.6 - 8.1 (7.5)	6.2 - 7.5	5.7
Barium	160 - 324 (207)	151 - 189 (173)	223 - 1,070 (767)	162 - 636	158
Beryllium	0.59 - 1.1 (0.80)	0.53 - 0.93 (0.74)	0.87 - 0.93 (0.90)	0.69 - 0.84	0.75
Cadmium	0.42 - 0.64 (0.50)	0.38 - 0.61 (0.51)	0.71 - 0.95 (0.87)	0.43 - 0.72	0.73
Calcium	8,580 - 14,600 (10,953)	10,100 - 161,000 (44,660)	4,650 - 8,770 (5,968)	7.740 - 13,200	7,680
Chromium	12.5 - 16.9 (14.4)	11.2 - 19.5 (14.5)	22.2 - 32.9 (26.4)	15.8 - 23.5	19.1
Copper	19.5 - 32.9 (24.2)	13.5 - 25.8 (21.6)	28.3 - 37.4 (33.3)	21.8 - 31.7	20.3
Lead	15.6 - 46.9 (28.1)	15.9 - 80.2 (35.8)	59.0 - 102 (74.0)	26.1 - 54.0	24.3
Mercury	0.05 - 0.19 (0.09)	0.05 - 0.12 (0.09)	0.13 - 0.35 (0.21)	0.05 - 0.14	0.09
Nickel	18.3 - 26.0 (22.1)	15.4 - 24.5 (21.5)	22.7 - 25.2 (24.1)	22.9 - 25.5	24.0
Selenium	0.84 - 1.4 (1.1)	BDL - 0.84	2.0 - 2.3 (2.2)	1.1 - 1.2	0.94
Silver	0.09 - 0.10 (0.09)	0.05 - 0.11 (0.08)	0.17 - 0.34 (0.26)	0.10 - 0.23	0.16
Thallium	0.21 - 0.27 (0.24)	0.21 - 0.25 (0.23)	0.27 - 0.30 (0.29)	0.29 - 0.30	0.25
Tin	0.50 - 1.2 (0.90)	0.50 - 2.1 (1.1)	1.6 - 3.1 (2.2)	0.80 - 1.9	1.4
Trivalent Chromium	12.5 - 16.9 (14.4)	11.2 - 19.5 (14.5)	22.2 -32.9 (26.4)	15.8 - 23.5	19.1
Zinc	53.8 - 100 (70.1)	41.3 - 107 (74.2)	81.5 - 143 (124)	78.2 - 142	77.0
Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites.					

Table 5. Detected metals in non-native fill (mg/kg).

Analyte	DMMU 3 F	DMMU 6 F	DMMU 7 F	DMMU 10 F
Aluminum	3,720 - 4,910 (4,360)	8,250 - 9,220 (8,735)	5,150 - 14,300 (8,905)	1,960 - 3,600
Antimony	0.04 - 0.08 (0.06)	0.08 - 0.10 (0.09)	0.14 - 0.64 (0.35)	0.03 - 0.04
Arsenic	2.6 - 3.6 (3.1)	5.6 - 6.2 (5.9)	5.4 - 6.8 (6.2)	1.5 - 3.7
Barium	62.8 - 87.8 (78.4)	153 - 245 (199)	359 - 1,050 (746)	38.2 - 99.4
Beryllium	0.26 - 0.41 (0.33)	0.60 - 0.74 (0.67)	0.42 - 0.93 (0.68)	0.20 - 0.35
Cadmium	0.19 - 0.29 (0.25)	0.48 - 0.56 (0.52)	0.38 - 1.4 (0.93)	0.16 - 0.27
Calcium	6,030 - 9,680 (8,280)	10,700 - 11,500 (11,100)	6,650 - 41,600 (18,188)	12,700 - 52600
Chromium	6.9 - 9.2 (8.0)	11.9 - 16.5 (14.2)	15.0 - 34.1 (23.9)	4.2 - 7.1
Copper	6.0 - 7.9 (7.0)	16.6 - 21.3 (19.0)	20.8 - 54.2 (37.8)	5.3 - 12.8
Lead	9.7 - 20.2 (16.4)	13.0 - 20.1 (16.6)	43.8 - 267 (206)	14.3 - 17.8
Mercury	0.02 - 0.03 (0.02)	0.05 - 0.05 (0.05)	0.05 - 0.22 (0.15)	0.02 - 0.03
Nickel	10.7 - 15.0 (12.9)	18.2 - 21.3 (19.8)	17.8 - 24.5 (21.4)	6.0 - 14.0
Selenium	0.86 - 0.99 (0.95)	0.78 - 1.3 (1.0)	0.74 - 1.0 (0.89)	0.24 - 0.76
Silver	0.04 - 0.09 (0.06)	0.09 - 0.09 (0.09)	0.04 - 0.23 (0.16)	0.03 - 0.06
Thallium	0.10 - 0.14 (0.12)	0.23 - 0.24 (0.24)	0.14 - 0.25 (0.20)	0.09 - 0.14
Tin	0.40 - 1.1 (0.63)	0.50 - 0.90 (0.70)	1.0 - 3.6 (2.5)	0.30 - 0.53
Trivalent Chromium	6.9 - 9.2 (8.0)	11.9 - 16.5 (14.2)	15.0 - 34.1 (23.9)	4.2 - 7.1
Zinc	24.3 - 37.7 (32.0)	46.3 - 75.6 (61.0)	209 - 519 (347)	19.7 - 47.2

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites.

Table 6. Detected metals in native subsurface soil (mg/kg).

Analyte	DMMU 3 N	DMMU 4/5 N	DMMU 6 N	DMMU 7 N	DMMU 10 N
Aluminum	8,210 - 14,100 (10,630)	4,910 - 14,400 (9,969)	9,740 - 13,000 (10,740)	5,710 - 10,800 (8,189)	6,690 - 14,000 (9,323)
Antimony	0.03 - 0.09 (0.06)	0.02 - 0.08 (0.05)	0.06 - 0.11 (0.08)	0.06 - 0.12 (0.09)	0.06 - 0.08 (0.07)
Arsenic	5.2 - 7.5 (5.9)	4.2 - 9.5 (6.3)	5.4 - 6.3 (5.9)	4.8 - 7.2 (5.9)	4.1 - 6.3 (5.0)
Barium	81.8 - 179 (127)	27.7 - 362 (143)	141 - 229 (177)	148 - 191 (173)	123 - 178 (144)
Beryllium	0.57 - 1.0 (0.77)	0.32 - 1.1 (0.68)	0.68 - 1.1 (0.84)	0.60 - 1.0 (0.78)	0.53 - 0.95 (0.72)
Cadmium	0.28 - 0.47 (0.39)	0.08 - 0.65 (0.35)	0.42 - 0.69 (0.53)	0.43 - 0.64 (0.53)	0.30 - 0.68 (0.48)
Calcium	7,600 - 11,300 (9,945)	2,460 - 25,000 (12,549)	8,980 - 13,600 (11,363)	8,900 - 19,000 (12,625)	6,610 - 12,000 (9,837)
Chromium	11.5 - 20.1 (15.3)	8.9 - 22.3 (15.0)	13.6 - 18.0 (14.9)	10.4 - 15.9 (13.7)	11.7 - 26.0 (16.5)
Copper	14.3 - 21.1 (17.5)	4.8 - 33.0 (18.6)	19.6 - 27.2 (22.3)	21.0 - 28.7 (24.1)	12.2 - 21.9 (18.5)
Lead	12.3 - 21.1 (15.0)	7.4 - 35.2 (17.4)	15.1 - 19.6 (17.0)	14.0 - 34.8 (22.8)	11.4 - 24.3 (18.0)
Mercury	0.03 - 0.05 (0.04)	0.01 - 0.13 (0.05)	0.04 - 0.06 (0.05)	0.03 - 0.09 (0.05)	0.03 - 0.08 (0.05)
Nickel	16.6 - 23.7 (19.9)	6.1 - 32.1 (19.1)	19.4 - 27.9 (22.2)	20.0 - 24.4 (23.3)	18.5 - 24.9 (21.9)
Selenium	1.2 - 1.7 (1.5)	0.51 - 1.6 (0.96)	0.74 - 1.6 (1.3)	0.98 - 1.7 (1.2)	0.54 - 1.1 (0.75)
Silver	0.08 - 0.12 (0.09)	0.02 - 0.12 (0.08)	0.08 - 0.11 (0.10)	0.08 - 0.12 (0.10)	0.03 - 0.14 (0.09)
Thallium	0.19 - 0.25 (0.23)	0.11 - 0.36 (0.23)	0.24 - 0.29 (0.26)	0.23 - 0.28 (0.26)	0.19 - 0.28 (0.24)
Tin	0.50 - 2.0 (0.85)	0.20 - 0.80 (0.55)	0.40 - 0.90 (0.67)	0.60 - 0.80 (0.71)	0.50 - 1.4 (0.83)
Trivalent Chromium	11.5 - 20.1 (15.3)	8.9 - 22.3 (14.9)	13.6 - 18.0 (14.9)	10.4 - 15.9 (13.7)	11.7 - 26.0 (16.5)
Zinc	41.8 - 76.8 (53.6)	20.1 - 102 (61.0)	54.1 - 64.3 (58.1)	56.0 - 106 (74.9)	49.0 - 85.5 (67.3)

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites.

Table 7. Detected metals in reference sediments and soil (mg/kg).

Analyte	Mississippi River (MR)	Mitigation Site (MT)	Saint Bernard (SB)	Bayou Laloutre (BL)
Aluminum	6,730	12,700	13,300	7,230
Antimony	0.04	0.75	0.09	0.03
Arsenic	3.3	12.4	6.6	5.8
Barium	106	191	80.2	132
Beryllium	0.46	1.0	1.0	0.61
Cadmium	0.45	1.7	0.46	0.31
Calcium	7,970	6,090	8,230	2,100
Chromium	13.3	42.3	19.2	10.8
Copper	10.9	84.5	19.4	13.2
Lead	14.1	264	14.7	9.9
Mercury	0.03	0.73	0.06	0.04
Nickel	16.6	28.2	23.0	16.2
Selenium	0.86	3.2	3.6	0.89
Silver	0.07	1.9	0.10	0.07
Thallium	0.14	0.28	0.22	0.15
Tin	0.82	12.9	0.83	0.34
Trivalent Chromium	13.3	22.1	19.2	10.8
Zinc	45.3	292	53.7	37.3

Table 8. Detected semi-volatiles in non-native sediments (µg/kg).

Analyte	DMMU 1 NN	DMMU 2 NN	DMMU 3 NN	DMMU 4 NN	DMMU 5 NN
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL
1,2-dichlorobenzene	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	BDL - 26.0	BDL	BDL	BDL - 13.0	BDL - 14.0
2,4-Dimethylphenol	BDL	BDL - 16.0	BDL	BDL - 27.0	BDL
2-Chloronaphthalene	BDL	BDL - 66.0	BDL	BDL	BDL
2-chlorophenol	BDL	BDL - 81.0	BDL	BDL	BDL
2-Methylnapthalene	11.0 - 54.0 (27.2)	BDL - 130	8.8 - 30.0 (22.3)	20.0 - 270 (68.3)	BDL - 100
4-Methylphenol	BDL - 27.0	BDL - 11.0	BDL	BDL - 15.0	BDL - 32.0
Acenaphthene	53.0 - 190 (90.3)	32.0 - 710 (254)	99.0 - 430 (316)	80 - 1,400 (342)	11.0 - 730 (196)
Acenaphthylene	21.0 - 150 (72.7)	28.0 - 180 (76.0)	9.4 - 110 (63.5)	21.0 - 140 (55.5)	5.7 - 69.0 (40.5)
anthracene	41.0 - 300 (133)	52.0 - 760 (302)	40.0 - 500 (283)	140 - 6,300 (1,128)	18.0 - 930 (319)
Benzo(a)anthracene	88.0 - 790 (330)	120 - 640 (387)	62.0 - 1,100 (564)	320 - 4,300 (1,323)	49.0 - 470 (295)
benzo(a)pyrene	97.0 - 780 (345)	140 - 610 (358)	55.0 - 940 (495)	330 - 3,000 (1,031)	54.0 - 400 (276)
Benzo(b)fluoranthene	130 - 1,100 (460)	170 - 570 (413)	76.0 - 1,300 (679)	420 - 3,700 (1284)	74.0 - 550 (372)
Benzo(ghi)perylene	84.0 - 690 (279)	100 - 350 (213)	41.0 - 760 (390)	300 - 2,100 (754)	47.0 - 290 (197)
Benzo(k)fluoranthene	53 - 460 (178)	69.0 - 220 (155)	23.0 - 380 (201)	150 - 1,400 (479)	27.0 - 200 (138)
Benzoic acid	BDL	BDL	BDL	BDL - 41.0	BDL - 54.0
bis(2-Ethylhexyl) phthalate	220 - 2,700 (822)	110 - 290 (173)	13.0 - 290 (171)	250 - 1,700 (650)	130 - 3,400 (679)
Butyl benzyl phthalate	BDL - 95.0	BDL	BDL	BDL - 29.0	BDL - 36.0
Chrysene	120 - 1,100 (417)	140 - 650 (408)	61.0 - 1,200 (600)	370 - 4,400 (1,420)	55.0 - 520 (349)
Dibenz(a,h)anthracene	16.0 - 150 (64)	20.0 - 71.0 (50.8)	5.5 - 200 (102)	72.0 - 570 (208)	BDL - 77.0
Dibenzofuran	BDL - 45.0	BDL - 55.0	22.0 - 57.0 (42.0)	22.0 - 630 (142)	4.8 - 480 (90.1)
Diethyl Phthalate	BDL	BDL	BDL	BDL	BDL
Di-n-butyl phthalate	BDL	BDL	BDL	BDL - 50.0	BDL - 15.0
Di-n-octyl phthalate	BDL	BDL	BDL	BDL	BDL
Fluoranthene	260 - 2,200 (887)	270 - 1,800 (965)	210 - 3,600 (1,903)	990 - 13,000 (3,711)	96.0 - 1,900 (998)
Fluorene	36.0 - 110 (56.8)	24.0 - 480 (176)	61.0 - 310 (224)	69.0 - 2,100 (431)	6.8 - 990 (213)
Indeno(1,2,3-cd)pyrene	71.0 - 670 (272)	94.0 - 310 (209)	34.0 - 650 (338)	300 - 2,200 (771)	44.0 - 290 (202)
Napthalene	BDL - 50.0	BDL - 41.0	7.2 - 32.0 (21.4)	18.0 - 210 (61.6)	BDL - 50.0
Pentachlorophenol	BDL	BDL	BDL	BDL - 18.0	BDL
Phenathrene	110 - 520 (220)	120 - 1,900 (690)	170 - 1,400 (807)	230 - 9,200 (2,085)	30 - 2,500 (601)
Phenol	BDL - 25.0	BDL - 22.0	BDL	BDL - 6.1	BDL
Pyrene	270 - 1,900 (830)	350 - 1,700 (972)	180 - 2,600 (1,427)	700 - 8,000 (2,458)	120 - 1,600 (844)

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 8 cont.

Analyte	DMMU 6 NN	DMMU 7 NN	DMMU 8 NN	DMMU 9 NN	DMMU 10 NN
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	3.7
1,2-dichlorobenzene	BDL	BDL	BDL	BDL	2.5
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	4.1
1,4-Dichlorobenzene	BDL - 11.0	4.5 - 6.2 (5.5)	BDL	8.7 - 12.0	13.0
2,4-Dimethylphenol	BDL	BDL	BDL	BDL	4.1
2-Chloronaphthalene	BDL	BDL	BDL	BDL	BDL
2-chlorophenol	BDL	BDL	BDL	BDL	BDL
2-Methylnapthalene	BDL - 31.0	1.9 - 470 (96.6)	13.0 - 86.0 (41.0)	BDL - 25.0	21.0
4-Methylphenol	BDL - 7.0	2.6 - 42.0 (15.3)	BDL	BDL	6.5
Acenaphthene	BDL - 160	2.9 - 83.0 (22.1)	80.0 - 580 (288)	17.0 - 540	79.0
Acenaphthylene	BDL - 17.0	BDL - 48.0	29.0 - 50.0 (42.0)	8.2 - 71.0	12.0
anthracene	BDL - 64.0	10.0 - 58.0 (25.4)	60.0 - 230 (144)	18.0 - 460	44.0
Benzo(a)anthracene	BDL - 94.0	11.0 - 63.0 (33.0)	120 - 310 (220)	57.0 - 570	120
benzo(a)pyrene	2.9 - 85.0 (37.7)	11.0 - 66.0 (34.8)	93.0 - 250 (186)	67.0 - 390	68.0
Benzo(b)fluoranthene	3.8 - 120 (53.7)	16.0 - 69.0 (34.8)	120 - 350 (263)	110 - 620	110
Benzo(ghi)perylene	BDL - 59.0	15.0 - 62.0 (33.4)	63.0 - 150 (121)	44.0 - 220	56.0
Benzo(k)fluoranthene	1.4 - 52.0 (22.6)	BDL - 8.6	36.0 - 120 (89.8)	48.0 - 210	36.0
Benzoic acid	BDL - 29.0	22.0 - 32.0 (27.4)	BDL	BDL	31.0
bis(2-Ethylhexyl) phthalate	BDL - 80.0	30.0 - 180 (70.2)	41.0 - 150 (108)	39.0 - 99.0	190
Butyl benzyl phthalate	7.0 - 31.0 (14.5)	BDL - 220	BDL	BDL	10.0
Chrysene	BDL - 89.0	12.0 - 89.0 (38.2)	140 - 340 (258)	88.0 - 740	150
Dibenz(a,h)anthracene	BDL - 16.0	BDL - 29.0	13.0 - 45.0 (33.0)	BDL - 55.0	12.0
Dibenzofuran	BDL - 60.0	2.7 - 25.0 (8.9)	11.0 - 130 (49.0)	4.3 - 45.0	18.0
Diethyl Phthalate	BDL - 3.3	BDL	BDL	BDL	BDL
Di-n-butyl phthalate	BDL - 23.0	24.0 - 38.0 (27.4)	BDL	BDL	7.6
Di-n-octyl phthalate	BDL - 29.0	BDL - 8.1	BDL	BDL	BDL
Fluoranthene	3.1 - 290 (113)	22.0 - 94.0 (52.6)	470 - 1,400 (960)	210 - 2,800	380
Fluorene	BDL - 140	2.9 - 48.0 (14.7)	46.0 - 540 (227)	8.7 - 380	53.0
Indeno(1,2,3-cd)pyrene	BDL - 28.0	18.0 - 57.0 (32.4)	57.0 - 170 (129)	39.0 - 220	49.0
Napthalene	BDL - 36.0	2.8 - 35.0 (10.3)	10.0 - 19.0 (15.3)	BDL - 24.0	16.0
Pentachlorophenol	BDL	BDL	BDL	BDL	BDL
Phenathrene	2.2 - 310 (91.1)	9.7 - 220 (58.3)	190 - 850 (513)	29.0 - 1,200	320
Phenol	BDL - 9.8	BDL - 11.0	BDL	BDL	6.9
Pyrene	3.0 - 180 (76.8)	17.0 - 120 (57.0)	330 - 870 (645)	310 - 2,200	350

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 9. Detected semi-volatiles in non-native fill (µg/kg).

Analyte	DMMU 3 F	DMMU 6 F	DMMU 7 F	DMMU 10 F
1,4-Dichlorobenzene	BDL	BDL	8.1 - 15.0 (12.8)	8.9
2,4-Dimethylphenol	BDL	BDL	BDL - 16.0	BDL
2-Methylnapthalene	BDL	BDL	15.0 - 49.0 (32.0)	BDL - 3.5
4-Methylphenol	BDL	BDL	BDL - 20.0	BDL - 3.4
Acenaphthene	2.8 - 6.3 (4.7)	BDL	92.0 - 290 (171)	1.7 - 6.6
Acenaphthylene	BDL - 2.9	BDL	61.0 - 250 (130)	BDL - 4.5
anthracene	5.9 - 13.0 (8.5)	BDL - 4.1	160 - 420 (330)	BDL - 5.6
Benzo(a)anthracene	16.0 - 31.0 (23.3)	4.8 - 24.0 (14.4)	320 - 840 (575)	8.0 - 160
benzo(a)pyrene	16.0 - 29.0 (22.0)	7.2 - 30.0 (18.6)	370 - 1,200 (703)	7.4 - 180
Benzo(b)fluoranthene	23.0 - 38.0 (29.3)	8.1 - 38.0 (23.1)	500 - 1,600 (970)	10.0 - 230
Benzo(ghi)perylene	16.0 - 28.0 (21.3)	BDL - 29.0	160 - 800 (475)	BDL - 150
Benzo(k)fluoranthene	8.2 - 12.0 (10.4)	2.9 - 12.0 (7.5)	BDL - 680	BDL - 87.0
Benzoic acid	BDL	BDL	44.0 - 73.0 (55.3)	4.9
bis(2-Ethylhexyl) phthalate	BDL - 9.8	10.0 - 22.0 (16.0)	88.0 - 1,100 (512)	22.0 - 23.0
Butyl benzyl phthalate	BDL	BDL - 12.0	BDL - 40.0	5.5 - 5.7
Chrysene	20.0 - 29.0 (23.7)	4.5 - 29.0 (16.8)	370 - 1,000 (705)	8.7 - 160
Dibenz(a,h)anthracene	2.4 - 7.0 (4.4)	BDL - 5.1	74.0 - 210 (133)	BDL - 34.0
Dibenzofuran	1.9 - 3.4 (2.6)	BDL	17.0 - 80.0 (51.0)	1.8 - 33.0
Di-n-butyl phthalate	BDL	BDL	BDL - 49.0	BDL
Di-n-octyl phthalate	BDL - 3.2	BDL	BDL	BDL - 3.9
Fluoranthene	54.0 - 63.0 (58.0)	6.7 - 47.0 (26.9)	860 - 3,600 (2,165)	11.0 - 170
Fluorene	3.6 - 7.1 (5.2)	BDL	58.0 - 210 (128)	BDL - 3.6
Indeno(1,2,3-cd)pyrene	13.0 - 23.0 (17.7)	21.0 - 53.0 (37.0)	180 - 810 (485)	BDL - 150
Napthalene	BDL - 2.4	BDL	16.0 - 66.0 (36.3)	2.1 - 4.1
N-Nitrosodiphenylamine	BDL	BDL	BDL - 540	BDL
Phenathrene	29.0 - 44.0 (35.0)	2.0 - 13.0 (7.5)	220 - 720 (565)	7.0 - 42.0
Phenol	BDL	BDL	BDL - 7.9	BDL - 2.4
Pyrene	35.0 - 49.0 (40.0)	6.2 - 52.0 (29.1)	910 - 3,300 (1,953)	14.0 - 190

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 10. Detected semi-volatiles in native subsurface soil (µg/kg).

Analyte	DMMU 3 N	DMMU 4/5 N	DMMU 6 N	DMMU 7 N	DMMU 10 N
1,2,4-Trichlorobenzene	BDL	BDL	BDL	BDL	BDL - 5.9
1,2-dichlorobenzene	BDL	BDL - 130	52.0 - 110 (84.0)	96.0 - 440 (157)	BDL
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL - 2.0
1,4-Dichlorobenzene	BDL	BDL - 14.0	BDL - 7.9	5.1 - 19.0 (10.4)	8.0 - 14.0 (10.2)
2,4-Dimethylphenol	BDL	BDL	BDL - 2.8	BDL - 1.9	BDL - 4.4
2,6-Dinitrotoluene	BDL	BDL	BDL	BDL - 14.0	BDL
2-chlorophenol	BDL	BDL - 50.0	7.3 - 110 (66.2)	12.0 - 300 (95.9)	BDL
2-Methylnapthalene	BDL	BDL - 7.4	BDL - 110	BDL - 390	BDL - 29.0
4-Methylphenol	BDL	BDL - 5.9	BDL - 15.0	BDL - 11.0	5.0 - 14.0 (8.3)
Acenaphthene	BDL - 4.4	BDL - 23.0	BDL - 190	1.7 - 45.0 (12.0)	2.2 - 400 (134.9)
Acenaphthylene	BDL	BDL - 4.6	BDL - 4.1	BDL - 5.8	BDL - 14.0
anthracene	BDL - 3.1	BDL - 220	BDL - 30.0	BDL - 22.0	BDL - 70.0
Benzo(a)anthracene	BDL - 7.3	BDL - 62.0	BDL - 19.0	BDL - 40.0	BDL - 99.0
benzo(a)pyrene	BDL - 7.8	BDL - 60.0	BDL - 10.0	BDL - 44.0	BDL - 51.0
Benzo(b)fluoranthene	BDL - 10.0	BDL - 74.0	BDL - 28.0	3.5 - 38.0 (16.6)	7.4 - 76.0 (31.5)
Benzo(ghi)perylene	BDL - 2.2	BDL - 46.0	BDL - 20.0	BDL - 43.0	BDL - 50.0
Benzo(k)fluoranthene	BDL - 3.2	BDL - 28.0	BDL - 9.4	BDL - 12.0	BDL - 26.0
Benzoic acid	BDL	BDL - 21.0	BDL - 32.0	7.1 - 41.0 (21.6)	6.0 - 18.0 (12.3)
bis(2-Ethylhexyl) phthalate	BDL - 9.6	BDL - 66.0	BDL - 64.0	16.0 - 75.0 (30.7)	11.0 - 76.0 (34.0)
Butyl benzyl phthalate	BDL - 17.0	BDL - 13.0	BDL - 150	BDL - 150	BDL - 12.0
Chrysene	BDL - 4.5	BDL - 72.0	BDL - 22.0	BDL - 63.0	6.0 - 100 (37.4)
Dibenz(a,h)anthracene	BDL	BDL - 15.0	BDL	BDL	BDL - 12.0
Dibenzofuran	BDL	BDL - 18.0	BDL - 110	2.3 - 7.3 (3.7)	2.4 - 28.0 (11.0)
Diethyl Phthalate	BDL	BDL	BDL - 3.3	BDL	BDL - 3.0
Di-n-butyl phthalate	BDL	BDL - 12.0	BDL - 28.0	7.0 - 29.0 (15.7)	5.4 - 6.3 (6.0)
Di-n-octyl phthalate	BDL - 2.6	BDL	BDL - 40.0	BDL - 19.0	BDL - 4.6
Fluoranthene	3.5 - 20.0 (9.6)	BDL - 170	BDL - 120	BDL - 110	7.8 - 850 (289)
Fluorene	BDL - 2.7	BDL - 60.0	BDL - 140	BDL - 35.0	2.3 - 240 (81.5)
Indeno(1,2,3-cd)pyrene	BDL - 3.8	BDL - 50.0	BDL - 11.0	BDL - 26.0	BDL - 41.0
Isophorone	BDL	BDL - 11.0	BDL	BDL - 7.2	BDL
Napthalene	BDL	BDL - 6.1	BDL - 150	BDL - 32.0	1.7 - 28.0 (10.7)
Phenathrene	2.2 - 8.3 (4.9)	8.5 - 130 (39.4)	BDL - 290	5.1 - 130 (31.0)	7.7 - 1,500 (506)
Phenol	BDL	BDL - 4.7	BDL - 5.7	BDL - 7.9	2.4 - 7.2 (4.1)
Pyrene	2.7 - 15.0 (7.3)	BDL - 120	BDL - 67.0	BDL - 120	9.0 - 550 (190)

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 11. Detected semi-volatiles in reference sediments and soil (µg/kg).

Analyte	Mississippi River (MR)	Mitigation Site (MT)	Saint Bernard (SB)	Bayou Laloutre (BL)
1,2-dichlorobenzene	60.0	170	BDL	BDL
2-chlorophenol	42.0	1,300	110	12.0
2-Methylnapthalene	2.40	27.00	BDL	BDL
Acenaphthene	1.9	BDL	BDL	BDL
Acenaphthylene	BDL	110	BDL	BDL
anthracene	2.8	91.0	BDL	BDL
Benzo(a)anthracene	7.4	180	BDL	BDL
benzo(a)pyrene	8.9	210	BDL	BDL
Benzo(b)fluoranthene	BDL	320	BDL	BDL
Benzo(ghi)perylene	4.60	280	BDL	BDL
Benzo(k)fluoranthene	BDL	110	BDL	BDL
bis(2-Ethylhexyl) phthalate	9.6	170	15.0	BDL
Butyl benzyl phthalate	BDL	350	BDL	BDL
Chrysene	9.2	220	BDL	BDL
Dibenz(a,h)anthracene	BDL	57.0	BDL	BDL
Fluoranthene	16.0	410	BDL	BDL
Fluorene	2.0	BDL	BDL	BDL
Indeno(1,2,3-cd)pyrene	5.9	200	BDL	BDL
Napthalene	2.20	BDL	BDL	BDL
Phenathrene	8.7	130	BDL	BDL
Pyrene	9.5	280	BDL	BDL
BDL = Below Detection Limit.				

Table 12. Detected pesticides, PCBs, and TPH in non-native sediment (µg/kg) unless otherwise noted.

Analyte	DMMU 1 NN	DMMU 2 NN	DMMU 3 NN	DMMU 4 NN	DMMU 5 NN
Aldrin	BDL - 14.0	BDL - 10.0	BDL - 0.39	BDL - 10.0	BDL - 13.0
alpha-BHC	BDL	BDL - 4.2	BDL	BDL	BDL - 0.66
alpha-chlordane	BDL - 17.0	BDL	BDL	BDL - 36.0	BDL
beta-BHC	BDL - 27.0	BDL - 23.0	BDL	BDL	BDL
DDD	5.3 - 36.0 (19.5)	8.2 - 27.0 (16.4)	13.0 - 29.0 (22.0)	BDL - 17.0	3.2 - 66.0 (17.8)
DDE	1.6 - 14.0 (6.5)	2.3 - 7.1 (4.4)	5.0 - 9.4 (7.6)	BDL - 8.2	BDL - 15.0
delta-BHC	BDL - 4.4	BDL	BDL	BDL - 4.2	BDL - 6.1
Dieldrin	BDL	BDL	BDL	BDL - 9.5	BDL - 2.4
endosulfan I	BDL	BDL - 1.2	BDL	BDL	BDL
Endosulfan II	BDL - 22.0	BDL	BDL	BDL	BDL
Endosulfan Sulfate	BDL - 16.0	BDL - 7.0	BDL - 5.1	BDL - 5.8	BDL - 6.5
Endrin aldehyde	BDL	BDL	BDL	BDL	BDL
gamma-chlordane	3.0 - 25.0 (9.9)	2.5 - 7.9 (4.7)	3.2 - 6.5 (4.6)	BDL - 260	BDL - 8.6
Heptachlor	BDL - 7.5	BDL - 0.85	BDL	BDL	BDL
Heptachlor epoxide	BDL - 9.2	BDL	BDL	BDL - 15.0	BDL - 5.4
Lindane	0.59 - 5.1 (2.5)	BDL - 2.5	BDL - 9.5	BDL - 7.6	BDL - 4.4
Methoxychlor	6.9 - 41.0 (21.2)	10.0 - 20.0 (14.8)	BDL - 16.0	BDL	BDL - 4.5
PCB-1016	BDL	BDL	BDL	BDL - 29.0	BDL
PCB-1248	28.0 - 200 (98)	24.0 - 93.0 (60.5)	48.0 - 87.0	BDL - 150	BDL - 260
PCB-1254	BDL - 250	39.0 - 140 (92.5)	71.0 - 100 (86.3)	BDL - 180	BDL - 260
PCB-1260	BDL - 130	BDL - 27.0	BDL	BDL - 150	BDL - 180
Total PCB	49.0 - 450 (198)	91.0 - 230 (159)	120 - 190 (150)	BDL - 420	BDL - 710
TPH-Diesel* (mg/kg)	22.0 - 88.0 (50.5)	15.0 - 270 (118)	370 - 570 (477)	58.0 - 2,100 (709)	230 - 1,000 (476)
TPH-Gasoline	54.0 - 150 (102)	89 - 59,000 (10,004)	180 - 260 (217)	54.0 - 2,600 (652)	48.0 - 1,200 (291)

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 12 cont

Analyte	DMMU 6 NN	DMMU 7 NN	DMMU 8 NN	DMMU 9 NN	DMMU 10 NN
Aldrin	BDL - 3.0	2.0 - 11.0 (6.6)	BDL - 9.2	BDL	6.1
alpha-BHC	BDL	BDL	BDL - 3.9	BDL	BDL
alpha-chlordane	BDL - 3.1	BDL	BDL	BDL	BDL
beta-BHC	BDL	BDL	BDL - 10.0	BDL	BDL
DDD	BDL - 2.8	BDL - 5.4	8.3 - 16.0 (13.3)	BDL - 1.6	3.4
DDE	BDL - 0.6	BDL - 1.3	2.8 - 4.3 (3.7)	BDL - 0.60	3.1
delta-BHC	0.39 - 3.6 (1.8)	0.92 - 2.7 (1.9)	BDL	BDL	1.6
Dieldrin	BDL - 1.5	BDL	BDL	BDL	1.9
endosulfan I	BDL	BDL	BDL	BDL	BDL
Endosulfan II	BDL - 2.5	BDL - 5.6	BDL	BDL	1.7
Endosulfan Sulfate	BDL - 4.0	BDL - 4.4	BDL - 4.3	BDL	BDL
Endrin aldehyde	BDL	BDL - 2.7	BDL	BDL	BDL
gamma-chlordane	BDL - 0.83	BDL	1.7 - 4.3 (3.3)	BDL	BDL
Heptachlor	BDL - 0.56	BDL	BDL	BDL	BDL
Heptachlor epoxide	BDL - 1.1	BDL - 1.5	BDL	BDL	BDL
Lindane	BDL - 0.35	BDL - 1.0	BDL - 4.9	BDL	1.3
Methoxychlor	BDL	BDL	3.6 - 18.0 (11.9)	BDL	BDL
PCB-1016	BDL	BDL	BDL	BDL	BDL
PCB-1248	BDL - 20.0	BDL	11.0 - 52.0 (39.3)	BDL - 10.0	17.0
PCB-1254	BDL	BDL	BDL - 82.0	BDL - 14.0	BDL
PCB-1260	BDL - 83.0	BDL - 27.0	BDL - 45	BDL	22.0
Total PCB	BDL - 83.0	BDL - 27.0	22.0 - 130 (83.3)	BDL - 24.0	39.0
TPH-Diesel* (mg/kg)	49.0 - 170 (83.0)	55.0 - 690 (219)	18.0 - 120 (47.8)	45.0 - 550	17.0
TPH-Gasoline	41.0 - 85.0 (70.8)	80.0 - 260 (118)	120 - 1,800 (563)	55.0 - 140	83.0

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 13. Detected pesticides, PCBs, and TPH in non-native fill (µg/kg) unless otherwise noted.

Analyte	DMMU 3 F	DMMU 6 F	DMMU 7 F	DMMU 10 F
Aldrin	BDL - 0.39	BDL - 0.6	BDL - 34.0	1.7 - 2.0
alpha-chlordane	BDL	BDL	BDL - 56.0	BDL
beta-BHC	BDL - 6.5	BDL	BDL - 180	BDL
DDD	1.8 - 1.9 (1.9)	BDL - 20.0	BDL - 25.0	BDL - 0.40
DDE	1.3 - 5.7 (2.9)	BDL	BDL - 14.0	BDL
delta-BHC	1.0 - 3.7 (2.6)	0.67 - 2.3 (1.5)	BDL - 6.2	0.47 - 0.55
Dieldrin	BDL - 1.0	BDL	BDL - 32.0	BDL
Endosulfan II	BDL	BDL	BDL	0.74
Endosulfan Sulfate	BDL	BDL - 3.3	BDL - 17.0	BDL
Endrin	BDL	BDL	BDL - 10.0	BDL
Endrin aldehyde	BDL - 1.7	BDL	BDL - 4.1	BDL
gamma-chlordane	BDL - 0.93	BDL - 12.0	BDL - 27.0	BDL
Heptachlor epoxide	BDL	BDL - 11.0	BDL - 7.2	BDL
Lindane	BDL - 1.0	BDL	1.9 - 14.0 (6.6)	BDL - 0.28
PCB-1232	BDL	BDL	BDL - 2,300	BDL
PCB-1254	BDL	BDL - 430	BDL - 93.0	BDL
PCB-1260	BDL	BDL	BDL - 540	BDL
Total PCB	BDL	BDL - 430	BDL - 2,800	BDL
TPH-Diesel* (mg/kg)	44.0 - 100 (67.7)	18.0 - 160 (89.0)	170 - 1,300 (510)	19.0 - 110
TPH-Gasoline	42.0 - 46.0 (43.3)	48.0 - 100 (74.0)	82.0 - 1,000 (371)	BDL - 61.0

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 14. Detected pesticides, PCBs, and TPH in native subsurface soil (µg/kg) unless otherwise noted.

Analyte	DMMU 3 N	DMMU 4/5 N	DMMU 6 N	DMMU 7 N	DMMU 10 N
Aldrin	BDL - 4.0	0.88 - 21.0 (8.6)	BDL - 2.5	BDL - 7.2	3.8 - 10.0 (6.0)
alpha-chlordane	BDL	BDL	BDL	BDL - 1.7	BDL
beta-BHC	BDL - 1.1	BDL	BDL	BDL	BDL
DDD	BDL - 8.8	BDL - 2.6	BDL - 3.0	BDL - 8.1	0.50 - 1.9 (1.2)
DDE	BDL - 1.1	BDL - 0.20	BDL	BDL - 2.2	BDL - 1.4
delta-BHC	BDL - 7.2	BDL	BDL - 3.9	BDL - 1.8	BDL - 1.1
Dieldrin	BDL - 4.3	BDL - 0.56	BDL	BDL - 3.6	BDL
endosulfan I	BDL - 1.6	BDL - 57.0	BDL	BDL	BDL
Endosulfan II	BDL - 1.4	BDL - 2.0	BDL - 6.6	BDL - 15.0	0.71 - 2.1 (1.26)
Endosulfan Sulfate	BDL - 20.0	BDL - 0.34	BDL	BDL	BDL - 0.35
Endrin	BDL - 2.9	BDL	BDL	BDL - 1.2	BDL - 0.63
Endrin aldehyde	BDL - 9.4	BDL - 0.51	BDL	BDL	BDL
gamma-chlordane	BDL - 0.26	BDL - 2.0	BDL	BDL - 3.5	BDL
Heptachlor	BDL - 3.3	BDL	BDL	BDL	BDL
Heptachlor epoxide	BDL - 1.2	BDL - 1.4	BDL - 0.5	BDL	BDL
Lindane	BDL - 2.5	BDL - 2.0	BDL - 1.0	BDL - 0.79	0.34 - 0.68 (0.52)
PCB-1016	BDL	BDL - 6.3	BDL	BDL	BDL
PCB-1248	BDL	BDL - 27.0	BDL	BDL	BDL
PCB-1254	BDL	BDL - 50.0	BDL	BDL	BDL
PCB-1260	BDL - 1.3	BDL - 3.4	BDL	BDL - 6.6	BDL
Total PCB	BDL - 1.3	BDL - 50.0	BDL	BDL - 6.6	BDL
TPH-Diesel* (mg/kg)	14.0 - 190 (64.0)	BDL	BDL	BDL	5.0 - 39.0 (20.7)
TPH-Gasoline	44.0 - 95.0 (66.8)	BDL	BDL	BDL	BDL - 120

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 15. Detected pesticides, PCBs, and TPH in reference sediments and soil (µg/kg).

Analyte	Mississippi River (MR)	Mitigation Site (MT)	Saint Bernard (SB)	Bayou Laloutre (BL)
DDD	BDL	BDL	BDL	0.16
DDE	0.79	31.0	BDL	0.17
delta-BHC	BDL	BDL	11.00	3.40
Endrin	3.40	29.0	4.9	0.89
PCB-1248	BDL	240	BDL	BDL
PCB-1260	5.1	130	BDL	BDL
Total PCB	5.1	370	BDL	BDL

BDL = Below Detection Limit.

Table 16. Other detected analytes in non-native sediment (µg/kg) unless otherwise noted.

Analyte	DMMU 1 NN	DMMU 2 NN	DMMU 3 NN	DMMU 4 NN	DMMU 5 NN
Dibutyltin	BDL - 3.3	BDL	BDL	BDL - 11.0	BDL - 7.3
Tributyltin	BDL - 16.0	BDL	BDL - 3.8	BDL - 80.0	BDL - 6.6
Cyanide* (mg/kg)	BDL - 0.49	BDL - 3.6	BDL - 7.3	BDL - 4.7	BDL - 2.0
NH4-N* (mg/kg)	176 - 328 (248)	139 - 278 (221)	263 - 288 (278)	57.8 - 382 (184)	5.1 - 256 (119)
Dalapon	BDL	BDL	BDL	BDL - 25.0	BDL
Dichloroprop	BDL - 35.0	BDL	BDL - 76.0	BDL - 100	BDL
Dinoseb	BDL	BDL	BDL - 7.7	BDL - 4.7	BDL
2-Butanone	BDL	BDL	BDL	BDL - 2.5	BDL
Acetone	BDL - 20.0	BDL - 27.0	BDL	BDL - 19.0	BDL - 38.0
Benzene	BDL	BDL - 120	BDL	BDL	BDL
Bromodichloromethane	BDL	BDL	BDL	BDL - 4.2	BDL
Carbon disulfide	BDL	BDL	BDL	BDL - 3.3	BDL
Chlorobenzene	BDL	BDL - 27,000	BDL	BDL	BDL
Chloroform	BDL	BDL	BDL	BDL - 34.0	BDL
Ethylbenzene	BDL	BDL	BDL	BDL - 7.0	BDL
isopropylbenzene	BDL	BDL	BDL	BDL - 8.8	BDL
Methylene chloride	3.0 - 4.7 (3.9)	BDL - 5.0	5.0 - 6.1 (5.7)	2.5 - 6.9 (4.8)	3.3 - 11.0 (5.6)
n-Propylbenzene	BDL	BDL	BDL	BDL - 2.1	BDL
Analyte	**DMMU 6 NN**	**DMMU 7 NN**	**DMMU 8 NN**	**DMMU 9 NN**	**DMMU 10 NN**
Dibutyltin	BDL	BDL	BDL	BDL	2.3
Tributyltin	BDL	BDL	BDL - 3.0	BDL	BDL
Cyanide* (mg/kg)	BDL	BDL	BDL - 0.28	BDL - 22.5	BDL
NH4-N* (mg/kg)	36.4 - 84.2 (54.5)	74.2 - 120 (89.6)	16.1 - 282 (116)	130 - 250	237
Dalapon	BDL	BDL	BDL	BDL	BDL
Dichloroprop	BDL	BDL	BDL - 21.0	BDL - 130	BDL
Dinoseb	BDL	BDL	BDL	BDL	BDL
2-Butanone	BDL	BDL	BDL	BDL	BDL
Acetone	BDL - 29.0	7.7 - 23.0 (16.5)	BDL	BDL	12.0
Benzene	BDL	BDL	BDL	BDL	BDL
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL
Carbon disulfide	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	BDL	BDL	BDL	BDL	BDL
Chloroform	BDL	BDL	BDL	BDL	BDL
Ethylbenzene	BDL	BDL	BDL	BDL	BDL
isopropylbenzene	BDL	BDL	BDL	BDL	BDL
Methylene chloride	BDL - 67.0	BDL	2.9 - 3.5 (3.3)	2.6 - 4.0	BDL
n-Propylbenzene	BDL	BDL	BDL	BDL	BDL

Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected.
BDL = Below Detection Limit.

Table 17. Other detected analytes in non-native fill (µg/kg) Unless otherwise noted.

Analyte	DMMU 3 F	DMMU 6 F	DMMU 7 F	DMMU 10 F
Dibutyltin	BDL	BDL	BDL - 67.0	BDL
Monobutyltin	BDL	BDL	BDL - 15.0	BDL
Tributyltin	BDL	BDL	BDL - 4.1	BDL
Cyanide* (mg/kg)	BDL - 0.21	BDL	BDL - 10.2	BDL
NH4-N* (mg/kg)	11.6 - 28.3 (18.2)	80.1 - 81.3 (80.7)	25.4 - 192 (107)	31.5 - 41.5
2,4-DB	BDL	BDL	BDL - 2,000	BDL
Dichloroprop	BDL	BDL	BDL - 25.0	BDL
Acetone	BDL	BDL - 38.0	BDL	BDL
isopropylbenzene	BDL	BDL	BDL - 5.5	BDL
Methylene chloride	2.0 - 3.6 (2.7)	BDL - 50.0	BDL - 4.4	BDL - 4.8
Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected. BDL = Below Detection Limit.				

Table 18. Other detected analytes in native subsurface soil (µg/kg) unless otherwise noted.

Analyte	DMMU 3 N	DMMU 4/5 N	DMMU 6 N	DMMU 7 N	DMMU 10 N
Cyanide* (mg/kg)	BDL - 0.32	BDL - 1.7	BDL	BDL	BDL - 0.24
NH4-N* (mg/kg)	60.5 - 200 (132)	1.5 - 227 (141)	86.7 - 185 (137)	33.5 - 211 (143)	119 - 183 (149)
2,4,5-T	BDL	BDL - 0.17	BDL	BDL	BDL
Dalapon	BDL	BDL - 36.0	BDL	BDL	BDL
Dicamba	BDL	BDL	BDL	BDL - 40.0	BDL
Dichloroprop	BDL	BDL	BDL	BDL - 120	BDL
MCPP	BDL	BDL - 2,600	BDL	BDL	BDL
Acetone	BDL - 46.0	BDL - 10.0	BDL - 38.0	BDL - 68.0	BDL - 30.0
Bromodichloromethane	BDL	BDL - 4.4	BDL	BDL	BDL
Chloroform	BDL	BDL - 33.0	BDL	BDL	BDL
isopropylbenzene	BDL	BDL - 11.0	BDL	BDL	BDL
Methylene chloride	2.4 - 5.4 (4.0)	BDL - 4.3	BDL - 1.7	BDL	BDL
Minimum, maximum, and average concentrations (in parentheses) are provided for DMMUs with multiple sampling sites where an anlayte was detected. BDL = Below Detection Limit.					

Table 19. Other detected analytes in reference sediments and soil (µg/kg) unless otherwise noted.

Analyte	Mississippi River (MR)	Mitigation Site (MT)	Saint Bernard (SB)	Bayou Laloutre (BL)
Cyanide* (mg/kg)	BDL	1.0	BDL	0.16
NH4-N* (mg/kg)	125	148	115	2.3
2,4,5-T	BDL	BDL	BDL	0.13
Dinoseb	BDL	BDL	BDL	0.91
Methylene chloride	4.2	15.0	7.2	2.9
BDL = Below Detection Limit.				

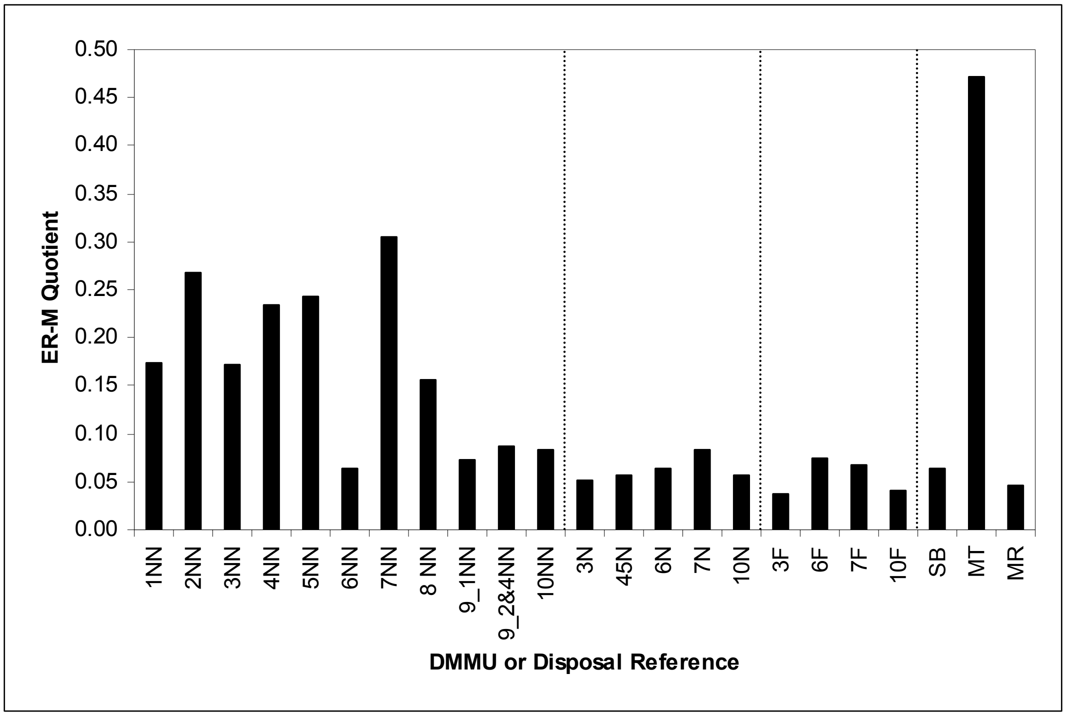


Figure 5. Metals ER-M_Q for DMMU sediment composites and disposal reference sediments.

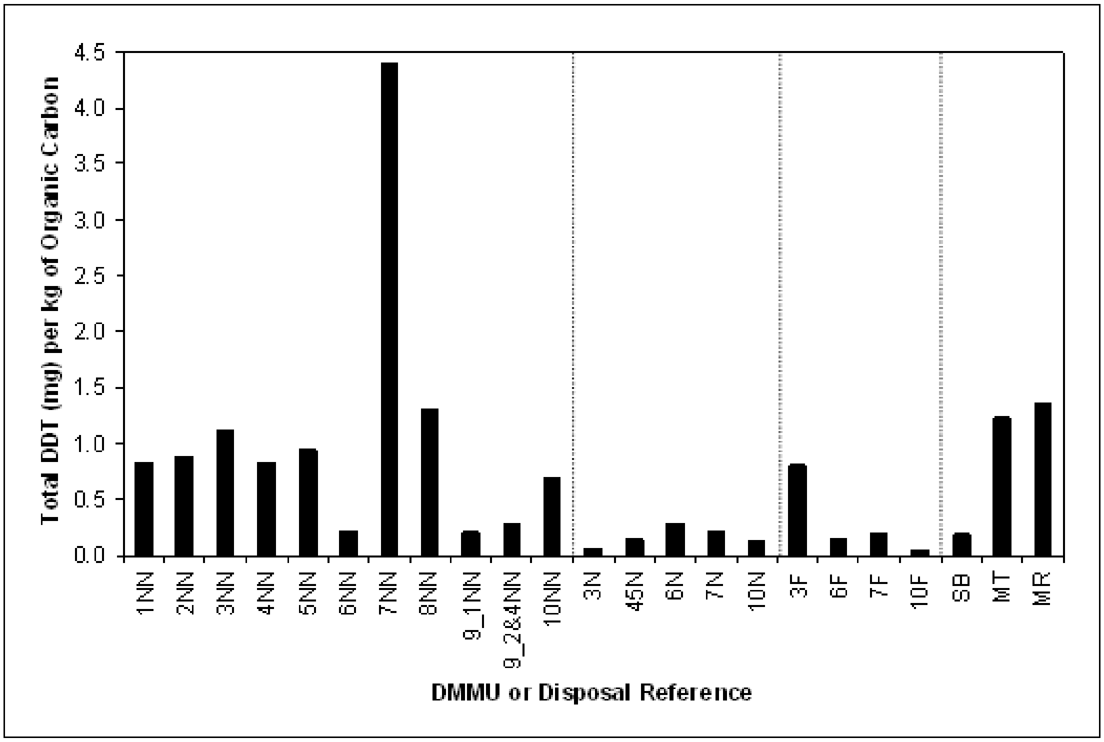


Figure 6. Total DDT normalized per kg of organic carbon for DMMU sediment composites and disposal reference sediments.

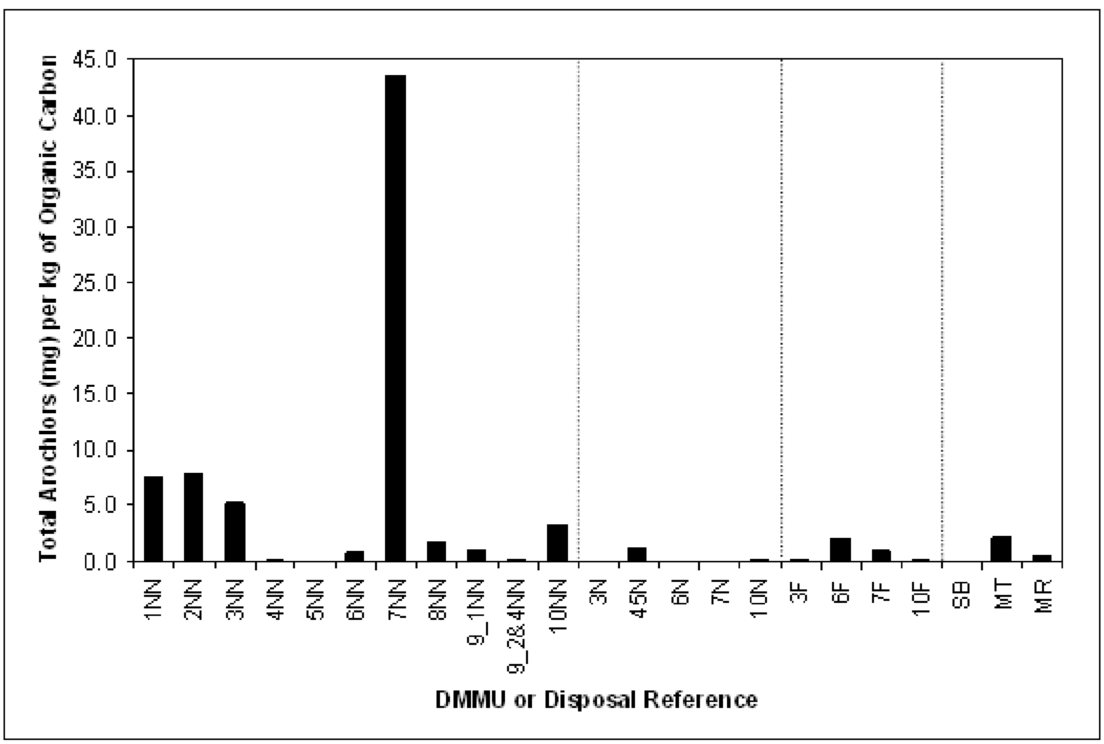


Figure 7. Total Aroclors normalized per kg of organic carbon for DMMU sediment composites and disposal reference sediments.

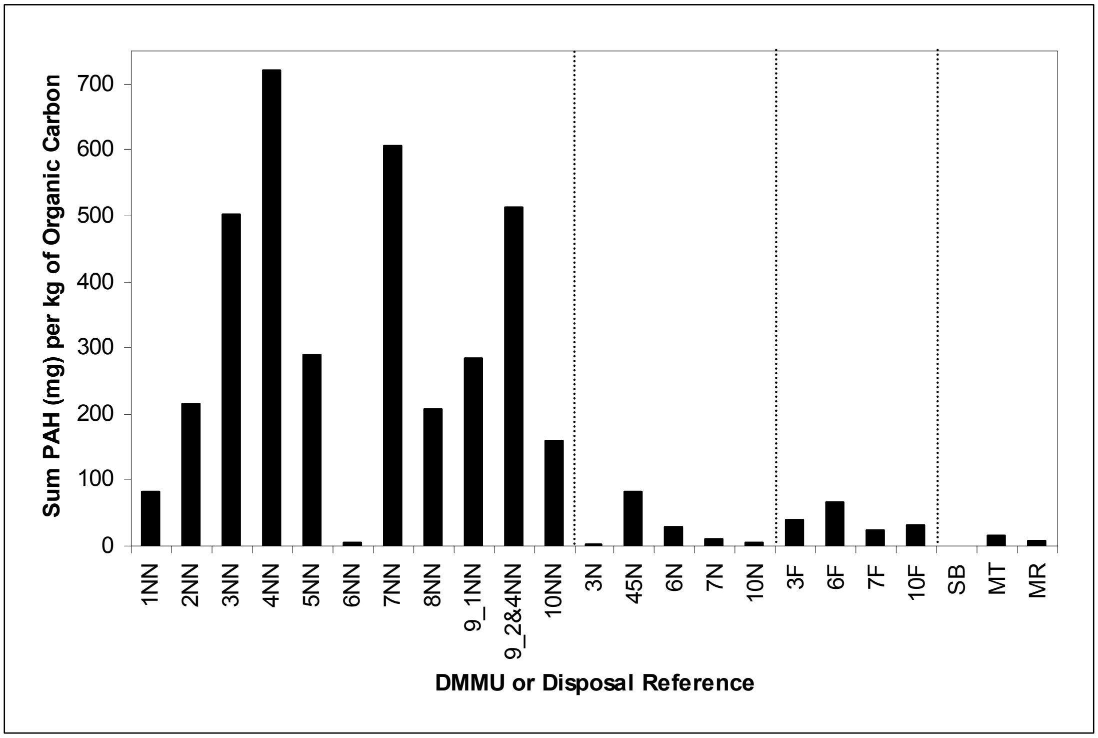


Figure 8. Sum PAH normalized per kg of organic carbon for DMMU sediment composites and disposal reference sediments. Sum PAH is defined as the sum of 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibiz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)perylene, naphthalene, phenathrene, and pyrene. For any PAH reported as a non-detect, 1/2 the reporting limit was included in the summation.

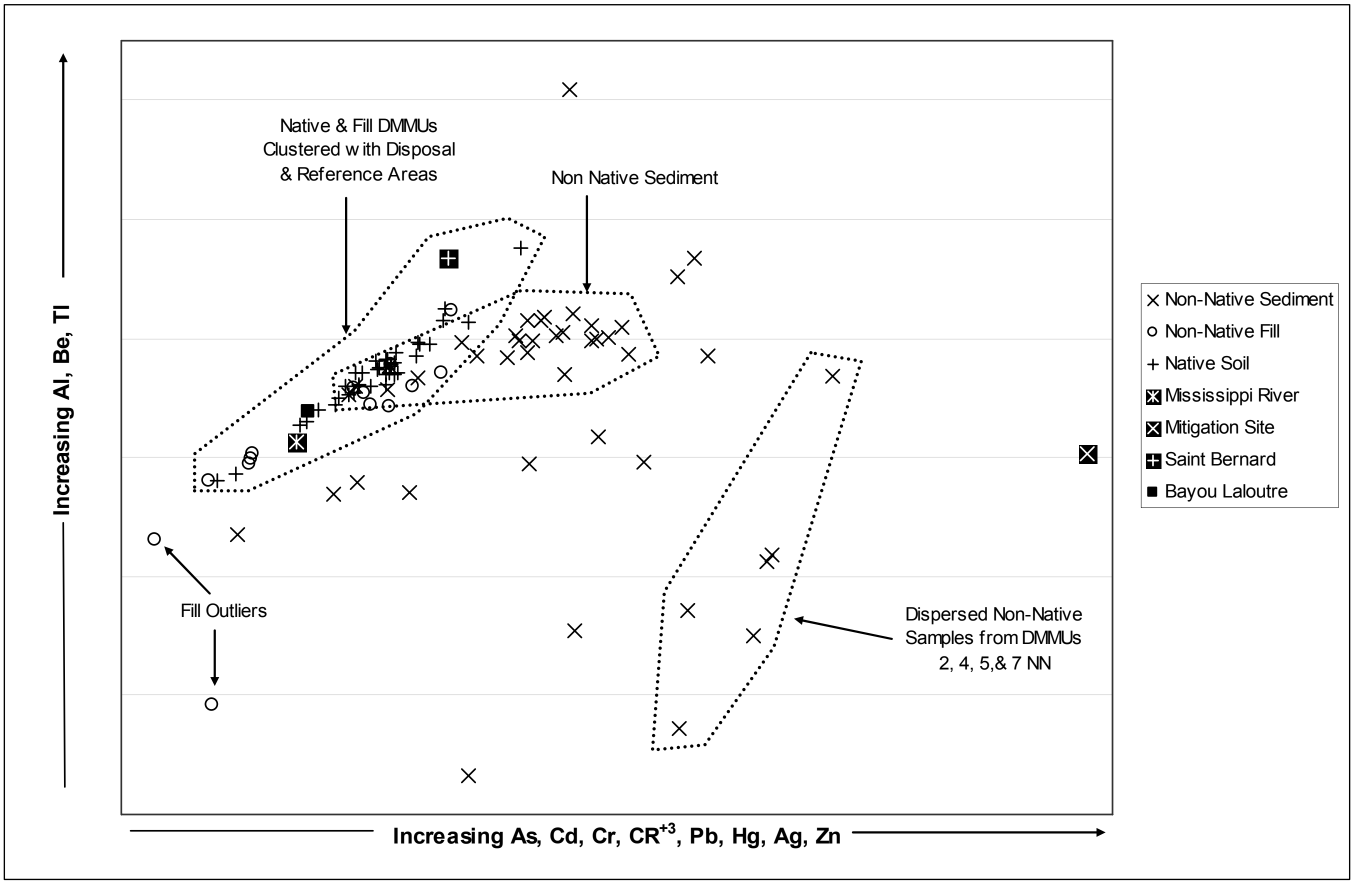


Figure 9. Sediment chemistry, metals MDS scores.

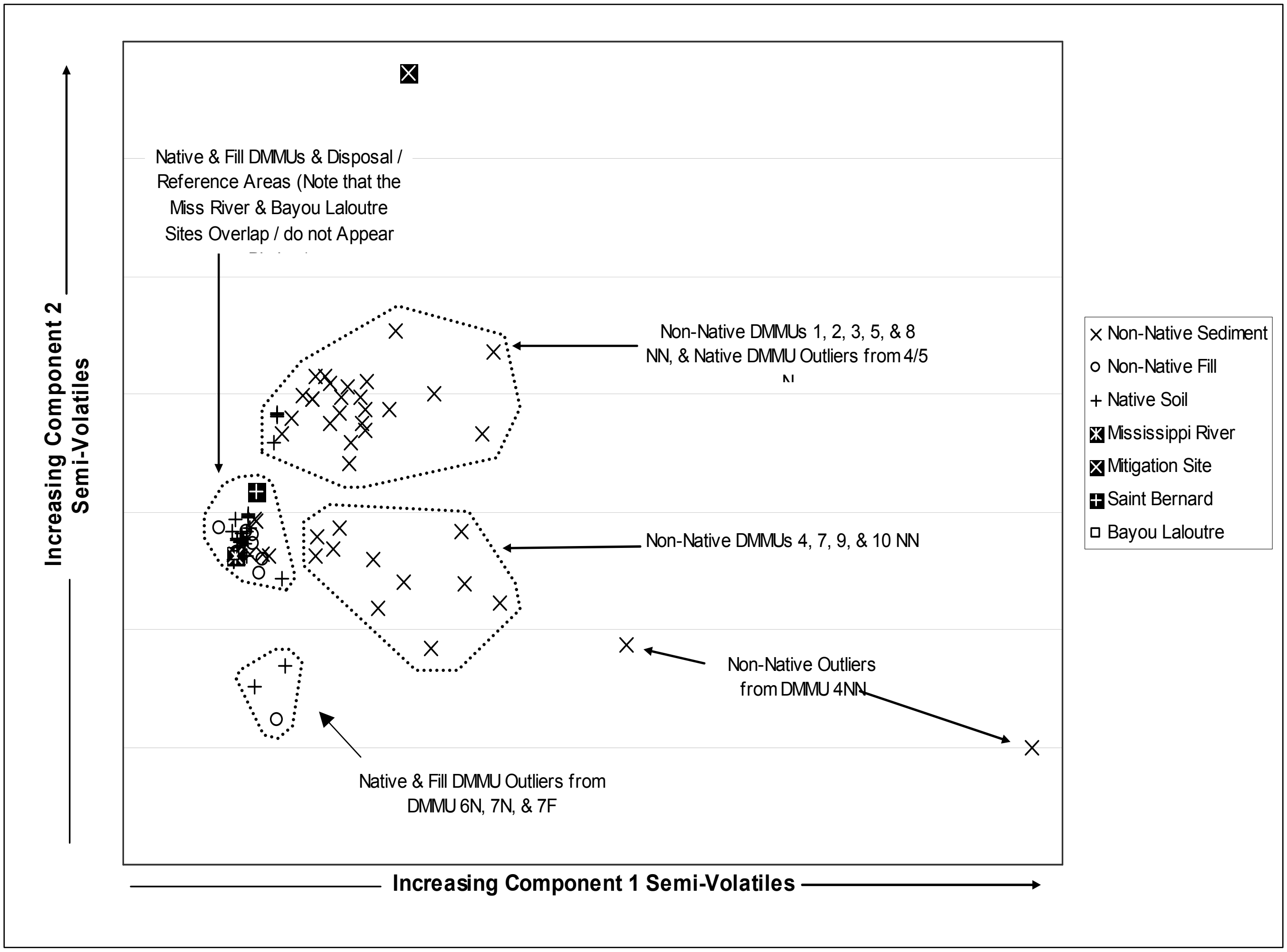


Figure 10. Sediment chemistry, semi-volatile scores.

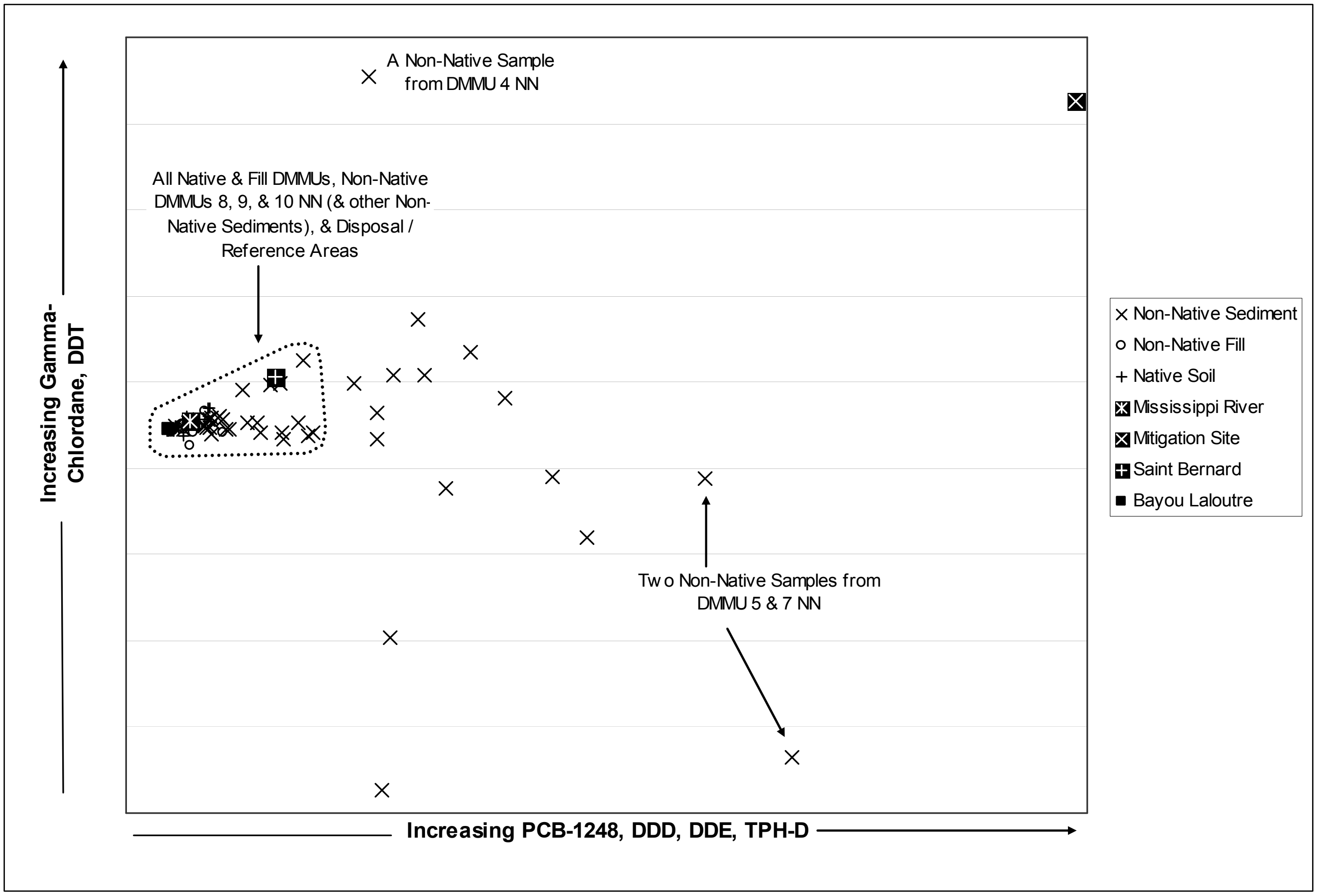


Figure 11. Sediment chemistry, pesticide, PAH, and PCB MDS scores.

3 Water Column Toxicity Evaluation

3.1. Freshwater water column toxicity evaluation

In water column toxicity tests, a sensitive water column organism is exposed for 96 hours to serial dilutions (100, 50, and 10%) of dredged material elutriate, a site water treatment, and a performance control treatment of dechlorinated water, which is also used to dilute the elutriate to the 50 and 10% dilution treatments. When survival in the 100% dredged material elutriate treatment was at least 10% less than survival in the control, the results were evaluated statistically to determine if the survival in the elutriate treatment was significantly lower than the control.

Ninety-six-hour suspended particulate phase water column toxicity tests using the fathead minnow (*Pimphales promelas*), a freshwater fish, were conducted in three batches at elutriate concentrations of 0% (control water), 10%, 50%, and 100% (Weston Solutions 2008). Water quality parameters (i.e., temperature, pH, dissolved oxygen [DO], conductivity, and ammonia) were measured from each replicate chamber at experiment initiation and termination. Environmental chamber temperature was monitored and recorded daily. The endpoint assessed was survivorship, defined as complete lack of motility as determined by use of a blunt probe as necessary. Test acceptability criterion was greater than 90 percent mean control survival. A summary of survival data is presented in Table 20 and Figure 12. Mean survival in the control water for the three batches was high (92.0 % or higher, Table 21) and indicated that test conditions and health of the organisms were acceptable.

Survival in the 100% elutriate treatment was significantly lower than in the control water for non-native sediments of DMMUs 1, 6, 7, and 9 (DMMUs 1 NN, 6 NN, 7 NN, 9-1 NN), native subsurface soils of DMMUs 4/5, 6, 7, and 10 (DMMUs 4/5 N, 6 N, 7 N, and 10 N) and fill material from the bank of DMMUs 3 and 6 (DMMUs 3F and 6F) (Table 20). Among those, dilution to 50% concentration of elutriates from DMMUs 1 NN, 6 NN, 6 F, 9-1NN, 4/5 N, and 7 N resulted in survival not significantly lower than in the control, demonstrating that a 2-fold dilution removed the acute toxicity promoted by their elutriates. Further dilution to 10% removed the acute toxicity of the elutriate of DMMU 7 NN and 10 N, but not for the elutriate of DMMU 3F. An exception to the trend of overall increase in survival with decreasing elutriate concentration was observed for the elutriate of DMMU 8NN, for which survival in the 10% dilution elutriate was significantly decreased while no statistical difference was determined for the 100% and 50% elutriates. The observed overall no change in toxicity is a departure of the expected trend of increasing dilution of the elutriate causing decrease in mortality.

Table 20. *Pimephales promelas* 4-day freshwater suspended phase toxicity tests. Mean percent survival in exposure to IHNC dredged material elutriates at different dilutions, statistical comparison with mean survival in control water, and toxicity endpoints.

DMMU	Treatment (% elut.)	Percent Survival			LOEC (% elut.)	LC50 (% elut.)	Batch
		Mean	Std. Dev	Statistical Comparison with Reference			
1 NN	100	58	13	**Different**	100	ND	1
	50	98	4	Not different			
	10	98	4	Not different			
2 NN	100	78	16	Not different	ND	ND	1
	50	94	9	Not different			
	10	100	0	Not different			
3 NN	100	98	4	Not different	ND	ND	1
	50	92	8	Not different			
	10	96	5	Not different			
3 N	100	94	5	Not different	ND	ND	
	50	92	13	Not different			
	10	88	8	Not different			
3 F	100	50	20	**Different**	10	ND	1
	50	58	11	**Different**			
	10	50	19	**Different**			
4 NN	100	94	9	Not different	ND	ND	3
	50	94	5	Not different			
	10	100	0	Not different			
5 NN	100	92	8	Not different	ND	ND	3
	50	96	5	Not different			
	10	100	0	Not different			
4/5 N	100	2	4	**Different**	100	69	3
	50	94	5	Not different			
	10	100	0	Not different			
6 NN	100	86	5	Not different	ND	ND	2
	50	96	5	Not different			
	10	86	17	Not different			

LOEC = lowest-observed effects concentration. LC50 = median effect concentration.
ND = not determined due to insufficient mortality. "elut" = elutriate.

Table 20 cont.

DMMU	Treatment (% elut.)	Percent Survival			LOEC (% elut.)	LC50 (% elut.)	Batch
		Mean	Std. Dev	Statistical Comparison with Reference			
6 N	100	70	20	**Different**	100	ND	2
	50	86	5	Not different			
	10	82	25	Not different			
6 F	100	82	8	**Different**	100	ND	2
	50	82	19	Not different			
	10	82	16	Not different			
7 NN	100	14	11	**Different**	50	42	2
	50	46	22	**Different**			
	10	90	10	Not different			
7 N	100	18	20	**Different**	100	72	2
	50	82	11	Not different			
	10	88	13	Not different			
7 F	100	76	13	Not different	ND	ND	2
	50	96	5	Not different			
	10	100	0	Not different			
8 NN	100	86	13	Not different	10	ND	1
	50	98	4	Not different			
	10	53	17	**Different**			
9-1 NN	100	82	11	**Different**	100	ND	3
	50	98	4	Not different			
	10	98	4	Not different			
9 2,4-NN	100	94	5	Not different	ND	ND	3
	50	92	8	Not different			
	10	92	13	Not different			
10 NN	100	88	11	Not different	ND	ND	2
	50	82	8	Not different			
	10	94	5	Not different			
10 N	100	2	4	**Different**	50	26	2
	50	14	15	**Different**			
	10	98	4	Not different			
10 F	100	72	33	Not different	ND	ND	2
	50	92	13	Not different			
	10	90	17	Not different			

LOEC = lowest-observed effects concentration. LC50 = median effect concentration.
ND = not determined due to insufficient mortality. "elut" = elutriate.

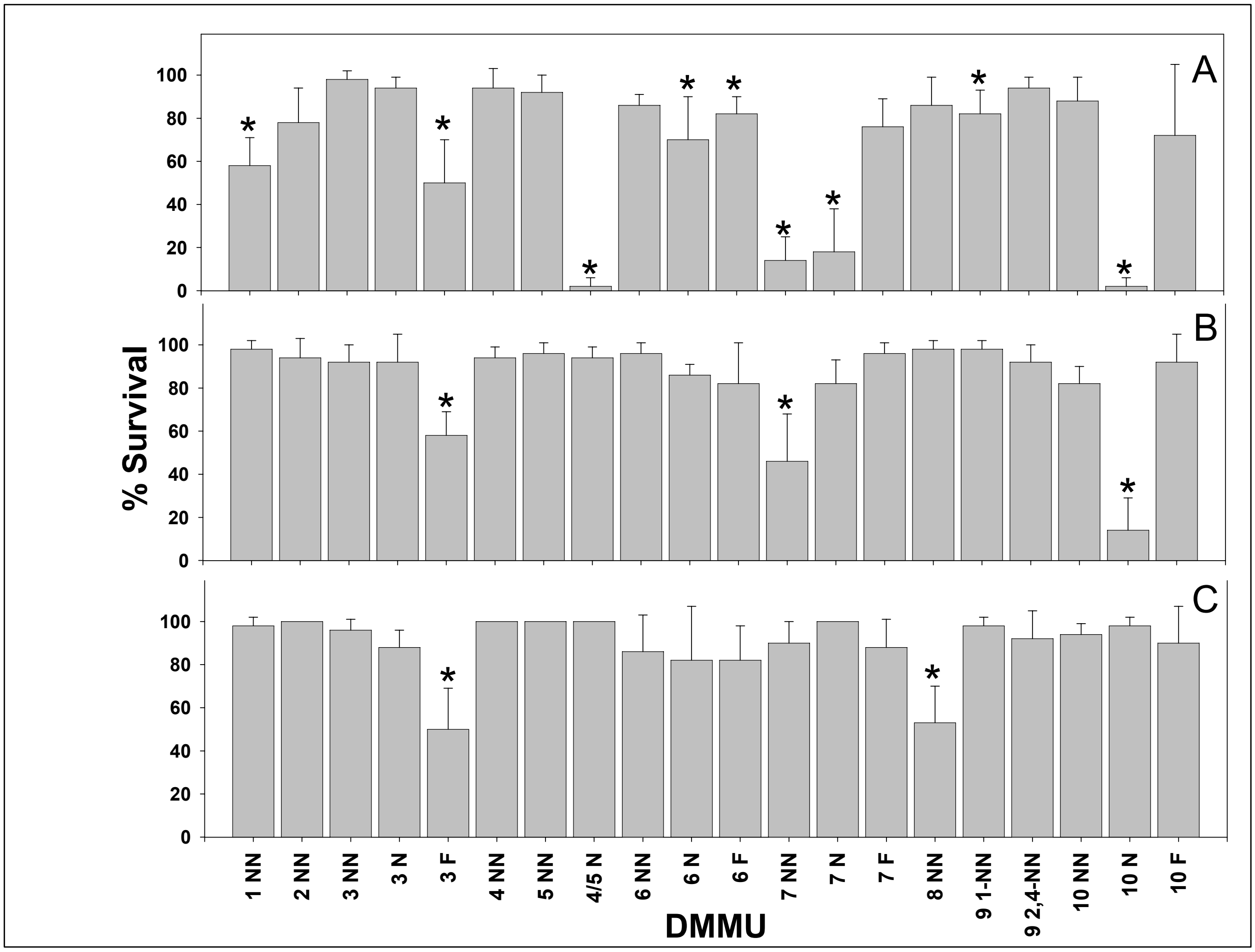


Figure 12. ***Pimephales promelas*** **4-day freshwater suspended phase toxicity tests. Mean percent survival in exposure to IHNC dredged material elutriates at different dilutions. * indicates statistically significant decreased survival.**

Table 21. ***Pimephales promelas*** **4-day freshwater suspended phase toxicity tests. Mean percent survival in exposure to control water for exposure batches 1, 2, and 3.**

Batch	Percent Survival	
	Mean	Std. Dev
1	92	4
2	96	5
3	98	4

The reasons for the lack of decrease mortality trend for DMMU 8 NN are unknown.

Lowest observable effects concentrations (LOEC) were determined for treatments with at least one treatment significantly different from the control (Table 20). Median lethal concentrations (LC_{50}), representing percent dilution associated with 50% mortality, were determined for elutriates from DMMUs 4/5N, 7NN, 7N, and 10N but could not determined for elutriate from DMMUs 1 NN, 3 F, 6 N, 6 F, 9-1 NN with at least one significantly different treatment due to insufficient mortality (Table 20).

Ammonia was a potential contaminant contributing to the significantly decreased survival in some samples based on concentrations measured at exposure initiation (Table 22). An ammonia toxicity reduction was conducted using zeolite (Hockett and Mount 1996, Burgess et al. 2003). Since zeolite may remove some metals, ethylenediamine tetraacetic acid (EDTA) was used to complex metals in a separate treatment in order to discriminate between metals and ammonia toxicity. EDTA should not alter ammonia concentrations. Separate aliquots of elutriate samples suspected of ammonia toxicity were treated with zeolite and EDTA. These separate treatments were run side-by-side with the untreated elutriate. It was concluded that ammonia may have contributed to the decreased toxicity in elutriates from DMMUs 7 NN, 4/5 N and 9-1 NN. In addition, ammonia was unlikely to have contributed to toxicity in the elutriate of DMMU 6 N, while inconclusive results were obtained for elutriates from DMMUs 1 NN and 2 NN (Weston Solutions 2008).

Based on the results of the suspended particulate phase water column toxicity tests, dredged materials from DMMUs 2 NN, 3 NN, 3N, 4 NN, 5 NN, 6 NN, 7 F, 8 NN, 9-2,4 NN, 10NN and 10 F are not predicted as acutely toxic to freshwater water column organisms .

Dredged materials from DMMUs 1 NN, 3 F, 4/5 N, 6 N, 6 F, 7 NN, 7 N, 9-1 NN, and 10 N are predicted as potentially acutely toxic to freshwater water column organisms. Those dredged materials were further analyzed for their potential to cause acute toxic impacts to water column organisms at the Mississippi River disposal site according to available dilution across an allowable mixing zone (Section 4).

Potential for dredged material disposal causing adverse impacts to water column organisms at the Mississippi River disposal site was further evaluated by comparing potential for state or Federal water quality standards to be exceeded outside the mixing zone (Section 4).

Table 22. *Pimephales promelas* 4-day suspended phase freshwater toxicity tests. Ammonia concentration measured at exposure initiation and mean percent survival in undiluted elutriate and in zeolite- and EDTA-treated undiluted elutriate at exposure termination.

DMMU	Treatment	Day 0 Ammonia	Percent Survival		
		mg/L	Mean	Std. Dev	Statistical Comparison with Reference
1 NN	100%	5	58	13	**Different**
	100%-Zeolite	< 1	100	0	Not different
	100%-EDTA	4	0	0	Not different
2 NN	100%	5	78	16	Not different
	100%-Zeolite	< 1	100	0	Not different
	100%-EDTA	4	0	0	**Different**
6 N	100%	6	70	20	Not different
	100%-Zeolite	< 1	57	23	**Different**
	100%-EDTA	6	67	6	**Different**
7 NN	100%	5	14	11	**Different**
	100%-Zeolite	< 1	83	6	**Different**
	100%-EDTA	5	17	12	**Different**
4/5 N	100%	> 8	2	4	**Different**
	100%-Zeolite	<1	80	0	**Different**
	100%-EDTA	> 8	0	0	**Different**
9-1 NN	100%	5	82	11	**Different**
	100%-Zeolite	< 1	97	6	Not different
	100%-EDTA	4	87	6	Not different

3.2. Estuarine water column toxicity evaluation

Ninety-six-hour suspended particulate phase water column toxicity tests using sheepshead minnow (*Cyprinodon variegatus*), an estuarine fish, were conducted in three batches at elutriate concentrations of 0% (control water), 10%, 50%, and 100% (Weston Solutions 2008). Water quality parameters (i.e., temperature, pH, dissolved oxygen [DO], conductivity, and ammonia) were measured from each replicate chamber at experiment initiation and termination. Environmental chamber temperature was monitored and recorded daily. The endpoint assessed was survivorship, defined as complete lack of motility as determined by use of a blunt probe as necessary. Test acceptability criterion was greater than 90 percent mean control survival. A summary of survival data is presented in Table 23 and Figure 13. Mean survival in the control water for the three batches was high (98% or higher) and indicated that test conditions and health of the organisms were acceptable (Table 24). Mean survival was high (96% and higher) in all treatments for all elutriate samples evaluated.

There was no significant difference in survival between elutriates derived from channel sediment and control water for all of the samples and elutriate concentrations. Because there were only minor (4% and lower) and non-significant differences in survival between elutriates derived from channel sediment and control water for all of the samples and elutriate concentrations, no LOEC or LC_{50} values could be generated for the samples evaluated.

Based on the results of the suspended particulate phase water column toxicity tests, dredged materials from all DMMUs are not predicted as acutely toxic to estuarine column organisms. Potential for dredged material disposal causing adverse impacts to water column organisms at the mitigation site was further evaluated by comparing potential for state or Federal water quality standards to be exceeded outside the mixing zone (Section 4).

Table 23. ***Cyprinodon variegatus*** **estuarine 4-day suspended phase toxicity tests. Mean percent survival in exposure to IHNC dredged material elutriates at different dilutions and statistical comparison with mean survival in control water.**

DMMU	Treatment (% elut.)	Percent Survival			LOEC (% elut.)	LC50 (% elut.)	Batch
		Mean	Std. Dev	Statistical Comparison with Reference			
1 NN	100	100	0	**Different**	ND	ND	1
	50	100	0	Not different			
	10	100	0	Not different			
2 NN	100	100	0	Not different	ND	ND	1
	50	100	0	Not different			
	10	100	0	Not different			
3 NN	100	100	0	Not different	ND	ND	1
	50	98	4	Not different			
	10	100	0	Not different			
3 N	100	100	0	Not different	ND	ND	1
	50	100	0	Not different			
	10	100	0	Not different			
3 F	100	100	0	Not different	ND	ND	1
	50	100	0	Not different			
	10	100	0	Not different			
4 NN	100	100	0	Not different	ND	ND	3
	50	100	0	Not different			
	10	100	0	Not different			
5 NN	100	100	0	Not different	ND	ND	3
	50	100	0	Not different			
	10	100	0	Not different			
4/5 N	100	98	4	Not different	ND	ND	3
	50	100	0	Not different			
	10	100	0	Not different			
6 NN	100	100	0	Not different	ND	ND	2
	50	100	0	Not different			
	10	100	0	Not different			

LOEC = lowest-observed effects concentration.
LC50 = median effect concentration.
ND = not determined due to insufficient mortality.
"elut" = elutriate.

Table 23 cont.

DMMU	Treatment (% elut.)	Percent Survival Mean	Std. Dev	Statistical Comparison with Reference	LOEC (% elut.)	LC50 (% elut.)	Batch
6 N	100	98	4	Not different	ND	ND	2
	50	100	0	Not different			
	10	100	0	Not different			
6 F	100	100	0	Not different	ND	ND	2
	50	98	4	Not different			
	10	96	5	Not different			
7 NN	100	100	0	Not different	ND	ND	2
	50	100	0	Not different			
	10	100	0	Not different			
7 N	100	100	0	Not different	ND	ND	2
	50	100	0	Not different			
	10	100	0	Not different			
7 F	100	98	4	Not different	ND	ND	2
	50	96	5	Not different			
	10	100	0	Not different			
8 NN	100	100	0	Not different	ND	ND	1
	50	100	0	Not different			
	10	100	0	Not different			
9-1 NN	100	100	0	Not different	ND	ND	3
	50	100	0	Not different			
	10	100	0	Not different			
9 2,4-NN	100	96	5	Not different	ND	ND	3
	50	100	0	Not different			
	10	100	0	Not different			
10 NN	100	96	9	Not different	ND	ND	2
	50	100	0	Not different			
	10	100	0	Not different			
10 N	100	100	0	Not different	ND	ND	2
	50	100	0	Not different			
	10	100	0	Not different			
10 F	100	100	0	Not different	ND	ND	2
	10	100	0	Not different			
	100	100	0	Not different			

LOEC = lowest-observed effects concentration.
LC50 = median effect concentration.
ND = not determined due to insufficient mortality.
"elut" = elutriate.

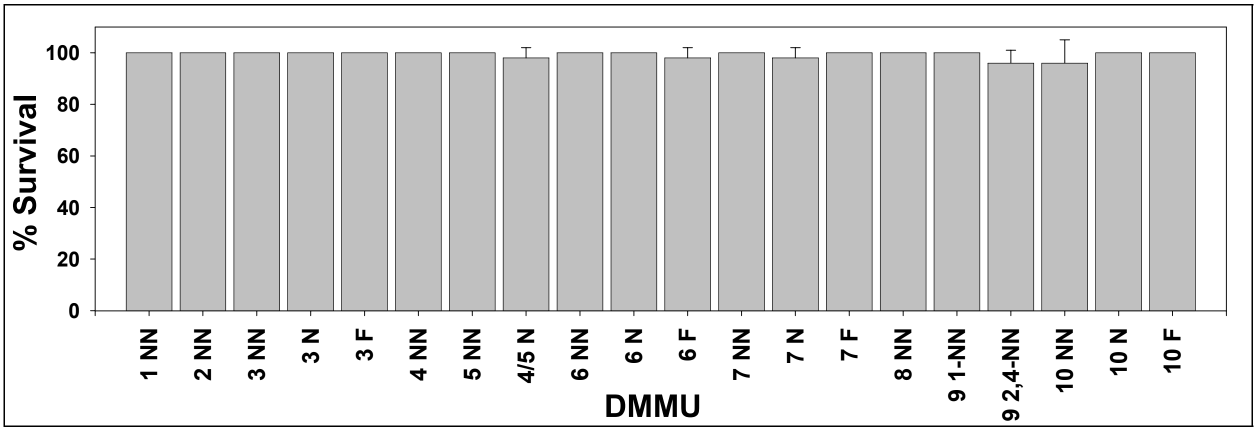


Figure 13. ***Cyprinodon variegatus*** **estuarine 4-day suspended phase toxicity tests. Mean percent survival in exposure to IHNC dredged material elutriates at different dilutions.**

Table 24. ***Cyprinodon variegatus*** **estuarine 4-day solid phase toxicity tests. Mean percent survival in exposure to control water for exposure batches 1, 2, and 3.**

Batch	Percent Survival	
	Mean	Std. Dev
1	100	0
2	100	0
3	98	4

4 Comparison of Standard and Modified Elutriate Results to Standards and Calculation of Mixing Zones

This section of the report addresses the interpretation of elutriate testing results for the various placement alternatives under consideration. Four placement alternatives are being considered:

- Open water disposal in the Mississippi River.
- Upland disposal in a CDF, with effluent discharge to the GIWW or Bayou Bienvenue.
- Beneficial use placement in the proposed mitigation site.
- Beneficial use placement as construction fill around the new lock.

The standard elutriate test is used to model impacts associated with open water disposal, while the modified elutriate test is used to model impacts associated with discharges from a CDF. These tests are discussed in that context in Sections 4.1 and 4.2, respectively. Both the standard and elutriate tests are potentially applicable for evaluation of impacts associated with placement of material at the mitigation site. The modified elutriate test more likely reflects the effects of aeration that would occur if the discharge takes place above the surface of the water, above newly placed material, or in shallow water depths. The standard elutriate test more likely reflects the water quality impacts of subsurface discharges at depth. At the present stage of planning, the degree of containment that will be employed has not been determined. Water depth is believed to be shallow throughout the mitigation site, but given the uncertainty regarding the disposal operation and the site in general, both standard and elutriate tests were considered in the context of potential placement in the mitigation site, discussed in Section 4.3. The dredging elutriate is used to predict effects on water quality during dredging, and the dredging elutriate test is discussed in that context in Appendix C.

In each of the following sections, a summary of the elutriate results is presented. These are followed by tables comparing elutriate concentrations to water quality criteria or standards and listing the corresponding dilution requirements obtained through this comparison. The ability of the receiving water to achieve the necessary dilution in a mixing zone compliant with State of Louisiana water quality regulations is then evaluated, relevant or mitigating points discussed, and conclusions presented. There are a number of similarities between the sections and this may be confusing to the reader. The general organization of these sections is offered here to provide additional clarity. Relevant tables and figures are located at the end of each section.

4.1. Potential water quality impacts associated with open water disposal of dredged material

4.1.1. Objectives

4.1.2. Data evaluation and dilution requirements

MR site dilution requirements

Mitigation site dilution requirements

4.1.3. Mixing

4.1.4. Discussion

4.1.5. Conclusions

4.2. Potential water quality impacts associated with release of effluent from confined disposal facilities

4.2.1. Objectives

4.2.2. Data evaluation and dilution requirements

GWW dilution requirements

Bayou Bienvenue dilution requirements

4.2.3. Mixing

GIWW mixing

Bayou Bienvenue mixing

4.2.4. Conclusions

4.3. Mixing evaluation for placement of dredged material in the proposed mitigation site

4.3.1. Objectives

4.3.2. Data evaluation and dilution requirements

Material suitability

Dilution requirements

4.3.3. Mitigation site mixing

4.3.4. Potential recoverable area

4.3.5. Conclusion

4.1. Potential water quality impacts associated with open water disposal of dredged material

4.1.1 Objectives

The standard elutriate (SE) test is described in USEPA and USACE (1998), Section 10.1.2.1 and is specified for the assessment of potential water quality impacts associated with open water disposal of dredged material. It is used in conjunction with appropriate testing and evaluation of potential benthic impacts in order to determine suitability of dredged material for open water disposal.

The ITM provides for preliminary (Tier I) screening of potential water column impacts on the basis of existing information. The manual then states, “If a water quality standard (WQS) determination cannot be made in Tier I, Tier II evaluation is necessary to determine whether the discharge complies with 230.10(b)(1)” (which pertains to compliance with water quality standards and other considerations as spelled out in CFR 40 Part 230 *Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material, Subpart B--Compliance With the Guidelines*, Sec. 230.10 *Restrictions on discharge*).

The ITM also states, “The discharge of dredged material cannot cause the WQS to be exceeded outside the mixing zone unless the State provides a variance to the standard. There are two approaches for the Tier II water column evaluation for WQS compliance. One approach is to use the numerical models provided in Appendix C (of the ITM) as a screen, assuming that all of the contaminants in the dredged material are released into the water column during the disposal process. The other approach applies the same model with results from chemical analysis of the elutriate test.”

The assumption that all of the contaminants in the dredged material are released into the water column is an overly conservative assumption. Typically only a fraction of the contaminants sorbed to sediment are leachable, and desorption of that fraction may take place over a relatively long period of time in some instances. For this reason, the standard elutriate test is considered a better indicator of expected water quality impacts associated with open water disposal. Dissolved contaminant concentrations in the elutriate are compared to applicable water quality standards or water quality criteria (WQC) to determine whether there are any exceedances. For those contaminants where exceedances are noted, the degree of dilution required to meet water quality standards can be determined and the size of mixing zone required to achieve this dilution calculated using parameters specific to the proposed disposal site. If a definitive determination cannot be made as a result of analytical limitations (as when criteria are lower than analytical reporting limits, for example) or if there is concern regarding contaminants for which there are no available water quality criteria, or concern regarding potential interactive effects, Tier III toxicity testing is used to determine dilution requirements. Based on the results of elutriate toxicity testing, an LC50 value is calculated. The LC50 represents the dilution at which 50% mortality of the test organisms is expected. The minimum dilution required is then equal to 0.01 times the LC50 dilution. Where no elutriate toxicity tests result in 50% or greater mortality, but the mortality in the elutriate without dilution is statistically greater than the control, expert judgment is required to determine a scientifically defensible dilution. One might choose one of:

- A one hundredfold dilution (0.01 times 100% concentration) if substantial mortality occurs at more than one dilution of the elutriate.
- The dilution at which no statistically significant mortality was observed.
- The dilution required to meet a suitably conservative alternative water quality criteria deemed acceptable to all stakeholders and regulatory agencies.

If adequate dilution can be achieved within an area meeting the State requirements for mixing zones, open water disposal would be permitted on the basis of water quality standards, assuming other requirements of open water disposal area met (no benthic toxicity).

4.1.2. Data evaluation and dilution requirements

Standard elutriates were prepared by ERDC and samples split for toxicity testing and chemical analysis. Toxicity testing was performed at ERDC and chemical analysis by Test America. Water samples were obtained from the existing Mississippi River (MR) open water disposal site near the mouth of the Inner Harbor Navigation Canal in New Orleans and analyzed by Test America for background concentrations of contaminants of concern (COCs). Water samples were also taken for analysis from the proposed wetland mitigation site near Bayou Bienvenue.

Mean and maximum dissolved contaminant concentrations were determined for each constituent, utilizing the results obtained from all DMMU standard elutriates composites (Table 25). For calculation of the means, a value of half the reporting limit (0.5RL) was assumed for all non-detects. Where the maximum elutriate concentration was less than the laboratory reporting limit (RL) for that sample, the highest qualified value was assumed to represent the maximum. Where the maximum elutriate concentration was less than the RL *and* there were no qualified values (all samples were non-detect), it was assumed the compound was not present and no dilutions were calculated.

If adequate mixing is available to dilute the maximum predicted concentrations for each contaminant to its water quality criteria or to meet the dilution required on the basis of toxicity testing, within an acceptable mixing zone, then mixing can be achieved for all materials. Geometric means were also calculated, however, in order to evaluate mixing zone requirements for the majority of the dredged material. The geometric mean takes into account the influence of a few high or low values on the mean. Where the geometric mean is much lower than the arithmetic mean, it suggests that with the exception of when high concentration areas are dredged, effluent concentrations are generally better represented by the geometric mean. Also, the mixing that occurs during dredging may have the effect of reducing effluent concentrations from the observed maximums somewhat.

Elutriate concentrations (maximum and geometric mean values) were compared to the most conservative of acute and chronic Federal and State of Louisiana water quality criteria. Where no such criteria existed, EPA Region 4 water quality screening criteria for hazardous waste sites were used, if available. Where elutriate concentrations exceeded either acute or chronic water quality standards, dilutions were calculated using background concentrations of the receiving waters (Mississippi River and proposed mitigation site). Dilution requirements are expressed as the dilution ratio, which is the ratio of receiving water volume to effluent volume. Where background concentrations exceeded the standard, dilution was calculated to 10% above background. Dilutions were also calculated based on results of the Tier III Toxicity Tests and the LC50 values.

Two elutriate samples were problematic in the analysis. The aluminum concentration for DMMU 10 sample C3&4-FN was three orders of magnitude higher than the other samples, and concentrations were one to two orders of magnitude higher for all other metals except selenium and silver. The aluminum concentration reported for this sample was 1.42 g/L, suggesting the sample contained colloidal clays and that the aluminum concentration reported was actually derived from the clay matrix rather than the dissolved phase. This could be responsible for the elevation of other metals concentrations as well, although total suspended solids were comparable to that of the other samples. There are several other inconsistencies relative to this and another composite obtained at this location as well. Metals concentrations were elevated in the elutriate of DMMU 10 sample C3&4-F, yet this sample only required a dilution of one based on toxicity, and benthic toxicity of the sediment was not significantly different from controls. Toxicity of the elutriate of DMMU 10 sample C3&4-FN was the highest of all samples tested, but was still of the same order of magnitude as samples taken from various locations throughout the project area. Benthic toxicity was significantly higher than control for the sediment from DMMU 10 sample C3&4-FN, but the difference in mortality was less than 20% (the threshold at which benthic toxicity would preclude open water disposal). Concentrations of organic compounds were not appreciably elevated in either of these elutriates, and metals were not elevated in the sediment of either of these two composites. For both elutriate samples, pH was at the upper range reported for all elutriates, which would tend to limit metals solubilization rather than facilitate it. Given these inconsistencies, the results obtained for metals analysis for the elutriate of DMMU 10 sample C3&4 - FN were considered unreliable and the next highest concentration measured was taken for the purposes of calculating maximum dilutions. Mean dilutions were calculated using the geometric mean, which better reflects the central tendency of the data than the arithmetic mean in cases where there are a few extreme data points. Affected compounds are footnoted in these tables.

A few standard elutriate samples were rejected in the data validation, and these data points were removed from the database before dilutions were calculated. The impact on dilution requirements was minimal in any case, since two of the affected compounds have no water quality criteria, and 3 samples were non-detect, having little impact on mean effluent concentrations. Affected samples are summarized in Table 26.

MR site dilution requirements

For disposal in the MR disposal site, a maximum dilution of 69, for barium, was required to meet freshwater acute criteria, and a maximum dilution of 697, for total PCBs, was required to meet freshwater chronic criteria (Table 27). Dilutions based on mean (geometric mean) elutriate concentrations (Table 28) resulted in a maximum dilution requirement of 18 to meet freshwater acute criteria, and a dilution requirement of 90 to meet freshwater chronic criteria (both for barium).

Maximum dilutions obtained based on toxicity testing of freshwater elutriates ranged from 1 to 384 (Table 29), with the elutriate of DMMU 10 sample C3&4 - FN setting the upper end of dilution requirements.

Mitigation site dilution requirements

Sediment from some DMMUs has been ruled out for open water disposal on the basis of benthic toxicity (see Table 1, Dredging and Disposal Plan (ERDC 2008). Those areas include DMMUs 1 and 2, 4 and 5, and part of DMMUs 3 and 9. Some of these materials are suitable for placement in a freshwater environment but not in a marine environment, or for placement in a marine but not freshwater environment. For simplicity, all elutriate data was initially considered in the mixing zone analysis on the premise that if maximum required dilutions could be achieved, no further breakdown of the data would be necessary. For the MR disposal site, this proved to be true. For the mitigation site, however, exclusion of some materials on the basis of water column impacts was found to be necessary. Also, method of containment within the mitigation site is yet to be determined, requiring consideration of both standard and modified elutriate results. For this reason, dilution and mixing requirements for placement in the mitigation site are treated separately in Section 4.3.

4.1.3. Mixing

Using physical and chemical properties of the receiving water at the MR disposal site, attainable dilution was calculated for high and low flow receiving water conditions for barge dump and for continuous pipeline discharge. STFATE was used to model barge dumping of mechanically dredged sediment and CDFATE was used to model continuous discharge of hydraulically dredged sediment. STFATE and CDFATE are programs in the USACE ADDAMS models (http://el.erdc.usace.army.mil/elmodels/pdf/ee-06-12.pdf).

Figures 14 through 17 illustrate the distance required to achieve a specified dilution ratio for the different conditions assumed. These figures show that a dilution of 700 can be achieved for high flow conditions (Figures 14 and 15) in approximately:

- 1000 ft for pipeline discharge
- 1000 ft for barge discharge

For low flow conditions (Figures 16 and 17), a dilution of 700 can be achieved in approximately:

- 2100 ft for pipeline discharge
- 1400 ft for barge discharge

4.1.4. Discussion

Mixing zone requirements are set forth in Louisiana State Environmental Regulatory Code Part IX, Subpart 1, Chapter 11, §1115C. According to this section, aquatic life criteria apply within the mixing zone, and human health criteria apply only below the point of discharge after complete mixing. Mixing zones are exempted from general and numerical criteria as specified in LAC 33:IX.1113, except as required in paragraph C.5 of this Section. Paragraph C.5 provides narrative criteria pertaining to floating material, substances in concentrations that will produce undesirable or nuisance aquatic life, and materials in concentrations causing acute toxicity to aquatic life. Numerical acute criteria or other acute quantitative limits for toxic substances are applied within the mixing zone, in a zone of initial dilution (ZID) to protect against acute toxicity. Waters outside of the mixing zone must meet all standards for the particular body of water, which requires meeting chronic aquatic life criteria for toxic substances at the edge of the mixing zone. The 7Q10 is specified, limiting 7-day average concentration exceedances (of chronic aquatic life criteria) to no more than once every 10 years. Chloride, sulfate and total dissolved solids criteria are to be met below the point of discharge after complete mixing (no criteria are provided for these constituents in the LA State Regulatory Code for the IHNC or Bayou Bienvenue).

Limits of mixing zones may include, but are not limited to, linear distances from point source discharges, surface area involvement and volume of receiving water. Nearby mixing zones must be taken into consideration such that overlapping mixing zones do not impair any designated water use in the receiving water body when the water body is considered as a whole.

A list of discharge permits in the vicinity of the MR disposal site was requested from Louisiana Department of Environmental Quality (DEQ). Businesses and industries discharging into the Mississippi River for the reach one mile upstream and downstream of the intersection of the MR and IHNC are listed in Table 30. No discharge permits were found for the Navy shipyard, which is on the east bank of the Mississippi River, where Poland Avenue bends at the river, or for the Alabo Street Wharf, which is just south of the Holy Cross neighborhood. The approximate locations of these and the permitted facilities are shown on a Google earth map (Figure 18). There are also some smaller facilities on the west bank, which may or may not be connected to AEP Elmwood LLC (AEP) and LMS Ship Management (LMS). They do not appear to have separate discharge permits based on the information provided by DEQ. In addition, there were also a few permits for which no coordinates or other location information was provided. Permit holders for these, which are all storm water discharges, are LADOTD and USACE and are also listed in Table 30. No information was available regarding mixing zone dimensions for these permits, which will be necessary to verify that there is no unacceptable overlap with the proposed mixing zone for the Mississippi River disposal site. Given that disposal has taken place at the Mississippi River disposal site in the past, it seems likely that this is not an issue, but acceptability of the proposed mixing zone will require further confirmation with LA DEQ.

Water intakes must also be considered so that the proposed mixing zone will not adversely impact water quality in these locations. The only drinking water intake that could be found between mile markers 93 and 83 of the Mississippi River (the Inner Harbor Navigation Canal is located at mile marker 92.6) serves the St. Bernard Parish waterworks and is located at 29° 55’ 31.046”N, 89° 57’ 34.925”W (approximately 4.7 miles below the mouth of the IHNC, personal communication Jesse Means, State of Louisiana, April 2, 2008). This is well beyond the boundaries of the proposed mixing zone for the open water disposal site and should not be impacted by the disposal operation. To verify this, dissolved standard elutriate concentrations were compared to federal primary and secondary drinking water standards and produced a maximum dilution requirement of 120. This dilution ratio is estimated to be met within approximately 50 to 350 ft for all scenarios considered here.

4.1.5. Conclusions

Based on the modeling conducted for disposal in the MR disposal site, a 700 fold dilution could be met within 2100 ft from the discharge point for low flow conditions and within 1000 ft for high flow conditions.   This will meet the most stringent dilution requirements based on comparison of elutriate concentrations to water quality criteria and will also satisfy the maximum dilution requirements based on the elutriate toxicity testing. This distance is consistent with the point at which non-detect concentrations have been observed during disposal operations in the past. Also, the dilutions required to be protective based on toxicity can be met within approximately 1400 ft for worst case conditions (low flow, pipeline disposal), as the maximum dilution based on toxicity was less than 400. As these mixing zone dimensions appear to be reasonable and consistent with past operation, it appears that none of the materials tested would be excluded from open water disposal on the basis of water column impacts outside of an authorized mixing zone.

Further, evaluation of potential impacts on the St. Bernard Parish waterworks inlet indicates that dilution required in order to meet drinking water standards can be achieved within no more than 350 ft from the point of disposal for all scenarios. No information was available to confirm that the proposed mixing zone for the Mississippi River disposal site would not intersect with mixing zones for other permitted discharges. This seems unlikely to be an issue given the long-standing nature of the disposal site, but State criteria require verification that overlap will not result in unacceptable conditions. Without further information regarding mixing zone dimensions for nearby permitted discharges, this remains to be confirmed.

Table 25. Standard elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values ≥ RL								
1,4-Dichlorobenzene	0.106	0.104	0.190	µg/L	0.046	0.190		7_4- NN
2-Methylnaphthalene	0.153	0.107	2.30	µg/L	0.047	0.200		7_9-F
4,4'-DDD	0.00814	0.00299	0.160	µg/L	0.004	0.025	PG N	7_2- NN
4,4'-DDE	0.00574	0.00202	0.0870	µg/L	0.003	0.025	PG	7_2- NN
4,4'-DDT	0.00767	0.00341	0.0620	µg/L	0.001	0.003	PG	4_5- NN
4-Methylphenol	0.456	0.417	1.10	µg/L	0.069	0.940		10_C3&4- FN
Acenaphthene	0.317	0.161	4.10	µg/L	0.049	0.190		4_5- NN
Aldrin	0.00522	0.00224	0.0510	µg/L	0.001	0.003	PG N	4_5- NN
alpha-Chlordane	0.00190	0.00146	0.0150	µg/L	0.001	0.003	PG N	5_4- NN
Aluminum	26006	450	1420000	µg/L	12.1	300		10_C3&4- FN
Ammonia as Nitrogen	9.14	8.17	16.9	mg/L	0.047	0.500	J	4_C1_3- NN
Anthracene	0.160	0.122	1.30	µg/L	0.048	0.190		4_5- NN
Antimony	3.28	2.63	14.8	µg/L	0.240	10.0		7_2- NN
Aroclor 1016	0.0136	0.0105	0.160	µg/L	0.005	0.019		4_5- NN
Aroclor 1242	0.0184	0.0107	0.390	µg/L	0.004	0.019		7_2- NN
Aroclor 1248	0.0655	0.0174	1.50	µg/L	0.004	0.019		5_4- NN
Aroclor 1254	0.0841	0.0185	0.930	µg/L	0.004	0.019		4_5- NN
Aroclor 1260	0.0684	0.0168	1.40	µg/L	0.003	0.019		7_2- NN
Aroclors (Total)	0.217	0.0304	2.80	µg/L	0.006	0.019		5_4- NN
Arsenic	10.8	7.12	210	µg/L	1.40	10.0		10_C3&4- FN
Barium	985	748	6460	µg/L	0.760	100		10_C3&4- FN
Benzo(a)anthracene	0.114	0.101	1.00	µg/L	0.039	0.190		4_5- NN
Benzo(a)pyrene	0.101	0.0980	0.370	µg/L	0.041	0.190		4_5- NN

Table 25. Standard elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values ≥ RL (cont)								
Benzo(b)fluoranthene	0.104	0.0984	0.510	µg/L	0.029	0.190		4_5- NN
Benzo(k)fluoranthene	0.0986	0.0976	0.210	µg/L	0.037	0.190		4_5- NN
Beryllium	2.79	1.73	60.4	µg/L	0.680	10.0		10_C3&4- FN
beta-BHC	0.00550	0.00211	0.065	µg/L	0.001	0.003	PG N	2_C1_6- NN
bis(2-Ethylhexyl) phthalate	0.937	0.587	5.70	µg/L	0.110	0.950		7_4- NN
Cadmium	2.24	1.85	15.6	µg/L	1.10	10.0		10_C3&4- FN
Calcium	173000	144000	413000	µg/L	31.3	500		7_9-F
Chromium	30.2	6.55	1350	µg/L	1.100	20.0	J	10_C3&4- FN
Chromium III	42.0	6.75	1350	µg/L	0.270	2.00		10_C3&4- FN
Chromium VI	0.0521	0.0056	2.5	mg/L	0.0026	0.01		10_C3&4- FN
Chrysene	0.107	0.0969	0.770	µg/L	0.033	0.190		4_5- NN
Copper	35.7	5.01	1730	µg/L	1.40	20.0		10_C3&4- FN
Cyanide, Total	4.34	3.81	14.2	µg/L	1.70	10.0		4_5- NN
delta-BHC	0.00969	0.00374	0.120	µg/L	0.000	0.003	PG N	4_5- NN
Dibenzofuran	0.416	0.349	1.10	µg/L	0.050	0.940		4_5- NN
Dibutyltin	0.0814	0.0285	1.50	µg/L	0.010	0.780		4_4- NN
Dieldrin	0.00477	0.00181	0.0980	µg/L	0.004	0.025	PG N	7_2- NN
Endosulfan I[1]	0.00183	0.00146	0.0057	µg/L	0.000	0.003		4_5- NN
Endosulfan II	0.00282	0.00190	0.0140	µg/L	0.001	0.003	PG N	8_C1_4- NN
Endosulfan sulfate	0.00673	0.00278	0.0570	µg/L	0.008	0.025		7_2- NN
Endrin	0.00443	0.00197	0.0580	µg/L	0.000	0.003		4_5- NN
Endrin aldehyde	0.00235	0.00171	0.0160	µg/L	0.001	0.003	PG	4_5- NN
Fluoranthene	0.234	0.124	4.80	µg/L	0.047	0.190		4_5- NN

Table 25. Standard elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values ≥ RL (cont)								
Fluorene	0.201	0.124	3.00	µg/L	0.051	0.190		4_5- NN
gamma-BHC (Lindane)	0.00374	0.00286	0.0160	µg/L	0.001	0.003	PG N	7_3- NN
gamma-Chlordane	0.00703	0.00286	0.0740	µg/L	0.004	0.025	PG	7_2- NN
Heptachlor	0.00927	0.00285	0.100	µg/L	0.001	0.003	PG N	4_5- NN
Heptachlor epoxide	0.00524	0.00201	0.0540	µg/L	0.000	0.003	PG	5_4- NN
Lead	21.3	2.32	1050	µg/L	0.200	10.0		10_C3&4- FN
Mercury	0.130	0.101	1.90	µg/L	0.055	0.200		10_C3&4- FN
Methoxychlor	0.00657	0.00339	0.0720	µg/L	0.001	0.005	PG	4_5- NN
Naphthalene	0.116	0.0991	0.820	µg/L	0.043	0.200		9_1- NN
Nickel	17.9	3.64	773	µg/L	0.730	10.0		10_C3&4- FN
N-Nitrosodiphenylamine	0.111	0.101	0.850	µg/L	0.046	0.190		7_4- NN
pH	7.77	7.77	8.70	No Units				9_C2&4- NN
Phenanthrene	0.332	0.154	6.90	µg/L	0.052	0.190		4_5- NN
Phenol	0.141	0.114	1.20	µg/L	0.021	0.190		4_7_- NN
Pyrene	0.209	0.127	3.20	µg/L	0.053	0.190		4_5- NN
Selenium	34.7	29.1	103	µg/L	2.10	50.0	J	10_C3&4- FN
Thallium	1.09	0.516	11.6	µg/L	0.180	10.0		10_C3&4- FN
Tin	12.9	11.7	77.7	µg/L	7.60	50.0		10_C3&4- FN
Total Organic Carbon	7.58	7.12	20.4	mg/L				9_C2&4- NN
Total Suspended Solids	13.9	10.4	56.0	mg/L	3.40	4.00		7_2- NN
TPH (as Diesel)	1970	598	29000	µg/L	940	2000		7_2- NN
TPH (as Gasoline)	60.9	47.4	870	µg/L	28.0	100	B	7_2- NN
Tributyltin	0.520	0.0531	13.0	µg/L	0.012	0.900		4_4- NN

Table 25. Standard elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values ≥ RL (cont)								
Zinc	64.1	11.9	2910	µg/L	6.00	50.0		10_C3&4- FN
Group II: Maximum Value <RL, highest detected value shown								
2,4,6-Trichlorophenol	0.479	0.470	0.0700	µg/L	0.055	0.960	J	10_1- NN
2,4-DB	1.93	1.89	3.00	µg/L	0.590	4.00	J PG	7_9-F
2,4-Dichlorophenol	0.0967	0.0965	0.0600	µg/L	0.047	0.190	J	10_1- NN
2-Chloronaphthalene	0.0967	0.0965	0.0610	µg/L	0.042	0.190	J	10_1- NN
2-Nitrophenol	0.480	0.472	0.0950	µg/L	0.052	0.960	J	10_1- NN
4-Bromophenyl phenyl ether	0.480	0.472	0.0950	µg/L	0.048	0.960	J	10_1- NN
4-Nitrophenol	2.40	2.39	1.60	µg/L	0.067	4.80	J	10_1- NN
Acenaphthylene	0.0968	0.0966	0.0640	µg/L	0.044	0.190	J	10_1- NN
alpha-BHC	0.00190	0.00153	0.00560	µg/L	0.001	0.003	PG	2_C1_6- NN
Benzo(ghi)perylene	0.0966	0.0958	0.120	µg/L	0.026	0.190	J	4_5- NN
Benzoic acid	2.27	2.10	3.40	µg/L	0.400	4.80	J	7_4- NN
Butyl benzyl phthalate	0.449	0.433	0.480	µg/L	0.130	0.960	J	10_1- NN
Dalapon	1.02	1.01	1.90	µg/L	0.520	2.00	J	10_1- NN
Dibenz(a,h)anthracene	0.0964	0.0959	0.0430	µg/L	0.033	0.190	J	4_5- NN
Diethyl phthalate	0.481	0.479	0.520	µg/L	0.230	0.940	J	4_7_- NN
Di-n-butyl phthalate	0.435	0.401	0.350	µg/L	0.045	0.960	J	10_1- NN
Di-n-octyl phthalate	0.479	0.466	0.0430	µg/L	0.041	0.960	J	10_1- NN
Indeno(1,2,3-cd)pyrene	0.0978	0.0977	0.120	µg/L	0.045	0.190	J	4_5- NN
Pentachlorophenol	0.492	0.491	0.780	µg/L	0.080	0.960	J	10_1- NN
Silver	2.57	2.54	6.30	µg/L	0.770	10.0	B	10_C3&4- FN

Table 25. Standard elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group III: All Samples Non-Detect								
1,2,4-Trichlorobenzene	0.0973	0.0973	0.105	µg/L	0.042	0.210	U	
1,2-Dichlorobenzene	0.0973	0.0973	0.105	µg/L	0.033	0.210	U	
1,2-Diphenylhydrazine	0.0973	0.0973	0.105	µg/L	0.047	0.210	U	
1,3-Dichlorobenzene	0.0973	0.0973	0.105	µg/L	0.039	0.210	U	
2,2'-oxybis(1-Chloropropane)	0.0973	0.0973	0.105	µg/L	0.027	0.210	U	
2,4,5-T	0.500	0.500	0.500	µg/L	0.170	1.00	U	
2,4,5-TP (Silvex)	0.500	0.500	0.500	µg/L	0.160	1.00	U	
2,4-D	2.00	2.00	2.00	µg/L	1.50	4.00	U	
2,4-Dimethylphenol	0.487	0.486	0.550	µg/L	0.055	1.10	U	
2,4-Dinitrophenol	2.44	2.43	2.65	µg/L	1.40	5.30	U	
2,4-Dinitrotoluene	0.487	0.486	0.550	µg/L	0.048	1.10	U	
2,6-Dinitrotoluene	0.487	0.486	0.550	µg/L	0.054	1.10	U	
2-Chlorophenol	0.487	0.486	0.550	µg/L	0.048	1.10	U	
3,3'-Dichlorobenzidine	0.487	0.486	0.550	µg/L	0.043	1.10	U	
4,6-Dinitro-2-methylphenol	2.44	2.43	2.65	µg/L	1.50	5.30	U	
4-Chloro-3-methylphenol	0.487	0.486	0.550	µg/L	0.063	1.10	U	
4-Chlorophenyl phenyl ether	0.487	0.486	0.550	µg/L	0.045	1.10	U	
Aroclor 1221	0.00962	0.00961	0.0100	µg/L	0.005	0.020	U	
Aroclor 1232	0.00962	0.00961	0.0100	µg/L	0.006	0.020	U	
Benzidine	9.73	9.73	10.50	µg/L	6.00	21.0	U	
bis(2-Chloroethoxy)methane	0.487	0.486	0.550	µg/L	0.130	1.10	U	
bis(2-Chloroethyl) ether	0.0973	0.0973	0.105	µg/L	0.049	0.210	U	
Chlordane (technical)	0.0157	0.0133	0.120	µg/L	0.071	0.240	U	

Table 25. Standard elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group III: All Samples Non-Detect (cont)								
Diazinon	0.483	0.483	0.500	µg/L	0.120	1.00	U	
Dicamba	1.00	1.00	1.00	µg/L	0.330	2.00	U	
Dichlorprop	2.00	2.00	2.00	µg/L	0.720	4.00	U	
Dimethyl phthalate	0.487	0.486	0.550	µg/L	0.045	1.10	U	
Dinoseb	0.300	0.300	0.300	µg/L	0.260	0.600	U	
Hexachlorobenzene	0.0973	0.0973	0.105	µg/L	0.046	0.210	U	
Hexachlorobutadiene	0.0973	0.0973	0.105	µg/L	0.040	0.210	U	
Hexachlorocyclopentadiene	0.487	0.486	0.550	µg/L	0.085	1.10	U	
Hexachloroethane	0.487	0.486	0.550	µg/L	0.046	1.10	U	
Isophorone	0.487	0.486	0.550	µg/L	0.050	1.10	U	
MCPA	200	200	200	µg/L	94.0	400	U	
MCPP	200	200	200	µg/L	130	400	U	
Monobutyltin	0.418	0.292	5.00	µg/L	0.050	10.0	U	
Nitrobenzene	0.0973	0.0973	0.105	µg/L	0.068	0.210	U	
N-Nitrosodimethylamine	0.487	0.486	0.550	µg/L	0.048	1.10	U	
N-Nitrosodi-n-propylamine	0.0973	0.0973	0.105	µg/L	0.063	0.210	U	
Tetrabutyltin	0.0396	0.0285	0.500	µg/L	0.009	1.00	U	
Toxaphene	0.00164	0.00139	0.0125	µg/L	0.007	0.025	U	

B Compound was detected in the method blank. **J** Compound detected but below the reporting limit (the value given is an estimate).
N The RPD between the results from both columns is > 100%. **PG** The % difference between the results from both columns is >40% (SW846).
U Compound analyzed but not detected.

Table 26. Standard elutriate data validation rejects.

Sample	Compound
10_1 - NN	3,3'-Dichlorobenzidine
4_5 - NN	Chromium, hexavalent
4_7_ - NN	Chromium, hexavalent
10_C3&4 - FN	Chromium, hexavalent
10_0C3&4 - F	Mercury-DISS
6_1 - NN	Monobutyltin
6_3 - F	Monobutyltin
6_4 - F	Monobutyltin
6_5 - F	Monobutyltin
6_1 - N	Monobutyltin
6_3 - FN	Monobutyltin
6_4 - FN	Monobutyltin

Table 27. Maximum standard elutriate concentration, Mississippi River background concentrations, available freshwater criteria/standards and dilution ratios for open water disposal in Mississippi River disposal site.

Contaminants	Maximum Elutriate Concentration	Mississippi River Water Concentration: Reported	Mississippi River Water Concentration: Assumed	Federal Primary: Acute Toxicity Primary Criteria	Federal Primary: Chronic Toxicity Primary Criteria	Federal Primary & Secondary: Acute Toxicity Criteria	Federal Primary & Secondary: Chronic Toxicity Criteria	US EPA Region 4 Water Quality Screening Values for Hazardous Waste Sites: Acute Toxicity Criteria	US EPA Region 4 Water Quality Screening Values for Hazardous Waste Sites: Chronic Toxicity Criteria	State of Louisiana: Acute Standards	State of Louisiana: Chronic Standards	Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	Dilution Ratios: Meeting Acute Criteria	Dilution Ratios: Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
Metals															
Aluminum	4690	11.3BJ	11	750a	87a	750a	87a	750	87			750	87	**5**	**61**
Antimony	14.8	0.09B	0.090			180b	30b	1300	160			180	30	0	0
Arsenic	11.9	1.80	1.800	340	150	66c	3.1d	340e	150e	339.8	150	339.8	150	0	0
Barium	2590	74.1	74.100			110b	4b					110	4	**69**	**339**
Beryllium	3.00	1U	0.500			35b	0.66b	16	0.053			35	1	0	**15**
Cadmium	15.6	1U	0.5	2.0	.25	2.0	.25	2.0	.25	15n	0.62n	2.0	.25	**9**	**301**
Chromium III	693	3.50	3.500	570	74	570	74	570	74	310n	103n	310	74	**1.25**	**8.78**
Chromium VI	13.0	10U	5.000	16	11	16	11	16	11	16	11	16	11	0	**0.33**
Copper	14.1	2.1J	2.100	13	9	13	9	13	9	10n	7n	10	7	**0.52**	**1.45**
Lead	9.90	0.34BJ	0.340	65	2.5	65	2.5	65	3	30n	1.2n	30	1	0	**10**
Mercury	0.170	0.2U	0.100	1.4	0.77	1.4	0.77	1.4	0.77	2.04	0.01	1	0.01	0	**6**
Nickel	7.20	1.50	1.500	470	52	470	52	470	52	788n	88n	470	52	0	0
Selenium	61.2r	0.89B	0.890		5q	20f	5	20g	5.00			20	5	**2**	**14**
Silver	1.25	1U	0.5	3.2		3.2	0.36b	3.2	0.012			3.2	0.36	0	**14**
Thallium	1.25	0.031BJ	0.031			110b	12b	140	4			110	12	0	0
Tin	1.25	1.6B	1.600			2700b	73b					2700	73	0	0
Zinc	49.8	8.70	8.700	120	120	120	120	120	120	64m	58m	64	58	0	0
Organotins															
Dibutyltin	1.50	0.037U	0.019											NS[1]	NS
Monobutyltin														NS	NS
Tetrabutyltin														NS	NS
Tributyltin	13.0	0.043U	0.022	0.46h	0.072h	0.46h	0.072h		0.026			0.46	0.072	**29**	**256**
Inorganic/General Chemistry															
Cyanide	14.2	10U	5.000	22	5.2	22	5.2	22	5.2	45.9	5.4	22	5.2	0	**17**
Ammonia-N	16900	68B	68.000	17000i	1900i							17000	1900	0	**8**
PAHs															
2-Methylnaphthalene	2.30	.19U	0.095											NS	NS
Acenaphthene	4.10	.19U	0.095			80f	23f	170	17			80	23	0	0
Acenaphthylene	0.105	.19U	0.095											NS	NS
Anthracene	1.30	.19U	0.095			13b	0.73b					13	0.73	0	**0.9**
Benzo(a)anthracene	1.00	.19U	0.095			0.49b	0.027b					0.49	0.027	**1**	**94**
Benzo(a)pyrene	0.370	.19U	0.095			0.24b	0.014b					0.24	0.014	**0.90**	**28**
Benzo(b)fluoranthene	0.510	.19U	0.095											NS	NS
Benzo(g,h,i)perylene	0.120	.19U	0.095											NS	NS
Benzo(k)fluoranthene	0.210	.19U	0.095											NS	NS
Chrysene	0.770	.19U	0.095											NS	NS

Table 27. Maximum standard elutriate concentration, Mississippi River background concentrations, available freshwater criteria/standards and dilution ratios for open water disposal in Mississippi River disposal site.

Contaminants	Maximum Elutriate Concentration	Mississippi River Water Concentration		Federal				US EPA Region 4		State of Louisiana		Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	Dilution Ratios	
				Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Acute Standards	Chronic Standards				
		Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria					Meeting Acute Criteria	Meeting Chronic Criteria
	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L		
Dibenzo(a,h)anthracene	0.105	.19U	0.095											NS	NS
Dibenzofuran	1.10	.95U	0.475			66b	3.7b					66	3.7	0	0
Fluoranthene	4.80	.19U	0.095			33.6f	6.16f	398	39.8			33.6	6.16	0	0
Fluorene	3.00	.19U	0.095			70b	3.9b					70	3.9	0	0
Indeno(1,2,3-c,d)pyrene	0.120	.19U	0.095											NS	NS
Naphthalene	0.820	.19U	0.095			190b	12b	230	62			190	12	0	0
Phenanthrene	6.90	.083J	0.083			30f	6.3f					30	6.3	0	**0.1**
Pyrene	3.20	.19U	0.095											NS	NS
Semi-Volatile Organic Compounds															
1,4-Dichlorobenzene	0.190	.076J	0.076			180b	15b	112	11.2			180	15	0	0
2,4,6-Trichlorophenol	0.550	.95U	0.475				970f	32	3.2				970	0p	0
2,4-Dichlorophenol	0.105	.19U	0.095			2020f	365f	202	36.5	202	101	202	101	0	0
2-Chloronaphthalene	0.105	.19U	0.095			1600f						1600		0	NS
2-Nitrophenol	0.550	.95U	0.475			230f	150f		3500			230	150	0	0
4-Bromophenyl phenyl ether	0.550	.95U	0.475				1.5b						1.5	NS	0
4-Methylphenol (p-Cresol)	1.10	.95U	0.475											NS	NS
4-Nitrophenol	2.65	4.8U	2.4			1200b	300b	828	82.8			1200	300	0	0
Benzoic acid	3.40	4.8U	2.4			740b	42b					740	42	0	0
Benzyl butyl phthalate	0.550	.95U	0.475				19b	330	22				19	0p	0
Bis(2-ethylhexyl) phthalate	5.70	.22J	0.220			27b	3b	1110	<0.3			27	3	0	**1.0**
Diethyl phthalate	0.550	.95U	0.475			1800b	210b	5210	521			1800	210	0	0
Di-n-butyl phthalate	0.550	.95U	0.475			190b	35b	94	9.4			190	35	0	0
Di-n-octyl phthalate	0.550	.95U	0.475				708i						708	NS	0
N-Nitrosodiphenylamine	0.850	.19U	0.095			3800b	210b	585	58.5			3800	210	0	0
Pentachlorophenol	0.780	.95U	0.475	19	15	19b	15b	19j	15k			19	15	0	0
Phenol	1.20	.19U	0.095			3600f	110f	1020	256	700	350	700	350	0	0
Chlorinated Pesticides															
4,4'-DDD	0.160	.00093J PG	0.001			0.19b	0.011b	0.064	0.0064	0.030	0.006	0.03	0.006	**4**	**30**
Aldrin	0.051	.0026U	0.001	3		3		3	0.3	3		3		0	0p
alpha-BHC	0.013	.0026U	0.001			39b	2.2b		500			39	2.2	0	0
alpha-Chlordane	0.015	.0026U	0.001	2.4m	0.0043m	2.4m	0.0043m	2.4m	0.0043m			2.4	0.0043	0	**4**
beta-BHC	0.065	.0026U	0.001			39b	2.2b		5000			39	2.2	0	0
delta-BHC	0.120	.0026U	0.001			39b	2.2b					39	2.2	0	0
Dieldrin	0.098	.0026U	0.001	0.24	0.056	0.24	0.056	0.24	0.0560	0.2374	0.0557	0.2374	0.0557	0	**0.8**
Endosulfan I	0.013	.0026U	0.001	0.22	0.056	0.22	0.056	0.22	0.056	0.220	0.0560	0.22	0.056	0	0
Endosulfan II	0.014	.0026U	0.001	0.22	0.056	0.22	0.056	0.22	0.056			0.22	0.056	0	0
Endosulfan sulfate	0.057	.0026U	0.001											NS	NS

Table 27. Maximum standard elutriate concentration, Mississippi River background concentrations, available freshwater criteria/standards and dilution ratios for open water disposal in Mississippi River disposal site.

Contaminants	Maximum Elutriate Concentration	Mississippi River Water Concentration		Federal				US EPA Region 4		State of Louisiana		Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	Dilution Ratios	
				Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Acute Standards	Chronic Standards				
		Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria					Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
Endrin	0.058	.0014J PG N	0.001	0.086	0.036	0.086	0.036	0.086	0.0360	0.0864	0.0375	0.086	0.036	0	**0.6**
Endrin aldehyde	0.016	.0037PG N	0.004											NS	NS
gamma-BHC (Lindane)	0.016	.0015J PG	0.002	0.95		0.95		0.95	0.08	5.3	0.210	0.9500	0.2100	0	0
gamma-Chlordane	0.074	.0025J	0.003	2.4m	0.0043m	2.4m	0.0043m	2.4m	0.0043m			2.4	0.0043	0	**39**
Heptachlor	0.100	.0026U	0.001	0.52	0.0038	0.52	0.0038	0.52	0.0038			0.52	0.0038	0	**38**
Heptachlor epoxide	0.054	.0026U	0.001	0.52	0.0038	0.52	0.0038	0.52	0.0038			0.52	0.0038	0	**20**
Methoxychlor	0.072	.005U	0.003		0.03h		0.03h		0.03				0.03	NS	**2**
p,p'-DDE (4,4')	0.087	.0026U	0.001					105	10.5					0p	0p
p,p'-DDT (4,4')	0.062	.0014J	0.001	1.1	0.001	1.1	0.001	1.1	0.001	1.1	0.001	1.1	0.001	0	**432**
PCBs															
PCB(Aroclor-1016)	0.160	.02U	0.010					0.2	0.014					0p	**36.5p**
PCB(Aroclor-1242)	0.390	.02U	0.01			1.2b	0.53b	0.2	0.014			1.2	0.53	0	0
PCB(Aroclor-1248)	1.50	.02U	0.010			1.4b	0.081b	0.2	0.014			1.4	0.0810	**0.1**	**20**
PCB(Aroclor-1254)	0.930	.02U	0.010			0.6b	0.033b	0.2	0.014			0.6	0.033	**0.6**	**39**
PCB(Aroclor-1260)	1.40	.02U	0.010			1700b	94b	0.2	0.014			1700	94	0	0
PCB Total	2.80	.02U	0.010		0.014	2f	0.014		0.014	2.0	0.014	2	0.014	**0.4**	**697**
													Maximum	**69**	**697**
													Average	**2**	**38**
													Minimum	**0**	**0**

1 NS - No standard

a Non-priority pollutant pH 6.5-9, **b** secondary value, **c** As III 340 µg/L, As V 66 mg/L (secondary value), **d** As III 150 µg/L, As V 3.1 µg/L (secondary value), **e** As III, **f** outdated national ambient water quality standard, **g** the CMC=1/[(f1/CMC1)+(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/L and 12.83 µg/L, respectively, **h** non-priority pollutant, **i** federal EPA criteria for Ammonia, pH 7.6 & salmonids absent acute, pH 7.6 and T 26 deg C chronic, **j** at pH 7.8, pH dependent criteria e^(1.005pH-4.83), **k** at pH 7.8, pH dependent criteria e^(1.005pH-5.29), **m** chlordane species not specified, **n** harness dependent criteria, values from Weston IHNC database WQC summary 6 1 2008, **p** Based on EPA Region IV screening water quality criteria for hazardous waste sites, **q** total concentrations, **r** dissolved concentration (total concentrations not measured in SE)
B Compound was detected in the method blank. **J** Compound detected but below the reporting limit (the value given is an estimate). **N** The RPD between the results from both columns is > 100%. **PG** The % difference between the results from both columns is >40% (SW846). **U** Compound analyzed but not detected.

Table 28. Mean (geometric) standard elutriate concentration, Mississippi River background concentrations, available freshwater criteria/standards and dilution ratios for open water disposal in Mississippi River disposal site.

Contaminants	Mean (Geometric) Elutriate Concentration	Mississippi River Water Concentration		Federal				US EPA Region 4		State of Louisiana		Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	Dilution Ratios	
				Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Acute Standards	Chronic Standards				
		Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria					Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
Metals															
Aluminum	450	11.3BJ	11.3	750a	87a	750a	87a	750	87			750	87	0	**5**
Antimony	2.63	0.09B	0.090			180b	30b	1300	160			180	30	0	0
Arsenic	7.12	1.80	1.80	340	150	66c	3.1d	340e	150e	339.8	150	339.8	150	0	0
Barium	748	74.1	74.1			110b	4b					110	4	**18**	**90**
Beryllium	1.73	1U	0.500			35b	0.66b	16	0..53			35	0.660	0	**7**
Cadmium	1.85	1U	0.500	2.0	.25	2.0	.25	2.0	.25	15n	0.62n	2.0	.25	0	**26**
Chromium III	6.75	3.50	3.50	570	74	570	74	570.00	74.00	310n	103n	310	74	0	0
Chromium VI	0.00559	10U	5.00	16	11	16	11	16	11	16	11	16	11	0	0
Copper	5.01	2.1J	2.10	13	9	13	9	13.00	9.00	10n	7n	10	7	0	0
Lead	2.32	0.34BJ	0.340	65	2.5	65	2.5	65.00	2.50	30n	1.2n	30	1.2	0	**1**
Mercury	0.101	0.2U	0.100	1.4	0.77	1.4	0.77	1.4	0.7700	2.04	0.012	1.4	0.012	0	p
Nickel	3.64	1.50	1.50	470	52	470	52	470.00	52.00	788n	88n	470	52	0	0
Selenium	29.1t	0.89B	0.890		5s	20f	5	20g	5.00			20	5	**0.48**	**6**
Silver	2.54	1U	0.500	3.2		3.2	0.36b	3.2	0.012			3.2	0.360	0	**40**
Thallium	0.516	0.031BJ	0.031			110b	12b	140.00	4.00			110	12	0	0
Tin	11.7	1.6B	1.60			2700b	73b					2700	73	0	0
Zinc	11.9	8.70	8.70	120	120	120	120	120.00	120.00	64n	58n	64	58	0	0
Organotins															
Dibutyltin	0.0285	0.037U	0.019											NS	NS
Tributyltin	0.053	0.043U	0.022	0.46h	0.072h	0.46h	0.072h		0.026			0.460	0.072	0	0
Inorganic/General Chemistry															
Ammonia-N	8170	68B	68.0	17000i	1900i							17000	1900	0	**3**
Cyanide	3.81	10U	5.00	22	5.2	22	5.2	22	5.2	45.9	5.4	22	5.2	0	0
PAHs															
2-Methylnaphthalene	0.107	.19U	0.095											NS	NS
Acenaphthene	0.161	.19U	0.095			80f	23f	170	17			80	23	0	0
Acenaphthylene	0.097	.19U	0.095											NS	NS
Anthracene	0.122	.19U	0.095			13b	0.73b					13	0.73	0	0
Benzo(a)anthracene	0.101	.19U	0.095			0.49b	0.027b					0.49	0.027	0	p
Benzo(a)pyrene	0.0980	.19U	0.095			0.24b	0.014b					0.24	0.014	0	p
Benzo(b)fluoranthene	0.0984	.19U	0.095											NS	NS
Benzo(g,h,i)perylene	0.0958	.19U	0.095											NS	NS

Table 28. Mean (geometric) standard elutriate concentration, Mississippi River background concentrations, available freshwater criteria/standards and dilution ratios for open water disposal in Mississippi River disposal site.

Contaminants	Mean (Geometric) Elutriate Concentration	Mississippi River Water Concentration		Federal				US EPA Region 4		State of Louisiana		Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	Dilution Ratios	
				Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Acute Standards	Chronic Standards				
		Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria					Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
Benzo(k)fluoranthene	0.0976	.19U	0.095											NS	NS
Chrysene	0.0969	.19U	0.095											NS	NS
Dibenzo(a,h)anthracene	0.096	.19U	0.095											NS	NS
Dibenzofuran	0.349	.95U	0.475			66b	3.7b					66	3.7	0	0
Fluoranthene	0.124	.19U	0.095			33.6f	6.16f	398	39.8			33.6	6.16	0	0
Fluorene	0.124	.19U	0.095			70b	3.9b					70	3.9	0	0
Indeno(1,2,3-c,d)pyrene	0.0977	.19U	0.095											NS	NS
Naphthalene	0.0991	.19U	0.095			190b	12b	230	62			190	12	0	0
Phenanthrene	0.154	.083J	0.083			30f	6.3f					30	6.3	0	0
Pyrene	0.127	.19U	0.095											NS	NS
Semi-Volatile Organic Compounds															
1,4-Dichlorobenzene	0.104	.076J	0.076			180b	15b	112	11.2			180	15	0	0
2,4,6-Trichlorophenol	0.470	.95U	0.475				970f	32	3.2				970	0q	0
2,4-Dichlorophenol	0.0965	.19U	0.095			2020f	365f	202	36.5	202	101	202	101	0	0
2-Chloronaphthalene	0.0965	.19U	0.095			1600f						1600		0	NS
2-Nitrophenol	0.473	.95U	0.475			230f	150f		3500			230	150	0	0
4-Bromophenyl phenyl ether	0.473	.95U	0.475				1.5b						1.5	NS	0
4-Methylphenol (p-Cresol)	0.417	.95U	0.475											NS	NS
4-Nitrophenol	2.39	4.8U	2.40			1200b	300b	828	82.8			1200	300	0	0
Benzoic acid	2.10	4.8U	2.40			740b	42b					740	42	0	0
Benzyl butyl phthalate	0.433	.95U	0.475				19b	330	22				19	0q	0
Bis(2-ethylhexyl) phthalate	0.587	.22J	0.220			27b	3b	1110	<0.3			27	3	0	0
Diethyl phthalate	0.479	.95U	0.475			1800b	210b	5210	521			1800	210	0	0
Di-n-butyl phthalate	0.401	.95U	0.475			190b	35b	94	9.4			190	35	0	0
Di-n-octyl phthalate	0.466	.95U	0.475				708i						708	NS	0
N-Nitrosodiphenylamine	0.101	.19U	0.095			3800b	210b	585	58.5			3800	210	0	0
Pentachlorophenol	0.491	.95U	0.475	19	15	19b	15b	19j	15k			19	15	0	0
Phenol	0.114	.19U	0.095			3600f	110f	1020	256	700	350	700	350	0	0
Chlorinated Pesticides															
4,4'-DDD	0.00300	.00093J PG	0.001			0.19b	0.011b	0.064	0.0064	0.03	0.006	0.03	0.006	0	0
Aldrin	0.00220	.0026U	0.001	3		3		3	0.3	3		3		0	0q
alpha-BHC	0.00150	.0026U	0.001			39b	2.2b		500			39	2.2	0	0
alpha-Chlordane	0.00150	.0026U	0.001	2.4m	0.0043m	2.4m	0.0043m	2.4m	0.0043m			2.4	0.0043	0	0
beta-BHC	0.00210	.0026U	0.001			39b	2.2b		5000			39	2.2	0	0

Table 28. Mean (geometric) standard elutriate concentration, Mississippi River background concentrations, available freshwater criteria/standards and dilution ratios for open water disposal in Mississippi River disposal site.

Contaminants	Mean (Geometric) Elutriate Concentration	Mississippi River Water Concentration		Federal				US EPA Region 4		State of Louisiana		Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	Dilution Ratios	
				Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Acute Standards	Chronic Standards				
		Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria					Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L		
delta-BHC	0.00370	.0026U	0.001			39b	2.2b					39	2.2	0	0
Dieldrin	0.00180	.0026U	0.001	0.24	0.056	0.24	0.056	0.24	0.0560	0.2374	0.0557	0.2374	0.06	0	0
Endosulfan I	0.00150	.0026U	0.001	0.22	0.056	0.22	0.056	0.22	0.056	0.22	0.0560	0.22	0.06	0	0
Endosulfan II	0.00190	.0026U	0.001	0.22	0.056	0.22	0.056	0.22	0.056			0.22	0.06	0	0
Endosulfan sulfate	0.00280	.0026U	0.001											NS	NS
Endrin	0.00200	.0014J PG N	0.001	0.086	0.036	0.086	0.036	0.086	0.0360	0.0864	0.0375	0.086	0.036	0	0
Endrin aldehyde	0.00170	.0037PG N	0.004											NS	NS
gamma-BHC (Lindane)	0.00290	.0015J PG	0.002	0.95		0.95		0.95	0.08	5.3	0.21	0.95	0.21	0	0
gamma-Chlordane	0.00290	.0025J	0.003	2.4m	0.0043m	2.4m	0.0043m	2.4m	0.0043m			2.4	0.0043	0	0
Heptachlor	0.00290	.0026U	0.001	0.52	0.0038	0.52	0.0038	0.52	0.0038			0.52	0.0038	0	0
Heptachlor epoxide	0.00200	.0026U	0.001	0.52	0.0038	0.52	0.0038	0.52	0.0038			0.52	0.0038	0	0
Methoxychlor	0.00340	.005U	0.003		0.03h		0.03h		0.03				0.030	NS	0
p,p'-DDE (4,4')	0.00200	.0026U	0.001					105	10.5					0q	0q
p,p'-DDT (4,4')	0.00340	.0014J	0.001	1.1	0.001	1.1	0.001	1.1	0.001	1.1	0.001	1.1	0.001	0	**13**
PCB Congeners															
PCB(Aroclor-1016)	0.0105	.02U	0.010					0.2	0.014					0q	0q
PCB(Aroclor-1242)	0.0107	.02U	0.010			1.2b	0.53b	0.2	0.014			1.2	0.53	0	0
PCB(Aroclor-1248)	0.0174	.02U	0.010			1.4b	0.081b	0.2	0.014			1.4	0.081	0	0
PCB(Aroclor-1254)	0.0185	.02U	0.010			0.6b	0.033b	0.2	0.014			0.6	0.033	0	0
PCB(Aroclor-1260)	0.0168	.02U	0.010			1700b	94	0.2	0.014			1700	94	0	0
PCB Total	0.0304	.02U	0.010		0.014	2b	0.014		0.014	2	0.014	2	0.014	0	**4**
													Maximum	**18**	**90**
													Mean	**0.28**	**3**
													Minimum	**0**	**0**

1 NS - No standard

a Non-priority pollutant pH 6.5-9, **b** secondary value, **c** As III 340 µg/L, As V 66 mg/L (secondary value), **d** As III 150 µg/L, As V 3.1 µg/L (secondary value), **e** As III, **f** outdated national ambient water quality standard, **g** the CMC=1/[(f1/CMC1)+(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/L and 12.83 µg/L, respectively, **h** non-priority pollutant, **i** federal EPA criteria for Ammonia, ph 7.6 acute, pH 7.6 and T 26 deg C chronic, **j** at pH 7.8, pH dependent criteria e^(1.005pH-4.83), **k** at pH 7.8, pH dependent criteria e^(1.005pH-5.29), **m** chlordane species not specified, **n** harness dependent criteria, values from Weston IHNC database WQC summary 6 1 2008, **p** assumed background concentration exceeds criteria, elutriate concentration near background concentration, dilution ratio cannot be calculated, **q** based on EPA Region IV screening water quality criteria for hazardous waste sites, , **s** total concentrations, **t** dissolved concentration (total concentrations not measured in SE)
B Compound was detected in the method blank. **J** Compound detected but below the reporting limit (the value given is an estimate). **N** The RPD between the results from both columns is > 100%. **PG** The % difference between the results from both columns is >40% (SW846). **U** Compound analyzed but not detected.

Table 29. Dilution requirements for standard elutriates based on LC50 values from freshwater elutriates.

DMMU	LC50 (% Elutriate)	LOEC (% Elutriate)	NOEC (% Elutriate)	Toxicity Criteria (% Elutriate)	Dilution Ratio For Toxicity Criteria
1 NN	ND	100	50	50	1
2 NN	ND	ND	ND	ND	0
3 NN	ND	ND	ND	ND	0
3 N	ND	ND	ND	ND	0
3 F	ND	10	1*	1	99
4 NN	ND	ND	ND	ND	0
5 NN	ND	ND	ND	ND	0
4/5 N	69	100	50	0.69	144
6 NN	ND	ND	ND	ND	0
6 N	ND	100	50	50	1
6 F	ND	100	50	50	1
7 NN	42	50	10	0.42	237
7 N	72	100	50	0.72	138
7 F	ND	ND	ND	ND	0
8 NN	ND	10	1*	1	99
9 -1 NN	ND	100	50	50	1
9-2&4 NN	ND	ND	ND	ND	0
10 NN	ND	ND	ND	ND	0
10 N	26	50	10	0.26	384
10 F	ND	ND	ND	ND	0

LC50 = median effect concentration. ND = not detected.
LOEC = lowest-observed effects concentration. NOEC = no observed effects concentration.

Table 30. Permitted discharges on the Mississippi River near the MR disposal site.

AI	AI Name	Permit No	Permit Type	Issued	Parish	Latitude				Longitude				Phys Address	City	State	Zip Code
						Deg	Min	Sec	Hun	Deg	Min	Sec	Hun				
25619	AEP Elmwood LLC	LA0096512	Indiv-Minor Industrial	01/20/04	Orleans	29	56	36		90	0	52		3700 Patterson Rd	Algiers	LA	70114
12803	Cooper T Smith Stevedoring Co - Mooring Division	LAG480150	Gen-LAG48-Light Commercial	09/05/02	Orleans	29	57	19	11	90	2	36	6	1240 Patterson Dr	Algiers	LA	70114
41181	Crescent Towing Co Inc	LAG532259	Gen-LAG53-Sanitary Class I	02/29/08	Orleans	29	57	18	7	90	2	33	51	1240 Patterson St	Algiers	LA	70114
41181	Crescent Towing Co Inc	LAR05N873	Gen-LAR05-Multi-Sector	07/26/07	Orleans	29	57	18	7	90	2	33	51	1240 Patterson St	Algiers	LA	70114
42267	LMS Ship Management Inc - Algiers Yard	LA0101028	Indiv-Minor Industrial	01/21/04	Orleans	29	57	21		90	2	30		900 Patterson Rd	Algiers	LA	70114
85733	LADOTD - Orleans Parish - LAR100000 Construction Stormwater Activity	LAR10C953	Gen-LAR10-Construction	04/13/05	Orleans									Orleans Parish	Orleans Parish	LA	70000
85733	LADOTD - Orleans Parish - LAR100000 Construction Stormwater Activity	LAR10C990	Gen-LAR10-Construction	05/06/05	Orleans									Orleans Parish	Orleans Parish	LA	70000
85733	LADOTD - Orleans Parish - LAR100000 Construction Stormwater Activity	LAR10D010	Gen-LAR10-Construction	05/16/05	Orleans									Orleans Parish	Orleans Parish	LA	70000
85733	LADOTD - Orleans Parish - LAR100000 Construction Stormwater Activity	LAR10D341	Gen-LAR10-Construction	02/02/06	Orleans									Orleans Parish	Orleans Parish	LA	70000
93683	USArmy COE - Orleans Parish Construction Stormwater Activity	LAR10D546	Gen-LAR10-Construction	06/19/06	Orleans									Orleans Parish	Orleans Parish	LA	70000
93683	USArmy COE - Orleans Parish Construction Stormwater Activity	LAR10E472	Gen-LAR10-Construction	10/09/07	Orleans									Orleans Parish	Orleans Parish	LA	70000
93683	USArmy COE - Orleans Parish Construction Stormwater Activity	LAR10E570	Gen-LAR10-Construction	11/29/07	Orleans									Orleans Parish	Orleans Parish	LA	70000
93683	USArmy COE - Orleans Parish Construction Stormwater Activity	LAR10E609	Gen-LAR10-Construction	12/12/07	Orleans									Orleans Parish	Orleans Parish	LA	70000

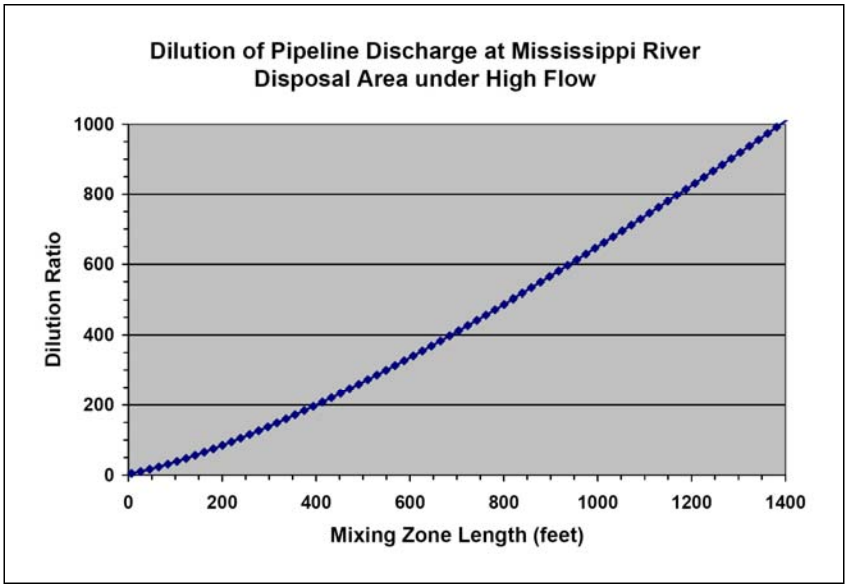


Figure 14. Dilution ratio as a function of distance for pipeline disposal under high flow conditions.

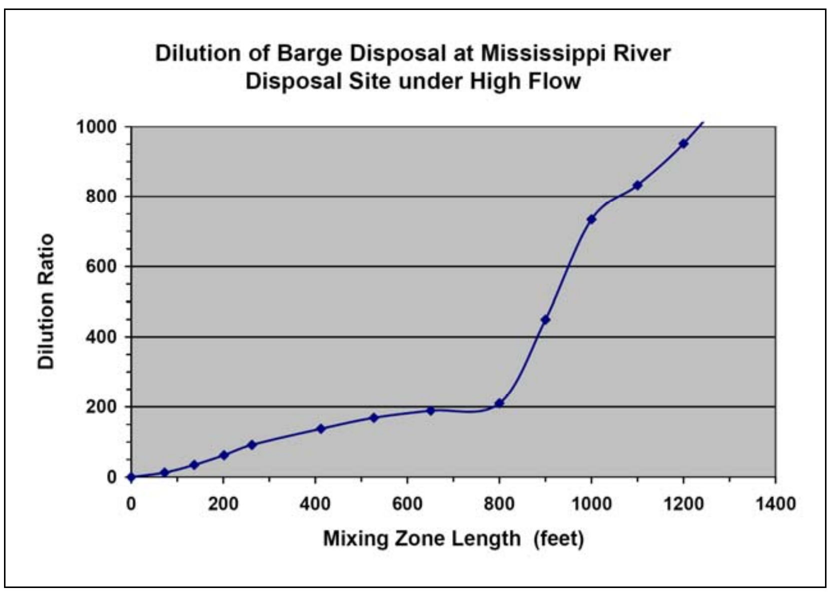


Figure 15. Dilution ratio as a function of distance for barge disposal under high flow conditions.

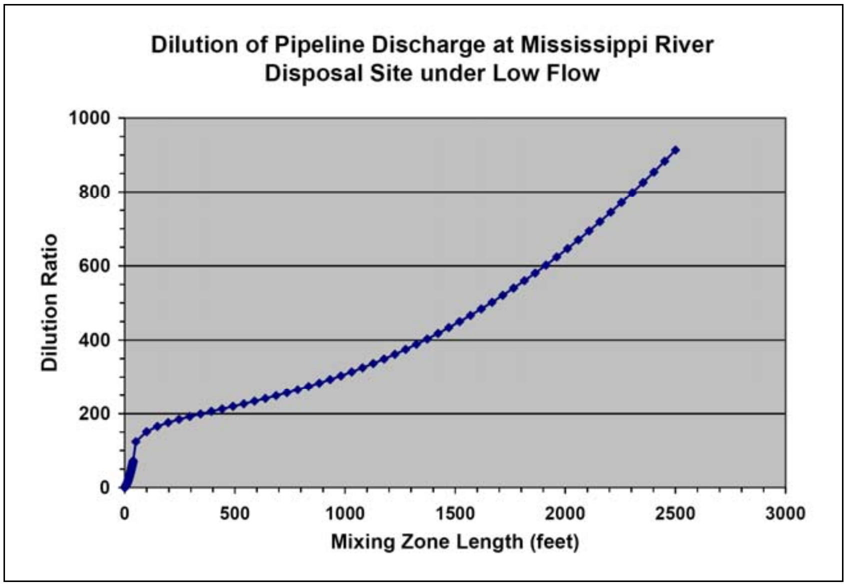


Figure 16. Dilution ratio as a function of distance for pipeline disposal under low flow conditions.

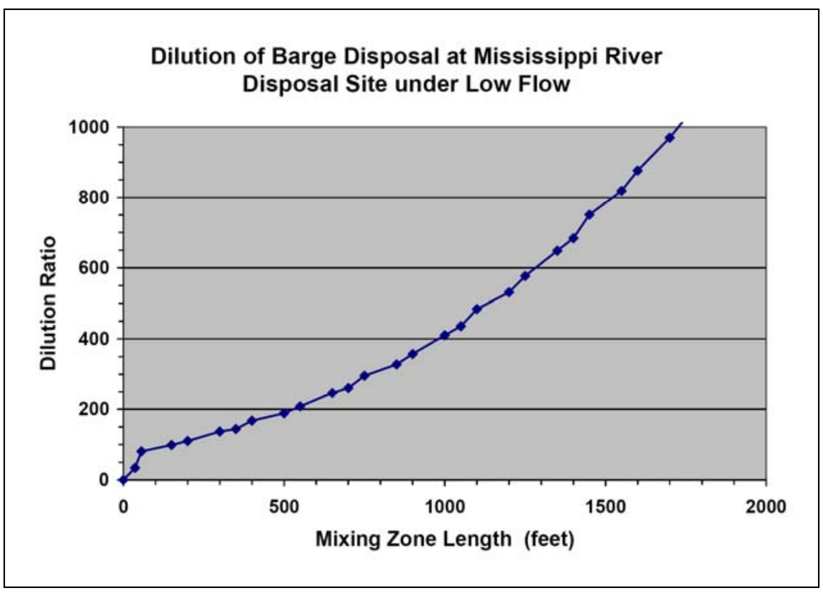


Figure 17. Dilution ratio as a function of distance for barge disposal under low flow conditions.

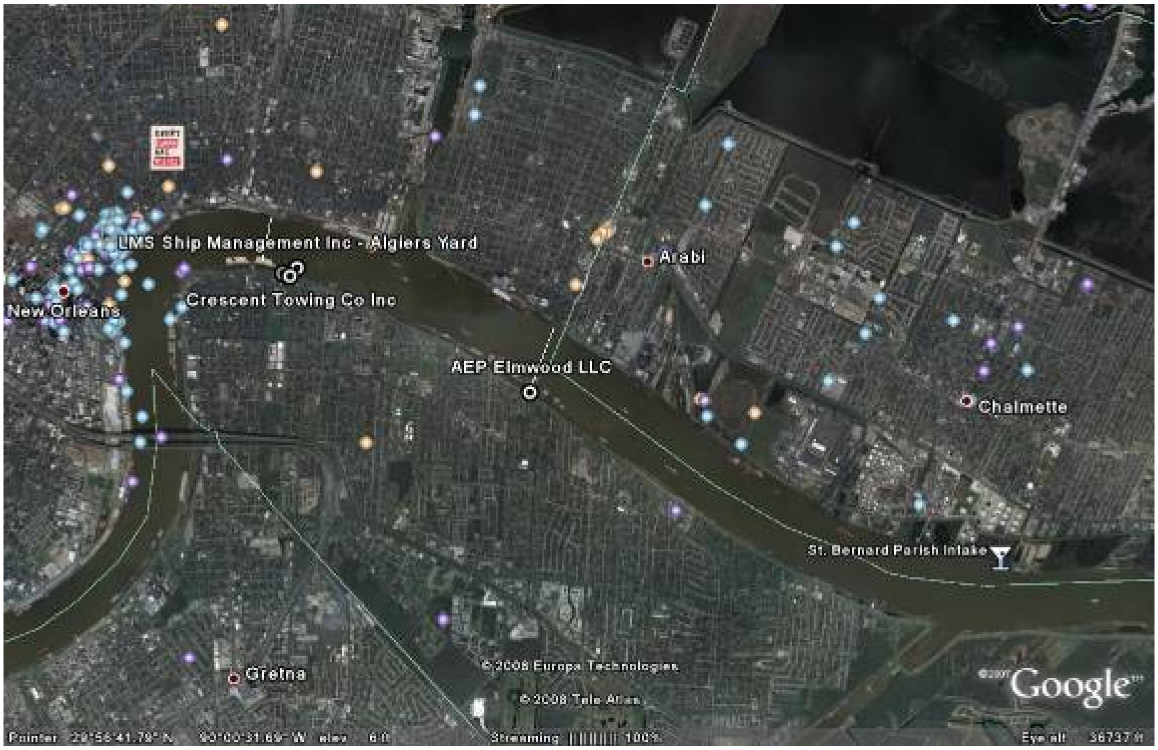


Figure 18. Approximate locations of permitted discharges.

4.2. Potential water quality impacts associated with release of effluent and runoff from confined disposal facilities

4.2.1. Objectives

The modified elutriate test is described in Appendix B of the Upland Testing Manual (UTM) (USACE 2003). The modified elutriate is specified for the assessment of water quality impacts associated with release of effluent from confined disposal facilities (CDFs). Effluent discharges are subject to regulation under CWA Section 404. Effluent is nationwide permitted at 33 CFR 330.5(16), which requires that a water quality certification be obtained from the appropriate agency. Typically, a CWA Section 401 Water Quality Certification is obtained from the State.

The UTM also specifies that evaluation of effluent discharges should consider the effects of mixing and dispersion. The Federal regulations implementing Section 404(b)(1), Clean Water Act (40 CFR 230), recognize this and explicitly provide for consideration of mixing in evaluating dredged material releases. Mixing zones are normally defined by the State regulatory agency as part of the CWA Section 401 Water Quality Certification requirements. The State of Louisiana sets forth requirements for mixing zones in LAC 33:IX.1115.C. If water quality standards (WQS) can be met within the prescribed boundaries of an approved mixing zone, there should not be an unacceptable environmental effect as a result of the effluent discharge.

The UTM provides for a tiered evaluation approach similar to those recommended for evaluation of open water disposal in the ITM (USEPA and USACE 1998). Tier I involves assessment of existing information to determine environmental pathways and contaminants of concern (COCs). Area land uses, industries, and previous sediment or effluent evaluations would be considered, for example. If information available in Tier I is insufficient to verify that no WQS will be violated outside of an approved mixing zone, Tier II screening is conducted. For Tier II, two screening procedures for estimating effluent contaminant concentrations are presented:

- Total dissolved release of COCs.
- Equilibrium partitioning.

The screening procedure based on the assumption of total dissolved release of COCs from sediment was developed for the ITM and is described in more detail in the previous discussion of the standard elutriate results. As previously noted, this procedure is considered to be overly conservative because only a portion of the contaminants associated with sediment will desorb and enter the dissolved phase. Equilibrium partitioning is considered to provide a reasonably conservative estimate of contaminant release from sediment, utilizing accepted conservative partitioning coefficients from adsorption studies to predict dissolved concentrations of contaminants expected in effluent. Predicted concentrations are compared to WQS and exceedances noted. Areas that may require dilution or effluent treatment can be identified and the need for Tier III testing, such as the modified elutriate, can be determined. The list of COCs may also be further refined in some cases. Tier II screening is not a requirement, though it may be helpful in maximizing use of analytical resources. Tier II and Tier III evaluations are normally sufficient for evaluation of effluent discharges. In special cases, Tier IV evaluations (formal risk assessment) may be required to address specific concerns unresolved by Tier II and Tier III evaluations.

In some cases, a definitive determination regarding the acceptability of an effluent discharge cannot be made on the basis of effluent chemistry, as when:

- Criteria are lower than analytical reporting limits.
- There is concern regarding contaminants for which there are no WQS.
- There is concern regarding potential interactive effects of contaminants.

In these cases, Tier III toxicity testing is used to determine dilution requirements. Based on the results of elutriate toxicity testing, an LC50 value is calculated, as previously described in discussion of the standard elutriate results (Section 4.1.1). Where survival is not statistically different from the control, no dilution is required based on toxicity.

In this case, Tier III testing (modified elutriate and water column toxicity tests) was conducted concurrently with sediment evaluations in order to facilitate an accelerated project schedule. As part of the evaluation of effluent discharges from the proposed CDF for the IHNC project, predicted effluent concentrations (based on results of the modified elutriate) were compared to WQS, and exceedances noted. Dilution required to meet WQS was calculated and properties of the receiving water considered in calculating attainable dilution and required mixing zone dimensions. Toxicity test results were also reviewed and dilution requirements considered for discharge from the CDF into the Gulf Intracoastal Waterway (GIWW) and Bayou Bienvenue.

4.2.2. Data evaluation and dilution requirements

Modified elutriates were prepared and analyzed by Test America (Weston Solutions 2008) and analyzed for total and dissolved concentrations. Results obtained for dissolved and total elutriate fractions are summarized here. The raw data is reported elsewhere (Weston Solutions 2008). (Effluent toxicity testing was done only on standard elutriates, both freshwater and marine. These were each split into two aliquots, with Test American doing the chemical analysis and ERDC conducting the toxicity tests.)

Because dredging site water largely determines the characteristics of the dredge effluent, elutriate tests are conducted using site water from the dredging site. In this case, some sites that are presently marine in character are expected be freshwater when dredging takes place (once the old lock is opened permanently). This may impact portions of DMMUs 9 and 10 in particular. The importance of this is that the higher ionic strength of saltwater limits the activity of contaminants to some degree, which may in turn result in reduced dissolved concentrations in the elutriate testing. The magnitude of this effect is expected to range from approximately 5% to 20%, based on a preliminary evaluation of Setschenow constants. This is not enough to alter dilution requirements any more than the sediment variability itself, but is mentioned here for completeness.

Water samples were obtained from Bayou Bienvenue and the mitigation site and analyzed by Test America for background concentrations of contaminants of concern (COCs). No water samples were taken from the Gulf Intracoastal Waterway (GIWW) specifically, but samples were taken from DMMU1, which is in close proximity. DMMU 1 water concentrations were therefore used to estimate water quality in the GIWW.

Mean (arithmetic and geometric) and maximum dissolved contaminant concentrations were determined for each constituent, utilizing the modified elutriate results obtained from all DMMUs (Table 31). As for the SE, a value of half the reporting limit (0.5RL) was assumed for all non-detects for calculation of the means. Where the maximum elutriate concentration was less than the corresponding laboratory reporting limit (RL) (the sample was a non-detect), the highest qualified value reported for the constituent was taken as the maximum. Where the maximum elutriate concentration was less than the RL *and* there were no qualified values (all samples were non-detect), it was assumed the compound was not present and no dilutions were calculated. Where RL were very high, effluent concentrations could be estimated using partitioning analysis. However, it is considered unlikely that these would produce higher dilution requirements than those of contaminants that were present in the elutriate in measurable concentrations. Total concentrations obtained for modified elutriates are summarized in Table 32 and are included for completeness, but none of the applicable criteria are expressed in terms of total concentrations.

Elutriate concentrations (maximum and geometric mean values, for GIWW and Bayou Bienvenue) were compared to applicable water quality criteria in order to determine the need for dilution. Salinity of overlying water was observed to vary from approximately 3 ppt to over 15 ppt in sediment samples taken for column settling tests (Weston Solutions 2008). As a result, it was not clear whether brackish or marine water quality criteria would apply. In order to obtain a conservative estimate of dilution requirements, Federal water quality criteria were therefore compared to both marine and brackish State of Louisiana water quality standards. The lowest of these three values was used to calculate necessary dilutions. For a few constituents no Federal or State criteria were available. In these cases, EPA Region 4 water quality screening criteria for hazardous waste sites were used. Although these are screening values rather than enforceable standards, they were used as part of a "weight of evidence" approach to evaluate potential impacts. Toxicity testing is normally utilized to resolve questions regarding constituents for which there are no criteria. Toxicity tests were not conducted on modified elutriates however. Dilutions based on the LC50 values obtained for the standard elutriates may be applicable here, although higher mobility of metals would be expected in the modified elutriate. For the SE, no statistically significant toxicity was observed in marine effluent toxicity tests, which would indicate no dilution based on toxicity is required. Comparison of contaminant concentrations in modified elutriates and standard elutriates indicates they are generally comparable and in no case were metals higher in modified elutriates than in SE. The toxicity testing conducted on the standard elutriates is therefore considered to be reasonably representative for determination of dilution requirements for modified elutriates where standards are not available.

Where elutriate concentrations exceeded either acute or chronic water quality standards, dilutions were calculated using background concentrations of the receiving waters. Where background concentrations exceeded the standard, dilution was calculated to 10% above background. Where background exceeded the elutriate concentrations, no dilution could be calculated.

Runoff concentrations are normally considered as part of the mixing zone analysis. Predicted runoff concentrations are compared to acute criteria rather than chronic, due to the short-term and intermittent nature of discharges. Suspended solids concentrations are also lower in runoff as compared to effluent. Dilution requirements for runoff discharges are therefore typically much less than that required for the effluent pathway and can be estimated conservatively based on elutriate concentrations for the unoxidized case (dredged material surface is wet). Metals mobility typically increases as material dries and oxidizes, however, and the simplified laboratory runoff procedure (SLRP) test is used to model this (Price and Skogerboe 2000). Runoff concentrations and dilution requirements for the oxidized case will therefore require consideration of the SLRP test results. A review and update of the preliminary pathway analysis, including analysis of the SLRP results, are planned when ongoing data acquisition efforts are completed for the disposal site.

The analytical data was subjected to a rigorous data validation process (Weston Solutions 2008). Data validation normally involves verifying quality control parameters imbedded in the data such as surrogate recovery and evaluating such things as instrument calibration ranges and other factors potentially impacting the reliability of the results. If any quality control parameters are found to fall outside accepted ranges, and no corrective action can be taken, the data may be rejected. Six modified elutriate samples (dissolved concentrations) were rejected in the data validation, and these data points were removed from the database before dilutions were calculated. Affected samples and compounds are summarized in Table 33. Modified elutriate from DMMU 10 sample C3&4-F was rejected for 100 different compounds. Two were metals (hexavalent chromium and Monobutyltin), and the remainder was organic compounds. Monobutyltin was affected for five samples, and endrin aldehyde was affect for two samples. The remainder of the affected compounds were associated with the modified elutriate from DMMU 10 sample C3&4 - F.

Six elutriate samples (total concentrations) were rejected for three compounds. These samples and compounds are also listed in Table 33.

GIWW dilution requirements

For discharge to the GIWW, a maximum dilution of 770 (copper, DMMU 10 sample C3&4 - N) was required to meet marine acute criteria, and a maximum dilution of 3179 (tributyltin, DMMU 4 sample 4 - NN) was required to meet marine chronic criteria, (Table 34). However, DMMU 10 sample C3&4 - N results were two orders of magnitude higher than all the other samples and an order of magnitude higher than the next highest sample, which was DMMU 10 sample C3&4 - F. For both composites from DMMU 10, sediment concentrations were not correspondingly elevated. For DMMU 10 sample C3&4 - F, extremely high TSS concentrations (40,000 mg/L) were reported. Maximum dilution based on the highest reliable sample concentration (DMMU 4 sample 5 - NN) resulted in a dilution ratio of 8 to meet acute (and chronic) criteria for copper.

Lead dilution requirements were also relatively high to meet chronic criteria (197), but again the maximum elutriate concentration was associated with DMMU 10 sample 3C&4 - N, which was two orders of magnitude higher than all other samples except DMMU 10 sample 3C&4 - F. As for copper, sediment concentrations for these composites were not elevated suggesting analytical error in the elutriate results. Substitution of the highest reliable elutriate concentration for lead (DMMU 4/5 sample 8 - N) results in a dilution ratio of 8 to meet marine chronic criteria (and 0 to meet acute criteria).

Maximum overall dilution remains at 3179 for marine chronic criteria, due to the high concentration of tributyltin in the modified elutriate of DMMU 4 sample 4 - NN. For that sample, tributyltin sediment concentrations were the highest of all sediments tested, pH was in the same range as the other samples, and TSS were among the lowest, suggesting that the elevated elutriate concentrations are real. Activated carbon may be effective in reducing tributyltin concentrations in the effluent prior to discharge, thus reducing dilution requirements for this contaminant substantially. Bench testing will be required to evaluate effectiveness and determine needed carbon dosage.

Dilutions based on mean (geometric mean) elutriate concentrations (Table 35) indicated all marine acute criteria were met without mixing, and a maximum dilution of 6 was required to meet marine chronic criteria.

No toxicity testing was conducted on modified elutriates for determination of dilution requirements for constituents lacking WQC. Modified elutriate concentrations were therefore compared to standard elutriate concentrations to evaluate applicability of standard elutriate toxicity tests in determining modified elutriate dilution requirements. There were no metals for which any concentrations were higher in the modified elutriates (mean, geometric mean or maximum), and for the few organic constituents that were higher, the maximum was only 14% higher than the standard elutriates concentration. Standard elutriates toxicity tests are therefore thought to be reasonably representative of toxicity that would be expected with modified elutriates. Survival was not statistically different from control in toxicity testing conducted on marine standard elutriates, and no LC50 values resulted. Therefore, no dilution of effluent is considered necessary for discharge in the marine environment based on toxicity.

Bayou Bienvenue dilution requirements

For discharge to Bayou Bienvenue, a maximum dilution of 226, for copper, was required to meet marine acute criteria (DMMU 10 sample C3&4 - N), and a maximum dilution of 3105, for tributyltin, was required to meet marine chronic criteria (DMMU 4 sample 4 - NN) (Table 34).

However, DMMU 10 sample C3&4 - N results are considered unreliable, as previously discussed. Maximum dilution based on the highest reliable sample concentration (DMMU 4 sample 5 NN) resulted in a dilution ratio of 2.6 to meet acute criteria for copper (5.3 for chronic). Lead dilution requirements were also relatively high to meet chronic criteria (180), but again the maximum elutriate concentration was associated with DMMU 10 Composite 3&4N. Substitution of the highest reliable elutriate concentration for lead (DMMU 4/5 sample 8 - N) results in a dilution ratio of 7 to meet marine chronic criteria (0 to meet acute). Maximum overall dilution remains at 3105 for marine chronic, due to the high concentration of tributyltin in DMMU 4 sample 4 - NN.

Dilutions based on mean (geometric mean) elutriate concentrations (Table 35) indicated all marine acute criteria were met without mixing, and a maximum dilution of 8 was required to meet marine chronic criteria.

4.2.3. Mixing

GIWW mixing

Although data for the GIWW was limited, and the GIWW was not sampled or analyzed as part of the IHNC characterization effort, sufficient information regarding channel geometry and flow rate was available to estimate mixing zone dimensions necessary to achieve required dilutions. Currents on the GIWW and Mississippi River-Gulf Outlet (MR-GO) are affected by tidal action and freshwater inflows. Reportedly, the mean annual velocity in the channel is about 0.6 fps, but may exceed 2 fps on ebb or flood tides. During periods of low inflows into the lake, July through November, surface ebb and bottom velocities average about 0.8 and 1.7 fps, respectively. Both may exceed 2 fps. Based on a mean annual velocity of 0.6 fps and an estimated cross-sectional area of 2661 m^3, average flow in the GIWW was estimated to be approximately 17,000 cfs. (These estimates should be reviewed, however, when more information is available regarding the impacts of planned hurricane protection structures on the tidal exchange in this area.)

Mixing zone requirements are set forth in Louisiana State Environmental Regulatory Code Part IX, Subpart 1, Chapter 11, §1115C, and are further described in Section 4.1.4 of this report (under standard elutriate evaluations). One requirement of these regulations (as previously discussed) is that nearby mixing zones must be taken into consideration such that overlapping mixing zones do not impair any designated water use in the receiving water body when the water body is considered as a whole. There are no known point source discharges (governed by mixing zones) in this reach of the GIWW (personal communication Rodney Mach, USACE New Orleans District, February 28, 2008), and it is therefore believed that there are no mixing zones that would overlap with the CDF mixing zone. The only drinking water intake that could be found is located on the Mississippi River, between mile markers 93 and 83, located at 29° 55’ 31.046”N, 89° 57’ 34.925”W, and serving St. Bernard Parish waterworks (Personal communication Jesse Means, State of Louisiana, April 2, 2008). This intake will not be impacted by effluent and runoff discharges to the GIWW or Bayou Bienvenue.

The GIWW would be classified as a Category 3 water body (tidal channel with flow greater than 100 cubic feet per second (cfs) (Louisiana State Environmental Regulatory Code Part IX, Subpart 1, Chapter 11, §1115C). For such a water body, the zone of initial dilution (within which acute criteria may be exceeded) is restricted to 10 cfs or 1/30 of the flow, whichever is greater. In this case, the average flow in the GIWW was estimated to be approximately 17,000 cfs. The zone of initial dilution would be restricted to 1/30 of the cross-sectional area. Similarly, the mixing zone is restricted to 100 cfs or 1/3 of the flow, whichever is greater. The allowable mixing zone would therefore be restricted to 1/3 of the cross-sectional area of the GIWW.

Mixing zone curves were generated from CDFATE (Chase 1994), a model for dredged material discharges based on EPA’s CORMIX system for mixing zone determinations. Results of the mixing zone analysis (Figures 19 - 20) reflect attainable dilution as a function of distance from the discharge point. Figure 21 illustrates mixing zone width as a function of distance from discharge point, and Figure 22 illustrates the attainable dilution in the GIWW as a function of cross-sectional area. The maximum attainable dilution ratio in compliance with these mixing zone restrictions is approximately 120.

Assuming maximum copper and lead dilution requirements are revised as previously discussed, adequate dilution will be attainable within the mixing zone for all constituents except tributyltin (dilution ratio 3179 chronic), total PCBs (dilution ratio 404 chronic), Aroclor 1016 (dilution ratio 321 chronic), and dieldrin (dilution ratio 128 chronic). Effluent treatment may be required to address elevated levels of these constituents when dredging certain areas of the IHNC. However, the mixing that is inherent in dredging will likely flatten peak concentrations somewhat. Based on the geometric mean elutriate concentrations (Table 35), all dilution requirements can be met within the prescribed mixing zone in the GIWW.

If treatment is required, it is anticipated that simple broadcasting of activated carbon around the weir of the CDF will be effective in reducing effluent concentrations of organic compounds sufficiently to permit discharge. The use of activated carbon has been evaluated for another project to reduce volatile emissions from ponded water in a CDF. Bench testing will be required to establish dosage and contact time requirements to meet treatment objectives for the IHNC effluent.

Assuming maximum runoff concentrations from wet, unoxidized material can be conservatively estimated based on modified elutriate concentrations, evaluation of mixing zone requirements for runoff can be estimated based on comparison of modified elutriates to acute criteria. In this case, all dilution requirements for acute criteria can be met within the mixing zone. Determination of the mixing zone requirements for runoff from dried, oxidized material will require evaluation of the simplified laboratory runoff procedure (SLRP) data.

Bayou Bienvenue mixing

Data regarding geometry and flow rate in Bayou Bienvenue was insufficient to permit modeling of a mixing zone as was done for the GIWW. Bayou Bienvenue is sufficiently small in depth and width and the flow rate is sufficiently low that discharge from the CDF would fully envelop and mix with the entire flow of Bayou Bienvenue within a couple hundred feet of the discharge. As such, modeling is not needed and the dilution achieved is simply a ratio of the flow of Bayou Bienvenue and the CDF discharge. Flow rate within Bayou Bienvenue was estimated based on available information and appears to be quite limited, a function of tidal exchange, surface runoff, and stormwater pumping.

Stormwater pumping varies from 20 to 50 cfs on an annual basis with a characteristic average annual discharge rate of 33 cfs (National Marine Fisheries Service 1999). Pumping typically occurs no more than a few days per month and may average about 2 days per month. During these periods of pumping, the flow rate may average 500 cfs with instantaneous rates of more than 1000 cfs.

The drainage area is about 2780 acres (National Marine Fisheries Service 1999). The mean annual rainfall is about 50 inches, and the mean annual runoff would be about 30 inches. This would yield an average annual discharge rate of 10 cfs and would average about 120 cfs on days when runoff occurs, assuming about 30 runoff events per year.

The tidal flow is diurnal with an average tidal range of 1 ft (Appendix B, Page B-3, Section B.1.9, USACE 1997). Assuming a channel width of 130 ft and channel length of 20,000 ft (with discharge taking place at the southwest corner of the CDF and along the southern edge of the CDF), the average daily tidal exchange rate is 30 cfs. (Tidal exchange may be reduced as an effect of proposed hurricane protection provisions; therefore, these assumptions should be reviewed once those structures are in place.) In addition, the open area south of the proposed disposal area experiences a daily tidal range of approximately 6 inches over an area of 440 acres, resulting in an effective flow rate of 111 cfs. This area discharges into Bayou Bienvenue, resulting in a combined flow rate in Bayou Bienvenue of approximately 141 cfs (151 cfs including average annual runoff flows). Flow would be much greater (perhaps 700 cfs) following large precipitation events (10 to 20 days per year).

At a flow rate of 141 cfs, the dilution available for effluent discharged at a rate of 47 cfs into Bayou Bienvenue is 3 parts background flow to 1 part effluent (3:1). This dilution is inadequate to meet water quality criteria for the effluent pathway without treatment.

Runoff from the CDF would be discharged at a rate up to 1 inch per day from the interior area of the CDF. The interior areas of the disposal cells range from about 35 to 120 acres. Therefore, the runoff discharge rate from the CDF ranges up to 1.5 to 5 cfs. During these days, the flow rate in Bayou Bienvenue is estimated to range from about 220 cfs to 570 cfs, depending on stormwater pumping. As such, the dilution available for runoff discharges into Bayou Bienvenue would range from 44:1 to 380:1 or greater, assuming the entire width and depth of the bayou are enveloped in the mixing zone. This is adequate to meet dilution requirements for runoff without treatment for both maximum and mean predicted concentrations. Dilution requirements for runoff from dried, oxidized material have not yet been determined but are expected to be somewhat higher due to increased solubilization of metals under oxidized conditions.

Bayou Bienvenue would be classified as a Category 4 water body (tidal channel with flow less than 100 cubic feet per second) in Louisiana State Environmental Regulatory Code Part IX, Subpart 1, Chapter 11, §1115C. For Category 4 water bodies, the zone of initial dilution is restricted to 1/10 of the average flow over one tidal cycle (effectively, 1/10 of the cross-sectional area), and the mixing zone is permitted to encompass the entire cross-sectional area and flow.

4.2.4. Conclusions

Based on available information, maximum attainable dilution ratio for discharge of effluent to the GIWW is 120. Assuming maximum effluent concentrations for all DMMUs, adequate dilution will be attainable within a mixing zone complying with State of LA requirements for all constituents except tributyltin, total PCBs, Aroclor 1016, and dieldrin (assuming adjusted dilution requirements for copper and lead, as previously discussed). Effluent treatment may be required when dredging areas of the IHNC with elevated concentrations of these constituents. However, the mixing that is inherent in hydraulic dredging will likely reduce peak predicted effluent concentrations, as reflected by the geometric mean elutriate concentrations. For the mean predicted effluent concentrations, all dilution requirements can be met within the prescribed mixing zone in the GIWW.

For maximum runoff concentrations discharged to the GIWW, which were conservatively estimated for the unoxidized case using effluent concentrations, all acute criteria can be met within the prescribed mixing zone (assuming adjusted dilution requirements for copper and lead, as previously discussed). Dilutions for oxidized conditions are pending evaluation of the simplified laboratory runoff procedure (SLRP) data.

Based on limited information available regarding bathymetry and flow in Bayou Bienvenue, attainable dilution will be insufficient to accommodate effluent flows. Maximum attainable dilution ratios for runoff (occurring concurrently with surface runoff and pumping to the Bayou) are estimated to range between 44 and 380, assuming the entire width and depth of the bayou are enveloped in the mixing zone. This is adequate to meet dilution requirements for runoff from unoxidized material without treatment. Dilution requirements for runoff from oxidized material have not yet been determined but are expected to be higher due to increased solubilization of metals under oxidized conditions.

Table 31. Modified elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values above RL								
2-Methylnaphthalene	0.114	0.102	0.87	µg/L	0.046	0.2		7_9 - F
4,4'-DDD	0.00830	0.00251	0.14	µg/L	0.0019	0.013	PG N	7_2 - NN
4,4'-DDE	0.00480	0.00206	0.069	µg/L	0.0016	0.013	PG	7_2 - NN
4,4'-DDT	0.00159	0.00143	0.0059	µg/L	0.0033	0.013	PG	6_4 - FN
Acenaphthene	0.197	0.141	0.97	µg/L	0.049	0.19		4_6 - NN
Aldrin	0.00190	0.00148	0.014	µg/L	0.00056	0.0026		8_C1_4 - NN
alpha-BHC	0.00144	0.00136	0.0034	µg/L	0.0037	0.013		6_2 - NN
alpha-Chlordane	0.00146	0.00136	0.0047	µg/L	0.0027	0.013	PG	3_C1_3 - F
Aluminum	4114	200	200000	µg/L	6.1	150		10_C3&4 - FN
Ammonia as Nitrogen	6.96	5.71	19.6	mg/L	0.047	0.5		010_C1_6 - NN
Anthracene	0.110	0.104	0.43	µg/L	0.05	0.2		7_2 - NN
Antimony	2.89	2.35	11.2	µg/L	0.24	10		7_2 - NN
Aroclor 1016	0.0755	0.0160	0.84	µg/L	0.048	0.19		7_7_ - F
Aroclor 1248	0.0381	0.0192	0.24	µg/L	0.0045	0.02		8_C1_4 - NN
Aroclor 1254	0.0560	0.0217	0.45	µg/L	0.044	0.19		7_5 - F
Aroclor 1260	0.113	0.0247	1.6	µg/L	0.026	0.19		7_2 - NN
Aroclors (Total)	0.238	0.0387	2.2	µg/L	0.057	0.19		7_2 - NN
Arsenic	7.19	5.92	37.8	µg/L	0.7	5		10_C3&4 - FN
Barium	731	641	1660	µg/L	0.38	50		6_6 - FN
Benzo(a)anthracene	0.0945	0.0920	0.25	µg/L	0.04	0.2		7_2 - NN
Benzo(b)fluoranthene	0.0972	0.0950	0.25	µg/L	0.031	0.2		7_2 - NN
Beryllium	1.91	1.68	9.6	µg/L	0.34	5		10_C3&4 - FN
beta-BHC	0.00310	0.00170	0.03	µg/L	0.0007	0.0025	PG	6_6 - F

Table 31. Modified elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values above RL (cont)								
bis(2-Ethylhexyl) phthalate	0.819	0.524	6.5	µg/L	0.12	0.99		7_9 - F
Calcium	148643	134947	283000	µg/L	31.3	500		6_3 - FN
Chromium	9.90	6.21	216	µg/L	0.56	10		10_C3&4 - FN
Chrysene	0.0946	0.0920	0.23	µg/L	0.035	0.2		7_2 - NN
Copper	8.24	3.09	281	µg/L	0.7	10	J	10_C3&4 - FN
CR, Hexavalent	0.00562	0.00512	0.042	mg/L	0.0026	0.01		10_1 - NN
delta-BHC	0.0153	0.00323	0.28	µg/L	0.00046	0.0025	PG N	5_C1_3 - NN
Dibutyltin	0.0378	0.0221	0.8	µg/L	0.01	0.74		4_4 - NN
Dieldrin	0.00436	0.00190	0.082	µg/L	0.0019	0.013	PG N	7_2 - NN
Dissolved Organic Carbon-DISS	5.68	5.47	9.5	mg/L				010_C1_6 - NN
Endosulfan I	0.00135	0.00127	0.0029	µg/L	0.0018	0.013	PG	6_6 - F
Endosulfan II	0.00321	0.00188	0.039	µg/L	0.0037	0.013	PG N	7_2 - NN
Endosulfan sulfate	0.00349	0.00197	0.047	µg/L	0.0039	0.013		7_2 - NN
Endrin	0.00135	0.00128	0.0027	µg/L	0.0019	0.013	PG	3_C1_3 - F
Endrin aldehyde	0.00220	0.00145	0.037	µg/L	0.0029	0.013	PG N	7_2 - NN
Fluoranthene	0.156	0.122	1.4	µg/L	0.048	0.2		7_2 - NN
Fluorene	0.143	0.119	0.76	µg/L	0.051	0.19		4_5 - NN
gamma-BHC (Lindane)	0.00291	0.00209	0.029	µg/L	0.00074	0.0025	PG N	10_1 - NN
gamma-Chlordane	0.00429	0.00217	0.066	µg/L	0.0018	0.013	PG	7_2 - NN
Heptachlor	0.00226	0.00162	0.025	µg/L	0.00066	0.0025	PG N	6_2 - N
Heptachlor epoxide	0.00268	0.00151	0.041	µg/L	0.0024	0.013	PG N	7_2 - NN
Lead	4.25	1.18	147	µg/L	0.1	5	J	10_C3&4 - FN
Mercury	0.100	0.0979	0.28	µg/L	0.055	0.2		10_C3&4 - FN

Table 31. Modified elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values above RL (cont)								
Methoxychlor	0.00475	0.00301	0.052	µg/L	0.00088	0.0048	PG N	010_C1_6 - NN
Naphthalene	0.102	0.100	0.24	µg/L	0.043	0.2		7_9 - F
Nickel	5.65	3.34	133	µg/L	0.36	5		10_C3&4 - FN
pH-DISS	7.77	7.76	8.50	No Units				10_C3&4 - FN
Phenanthrene	0.156	0.123	0.74	µg/L	0.054	0.2		7_2 - NN
Pyrene	0.144	0.120	1	µg/L	0.055	0.2		7_2 - NN
Selenium	32.5	27.8	61.4	µg/L	1	25	E	010_C1_6 - NN
Total Suspended Solids	719	4.33	40000	mg/L	84	100		10_0C3&4 - F
TPH (as Diesel)	1544	327	27000	µg/L	1900	4000		7_2 - NN
TPH (as Gasoline)	50.0	47.9	160	µg/L	28	100		7_2 - NN
Tributyltin	0.190	0.0352	6.7	µg/L	0.012	0.86		4_4 - NN
Chromium III	9.35	5.28	216	µg/L	0.27	2		10_C3&4 - FN
Zinc	18.7	8.94	522	µg/L	3	25	J	10_C3&4 - FN
Group II: Maximum Value <RL, some qualified values reported								
2,4-DB	1.90	1.86	1.5	µg/L	0.59	4	J	6_3 - FN
2-Chlorophenol	0.485	0.484	0.45	µg/L	0.043	0.94	J	2_C1_6 - NN
Acenaphthylene	0.0963	0.0959	0.05	µg/L	0.043	0.19	J	2_C1_6 - NN
Benzo(a)pyrene	0.0965	0.0958	0.16	µg/L	0.043	0.2	J	7_2 - NN
Benzo(ghi)perylene	0.0952	0.0944	0.052	µg/L	0.027	0.2	J	7_2 - NN
Benzo(k)fluoranthene	0.0965	0.0964	0.1	µg/L	0.039	0.2	J	030C4_6 - N
Benzoic acid	2.40	2.38	0.8	µg/L	0.42	5	J	8_C1_4 - NN
Butyl benzyl phthalate	0.462	0.448	0.2	µg/L	0.14	1	J	5_8 - NN
Cadmium	1.77	1.55	2.1	µg/L	0.53	5	B	10_C3&4 - FN

Table 31. Modified elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group II: Maximum Value <RL, some qualified values reported (cont)								
Cyanide, Total	4.22	4.00	6.6	µg/L	1.7	10	B	6_6 - F
Dalapon	1.04	1.03	1.8	µg/L	0.52	2	J COL	45C2_10 - N
Dibenzofuran	0.431	0.386	0.19	µg/L	0.052	0.98	J	4_C1_3 - NN
Dichlorprop	1.97	1.96	1.2	µg/L	0.72	4	J	6_4 - FN
Diethyl phthalate	0.482	0.481	0.32	µg/L	0.24	0.98	J	7_2 - NN
Di-n-butyl phthalate	0.471	0.457	0.12	µg/L	0.045	0.98	J	7_2 - NN
Di-n-octyl phthalate	0.477	0.468	0.069	µg/L	0.042	0.99	J	030C4_6 - N
Phenol	0.0981	0.0979	0.15	µg/L	0.021	0.19	J	010_C1_6 - NN
Thallium	0.881	0.502	1.9	µg/L	0.09	5	B J	030C1_3 - FN
Tin	11.3	10.9	13.5	µg/L	3.8	25	B J	030C1_3 - FN
Group III: All Samples Non-Detect								
1,2,4-Trichlorobenzene	0.0971	0.0971	0.1	µg/L	0.04	0.2	U	
1,2-Dichlorobenzene	0.0971	0.0971	0.1	µg/L	0.032	0.2	U	
1,2-Diphenylhydrazine	0.0971	0.0971	0.1	µg/L	0.045	0.2	U	
1,3-Dichlorobenzene	0.0971	0.0971	0.1	µg/L	0.037	0.2	U	
1,4-Dichlorobenzene	0.0971	0.0971	0.1	µg/L	0.048	0.2	U	
2,2'-oxybis(1-Chloropropane)	0.0971	0.0971	0.1	µg/L	0.026	0.2	U	
2,4,5-T	0.500	0.500	0.5	µg/L	0.17	1	U	
2,4,5-TP (Silvex)	0.500	0.500	0.5	µg/L	0.16	1	U	
2,4,6-Trichlorophenol	0.485	0.485	0.5	µg/L	0.057	1	U	
2,4-D	2.00	2.00	2	µg/L	1.5	4	U	
2,4-Dichlorophenol	0.0971	0.0971	0.1	µg/L	0.049	0.2	U	
2,4-Dimethylphenol	0.485	0.485	0.5	µg/L	0.052	1	U	

Table 31. Modified elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group III: All Samples Non-Detect (cont)								
2,4-Dinitrophenol	2.43	2.43	2.55	µg/L	1.3	5.1	U	
2,4-Dinitrotoluene	0.485	0.485	0.5	µg/L	0.045	1	U	
2,6-Dinitrotoluene	0.485	0.485	0.5	µg/L	0.051	1	U	
2-Chloronaphthalene	0.0971	0.0971	0.1	µg/L	0.044	0.2	U	
2-Nitrophenol	0.485	0.485	0.5	µg/L	0.054	1	U	
3,3'-Dichlorobenzidine	0.485	0.485	0.5	µg/L	0.041	1	U	
4,6-Dinitro-2-methylphenol	2.43	2.43	2.55	µg/L	1.4	5.1	U	
4-Bromophenyl phenyl ether	0.485	0.485	0.5	µg/L	0.05	1	U	
4-Chloro-3-methylphenol	0.485	0.485	0.5	µg/L	0.059	1	U	
4-Chlorophenyl phenyl ether	0.485	0.485	0.5	µg/L	0.043	1	U	
4-Methylphenol	0.485	0.485	0.5	µg/L	0.074	1	U	
4-Nitrophenol	2.43	2.43	2.55	µg/L	0.072	5.1	U	
Aroclor 1221	0.0205	0.0129	0.095	µg/L	0.048	0.19	U	
Aroclor 1232	0.0205	0.0129	0.095	µg/L	0.057	0.19	U	
Aroclor 1242	0.0205	0.0129	0.095	µg/L	0.036	0.19	U	
Benzidine	9.71	9.71	10	µg/L	5.6	20	U	
bis(2-Chloroethoxy)methane	0.485	0.485	0.5	µg/L	0.12	1	U	
bis(2-Chloroethyl) ether	0.0971	0.0971	0.1	µg/L	0.046	0.2	U	
Chlordane (technical)	0.0129	0.0124	0.06	µg/L	0.036	0.12	U	
Diazinon	0.482	0.482	0.5	µg/L	0.12	1	U	
Dibenz(a,h)anthracene	0.0971	0.0971	0.1	µg/L	0.035	0.2	U	
Dicamba	1.00	1.00	1	µg/L	0.33	2	U	
Dimethyl phthalate	0.485	0.485	0.5	µg/L	0.042	1	U	

Table 31. Modified elutriate results - dissolved fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group III: All Samples Non-Detect (cont)								
Dinoseb	0.300	0.300	0.3	µg/L	0.26	0.6	U	
Hexachlorobenzene	0.0971	0.0971	0.1	µg/L	0.043	0.2	U	
Hexachlorobutadiene	0.0971	0.0971	0.1	µg/L	0.038	0.2	U	
Hexachlorocyclopentadiene	0.485	0.485	0.5	µg/L	0.08	1	U	
Hexachloroethane	0.485	0.485	0.5	µg/L	0.043	1	U	
Indeno(1,2,3-cd)pyrene	0.0971	0.0971	0.1	µg/L	0.048	0.2	U	
Isophorone	0.485	0.485	0.5	µg/L	0.047	1	U	
MCPA	200	200	200	µg/L	94	400	U	
MCPP	200	200	200	µg/L	130	400	U	
Monobutyltin	0.336	0.261	4.8	µg/L	0.05	9.6	U	
Nitrobenzene	0.0971	0.0971	0.1	µg/L	0.064	0.2	U	
N-Nitrosodimethylamine	0.485	0.485	0.5	µg/L	0.045	1	U	
N-Nitrosodi-n-propylamine	0.0971	0.0971	0.1	µg/L	0.059	0.2	U	
N-Nitrosodiphenylamine	0.0971	0.0971	0.1	µg/L	0.049	0.2	U	
Pentachlorophenol	0.485	0.485	0.5	µg/L	0.083	1	U	
Silver	2.50	2.50	2.50	µg/L	0.39	5	U	
Tetrabutyltin	0.0333	0.0264	0.48	µg/L	0.0086	0.96	U	
Toxaphene	0.00135	0.00129	0.0065	µg/L	0.0037	0.013	U	

COL The RPD between the results from both columns is > 40%, the lower of the two results is reported. **E** Compound was over the calibration range. **J** Compound detected but below the reporting limit (the value given is an estimate). **N** The RPD between the results from both columns is > 100%. **PG** The % difference between the results from both columns is >40% (SW846). **U** Compound analyzed but not detected.

Table 32. Modified elutriate results - total fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values above RL								
2-Methylnaphthalene	0.151	0.116	1.3	µg/L	0.045	0.19		7_9 - F
4,4'-DDD	0.0348	0.0142	0.26	µg/L	0.019	0.13	PG N	7_2 - NN
4,4'-DDT	0.0293	0.00813	0.23	µg/L	0.0067	0.025	PG	5_6 - NN
Acenaphthene	0.376	0.194	2.5	µg/L	0.052	0.2		9_1 - NN
Acenaphthylene	0.108	0.104	0.34	µg/L	0.05	0.22		2_C1_6 - NN
Aluminum	770179	619615	2310000	µg/L	60.6	1500		2_C1_6 - NN
Ammonia as Nitrogen	12.6	10.2	44.2	mg/L	0.094	1	J	4_C1_3 - NN
Anthracene	0.227	0.145	2.1	µg/L	0.051	0.2		4_6 - NN
Antimony	6.04	3.12	55.4	µg/L	0.47	20		4_6 - NN
Aroclor 1016	0.198	0.0174	2.7	µg/L	0.048	0.19		7_8 - F
Aroclor 1248	0.0805	0.0263	0.83	µg/L	0.0044	0.019		4_4 - NN
Aroclor 1254	0.238	0.0388	2.7	µg/L	0.044	0.19		7_3 - NN
Aroclor 1260	0.505	0.0522	7.8	µg/L	0.027	0.2		7_2 - NN
Aroclors (Total)	0.983	0.0863	8.1	µg/L	0.056	0.19		7_3 - NN
Arsenic	288	239	902	µg/L	0.7	5		7_4 - NN
Barium	13858	6518	172000	µg/L	3.8	500	E	010_C1_6 - NN
Benzo(a)anthracene	0.241	0.148	1.6	µg/L	0.039	0.19		7_4 - NN
Benzo(a)pyrene	0.240	0.140	2	µg/L	0.041	0.19		7_4 - NN
Benzo(b)fluoranthene	0.293	0.152	2.9	µg/L	0.029	0.19		7_4 - NN
Benzo(ghi)perylene	0.193	0.131	1.4	µg/L	0.026	0.19		7_4 - NN
Benzo(k)fluoranthene	0.162	0.122	1.1	µg/L	0.037	0.19		7_4 - NN
Beryllium	43.7	36.4	121	µg/L	0.34	5		7_4 - NN
bis(2-Ethylhexyl) phthalate	1.49	0.754	26	µg/L	0.12	0.99		7_7_ - F

Table 32. Modified elutriate results - total fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values above RL (cont)								
Butyl benzyl phthalate	0.438	0.395	1.6	µg/L	0.14	0.99		7_7_ - F
Cadmium	28.3	21.5	97.2	µg/L	0.53	5		7_4 - NN
Calcium	539268	512555	967000	µg/L	313	5000		2_C1_6 - NN
Chromium	1052	819	3530	µg/L	0.56	10		7_4 - NN
Chrysene	0.267	0.151	2.1	µg/L	0.033	0.19		7_4 - NN
Copper	1404	983	6640	µg/L	1.4	20		4_4 - NN
Cyanide, Total	16.3	6.75	224	µg/L	17	100		7_2 - NN
Dibenz(a,h)anthracene	0.103	0.101	0.31	µg/L	0.035	0.2		4_C1_3 - NN
Dibutyltin	0.788	0.217	6.6	µg/L	0.01	0.77		4_C1_3 - NN
Dieldrin	0.012	0.00402	0.2	µg/L	0.02	0.13	PG N	7_2 - NN
Endosulfan II	0.0137	0.00648	0.15	µg/L	0.0038	0.013	PG N	6_4 - FN
Endosulfan sulfate	0.0233	0.00635	0.42	µg/L	0.039	0.13	PG N	7_2 - NN
Endrin aldehyde	0.00814	0.00335	0.067	µg/L	0.0029	0.012		030C1_3 - FN
Fluoranthene	0.562	0.211	4.1	µg/L	0.047	0.19		7_4 - NN
Fluorene	0.280	0.164	2.2	µg/L	0.054	0.2		4_6 - NN
gamma-Chlordane	0.0132	0.00512	0.15	µg/L	0.0037	0.025	PG	5_6 - NN
Heptachlor epoxide	0.00826	0.00332	0.1	µg/L	0.0048	0.025	PG N	5_6 - NN
Indeno(1,2,3-cd)pyrene	0.176	0.126	1.3	µg/L	0.045	0.19		7_4 - NN
Lead	2027	1102	13300	µg/L	0.1	5	J	7_4 - NN
Mercury	6.67	3.53	45.5	µg/L	0.55	2		5_6 - NN
Methoxychlor	0.0143	0.00670	0.13	µg/L	0.0009	0.0049	PG N	8_C1_4 - NN
Naphthalene	0.133	0.115	0.89	µg/L	0.042	0.19		6_6 - FN
Nickel	980	821	2920	µg/L	0.36	5		7_4 - NN
N-Nitrosodiphenylamine	0.134	0.104	2.1	µg/L	0.046	0.19		7_4 - NN

Table 32. Modified elutriate results - total fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Measured values above RL (cont)								
pH	7.81	7.81	8.5	No Units				10_C3&4 - FN
Phenanthrene	0.499	0.215	3.7	µg/L	0.055	0.2		4_6 - NN
Pyrene	0.520	0.205	4.4	µg/L	0.053	0.19		7_4 - NN
Silver	6.78	3.85	36.1	µg/L	0.39	5		7_4 - NN
Tin	74.9	44.4	370	µg/L	37.9	250		10_C1_6 - NN
Total Organic Carbon	13.0	10.5	42	mg/L				8_C1_4 - NN
Total Suspended Solids	45053	36554	118000	mg/L	3.4	200		10_C1_6 - NN
TPH (as Diesel)	1941	679	24000	µg/L	940	3700	B	5_6 - NN
TPH (as Gasoline)	46.6	43.9	160	µg/L	28	100		2_C1_6 - NN
Tributyltin	3.59	0.309	120	µg/L	0.012	15		4_4 - NN
Chromium III	1023	634	3530	µg/L	0.27	2		7_4 - NN
Zinc	5487	3545	27400	µg/L	3	25	J	7_4 - NN
Group II: Maximum Value <RL, some qualified values reported								
2-Chlorophenol	0.489	0.489	0.4	µg/L	0.049	1.1	J	2_C1_6 - NN
4-Methylphenol	0.486	0.482	0.16	µg/L	0.071	0.97	J	7_9 - F
Aldrin	0.00645	0.00332	0.023	µg/L	0.00054	0.0025	PG	8_C1_4 - NN
alpha-BHC	0.00594	0.00297	0.0081	µg/L	0.0036	0.012	J	6_5 - F
alpha-Chlordane	0.00643	0.00323	0.022	µg/L	0.00055	0.0025	PG N	4_8 - NN
Benzoic acid	2.42	2.39	0.52	µg/L	0.42	5	J	5_C1_3 - NN
beta-BHC	0.00605	0.00306	0.0094	µg/L	0.0007	0.0025	PG N	6_2 - N
delta-BHC	0.00992	0.00485	0.058	µg/L	0.0023	0.013	PG N	5_4 - NN
Diethyl phthalate	0.488	0.486	0.27	µg/L	0.24	1	J	3_C4_6 - NN
Di-n-butyl phthalate	0.369	0.300	0.23	µg/L	0.046	1	J	3_C4_6 - NN
Di-n-octyl phthalate	0.484	0.474	0.064	µg/L	0.043	1	J	9_C2&4 - NN

Table 32. Modified elutriate results - total fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group II: Maximum Value <RL, some qualified values reported (cont)								
Endosulfan I	0.00616	0.00310	0.015	µg/L	0.00036	0.0025		8_C1_4 - NN
Endrin	0.00751	0.00344	0.045	µg/L	0.0019	0.013	PG	6_6 - FN
Heptachlor	0.00619	0.00313	0.016	µg/L	0.00068	0.0025	PG	8_C1_4 - NN
2,4-DB	1.99	1.97	2.7	µg/L	0.59	4	J PG	7_4 - NN
4,4'-DDE	0.0143	0.01	0.13	µg/L	0.017	0.13	PG N	7_2 - NN
CR, Hexavalent	2.33	2.14	5	mg/L	1.3	5	U G	7_4 - NN
Dalapon	0.997	0.992	1.3	µg/L	0.52	2	J COL	4/5_8 - N
Dibenzofuran	0.408	0.342	0.8	µg/L	0.053	1	J	5_C1_3 - NN
gamma-BHC (Lindane)	0.00731	0.00405	0.07	µg/L	0.036	0.13	J PG	7_3 - NN
Percent Solids	61.2	60.4	78.6	%	0			3_C1_3 - F
Selenium	71.8	63.2	232	µg/L	10.3	250	B J	2_C1_6 - NN
Thallium	11.8	9.54	38.4	µg/L	0.9	50	B J	10_C1_6 - NN
Group III: All Samples Non-Detect								
1,2,4-Trichlorobenzene	0.0985	0.0984	0.11	µg/L	0.043	0.22	U	8_C1_4 - NN
1,2-Dichlorobenzene	0.0985	0.0984	0.11	µg/L	0.034	0.22	U	8_C1_4 - NN
1,2-Diphenylhydrazine	0.0985	0.0984	0.11	µg/L	0.048	0.22	U	8_C1_4 - NN
1,3-Dichlorobenzene	0.0985	0.0984	0.11	µg/L	0.04	0.22	U	8_C1_4 - NN
1,4-Dichlorobenzene	0.0985	0.0984	0.11	µg/L	0.052	0.22	U	8_C1_4 - NN
2,2'-oxybis(1-Chloropropane)	0.0985	0.0984	0.11	µg/L	0.028	0.22	U	8_C1_4 - NN
2,4,5-T	0.500	0.500	0.5	µg/L	0.17	1	U	45C2_10 - N
2,4,5-TP (Silvex)	0.500	0.500	0.5	µg/L	0.16	1	U	45C2_10 - N
2,4,6-Trichlorophenol	0.492	0.491	0.55	µg/L	0.061	1.1	U	8_C1_4 - NN
2,4-D	2.00	2.00	2	µg/L	1.5	4	U	45C2_10 - N
2,4-Dichlorophenol	0.0985	0.0984	0.11	µg/L	0.052	0.22	U	8_C1_4 - NN

Table 32. Modified elutriate results - total fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group III: All Samples Non-Detect (cont)								
2,4-Dimethylphenol	0.492	0.491	0.55	µg/L	0.056	1.1	U	8_C1_4 - NN
2,4-Dinitrophenol	2.46	2.46	2.7	µg/L	1.4	5.4	U	8_C1_4 - NN
2,4-Dinitrotoluene	0.492	0.491	0.55	µg/L	0.049	1.1	U	8_C1_4 - NN
2,6-Dinitrotoluene	0.492	0.491	0.55	µg/L	0.055	1.1	U	8_C1_4 - NN
2-Chloronaphthalene	0.0985	0.0984	0.11	µg/L	0.048	0.22	U	8_C1_4 - NN
2-Nitrophenol	0.492	0.491	0.55	µg/L	0.058	1.1	U	8_C1_4 - NN
3,3'-Dichlorobenzidine	0.492	0.491	0.55	µg/L	0.044	1.1	U	8_C1_4 - NN
4,6-Dinitro-2-methylphenol	2.46	2.46	2.7	µg/L	1.5	5.4	U	8_C1_4 - NN
4-Bromophenyl phenyl ether	0.492	0.491	0.55	µg/L	0.054	1.1	U	8_C1_4 - NN
4-Chloro-3-methylphenol	0.492	0.491	0.55	µg/L	0.064	1.1	U	8_C1_4 - NN
4-Chlorophenyl phenyl ether	0.492	0.491	0.55	µg/L	0.046	1.1	U	8_C1_4 - NN
4-Nitrophenol	2.46	2.46	2.7	µg/L	0.076	5.4	U	8_C1_4 - NN
Aroclor 1221	0.0205	0.0129	0.1	µg/L	0.049	0.2	U	7_7_ - F
Aroclor 1232	0.0205	0.0129	0.1	µg/L	0.058	0.2	U	7_7_ - F
Aroclor 1242	0.0205	0.0129	0.1	µg/L	0.037	0.2	U	7_7_ - F
Benzidine	9.85	9.84	11	µg/L	6.1	22	U	8_C1_4 - NN
bis(2-Chloroethoxy)methane	0.492	0.491	0.55	µg/L	0.13	1.1	U	8_C1_4 - NN
bis(2-Chloroethyl) ether	0.0985	0.0984	0.11	µg/L	0.05	0.22	U	8_C1_4 - NN
Chlordane (technical)	0.0557	0.0283	0.6	µg/L	0.36	1.2	U	7_3 - NN
Diazinon	1.07	0.790	2.5	µg/L	0.58	5	U	7_4 - NN
Dicamba	1.00	1.00	1	µg/L	0.33	2	U	45C2_10 - N
Dichlorprop	2.00	2.00	2	µg/L	0.72	4	U	45C2_10 - N
Dimethyl phthalate	0.492	0.491	0.55	µg/L	0.046	1.1	U	8_C1_4 - NN
Dinoseb	0.300	0.300	0.3	µg/L	0.26	0.6	U	45C2_10 - N

Table 32. Modified elutriate results - total fraction.

Component Name	Mean	Geometric Mean	Maximum	Units	MDL	RL	Qualifier	Sample
Group III: All Samples Non-Detect (cont)								
Hexachlorobenzene	0.0985	0.0984	0.11	µg/L	0.047	0.22	U	8_C1_4 - NN
Hexachlorobutadiene	0.0985	0.0984	0.11	µg/L	0.041	0.22	U	8_C1_4 - NN
Hexachlorocyclopentadiene	0.492	0.491	0.55	µg/L	0.086	1.1	U	8_C1_4 - NN
Hexachloroethane	0.492	0.491	0.55	µg/L	0.047	1.1	U	8_C1_4 - NN
Isophorone	0.492	0.491	0.55	µg/L	0.051	1.1	U	8_C1_4 - NN
MCPA	200	200	200	µg/L	94	400	U	45C2_10 - N
MCPP	200	200	200	µg/L	130	400	U	45C2_10 - N
Monobutyltin	3.12	1.34	85	µg/L	0.05	170	U	4_4 - NN
Nitrobenzene	0.0985	0.0984	0.11	µg/L	0.069	0.22	U	8_C1_4 - NN
N-Nitrosodimethylamine	0.492	0.491	0.55	µg/L	0.049	1.1	U	8_C1_4 - NN
N-Nitrosodi-n-propylamine	0.0985	0.0984	0.11	µg/L	0.064	0.22	U	8_C1_4 - NN
Pentachlorophenol	0.492	0.491	0.55	µg/L	0.09	1.1	U	8_C1_4 - NN
Phenol	0.0985	0.0984	0.11	µg/L	0.024	0.22	U	8_C1_4 - NN
Tetrabutyltin	0.312	0.134	8.5	µg/L	0.0086	17	U	4_4 - NN
Toxaphene	0.00591	0.00296	0.065	µg/L	0.036	0.13	U	7_3 - NN

B Compound was detected in the method blank. **COL** The RPD between the results from both columns is > 40%, the lower of the two results is reported. **E** Compound was over the calibration range. **J** Compound detected but below the reporting limit (the value given is an estimate).
N The RPD between the results from both columns is > 100%. **PG** The % difference between the results from both columns is >40% (SW846).
U Compound analyzed but not detected.

Table 33. Modified elutriate data validation rejects.

Sample ID	Compound	Sample ID	Compound
10_ C3&4 - F	1,2,4-Trichlorobenzene-DISS	3_C4_6 - NN	Chromium, hexavalent-Total
10_ C3&4 - F	1,2-Dichlorobenzene-DISS	4_4 - NN	Chromium, hexavalent-Total
10_ C3&4 - F	1,2-Diphenylhydrazine-DISS	4_6 - NN	Chromium, hexavalent-Total
10_ C3&4 - F	1,3-Dichlorobenzene-DISS	10_ C3&4 - F	Chrysene-DISS
10_ C3&4 - F	1,4-Dichlorobenzene-DISS	10_ C3&4 - F	Dalapon-DISS
10_ C3&4 - F	2,2'-oxybis(1-Chloropropane)-DISS	10_ C3&4 - F	delta-BHC-DISS
10_ C3&4 - F	2,4,5-T-DISS	10_ C3&4 - F	Diazinon-DISS
10_ C3&4 - F	2,4,5-TP (Silvex)-DISS	10_ C3&4 - F	Dibenz(a,h)anthracene-DISS
10_ C3&4 - F	2,4,6-Trichlorophenol-DISS	10_ C3&4 - F	Dibenzofuran-DISS
10_ C3&4 - F	2,4-DB-DISS	10_ C3&4 - F	Dicamba-DISS
10_ C3&4 - F	2,4-D-DISS	10_ C3&4 - F	Dichlorprop-DISS
10_ C3&4 - F	2,4-Dichlorophenol-DISS	10_ C3&4 - F	Dieldrin-DISS
10_ C3&4 - F	2,4-Dimethylphenol-DISS	10_ C3&4 - F	Diethyl phthalate-DISS
10_ C3&4 - F	2,4-Dinitrophenol-DISS	10_ C3&4 - F	Dimethyl phthalate-DISS
10_ C3&4 - F	2,4-Dinitrotoluene-DISS	10_ C3&4 - F	Di-n-butyl phthalate-DISS
10_ C3&4 - F	2,6-Dinitrotoluene-DISS	10_ C3&4 - F	Di-n-octyl phthalate-DISS
10_ C3&4 - F	2-Chloronaphthalene-DISS	10_ C3&4 - F	Dinoseb-DISS
10_ C3&4 - F	2-Chlorophenol-DISS	010_C1_6 - NN	Dinoseb-Total
10_ C3&4 - F	2-Methylnaphthalene-DISS	10_ C3&4 - F	Endosulfan I-DISS
10_ C3&4 - F	2-Nitrophenol-DISS	10_ C3&4 - F	Endosulfan II-DISS
10_ C3&4 - F	3,3'-Dichlorobenzidine-DISS	10_ C3&4 - F	Endosulfan sulfate-DISS
10_ C3&4 - F	4,4'-DDE-DISS	10_1 - NN	Endrin aldehyde-DISS
10_ C3&4 - F	4,4'-DDT-DISS	10_ C3&4 - F	Endrin aldehyde-DISS
10_ C3&4 - F	4,6-Dinitro-2-methylphenol-DISS	10_ C3&4 - F	Endrin-DISS
10_ C3&4 - F	4-Bromophenyl phenyl ether-DISS	10_ C3&4 - F	Fluoranthene-DISS
10_ C3&4 - F	4-Chloro-3-methylphenol-DISS	10_ C3&4 - F	Fluorene-DISS
10_ C3&4 - F	4-Chlorophenyl phenyl ether-DISS	10_ C3&4 - F	gamma-Chlordane-DISS
10_ C3&4 - F	4-Methylphenol-DISS	10_ C3&4 - F	Heptachlor epoxide-DISS
10_ C3&4 - F	4-Nitrophenol-DISS	10_ C3&4 - F	Heptachlor-DISS
10_ C3&4 - F	Acenaphthene-DISS	10_ C3&4 - F	Hexachlorobenzene-DISS
10_ C3&4 - F	Acenaphthylene-DISS	10_ C3&4 - F	Hexachlorobutadiene-DISS
10_ C3&4 - F	Aldrin-DISS	10_ C3&4 - F	Hexachlorocyclopentadiene-DISS
10_ C3&4 - F	alpha-BHC-DISS	10_ C3&4 - F	Hexachloroethane-DISS
10_ C3&4 - F	alpha-Chlordane-DISS	10_ C3&4 - F	Indeno(1,2,3-cd)pyrene-DISS
10_ C3&4 - F	Anthracene-DISS	10_ C3&4 - F	Isophorone-DISS

Table 33. Modified elutriate data validation rejects.

Sample ID	Compound	Sample ID	Compound
10_ C3&4 - F	Aroclor 1016-DISS	10_ C3&4 - F	MCPA-DISS
10_ C3&4 - F	Aroclor 1221-DISS	10_ C3&4 - F	MCPP-DISS
10_ C3&4 - F	Aroclor 1232-DISS	10_ C3&4 - F	Methoxychlor-DISS
10_ C3&4 - F	Aroclor 1242-DISS	4_5 - NN	Monobutyltin
10_ C3&4 - F	Aroclor 1248-DISS	4_7_ - NN	Monobutyltin
10_ C3&4 - F	Aroclor 1254-DISS	7_4 - NN	Monobutyltin
10_ C3&4 - F	Aroclor 1260-DISS	10_ C3&4 - F	Monobutyltin
10_ C3&4 - F	Aroclors (Total)-DISS	10_C3&4 - N	Monobutyltin
10_ C3&4 - F	Benzidine-DISS	07_C1_9 - N	Monobutyltin – Total
10_ C3&4 - F	Benzo(a)anthracene-DISS	10_1 - NN	Monobutyltin – Total
10_ C3&4 - F	Benzo(a)pyrene-DISS	10_ C3&4 - F	Naphthalene-DISS
10_ C3&4 - F	Benzo(b)fluoranthene-DISS	10_ C3&4 - F	Nitrobenzene-DISS
10_ C3&4 - F	Benzo(ghi)perylene-DISS	10_ C3&4 - F	N-Nitrosodimethylamine-DISS
10_ C3&4 - F	Benzo(k)fluoranthene-DISS	10_ C3&4 - F	N-Nitrosodi-n-propylamine-DISS
10_ C3&4 - F	Benzoic acid-DISS	10_ C3&4 - F	N-Nitrosodiphenylamine-DISS
10_ C3&4 - F	beta-BHC-DISS	10_ C3&4 - F	Pentachlorophenol-DISS
10_ C3&4 - F	bis(2-Chloroethoxy)methane-DISS	10_ C3&4 - F	Phenanthrene-DISS
10_ C3&4 - F	bis(2-Chloroethyl) ether-DISS	10_ C3&4 - F	Phenol-DISS
10_ C3&4 - F	Butyl benzyl phthalate-DISS	10_ C3&4 - F	Pyrene-DISS
10_ C3&4 - F	Chlordane (technical)-DISS	10_ C3&4 - F	Toxaphene-DISS
10_ C3&4 - F	Chromium, hexavalent-DISS		

Table 34. Maximum modified elutriate concentration, DMMU1 and Bayou Bienvenue background concentrations, available marine criteria/standards and dilution ratios for effluent discharge in the GIWW and Bayou Bienvenue.

Contaminants	Maximum Elutriate Concentration	DMMU1 Site Water Concentration		Bayou Bienvenue Site Water Concentration		Federal				US EPA Region 4		State of Louisiana				Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	GIWW (DMMU1)		Bayou Bienvenue	
						Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Marine		Brackish				Dilution Ratios		Dilution Ratios	
		Reported	Assumed	Reported	Assumed	Acute Toxicity Primary Criteria	hronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Standards	Chronic Standards	Acute Standards	Chronic Standards			Meeting Acute Criteria	Meeting Chronic Criteria	Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L				
Metals																					
Aluminum	200000	17.9 B	17.9	6.0 B J	6													NS[1]	NS	NS	NS
Antimony	11.2	0.34 B	0.34	0.78 B	0.78													NS	NS	NS	NS
Arsenic	37.8	5.1	5.1	6	6	69	36	69	36	69a	36a	69	36	69	36	69	36	0	**0.06**	0	**0.06**
Barium	1660	80	80	114	114													NS	NS	NS	NS
Beryllium	9.6	1.3 B	1.3	1.0 U	0.5													NS	NS	NS	NS
Cadmium	2.1	5.0 U	2.5	1.0 U	0.5	40	8.8	40	8.8	40	8.8	45.35	10	15	0.62	15	0.62	0	**d**	0	**12**
Chromium III	216	6.6	6.6	6.1	6.1					1030	103	515	103	310	103	310	103	0	**1**	0	**1**
Chromium VI	42.0	0.010 U	0.005	0.010 U	0.005	1100	50	1100	50	1100	50	1100	50	16	11	16	11	**2**	**3**	**2**	**3**
Copper	281i	3.6 B	3.6	2.4 J	2.4	4.8	3.1	4.8	3.1	4.8	3.1	3.63	3.63	3.63	3.63	3.63	3.1	**770**	**770**	**226**	**397**
Lead	147j	0.46 B	0.46	0.39 B J	0.39	210	8.1	210	8.1	210	8.1	209	8.08	30	1.2	30	1.2	**4**	**197**	**4**	**180**
Mercury	0.28	0.20 U	0.1	0.20 U	0.1	1.8	0.94	1.8	0.94	1.8	0.940	2	0.0250	2	0.012	1.8	0.012	0	**17**	0	**17**
Nickel	133	0.87 B	0.87	3.6	3.6	74	8.2	74	8.2	74	8.2	74	8.2	74	8.2	74	8.2	**0.81**	**17**	**0.84**	**27**
Selenium	61.4	26.5	26.5	2.4 B	2.4	290	71	290	71	290	71					290	71	0	0	0	0
Thallium	1.9	0.18 B	0.18	0.095 B J	0.095			2130b		213	21.3					2130		0	0g	0	0g
Tin	13.5	25.0 U	12.5	8.1	8.1													NS	NS	NS	NS
Zinc	522	15.6 B	15.6	7.4	7.4	90	81	90	81	90	81	90	81	64	58	64	58	**9**	**11**	**8**	**9**
Organotins																					
Dibutyltin	0.8	.037U	0.0185	.037U	0.0185													NS	NS	NS	NS
Tributyltin	6.7	0.042 U	0.021	0.043 U	0.0215	0.42c	0.0074c	0.42c	0.0074c		0.01					0.42	0.0074	**16**	**3179**	**16**	**3105**
Inorganic/General Chemistry																					
Ammonia-N	19600	0.16	0.16	0.10 U	0.05	11000e	1700e									11000	1700	**0.78**	**11**	**0.78**	**11**
Cyanide	6.6	10.0 U	5	10.0 U	5	1	1	1	1	1	1	1		1		1	1	**2**	**2**	**2**	**2**
PAH's																					
2-Methylnaphthalene	0.87	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Acenaphthene	0.97	0.19 U	0.095	0.19 U	0.095			970b	710b	97	9.7					970	710	0	0	0	0
Acenaphthylene	0.05	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Anthracene	0.43	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(a)anthracene	0.25	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(a)pyrene	0.16	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(b)fluoranthene	0.25	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(g,h,i)perylene	0.052	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(k)fluoranthene	0.1	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Chrysene	0.23	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Dibenzofuran	0.19	0.95 U	0.475	0.94 U	0.475													NS	NS	NS	NS
Fluoranthene	1.4	0.19 U	0.095	0.19 U	0.095					4	1.6							0g	0g	0g	0g

Table 34. Maximum modified elutriate concentration, DMMU1 and Bayou Bienvenue background concentrations, available marine criteria/standards and dilution ratios for effluent discharge in the GIWW and Bayou Bienvenue.

Contaminants	Maximum Elutriate Concentration	DMMU1 Site Water Concentration		Bayou Bienvenue Site Water Concentration		Federal				US EPA Region 4		State of Louisiana				Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	GIWW (DMMU1)		Bayou Bienvenue	
						Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Marine		Brackish				Dilution Ratios		Dilution Ratios	
		Reported	Assumed	Reported	Assumed	Acute Toxicity Primary Criteria	hronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Standards	Chronic Standards	Acute Standards	Chronic Standards			Meeting Acute Criteria	Meeting Chronic Criteria	Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L				
Fluorene	0.76	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Naphthalene	0.24	0.19 U	0.095	0.19 U	0.095					235	23.5							0g	0g	0g	0g
Phenanthrene	0.74	0.19 U	0.095	0.082 J	0.082													NS	NS	NS	NS
Pyrene	1	0.19 U	0.095	.19U	0.095													NS	NS	NS	NS
Semi-Volatile Organic Compounds																					
2-Chlorophenol	0.45	0.95 U	0.475	0.94 U	0.47									258	129	129	258	0	0	0	0
Benzoic acid	0.8	4.8 U	2.4	0.51 J	0.51													NS	NS	NS	NS
Benzyl butyl phthalate	0.2	0.95 U	0.475	.94U	0.47					294.4	29.4							0g	0g	0g	0g
Bis(2-ethylhexyl) phthalate	6.5	0.61 J	0.61	0.29 J	0.29													NS	NS	NS	NS
Diethyl phthalate	0.32	0.95 U	0.475	0.94 U	0.47					759	75.9							0g	0g	0g	0g
Di-n-butyl phthalate	0.12	0.95 U	0.475	0.94 U	0.47						3.4							NS	0g	NS	0g
Di-n-octyl phthalate	0.069	0.95 U	0.475	0.94 U	0.47													NS	NS	NS	NS
Phenol	0.15	0.19 U	0.095	0.2	0.2			5800b		580	58	580	290	580	290	580	290	0	0	0	0
Chlorinated Pesticides																					
Aldrin	0.014	0.0088	0.0088	0.0027	0.0027	1.3		1.3		1.3	0.13	1.3		1.3		1.3		0	0g	0	0g
alpha-BHC	0.0034	0.0013 U	0.00065	0.0026 U	0.0013						1400							NS	0g	NS	0g
alpha-Chlordane	0.0047	0.0013 U	0.00065	0.0028 PG	0.0028	0.09f	0.004f	0.09f	0.004f	0.09f	0.004f					0.09	0.0040	0	**0.21**	0	**0.58**
beta-BHC	0.03	0.0013 U	0.00065	0.0026 U	0.0013													NS	NS	NS	NS
delta-BHC	0.28	0.090 PG N	0.09	0.084 PG N	0.084													NS	NS	NS	NS
Dieldrin	0.082	0.0059	0.0059	0.00054 J	0.00054	0.71	0.0019	0.71	0.0019	0.71	0.0019	0.71	0.0019	0.2374	0.0019	0.2374	0.0019	0	**128**	0	**59**
Endosulfan I	0.0029	0.0013 U	0.00065	0.00083 J	0.00083	0.034	0.0087	0.034	0.0087	0.034	0.0087	0.034	0.0087	0.034	0.0087	0.034	0.0087	0	0	0	0
Endosulfan II	0.039	0.0092 PG N	0.0092	0.019 PG	0.019	0.034	0.0087	0.034	0.0087	0.034	0.0087					0.034	0.0087	**0.20**	**31**	**0.33**	**10**
Endosulfan sulfate	0.047	0.0013 U	0.00065	0.0026 U	0.0013													NS	NS	NS	NS
Endrin	0.0027	0.0014 PG N	0.0014	0.0026 U	0.0013	0.037	0.0023	0.037	0.0023	0.037	0.0023	0.037	0.0023	0.037	0.0023	0.037	0.0023	0	**0.44**	0	**0.40**
Endrin aldehyde	0.037	0.0013 U	0.00065	0.0026 U	0.0013													NS	NS	NS	NS
gamma-BHC (Lindane)	0.029	0.01	0.01	0.0050 PG N	0.005	0.16		0.16		0.16	0.016	0.16		0.16		0.16		0	**2.17g**	0	**1g**
gamma-Chlordane	0.066	0.0013 U	0.00065	0.0072 PG	0.0072	0.09f	0.004f	0.09f	0.004f	0.09f	0.004f					0.09	0.004	0	**19**	0	**81**
Heptachlor	0.025	0.0013 U	0.00065	0.054 PG N	0.054	0.053	0.0036	0.053	0.0036	0.053	0.0036					0.053	0.0036	0	**7**	0	**d,g**
Methoxychlor	0.052	0.0025 U	0.00125	0.0050 U	0.0025		0.03c		0.03c		0.03						0.03	NS	**0.77**	NS	**0.80**
p,p'-DDD (4,4')	0.14	0.0013 U	0.00065	0.0026 U	0.0013					0.25	0.025	1.25	0.25	0.03	0.006	0.03	0.006	**4**	**25**	**4**	**29**

Table 34. Maximum modified elutriate concentration, DMMU1 and Bayou Bienvenue background concentrations, available marine criteria/standards and dilution ratios for effluent discharge in the GIWW and Bayou Bienvenue.

Contaminants	Maximum Elutriate Concentration	DMMU1 Site Water Concentration		Bayou Bienvenue Site Water Concentration		Federal				US EPA Region 4		State of Louisiana				Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	GIWW (DMMU1)		Bayou Bienvenue	
						Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Marine		Brackish				Dilution Ratios		Dilution Ratios	
		Reported	Assumed	Reported	Assumed	Acute Toxicity Primary Criteria	hronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Standards	Chronic Standards	Acute Standards	Chronic Standards			Meeting Acute Criteria	Meeting Chronic Criteria	Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L				
p,p'-DDE (4,4')	0.069	0.0013 U	0.00065	0.0058 PG N	0.0058					1.4	0.14							0g	0g	0g	0g
p,p'-DDT (4,4')	0.0059	0.0011 J PG	0.0011	0.0026 U	0.0013	0.13	0.001	0.13	0.001	0.13	0.001	0.13	0.001	0.13	0.001	0.13	0.001	0	**43**	0	**34**
PCBs																					
PCB(Aroclor-1016)	0.84	0.0094 U	0.0047	0.020 U	0.01					1.05	0.03							0g	**321g**	0g	**41g**
PCB(Aroclor-1248)	0.24	0.0094 U	0.0047	0.020 U	0.01					1.05	0.03							0g	**8g**	0g	**11g**
PCB(Aroclor-1254)	0.45	0.036	0.036	0.020 U	0.01					1.05	0.03							0g	**114g**	0g	**21g**
PCB(Aroclor-1260)	1.6	0.017	0.017	0.020 U	0.01					1.05	0.03							**0.53g**	**121g**	**0.53g**	**79g**
PCB Total	2.2	0.053	0.053	0.020 U	0.01		0.03	10b	0.03		0.03	10	0.03	2	0.014	2	0.014	**0.10**	**404**	**0.10**	**547**
																	Maximum	**770**	**3179**	**226**	**3105**
																	Mean	**21h**	**139h**	**7h**	**120h**
																	Minimum	**0**	**0**	**0**	**0**
1 NS - no standard																					

a As III, **b** outdated national ambient water quality criteria, **c** non-priority pollutant, **d** assumed background concentration exceeds criteria, elutriate concentration near background concentration, dilution ratio cannot be calculated, **e** EPA 440/5-88-004 Ammonia saltwater criteria document salinity 10 ppt, pH 7.6, T 25 deg C, **f** chlordane species not specified, **g** based on EPA Region IV screening water quality criteria for hazardous waste sites, **h** average values include dilutions based on alternative criteria, **i** Maximum copper concentration of 281 µg/L associated with DMMU 10 Composite 3&4N considered unreliable. Highest reliable value is 6. µg/L, for sample ID 04000005WTWAMD, resulting in dilutions of: GIWW Acute 8/Chronic 8, and Bayou Bienvenue Acute 3, Chronic 5, **j** Maximum lead concentration of 147 µg/L associated with DMMU 10 Composite 3&4N considered unreliable. Highest reliable value is 7 µg/L I, Sample ID 4500008NWNWAMD, resulting in the following dilutions: GIWW Acute 0/Chronic 8, Bayou Bienvenue Acute 0/Chronic 8
B Compound was detected in the method blank**. J** Compound detected but below the reporting limit (the value given is an estimate). **N** The RPD between the results from both columns is > 100%. **PG** The % difference between the results from both columns is >40% (SW846).
U Compound analyzed but not detected.

Table 35. Mean (geometric) modified elutriate concentration, DMMU1 and Bayou bienvenue background concentrations, available marine criteria/standards and dilution ratios for effluent discharge in the GIWW and Bayou Bienvenue.

Contaminants	Mean (Geometric) Elutriate Concentration	DMMU1 Site Water Concentration		Bayou Bienvenue Site Water Concentration		Federal				US EPA Region 4		State of Louisiana				Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	GIWW (DMMU1)		Bayou Bienvenue	
						Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Marine		Brackish				Dilution Ratios		Dilution Ratios	
		Reported	Assumed	Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Standards	Chronic Standards	Acute Standards	Chronic Standards			Meeting Acute Criteria	Meeting Chronic Criteria	Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L				
Metals																					
Aluminum	200	17.9 B	17.9	6.0 B J	6													NS	NS	NS	NS
Antimony	2.35	0.34 B	0.34	0.78 B	0.78													NS	NS	NS	NS
Arsenic	5.92	5.1	5.1	6	6	69	36	69	36	69a	36a	69	36	69	36	69	36	0	0	0	0
Barium	641	80	80	114	114													NS	NS	NS	NS
Beryllium	1.68	1.3 B	1.3	1.0 U	0.5													NS	NS	NS	NS
Cadmium	1.55	5.0 U	2.5	1.0 U	0.5	40	8.8	40	8.8	40	8.8	45.35	10	15	0.62	15	0.62	0	**d**	0	**8**
Chromium III	5.28	6.6	6.6	6.1	6.1					1030	103	515	103	310	103	310	103	0	0	0	0
Chromium VI	5.12	0.010 U	0.005	0.010 U	0.005	1100	50	1100	50	1100	50	1100	50	16	11	16	11	0	0	0	0
Copper	3.09	3.6 B	3.6	2.4 J	2.4	4.8	3.1	4.8	3.1	4.8	3.1	3.63	3.63	3.63	3.63	3.63	3.1	0	0	0	0
Lead	1.18	0.46 B	0.46	0.39 B J	0.39	210	8.1	210	8.1	210	8.1	209	8.08	30	1.2	30	1.2	0	0	0	0
Mercury	0.0979	0.20 U	0.1	0.20 U	0.1	1.8	0.94	1.8	0.94	1.8	0.94	2	0.025	2	0.012	1.8	0.012	0	**d**	0	**d**
Nickel	3.34	0.87 B	0.87	3.6	3.6	74	8.2	74	8.2	74	8.2	74	8.2	74	8.2	74	8.2	0	0	0	0
Selenium	27.8	26.5	26.5	2.4 B	2.4	290	71	290	71	290	71					290	71	0	0	0	0
Thallium	0.502	0.18 B	0.18	0.095 B J	0.095			2130b		213	21.3					2130		0	0g	0	0g
Tin	10.9	25.0 U	12.5	8.1	8.1													NS	NS	NS	NS
Zinc	8.94	15.6 B	15.6	7.4	7.4	90	81	90	81	90	81	90	81	64	58	64	58	0	0	0	0
Organotins																					
Dibutyltin	0.0221	.037U	0.0185	.037U	0.0185													NS	NS	NS	NS
Tributyltin	0.0352	0.042 U	0.021	0.043 U	0.0215	0.42c	0.0074c	0.42c	0.0074c		0.01					0.4200	0.0074	0	**6**	0	**5**
Inorganic/General Chemistry																					
Ammonia-N	5712	0.16	0.16	0.10 U	0.05	11000e	1700e									11000	1700	0	**2**	0	**2**
Cyanide	4.00	10.0 U	5	10.0 U	5	1	1	1	1	1	1	1		1		1	1	**d**	**d**	**d**	**d**
PAH's																					
2-Methylnaphthalene	0.102	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Acenaphthene	0.141	0.19 U	0.095	0.19 U	0.095			970b	710b	97	9.7					970	710	0	0	0	0
Acenaphthylene	0.0959	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Anthracene	0.104	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(a)anthracene	0.0920	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(a)pyrene	0.0958	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(b)fluoranthene	0.0950	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(g,h,i)perylene	0.0944	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Benzo(k)fluoranthene	0.0964	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Chrysene	0.0920	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Dibenzofuran	0.386	0.95 U	0.475	0.94 U	0.475													NS	NS	NS	NS
Fluoranthene	0.122	0.19 U	0.095	0.19 U	0.095					4	1.6							0g	0g	0g	0g

Table 35. Mean (geometric) modified elutriate concentration, DMMU1 and Bayou bienvenue background concentrations, available marine criteria/standards and dilution ratios for effluent discharge in the GIWW and Bayou Bienvenue.

Contaminants	Mean (Geometric) Elutriate Concentration	DMMU1 Site Water Concentration		Bayou Bienvenue Site Water Concentration		Federal				US EPA Region 4		State of Louisiana				Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	GIWW (DMMU1)		Bayou Bienvenue	
						Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Marine		Brackish				Dilution Ratios		Dilution Ratios	
		Reported	Assumed	Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Standards	Chronic Standards	Acute Standards	Chronic Standards			Meeting Acute Criteria	Meeting Chronic Criteria	Meeting Acute Criteria	Meeting Chronic Criteria
	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L				
Fluorene	0.119	0.19 U	0.095	0.19 U	0.095													NS	NS	NS	NS
Naphthalene	0.100	0.19 U	0.095	0.19 U	0.095					235	23.5							0g	0g	0g	0g
Phenanthrene	0.123	0.19 U	0.095	0.082 J	0.082													NS	NS	NS	NS
Pyrene	0.120	0.19 U	0.095	.19U	0.095													NS	NS	NS	NS
Semi-Volatile Organic Compounds																					
2-Chlorophenol	0.484	0.95 U	0.475	0.94 U	0.47									258	129	129	258	0	0	0	0
Benzyl butyl phthalate	0.448	0.95 U	0.475	.94U	0.47					294.4	29.4							0g	0g	0g	0g
Bis(2-ethylhexyl) phthalate	0.524	0.61 J	0.61	0.29 J	0.29													NS	NS	NS	NS
Diethyl phthalate	0.481	0.95 U	0.475	0.94 U	0.47					759	75.9							0g	0g	0g	0g
Di-n-butyl phthalate	0.457	0.95 U	0.475	0.94 U	0.47						3.4							NS	NS	NS	0g
Di-n-octyl phthalate	0.468	0.95 U	0.475	0.94 U	0.47													NS	NS	NS	NS
Phenol	0.0979	0.19 U	0.095	0.2	0.2			5800b		580	58	580	290	580	290	580	290	0	0	0	0
Benzoic acid	2.38	4.8 U	2.4	0.51 J	0.51													NS	NS	NS	NS
Chlorinated Pesticides																					
4,4'-DDD	0.00251	0.0013 U	0.00065	0.0026 U	0.0013					0.25	0.025	1.25	0.25	0.03	0.0060	0.03	0.0060	0	0	0	0
Aldrin	0.00148	0.0088	0.0088	0.0027	0.0027	1.3		1.3		1.3	0.13	1.3		1.3		1.3		0	0g	0	0g
alpha-BHC	0.00136	0.0013 U	0.00065	0.0026 U	0.0013						1400							NS	0g	NS	0g
alpha-Chlordane	0.00136	0.0013 U	0.00065	0.0028 PG	0.0028	0.09f	0.004f	0.09f	0.004f	0.09f	0.004f					0.09	0.004	0	0	0	0
beta-BHC	0.00170	0.0013 U	0.00065	0.0026 U	0.0013													NS	NS	NS	NS
delta-BHC	0.00323	0.090 PG N	0.09	0.084 PG N	0.084													NS	NS	NS	NS
Dieldrin	0.00190	0.0059	0.0059	0.00054 J	0.00054	0.71	0.0019	0.71	0.0019	0.71	0.0019	0.71	0.0019	0.2374	0.0019	0.2374	0.0019	0	**d**	0	0
Endosulfan I	0.00127	0.0013 U	0.00065	0.00083 J	0.00083	0.034	0.0087	0.034	0.0087	0.034	0.0087	0.034	0.0087	0.034	0.0087	0.034	0.0087	0	0	0	0
Endosulfan II	0.00188	0.0092 PG N	0.0092	0.019 PG	0.019	0.034	0.0087	0.034	0.0087	0.034	0.0087					0.034	0.0087	0	0	0	0
Endosulfan sulfate	0.00197	0.0013 U	0.00065	0.0026 U	0.0013													NS	NS	NS	NS
Endrin	0.00128	0.0014 PG N	0.0014	0.0026 U	0.0013	0.037	0.0023	0.037	0.0023	0.037	0.0023	0.037	0.0023	0.037	0.0023	0.037	0.0023	0	0	0	0
Endrin aldehyde	0.00145	0.0013 U	0.00065	0.0026 U	0.0013													NS	NS	NS	NS
gamma-BHC (Lindane)	0.00209	0.01	0.01	0.0050 PG N	0.005	0.16		0.16		0.16	0.016	0.16		0.16		0.16		0	0g	0	0g
gamma-Chlordane	0.00217	0.0013 U	0.00065	0.0072 PG	0.0072	0.09f	0.004f	0.09f	0.004f	0.09f	0.004f					0.09	0.004	0	0	0	0
Heptachlor	0.00162	0.0013 U	0.00065	0.054 PG N	0.054	0.053	0.0036	0.053	0.0036	0.053	0.0036					0.053	0.0036	0	0	0	0
Heptachlor epoxide	0.00151	0.0055	0.0055	0.0026 U	0.0013	0.053	0.0036	0.053	0.0036	0.053	0.0036					0.053	0.0036	0	0	0	0
Methoxychlor	0.00301	0.0025 U	0.00125	0.0050 U	0.0025		0.03c		0.03c		0.03						0.03	NS	0	NS	0

Table 35. Mean (geometric) modified elutriate concentration, DMMU1 and Bayou bienvenue background concentrations, available marine criteria/standards and dilution ratios for effluent discharge in the GIWW and Bayou Bienvenue.

Contaminants	Mean (Geometric) Elutriate Concentration	DMMU1 Site Water Concentration		Bayou Bienvenue Site Water Concentration		Federal				US EPA Region 4		State of Louisiana				Minimum Federal or Louisiana Acute Criteria or Standard	Minimum Federal or Louisiana Chronic Criteria or Standard	GIWW (DMMU1)		Bayou Bienvenue	
						Primary		Primary & Secondary		Water Quality Screening Values for Hazardous Waste Sites		Marine		Brackish				Dilution Ratios		Dilution Ratios	
		Reported	Assumed	Reported	Assumed	Acute Toxicity Primary Criteria	Chronic Toxicity Primary Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Toxicity Criteria	Chronic Toxicity Criteria	Acute Standards	Chronic Standards	Acute Standards	Chronic Standards			Meeting Acute Criteria	Meeting Chronic Criteria	Meeting Acute Criteria	Meeting Chronic Criteria
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L				
p,p'-DDE (4,4')	0.00206	0.0013 U	0.00065	0.0058 PG N	0.0058					1.4	0.14							0g	0g	0g	0g
p,p'-DDT (4,4')	0.00143	0.0011 J PG	0.0011	0.0026 U	0.0013	0.13	0.001	0.13	0.001	0.13	0.001	0.13	0.001	0.13	0.001	0.13	0.001	0	**2**	0	0
PCBs																					
PCB(Aroclor-1016)	0.0160	0.0094 U	0.0047	0.020 U	0.01					1.05	0.03							0g	0g	0g	0g
PCB(Aroclor-1248)	0.0192	0.0094 U	0.0047	0.020 U	0.01					1.05	0.03							0g	0g	0g	0g
PCB(Aroclor-1254)	0.0217	0.036	0.036	0.020 U	0.01					1.05	0.03							0g	0g	0g	0g
PCB(Aroclor-1260)	0.0247	0.017	0.017	0.020 U	0.01					1.05	0.03							0g	0g	0g	0g
PCB Total	0.0387	0.053	0.053	0.020 U	0.01		0.03	10b	0.03		0.03	10	0.03	2	0.014	2	0.014	0	**d**	0	**6**
																	Maximum	**0**	**6**	**0**	**8**
																	Mean	**0h**	**0.28h**	**0h**	**0.54h**
																	Minimum	**0**	**0**	**0**	**0**

1 NS - no standard

a As III, **b** outdated national ambient water quality criteria, **c** non-priority pollutant, **d** assumed background concentration exceeds criteria, elutriate concentration near background concentration, dilution ratio cannot be calculated, **e** EPA 440/5-88-004 Ammonia saltwater criteria document salinity 10 ppt, pH 7.6, T 25 deg C, **f** chlordane species not specified, **g** based on EPA Region IV screening water quality criteria for hazardous waste sites, **h** average values include dilutions based on alternative criteria

B Compound was detected in the method blank. **J** Compound detected but below the reporting limit (the value given is an estimate). **N** The RPD between the results from both columns is > 100%. **PG** The % difference between the results from both columns is >40% (SW846).
U Compound analyzed but not detected.

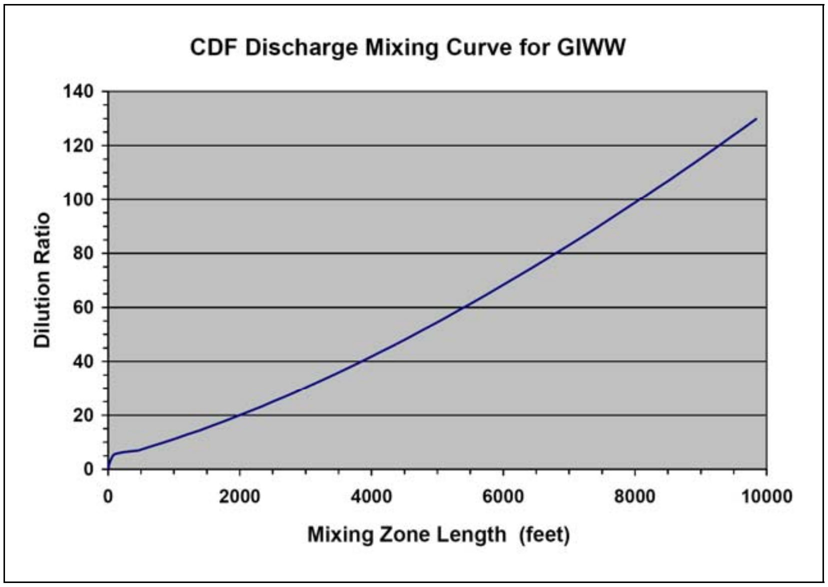


Figure 19. Attainable dilution versus mixing zone length for the GIWW.

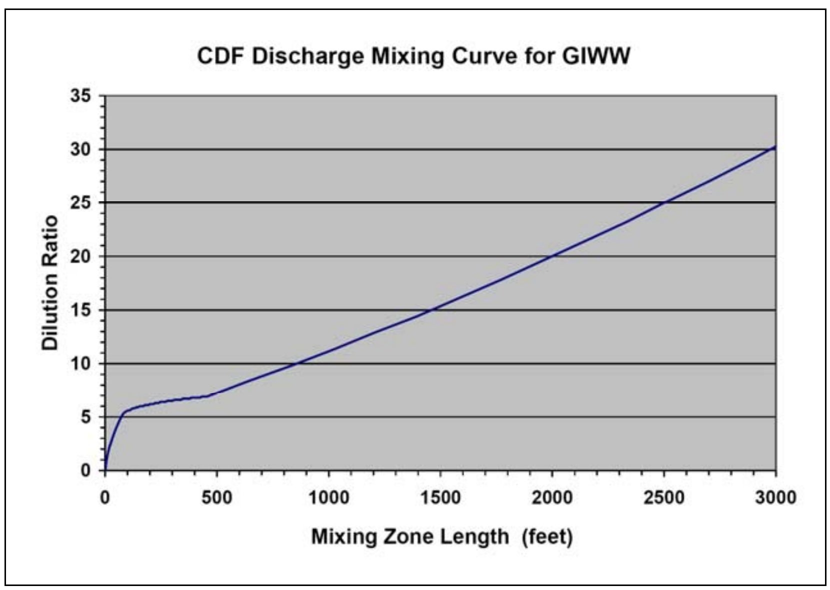


Figure 20. Attainable dilution versus mixing zone length for the GIWW (<1,000 ft).

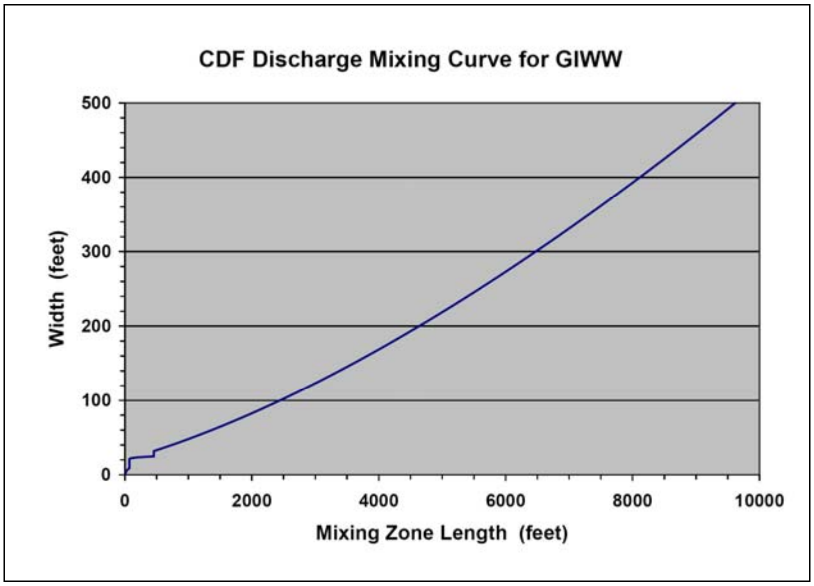


Figure 21. Mixing zone width as a function of distance from discharge point (GIWW).

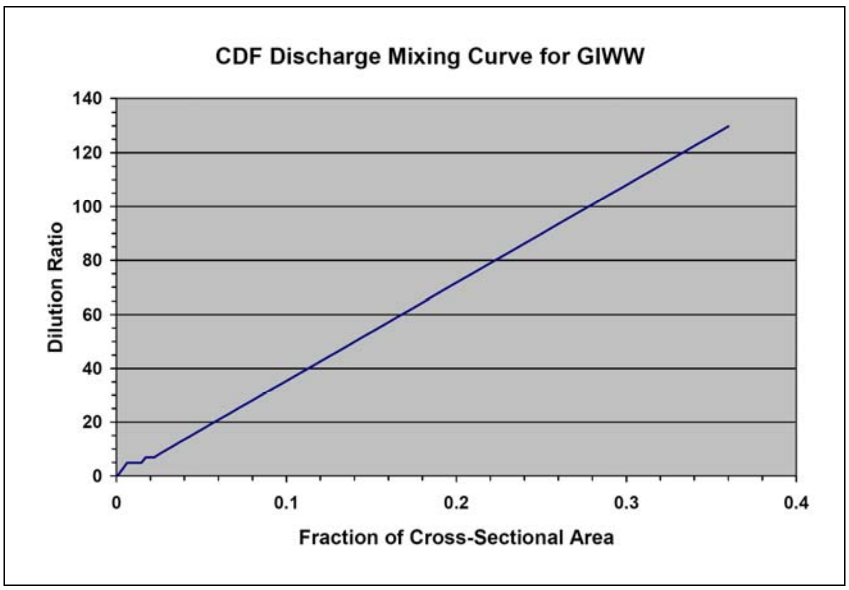


Figure 22. Attainable dilution as a function of cross-sectional area (GIWW).

4.3. Mixing evaluation for placement of dredged material in the proposed mitigation site

4.3.1. Objectives

The primary objective of this alternative is twofold:

- To mitigate for wetland areas potentially disturbed by construction of the CDF.
- To restore degraded wetland areas as a benefit of the project.

The area proposed for mitigation is located in a large triangular area of mostly open water (Figure 23 and 24). The selected area was reportedly not intended to be fixed in size or location, but “floatable” within the larger area as dictated by the logistics of placement, constructability of containment structures, and volume of material available and suitable for beneficial use. Total area contained within the larger triangle is estimated to be approximately 440 acres.

The principal concern of this section of the report is evaluation of water quality impacts potentially associated with placement of dredged material in the mitigation site.

4.3.2. Data evaluation and dilution requirements

Material suitability

Although this section is primarily concerned with evaluation of water quality impacts associated with dredged material placement in the mitigation site, suitability for placement must take into consideration benthic toxicity and bioaccumulation potential, discussed in Section 3. Suitability of each DMMU for open water placement in a marine or freshwater environment was summarized in the preliminary dredging plan (ERDC 2008). The preliminary dredging plan is reproduced here in part (Table 36) along with a proposed plan for placement of some material in the mitigation site. The principal difference between the proposed plan and Alternative II, previously presented in ERDC (2008), is the diversion of suitable materials from open water disposal to placement in the mitigation site. Shaded cells in Table 36 reflect the affected materials and volumes.

Dilution requirements

Materials selected for placement in the mitigation site were chosen not only on the basis of benthic toxicity, but also based on predicted dilution requirements. Initially it was thought that a structure would be constructed that would permit containment of solids and water in much the same manner as a CDF. In that case, effluent discharges would be best represented by the modified elutriate test results. However, due to the condition of the foundation soils throughout the mitigation site, construction of some type of temporary structure, such as hay bales, may be used instead to minimize flow of solids away from the intended placement area. This would not be sufficient to completely restrict flow of the associated water, and the entire triangular area would function in somewhat the same manner as a containment area (Figure 24). Unrestricted open water disposal at the mitigation site is yet another possibility for placement of material in the mitigation site, and aspects of this may be appropriately modeled by the standard elutriate test. However, because the water depth is limited and upland will be created, aeration will have a larger effect than is typical for open water placement. Aeration would be expected to result in greater liberation of metals to the water column. Because of the combined effects expected for dredged material placement in this area, both standard elutriate and modified elutriate results were considered as part of the mitigation site placement mixing zone evaluation.

It is anticipated that diluted effluent would ultimately discharge from the triangular area to Bayou Bienvenue. Discharge of effluent was ruled out for effluent from the CDF because dilution requirements could not be met. In this case, it is hoped that by selecting cleaner materials for placement in the mitigation site, dilution requirements would be reduced sufficiently to allow discharge to Bayou Bienvenue from the mitigation area.

In order to understand the range of dilutions the process variations might introduce, dilution ratios were initially calculated for all DMMUs suitable for placement in the marine environment. Dilution ratios were based on maximum elutriate concentrations obtained in both modified and standard elutriate tests for individual DMMUs, or parts of DMMUs (Table 36), with the mitigation site as the receiving water. These are summarized in Tables 37 and 38.

Maximum resulting dilution ratios for the modified elutriate test were:

- Acute 691 (DMMU 10k copper).
- Chronic 763 (DMMU 10k lead).

Maximum resulting dilution ratios for the standard elutriate test were:

- Acute 4314 (DMMU 10k copper).
- Chronic 5515 (DMMU 10k lead).

In addition, for both modified and standard elutriate tests, DMMU 7c and d required high dilutions for PCBs. There is some indication that analytical problems may be partly responsible since toxicity was not significantly higher for either DMMU 7 or DMMU 10, but this could not be resolved with the information available. Both of these DMMUs were therefore removed from consideration for placement in the mitigation site until further resolution can be obtained regarding the reliability of those results.

Resulting dilution requirements for the remaining DMMUs are illustrated graphically in Figures 25 and 26.

4.3.3. Mitigation site mixing

Maximum dilution required for the selected DMMUs to meet chronic water quality criteria was 170, for tributyltin (standard elutriate, DMMU 4/5), and to meet acute criteria was 18, for cyanide (modified elutriate, DMMU 6). Available dilution in the mitigation site was estimated based on total area encompassed by the entire triangular area. Flow in this area is believed to be limited to tidal fluctuations, but little definitive data was available at the time of this analysis. According to NOAA, the Gulf of Mexico experiences a diurnal tide (http://oceanservice.noaa.gov/education/kits/tides/tides07_cycles.html), with only one high and one low tide each day. An estimate of tidal range was obtained in a site visit made by MVN at low tide (0600 hours, June 16, 2008). Measurements were taken at two locations (stump and wall measurements in Figures 27 and 28). These suggest the tidal range in this location to be between roughly 5-1/2 and 6-1/4 inches. This corresponds well with measurements taken by the University of Wisconsin, who obtained real-time stage measurements from June 17 and June 18, 2007 of approximately 6 inches. The location of their gauge is indicated as WL in Figure 27.

Bottom elevation in the area of the proposed mitigation site ranges from approximately +1/2 to – 1-1/2 ft (NAVD88) (Hartman Engineering Inc. 2001). Hartman (2001) estimated maximum average water elevation at +1.64 ft (NGVD 29) based on the Paris Road gauge readings. (These readings did not capture tidal variations because they were taken at 0800 every day and therefore may not reflect actual maximum water levels. Also, there is a difference between reference elevations NAVD88 and NGVD 29 of approximately 0.2 ft.) These assumptions result in an estimated water depth in the mitigation area ranging from 1.14 ft to 3.14 ft (neglecting the adjustment for NAVD88 vs. NGVD 29). Assuming an average maximum water depth of 2 ft, a six-inch tidal variation would therefore represent a daily exchange of approximately 25 percent of the maximum water volume or an effective flow rate of 111 cfs.

The mitigation site would be classified as a Category 6 water body (coastal bays and lakes) (Louisiana State Environmental Regulatory Code Part IX, Subpart 1, Chapter 11, §1115C). For such a water body, the zone of initial dilution for protection of aquatic life (within which acute criteria may be exceeded) is restricted to a radial distance of 50 feet from the point of discharge. Similarly, the mixing zone within which chronic criteria may be exceeded is restricted to a radial distance of 200 ft.

A 24-h-in dredge is estimated to produce a slurry discharge of approximately 47.1 cfs. The dredge is assumed to operate 20 hr per day, which would produce an effective flow rate for a 24-hour period of approximately 39 cfs. Net inflow rate (the volumetric displacement rate) is estimated to be approximately 26 cfs, assuming about one third of the material storage will be above the water level (not displacing resident water) in this case. Given the estimated flow rate in the mitigation area of 111 cfs, this would yield an approximate dilution ratio of 4:1. This is insufficient to meet dilution requirements for acute or chronic criteria in most cases, in addition to requiring an area larger than that specified for either a zone of initial dilution or a mixing zone under LA water quality regulations. However, suspended phase toxicity testing conducted on the marine elutriates did not result in significant toxicity, even at full strength. If there are no other adverse affects anticipated with the placement, and given the interest and benefit associated with restoration of the wetland, this may be sufficient justification for a waiver from water quality criteria for this action.

Additional consideration must be given to dilution of water leaving the triangular area and flowing into Bayou Bienvenue. Assuming effluent dilution of 4:1 occurs within the triangular area, dilution requirements in Bayou Bienvenue will be reduced somewhat. However, the combined flow from the dredge and the tidal exchange of the triangular area must now be considered as influent to Bayou Bienvenue. An average flow rate in Bayou Bienvenue was estimated assuming a discharge weir would be located at the northeastern-most corner of the triangular area, at which point the bayou is approximately 9000 ft in length. Assuming 130 ft width and a 1 ft tidal range results in an average flow rate within the bayou of 13.5 cfs. Periods of higher flow may be expected, as was previously stated. Based on combined dredge and tidal outflows from the mitigation area of 137 cfs and average flows in Bayou Bienvenue of 13.5 cfs, this would result in an estimated maximum attainable dilution in Bayou Bienvenue of <<1. This is insufficient to meet applicable water quality criteria in Bayou Bienvenue, and a waiver will be required for discharge to Bayou Bienvenue as well.

4.3.4. Potential recoverable area

The wetland area potentially recoverable was estimated based on the assumption that if material proposed for permanent storage in the CDF could be utilized as construction fill, fill materials (designated as such because of their suitability for placement in either freshwater or marine environments) could be utilized for additional wetland restoration instead. The number of acres recoverable was estimated based on the relationship given in Hartman Engineering Inc (2001), which takes into account wave height and water depth. (See ERDC 2008 for site-specific assumptions used in deriving the following equation.) Assuming the volume of the material after initial consolidation and desiccation has taken place, V_{fill} will be approximately 1.5 times that of the in-situ sediment ($V_{in\text{-}situ}$):

$$A = \frac{V_{fill}}{d_{fill}} = \frac{1.5\,V_{in-situ}}{4.28 - 1.39x}$$

Where

$V_{in\text{-}situ}$ = in-situ sediment volume available (acre*ft)
x = bottom elevation (ft)
d_{fill} = depth of fill (ft)

Estimates of total acreage recoverable are summarized in Table 39 and range from 37 acres to 319 acres for the two lock construction alternatives under consideration.

4.3.5 Conclusions

Based on estimates of dilution requirements based on standard and modified elutriates for selected DMMUs, available dilution in both the mitigation site and in Bayou Bienvenue are insufficient to meet water quality criteria during dredged material disposal. However, because none of the elutriates demonstrated toxicity in marine suspended phase toxicity tests, and because there is potentially significant environmental and community benefit associated with restoration of the wetland, a waiver may be justified. Potentially recoverable wetland area was estimated to range between 37 acres and 148 acres for the FIP construction alternative, and between 115 acres and 319 acres for the CIP construction alternative.

Table 36. Dredging and disposal plan (revised 7 17 08).

In-Situ Volumes by Location and Material Type (yd^3)								Volume to Selected Placements Alternative II (ERDC 2008) (yd^3)								Volume to Selected Placements Proposed Alternative (yd^3)								Approximate Year Dredged			
DMMU/Location	Material Type[1]	Suitability (No Benthic Toxicity)		Total Volume		Volume by Section		Float in Place				Cast in Place				Float in Place				Cast in Place				Float-in-Place	Required Fill Volumes (yd^3)	Cast-in-Place	Required Fill Volumes (yd^3)
										CDF				CDF				CDF				CDF					
		FW[2]	SW[3]	FIP	CIP	FIP	CIP	Open Water	Wetland	Disposal	Fill Storage	Open Water	Wetland	Disposal	Fill Storage	Open Water	Wetland	Disposal	Fill Storage	Open Water	Wetland	Disposal	Fill Storage				
D1-05-1 thru 6	NN	USm[4]	USm	48,100	48,100	48100	48100	0	0	48100	0	0	0	48100	0	0	0	48100	0	0	0	48100	0	7	106762n	6	354203n
D2-05-1 thru 6	NN	USm	USm	88,700	155,200	88700	155200	0	0	88700	0	0	0	155200	0	0	0	88700	0	0	0	155200	0	7		6	
D3-05-1 thru 3	F	S[5]	S			62850	196700		0	0	0		0	0	0	**0**	**62850a**	0	0		**196700**	0	0	2-3		2-3	
D3-05-4 thru 6	NN	S	US	412,750	586,300	349900	389600	**412750q**	0	0	0	**586300q**	0	0	0	**349900a**	0	0	0	**389600**	0	0	0	2-3		2-3	
D3-05-1N thru 6N	N	S	US			a	a		0	0	0		0	0	0		0	0	0		0	0	0	2-3		2-3	
D4-05-1 thru 8	NN	S	US	152,800	257,800	152,800	257,800	152800	0	0	0	257800	0	0	0	152800	0	0	0	257800	0	0	0	2-3		2-3	
D5-05-1 thru 8	NN	US	US	143,400	245,200	78,500	83,500	0	0	78500	0	0	0	83500	0	0	0	78500	0	0	0	83500	0	2-3		2-3	
D4/5-05-1N-16N	N	S	S	b	b	64900h	161700h	**64900q**	0	0	0	**161700q**	0	0	0	**0**	**64900**	0	0	**0**	**161700**	0	0	2-3		2-3	
D6-05-1 & 2	NN	S	S																					1		1	
D6-05-3 thru 6	F	S	S	463,100	997,700	463,100	997,700	0	0	0	463100	346678	0	0	651022	59100	0	0	404000	346678	0	0	651022	1	None	1	None
D6-05-1N thru 6N	N	S	S																					1		1	
D7-05-1 thru 4	NN	US	S			101500	152500	0	0	101500	0	0	0	152500	0	0	0	101500	0	0	0	152500	0	1		1	
D7-05-5 thru 9	F	S	S	413,000	620,900	228000	79400									**228000**	0				**0**			1		1	
D7-05-1N-4N	N	S	S			c	c	**311500q**	0	0	0	**468400q**	0	0	0			0	0	**79400**		0	0	1		1	
D7-05-5N-9N	N					83500	389000									**0**	**83500**				**389000**						
D8-05-1 thru 4	NN	S	US	132,000	162,000	132,000	162,000	132000	0	0	0	162000	0	0	0	132000	0	0	0	162000	0	0	0	7		7	
D9-05-1&3	NN	S	US	192,200	192,200	192,200	192,200	150000	0	0	0	150000	0	0	0	150000	0	0	0	150000	0	0	0	11		11	

Table 36. Dredging and disposal plan (revised 7 17 08).

DMMU/Location	Material Type[1]	Suitability (No Benthic Toxicity) FW[2]	Suitability (No Benthic Toxicity) SW[3]	Total Volume FIP	Total Volume CIP	Volume by Section FIP	Volume by Section CIP	Alt. II (ERDC 2008) Float in Place Open Water	Alt. II Float in Place Wetland	Alt. II Float in Place CDF Disposal	Alt. II Float in Place CDF Fill Storage	Alt. II Cast in Place Open Water	Alt. II Cast in Place Wetland	Alt. II Cast in Place CDF Disposal	Alt. II Cast in Place CDF Fill Storage	Proposed Alt. Float in Place Open Water	Proposed Alt. Float in Place Wetland	Proposed Alt. Float in Place CDF Disposal	Proposed Alt. Float in Place CDF Fill Storage	Proposed Alt. Cast in Place Open Water	Proposed Alt. Cast in Place Wetland	Proposed Alt. Cast in Place CDF Disposal	Proposed Alt. Cast in Place CDF Fill Storage	Approx. Year Dredged Float-in-Place	Required Fill Volumes (yd³)	Cast-in-Place	Required Fill Volumes (yd³)
D9-05-2&4	NN	S	S					42200q	0	0	0	42200q	0	0	0	0	42200	0	0	0	42200	0	0	7		7	
D10-05-1	F	S	S	131,400	131,300	18300	18300	131,400	0	0	0	131,300				131,400	0	0	0	131,300				7	246825j	7	246825j
D10-05-2	F	d	d			e	e																	7		7	
D10-05-3&4	S	S	S			113100	113000																	7		7	
D10-05-1N	N	d	d			f	f																	7		7	
D10-05-2N	N	d	d			e	e																	7		7	
D10-05-3N&4N	N	S	S			g	g																	7		7	
D11-05-1&2	NN	d	d	38,782	38,782	38782i	38782i	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11		11	
Totals				2,216,232	3,435,482	2,216,232	3,435,482	1397550q	0	316800	463100	2306378q	0	439300	651022	1203200	253450	316800	404000	1516778	789600	439300	651022	Total	353587	Total	601028
								Grand Total			2,177,450	Grand Total			3,396,700	Grand Total			2,177,450	Grand Total			3,396,700	Capping Allowance	50000	Capping Allowance	50000
																								Grand Total	403587	Grand Total	651028

[1] Native/Non-native/Fill/Sediment, [2] Freshwater, [3] Saltwater, [4] Unsuitable, [5] Suitable, **a a** Native volumes included with 1-3 and 4-6 volumes above, therefore wetland placement volume is overestimated by the volume underlying DMMU 1 Sites 1-3, and the open water volume is underestimated by the same amount, **b** 4/5 is a vertical designation, volume included with 4 and 5, **c** Native below project depth (at -36ft), **d** Unknown assumed S, **e** Site 2 not sampled, **f** Included with 1 above, **g** Included with 3&4 above, **h** DMMU 5 native volumes only, DMMU 4 volumes were estimated as NN to full project depth, **i** Not scheduled for dredging, **j** Letter report assumes 70K of material being dredged plus remainder from previously stockpiled goes to fill. However water management at the lock fill site would be a problem if dredging hydraulically due to the small size of the site and limited hydraulic retention time, **m** Not tested, assumed unsuitable, **n** Letter report specifies backfill of West Side of New lock after U/S and D/S approach - assumed here to correspond to main north channel, **q** shaded areas represent material proposed for open water disposal in Alternative II (ERDC 2008), portions of which are proposed for wetland placement in proposed alternative

Table 37. Estimated dilution ratios required for individual DMMUs for placement in the mitigation site based on modified elutriate test - maximum dissolved concentration.

	DMMU3[a]		DMMU4/5[b]		DMMU6[f]		DMMU6[g]		DMMU6[h]		DMMU7[c]		DMMU7L[d]		DMMU7N[e]		DMMU9[i]		DMMU10[j]		DMMU10[k]		DMMU10[L]	
Contaminants	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**
Metals																								
Arsenic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.06**	0	0
Cadmium	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n
Chromium III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0
Chromium VI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE	0	0	0	0
Copper	n	n	0	0	0	0	0	n	0	n	n	n	**0.25**	**0.25**	0	n	0	0	**52**	**52**	**691**	**691**	**2**	**2**
Lead	0	0	0	**26**	0	0	0	0	0	0	0	**15**	0	n	0	n	0	0	0	**69**	**4**	**763**	0	**5**
Mercury	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	**17**	0	n
Nickel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	**0.86**	**45**	0	0
Selenium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Silver	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**
Zinc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**9**	**10**	0	0
Organotins																								
Tributyltin	0	n	0	n	0	n	0	n	0	n	0	127	0	n	0	n	0	n	0	n	0	0	0	n
Inorganic/General Chemistry																								
Cyanide	**11**	**11**	**14**	**14**	**11**	**11**	**18**	**18**	**11**	**11**	**11**	**11**	**11**	**11**	n	n	**3**	**3**	**2**	**2**	**2**	**2**	**11**	**11**
Semi-Volatile Organic Compounds																								
Benzidine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE	0	0	0	0
2-Chlorophenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE	0	0	0	0
2,4-Dichlorophenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE	0	0	0	0
Hexachlorobutadiene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pentachlorophenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE	0	0	0	0
Phenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE	0	0	0	0
Chlorinated Pesticides																								
Aldrin	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	NE	NS	0	0m	0	NS
gamma-BHC (Lindane)	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	**0.88m**
gamma-Chlordane	0	**0.83**	0	0	0	n	0	n	0	0	0	**99**	0	0	0	0	0	0	NE	NE	0	0	0	0
4,4'-DDD	0	0	0	0	0	0	0	0	0	0	**4**	**29**	0	0	0	0	0	0	0	0	0	0	0	**0.30**
p,p'-DDE (4,4')	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	NS	NS	0m	0m	0m	0m
p,p'-DDT (4,4')	0	**4**	0	n	0	n	0	**9**	0	**34**	0	**39**	0	n	0	**1.31**	0	n	NE	NE	0	n	0	n
Dieldrin	0	**13**	0	0	0	0	0	**0.33**	0	0	0	**134**	0	0	0	0	0	0	NE	NE	0	0	0	**24**
Endosulfan sulfate	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Endrin	0	**1**	0	0	0	0	0	0	0	0	0	**14**	0	0	0	0	0	0	NE	NE	0	0	0	0
Heptachlor	0	0	0	0	0	n	0	n	0	n	0	n	0	0	0	0	0	0	NE	NE	0	0	0	0
Heptachlor epoxide	0	0	0	0	0	0	0	0	0	0	0	**16**	0	0	0	0	0	0	NE	NE	0	0	0	0
Toxaphene	0	n	0	n	0	n	0	n	0	n	0	**39**	0	n	0	n	0	n	NE	NE	0	n	0	n
PCB Congeners																								
PCB Total	0	0	0	0	0	**15**	0	0	0	0	**0.10**	**547**	0	**447**	0	0	0	0	NE	NE	0	0	0	**19**
Maximum	**11**	**13**	**14**	**26**	**11**	**15**	**18**	**18**	**11**	**34**	**11**	**547**	**11**	**447**	**0.32**	**10**	**3**	**10**	**52**	**69**	**691**	**763**	**11**	**24**
Mean	**0.37**	**2**	**0.45**	**2**	**0.36**	**1**	**0.58**	**2**	**0.36**	**2**	**0.50**	**40**	**0.36**	**19**	**0.01**	**0.47**	**0.12**	**0.51**	**4**	**11**	**23**	**55**	**0.41**	**3**
Minimum	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0**	**0**

a DMMU 3 C1-3 Land, **b** DMMU 4/5N Comp 1&11, Sites 4, 5, 7, 8, 12 &13, **c** DMMU 7 Sites 2, 3, and 4, **d** DMMU 7Land Sites 5, 6, 7, 8 & 9, **e** DMMU 7N Comp 1-9, **f** DMMU 6 Site 1 and 2, **g** DMMU 6 Land Site 3, 4, 5, & 6, **h** DMMU 6N Sites 1, 2, 3, 4, 5 & 6, **I** DMMU 9 Comp 2&4, **j** DMMU 10 Land Comp 3 & 4, **k** DMMU 10N Comp 3 & 4, **l** DMMU 10 Site 1, **m** Based on EPA Region IV Water Quality Screening Criteria for Hazardous Waste Sites, **n** Background Exceeds WQC and Elutriate Concentrations

Table 38. Estimated dilution ratios required for individual DMMUs for placement in the mitigation site based on standard elutriate test - maximum dissolved concentrations.

	DMMU3[a]		DMMU4/5[b]		DMMU6[f]		DMMU6[g]		DMMU6[h]		DMMU7[c]		DMMU7L[d]		DMMU7N[e]		DMMU9[i]		DMMU10[j]		DMMU10[k]		DMMU10[L]	
Contaminants	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**
Metals																								
Arsenic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**	**6.19**	0	0
Cadmium	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	0	n	**0.05**	**51**	0	n
Chromium III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**6**	**3**	**13**	0	0
Chromium VI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE	0	0	0	0
Copper	0	0	**2**	**2**	n	n	**13**	**13**	**8**	**8**	0	n	**5**	**5**	0	0	n	n	**24**	**24**	**4314**	**4314**	**17**	**17**
Lead	0	0	0	**2**	0	n	0	**10**	0	**4**	0	**13**	0	**14**	0	0	0	**2**	0	**15**	**36**	**5515**	0	**37**
Mercury	0	n	0	6	0	n	0	n	0	n	0	n	0	n	0	n	0	n	NE	NE	**0.06**	**179**	0	n
Nickel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**13**	**10**	**273**	0	0
Selenium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.59**	0	0
Silver	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**0.32**	**10 m**	**2**	**26 m**	0	**10 m**
Thallium	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m
Zinc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**54**	**61**	0	0
Organotins																								
Tributyltin	0	n	0	**170**	0	n	0	n	0	n	**0.10**	**208**	0	n	0	n	0	n	0	**10**	0	**25**	0	n
Inorganic/General Chemistry																								
Cyanide	n	n	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**11**	**47**	**47**	**11**	**11**	**11**	**11**	**6**	**6**	**1**	**1**	**26**	**26**	**6**	**6**
PAH's																								
Acenaphthene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluoranthene	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m
Naphthalene	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m
Semi-Volatile Organic Compounds																								
Benzidine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Chloronaphthalene	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
2-Chlorophenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Di-n-butyl phthalate	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m
1,4-Dichlorobenzene	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m
2,4-Dichlorophenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diethyl phthalate	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m
Hexachlorobutadiene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Nitrophenol	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m
N-Nitrosodiphenylamine	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m
Pentachlorophenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlorinated Pesticides																								
Aldrin	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m
alpha-BHC	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m	NS	0m
gamma-BHC (Lindane)	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m	0	0m
alpha-Chlordane	0	0	0	0	0	0	0	0	0	0	0	**3**	0	0	0	0	0	0	0	0	0	0	0	0
gamma-Chlordane	0	**4**	0	0	0	n	0	0	0	0	0	**112**	0	**2**	0	0	0	0	0	0	0	0	0	n
4,4'-DDD	0	0	0	0	0	0	0	0	0	**0.83**	**5**	**33**	0	0	0	0	0	0	0	**0.81**	0	**0.15**	0	**0.74**
p,p'-DDE (4,4')	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m	0m
p,p'-DDT (4,4')	0	n	0	**5**	0	**32**	0	**74**	0	**127**	0	**85**	0	**31**	0	n	0	0	0	**266**	0	**243**	0	**44**

Table 38. Estimated dilution ratios required for individual DMMUs for placement in the mitigation site based on standard elutriate test - maximum dissolved concentrations.

	DMMU3[a]		DMMU4/5[b]		DMMU6[f]		DMMU6[g]		DMMU6[h]		DMMU7[c]		DMMU7L[d]		DMMU7N[e]		DMMU9[i]		DMMU10[j]		DMMU10[k]		DMMU10[L]	
Contaminants	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**	**Acute**	**Chronic**
Dieldrin	0	**7**	0	0	0	0	0	**2**	0	0	0	**160**	0	0	0	0	0	**7**	0	0	0	0	0	5
Endosulfan I	0	0	0	0	0	0	0	0	0	0	0	**0.51**	0	0	0	0	0	0	0	0	0	0	0	0
Endosulfan II	0	0	0	0	0	0	0	0	0	0	0	**0.51**	0	0	0	0	0	0	0	0	0	0	0	0
Endosulfan sulfate	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Endrin	0	0	0	**0.33**	0	**3**	0	0	0	0	0	**36**	0	0	0	0	0	0	0	**2**	0	**11**	0	**19**
Heptachlor	0	n	n	n	0	0	0	n	0	n	0	n	0	0	0	0	0	0	0	0	0	n	0	0
Heptachlor epoxide	0	0	0	0	0	0	0	0	0	0	0	**18**	0	0	0	0	0	0	0	0	0	0	0	0
Methoxychlor	NS	0	NS	0	NS	0	NS	**0.58**	NS	**0.18**	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0
Toxaphene	0	n	0	n	0	n	0	n	0	n	0	**85**	0	n	0	n	0	n	0	n	0	n	0	n
PCBs																								
PCB Total	0	**13**	0	**22**	0	0	0	0	0	0	0	**447**	0	0	0	0	0	**4**	0	0	0	0	0	**34**
Max	**0.32**	**13**	**11**	**170**	**11**	**32**	**13**	**74**	**11**	**127**	**47**	**447**	**11**	**31**	**11**	**11**	**6**	**10**	**24**	**266**	**4314**	**5515**	**17**	**44**
Average	**0.007519**	**0.89**	**0.31**	**5**	**0.26**	**1**	**0.57**	**3**	**0.44**	**4**	**1**	**31**	**0.36**	**2**	**0.26**	**0.52**	**0.15**	**0.74**	**0.66**	**8**	**103**	**250**	**0.53**	**4**
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

a DMMU 3 C1-3 Land, **b** DMMU 4/5N Comp 1&11, Sites 4, 5, 7, 8, 12 &13, **c** DMMU 7 Sites 2, 3, and 4, **d** DMMU 7Land Sites 5, 6, 7, 8 & 9, **e** DMMU 7N Comp 1-9, **f** DMMU 6 Site 1 and 2, **g** DMMU 6 Land Site 3, 4, 5, & 6, **h** DMMU 6N Sites 1, 2, 3, 4, 5 & 6, **I** DMMU 9 Comp 2&4, **j** DMMU 10 Land Comp 3 & 4, **k** DMMU 10N Comp 3 & 4, **l** DMMU 10 Site 1, **m** Based on EPA Region IV Water Quality Screening Criteria for Hazardous Waste Sites, **n** Background Exceeds WQC and Elutriate Concentrations

Table 39. Estimated restorable wetland area.

x (ft)	V_{insitu} (yd^3)			
	253450[a]	570250[b]	789600[c]	1228900[d]
	Area (acres)			
0.5	65.7	148	205	319
0	55.1	124	172	267
-0.5	47.4	107	148	230
-1	41.6	93.5	129	202
-1.5	37.0	83.3	115	180

a FIP without fill volumes, b FIP with additional fill volumes, c CIP without fill volumes, d CIP with additional fill volumes

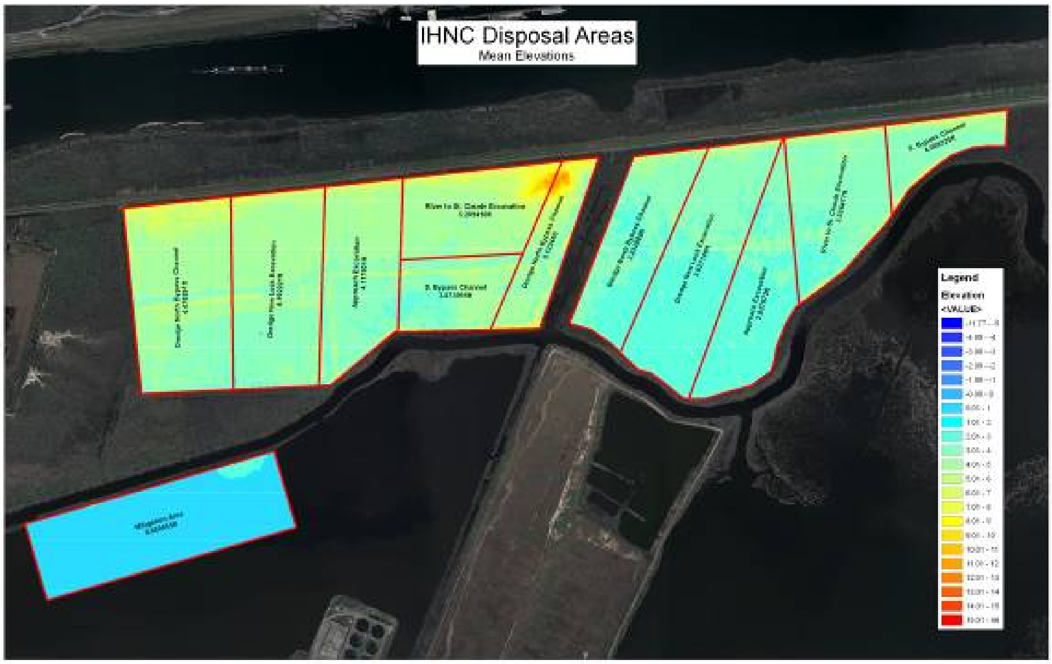


Figure 23. Representation of proposed wetland mitigation site.

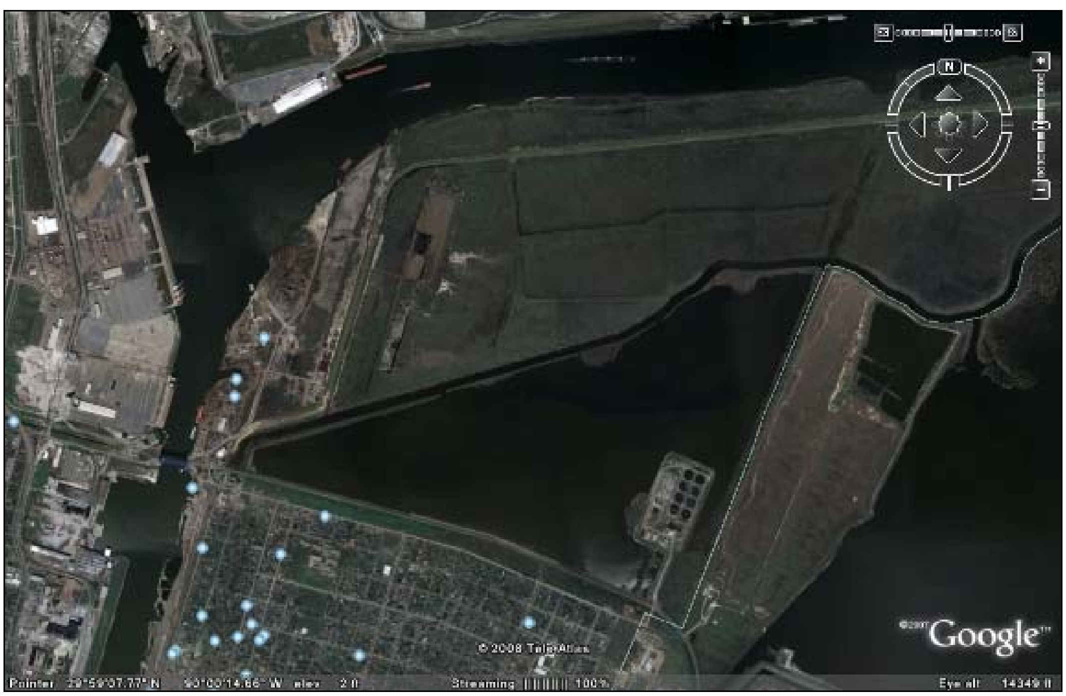


Figure 24. Triangular area containing proposed mitigation area.

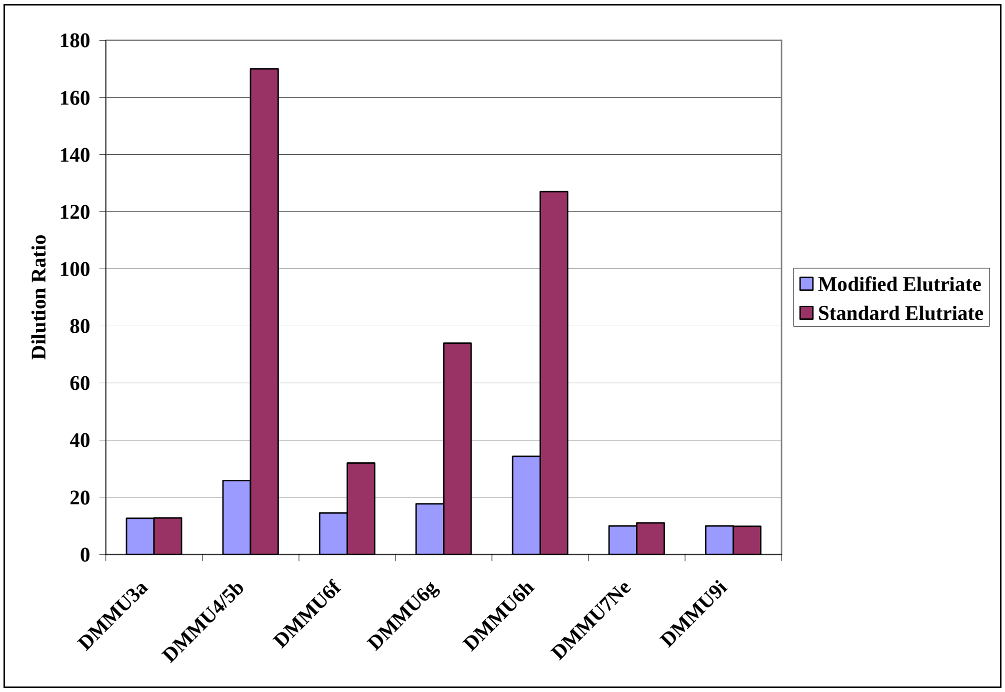


Figure 25. Maximum dilution ratios required to meet chronic criteria for selected DMMUs (see Table 37 footnotes for further explanation of site designations).

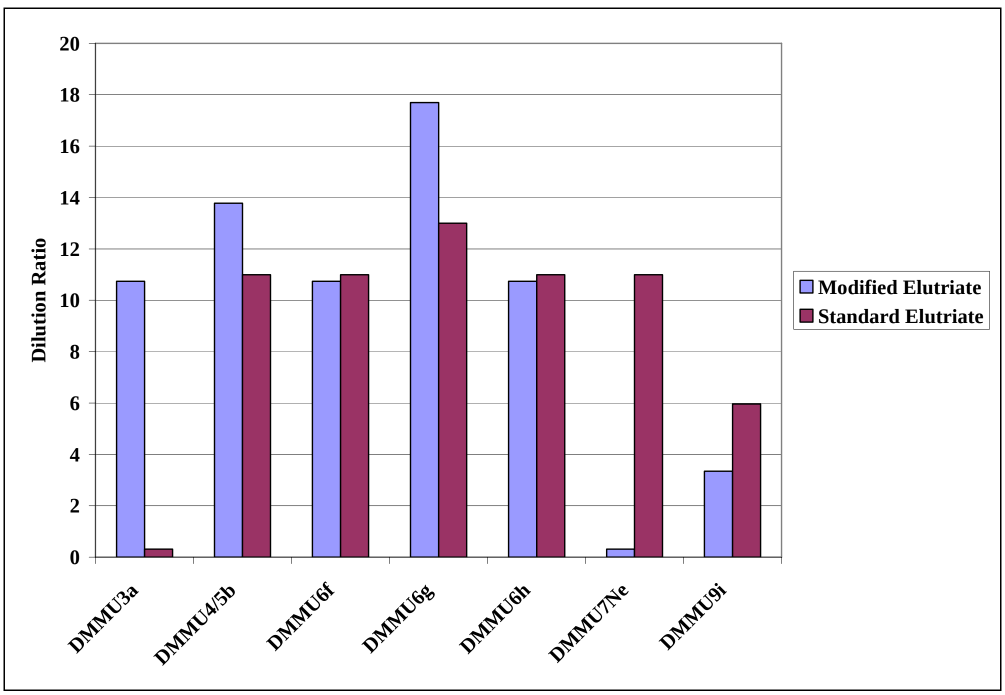


Figure 26. Maximum dilution ratios required to meet acute criteria for selected DMMUs (see Table 37 footnotes for further explanation of site designations).

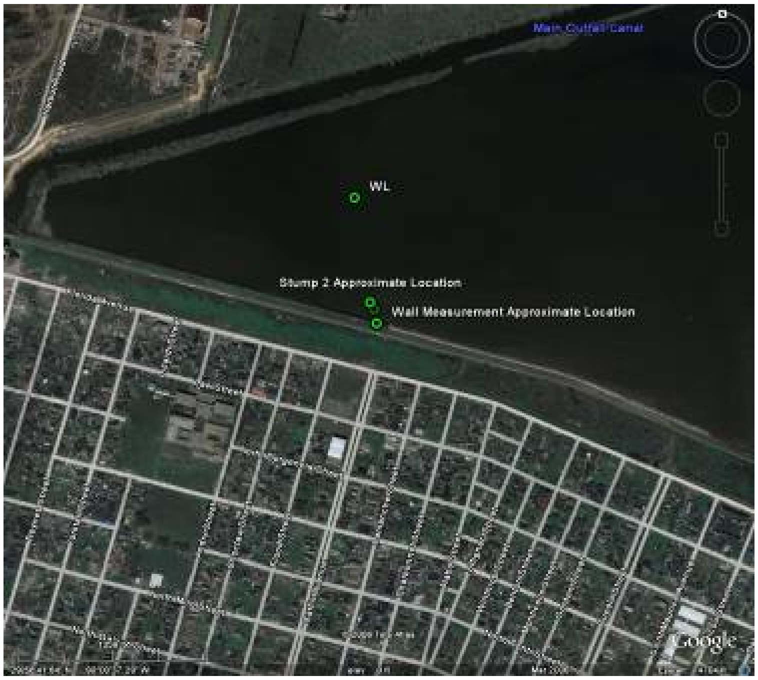


Figure 27. Locations of tidal range measurements in area of mitigation site.

Figure 28. Tidal range measurements taken at wall (left) and stump (right) in area near proposed mitigation site.

5 Benthic Toxicity Evaluation

Note that DMMUs 1 and 2 were not evaluated for benthic toxicity because Tier I evaluation (Appendix A) determined dredged material from those DMMUs as unsuitable for open water disposal.

5.1. Freshwater open water disposal evaluation

Dredged material is predicted to be acutely toxic to benthic organisms when the mortality of test organisms exposed to sediment from in-channel stations is statistically greater than the mortality of test organisms exposed to sediment from the reference area, and exceeds mortality of organisms exposed to sediment from the reference area by at least 20% when the test organisms are amphipods (10% is used for other recommended organisms).

Ten-day solid phase benthic toxicity tests using the amphipod, *Hyalella azteca*, were conducted in three batches (Weston Solutions 2008). A summary of amphipod survival data is presented in Table 40 and Figure 29. Mean survival in the control sediment for the three batches was high (85 % or higher) and indicated that test conditions and health of the organisms were acceptable. Mean survival in the reference sediment was 85% or higher for all three batches (Table 41). Survival in dredged material was significantly lower than in the reference sediment only for non-native sediments from DMMU 5 and from DMMU 7 (Table 40).

The observed significantly higher mortality of *Hyalella azteca* in DMMUs 5 NN and 7 NN was, at least partially, a response to the relatively elevated concentration of metals in those channel sediments. A linear regression of mean percent mortality with the average ER-M quotient (see Section 2.2) suggests a causal relationship between heavy metal concentration and decreased survival (Figure 30). A similar relationship with organic-carbon normalized sum-PAHs concentrations (Figure 30) yielded a much lower coefficient of determination ($r^2 = 0.25$), suggesting that those contaminants were present at sum concentrations too low to promote the observed mortality in non-native sediments from DMMUs 5 NN and 7 NN. Therefore, it is speculated that high concentrations of heavy metals in those DMMUs promoted the observed significant decrease in amphipod survival.

Based on the results of the solid phase toxicity tests, DMMUs 5 NN and 7 NN are predicted to be acutely toxic to freshwater benthic organisms. All remaining IHNC DMMUs are not predicted to be acutely toxic to freshwater benthic invertebrates.

Table 40. *Hyalella azteca* 10-day freshwater solid phase toxicity tests.

DMMU	Percent Survival			Batch
	Mean	Std. Dev	Statistical Comparison with Reference	
3 NN	91	8	Not different	1
3 N	95	8	Not different	1
3 F	93	7	Not different	1
4 NN	83	21	Not different	2
5 NN	60	33	**Different**	2
4/5 N	93	7	Not different	2
6 NN	90	9	Not different	1
6 N	95	5	Not different	2
6 F	95	8	Not different	3
7 NN	51	33	**Different**	2
7 N	89	8	Not different	2
7 F	95	8	Not different	3
8 NN	85	12	Not different	1
9-1 NN	91	15	Not different	3
9-2,4 NN	89	16	Not different	3
10 NN	91	10	Not different	2
10 N	86	14	Not different	3
10 F	80	33	Not different	3

Mean percent survival in exposure to IHNC dredged material samples and statistical comparison with mean survival in reference sediment sample.

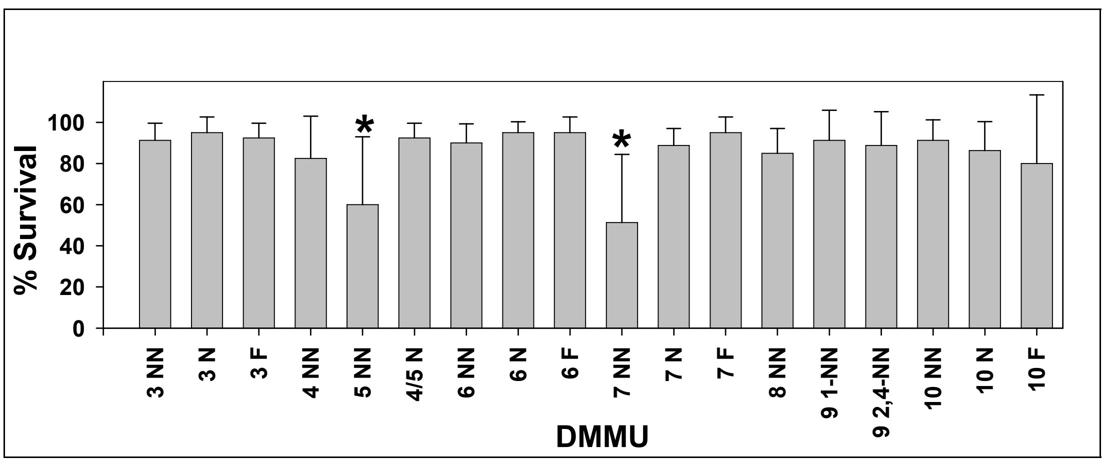


Figure 29. *Hyalella azteca* 10-day freshwater solid phase toxicity tests. Mean percent survival in exposures IHNC dredged material samples. * indicates statistically significant decreased survival.

Table 41. *Hyalella azteca* 10-day freshwater solid phase toxicity tests.

Batch	Percent Survival	
	Mean	Std. Dev
1	89	11
2	98	5
3	85	13
Mean percent survival in exposure to reference sediment for exposure batches 1, 2, and 3.		

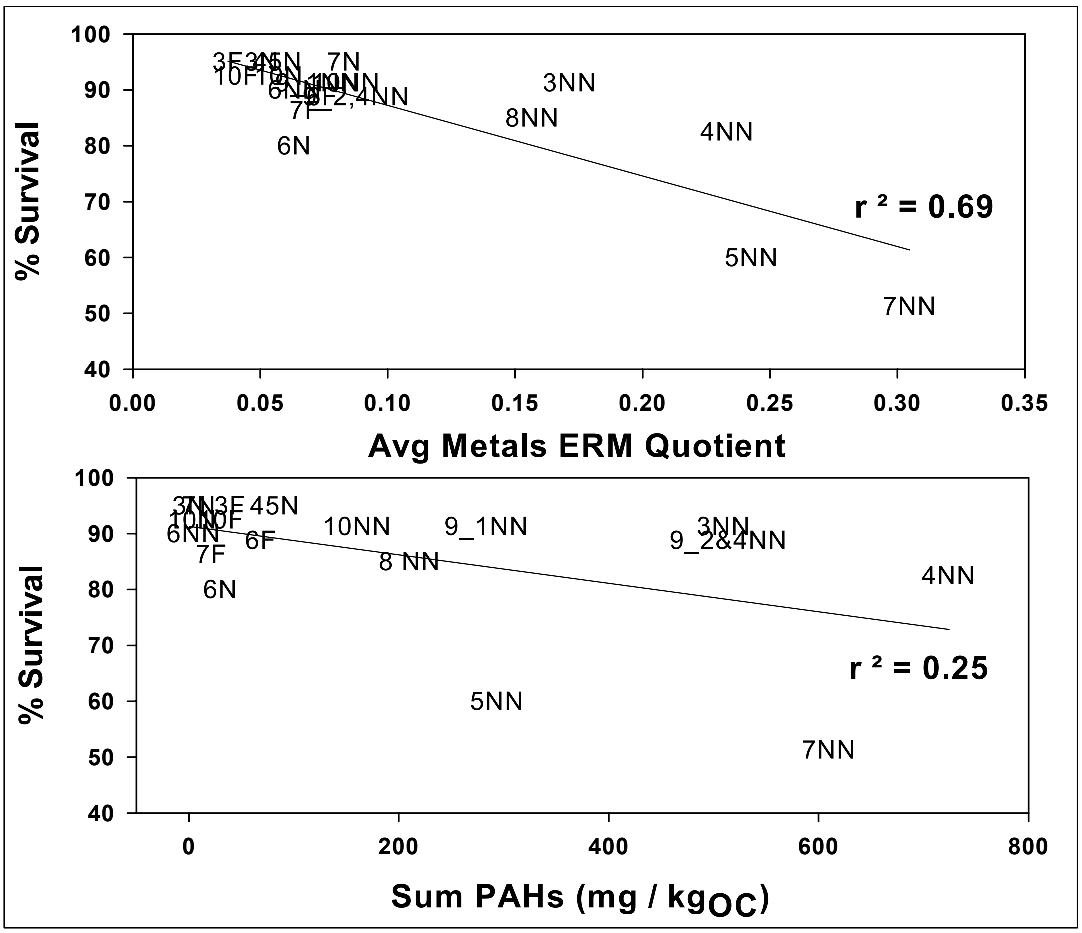


Figure 30. Benthic toxicity evaluation. Mean percent survival of *Hyalella azteca* exposed to IHNC dredged material. * indicates statistically significant decreased survival.

5.2. Estuarine open water disposal evaluation

Ten-day solid phase benthic toxicity tests using the estuarine amphipod, *Leptocheirus plumulosus*, were conducted in three batches (Weston Solutions 2008). A summary of amphipod survival data is presented in Table 42 and Figure 31. Mean survival in the control sediment (94% or higher) indicated that test conditions and health of the organisms were acceptable for the three batches. Mean survival in the reference sediment was 82% or higher for all three batches (Table 43). Survival in dredged material was significantly lower than in the reference sediment for non-native sediments and subsurface soil from DMMUs 3 NN, 3 N, 4 NN, 5 NN, 8 NN, and 9-1 NN (Table 42). Therefore, benthic toxicity is predicted for those dredged material samples.

The concentration of metals in channel sediments from DMMUs 3 NN, 4 NN, 5 NN, and 8 NN likely contributed to the relatively high mortality of *Leptocheirus plumulosus* in laboratory toxicity tests. A linear regression of mean metals ER-M quotient with mean percent mortality suggests a causal relationship between metals concentration and decreased survival (Figure 32). Elimination of DMMU 7 NN, where survival was high despite a relatively high metals ER-M quotient, from the analysis demonstrated a stronger linear relationship ($r^2 = 0.68$). The relationship between organic-carbon normalized total PAHs concentration (sum concentration of acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) and *L. plumulosus* survival (Figure 33) yielded a much lower coefficient of determination ($r^2 = 0.28$), suggesting that those contaminants were present at concentrations too low to significantly contribute to the observed high mortality.

Based on the results of the solid phase toxicity tests, dredged material from DMMUs 3 NN, 3 N, 4 NN, 5 NN, 8 NN, and 9-1 NN are predicted to be acutely toxic to estuarine benthic invertebrates. All remaining IHNC DMMUs are not predicted to be acutely toxic to estuarine benthic invertebrates.

Table 42. *Leptocheirus plumulosus* 10-day solid phase toxicity tests.

DMMU	Percent Survival			Batch
	Mean	Std. Dev	Statistical Comparison with Reference	
3 NN	42	13	**Different**	1
3 N	69	16	**Different**	1
3 F	75	10	Not different	1
4 NN	50	19	**Different**	2
5 NN	32	14	**Different**	2
4/5 N	67	10	Not different	2
6 NN	93	8	Not different	1
6 N	85	5	Not different	2
6 F	81	10	Not different	3
7 NN	80	14	Not different	2
7 N	86	12	Not different	2
7 F	90	6	Not different	3
8 NN	39	7	**Different**	1
9-1 NN	59	10	**Different**	3
9-2,4 NN	67	10	Not different	3
10 NN	89	7	Not different	2
10 N	82	9	Not different	3
10 F	92	3	Not different	3
Mean percent survival in exposure to IHNC dredged material samples and statistical comparison with mean survival in reference sediment sample.				

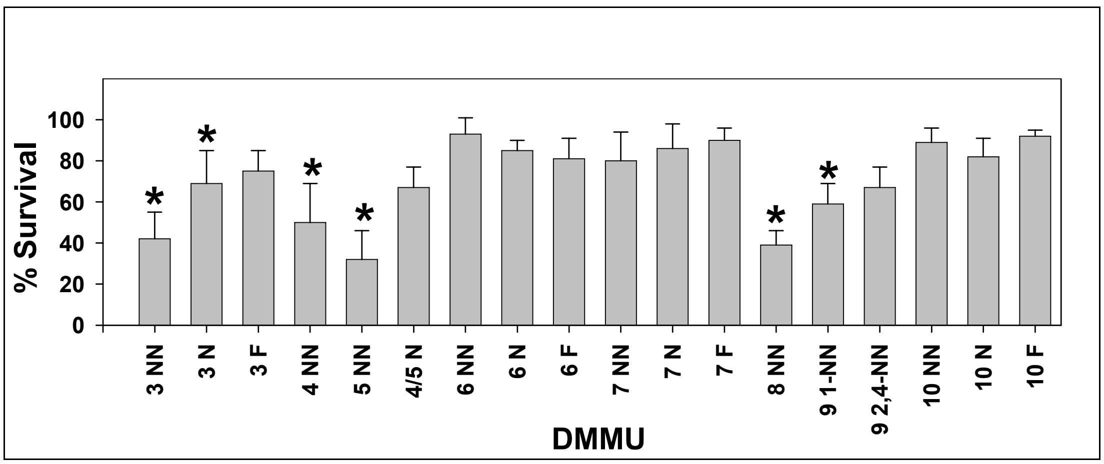


Figure 31. *Leptocheirus plumulosus* estuarine 10-day solid phase toxicity tests. Mean percent survival in exposures IHNC dredged material samples. * indicates statistically significant decreased survival.

Table 43. *Leptocheirus plumulosus* 10-day solid phase toxicity tests.

Batch	Percent Survival	
	Mean	Std. Dev
1	89	7
2	98	5
3	85	6
Mean percent survival in exposure to reference sediment for exposure batches 1, 2, and 3.		

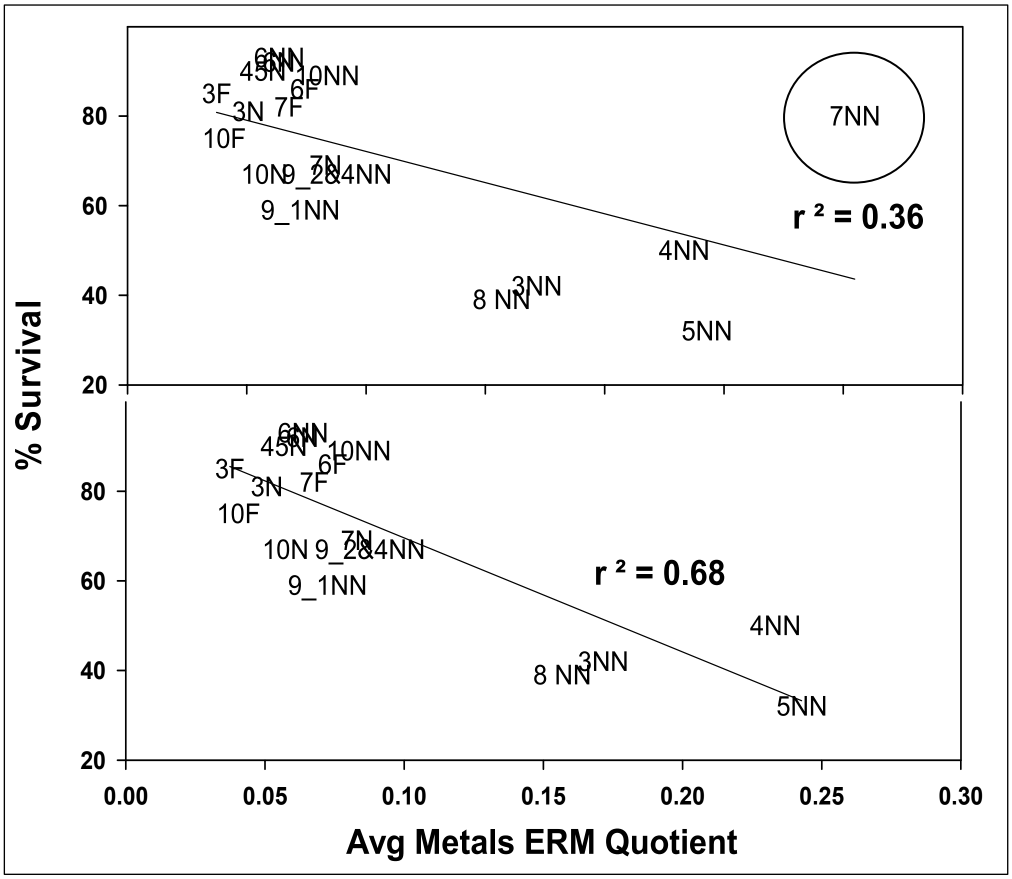


Figure 32. Benthic toxicity evaluation. Mean percent survival of *Leptocheirus plumulosus* exposed to IHNC dredged material as a function the average metals ERM quotient for all samples evaluated (top) and for sample 7 NN excluded from the regression (bottom).

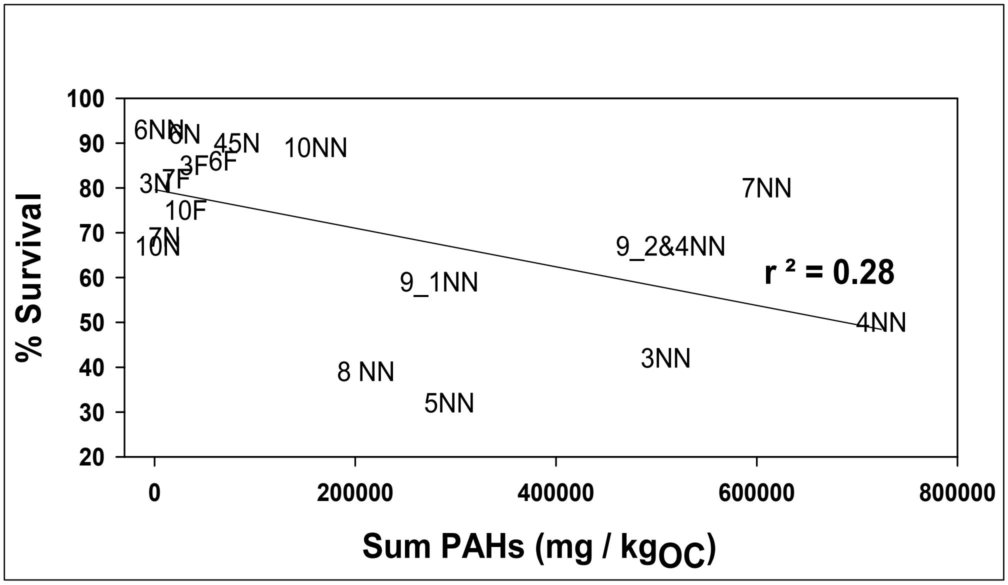


Figure 33. Benthic toxicity evaluation. Mean percent survival of *Leptocheirus plumulosus* exposed to IHNC dredged material samples as a function of organic-carbon normalized Sum PAHs concentrations.

6 Bioaccumulation Potential Evaluation

According to the ITM, data from bioaccumulation tests are evaluated at two levels. First, the amount of bioaccumulation of a specific contaminant in tissues exposed to dredged material is compared to applicable USFDA Action or Tolerance Levels for Poisonous or Deleterious Substances in Fish and Shellfish for Human Food, when such levels have been set for the particular contaminants. Comparison with state fish consumption advisories and guidelines is also recommended. If the tissue concentration of the contaminant is not less than the USFDA levels, the dredged material is predicted to result in benthic bioaccumulation, and there is the potential for the dredged material to have an "unacceptable adverse effect." The USFDA levels (http://www.foodsafety.gov/~lrd/fdaact.html) are based on human-health as well as economic considerations, but do not indicate the potential for environmental impact on the contaminated organisms or the potential for biomagnification. Because contamination of food in excess of FDA levels is considered a threat to human health, concentrations in excess of such levels in any test species are considered to be predictive of benthic bioaccumulation of contaminants (USEPA and USACE 1998). This guidance applies even though the test species may not be a typical human food item partly because certain contaminants can be transferred through aquatic food webs, but mainly because uptake to USFDA levels in relatively short-term tests with one species may indicate the potential for accumulation in other species.

If the tissue concentration of the contaminant is less than the USFDA level or if there is no USFDA level for comparison, the contaminant concentration in tissues exposed to dredged material is compared to contaminant concentrations of tissues exposed to sediment from the reference area. If the tissue concentration of the contaminant in organisms exposed to dredged material does not statistically exceed the tissue concentration of the contaminant in organisms exposed to sediment from the reference area, the dredged material is not predicted to result in benthic bioaccumulation. If tissue concentrations of the contaminant in organisms exposed to dredged material statistically exceed those of organisms exposed to sediment from the reference area, the conclusion regarding benthic bioaccumulation is based on technical evaluations such as the following:

- The toxicological importance of the contaminant.
- The propensity for the contaminant to bioaccumulate in higher trophic levels within aquatic food webs.

- The magnitude by which bioaccumulation in tissues of organisms exposed to dredged material exceed bioaccumulation in tissues of organisms exposed to sediment from the reference area.
- The number of contaminants for which bioaccumulation from the dredged material is statistically greater than bioaccumulation from sediment from the reference area.
- The magnitude by which the contaminant whose bioaccumulation from dredged material exceeds that from the reference area also exceeds the concentrations found in comparable species living in the vicinity of the proposed disposal area.

6.1. Freshwater bioaccumulation potential evaluation

Non-native sediment from DMMUs 5 and 7 (5 NN and 7 NN) were predicted to be acutely toxic to benthic organisms, and therefore unsuitable for open water disposal. Therefore, bioaccumulation data for those DMMUs were not further evaluated for bioaccumulation potential.

Twenty-eight-day solid phase benthic bioaccumulation tests using the clam, *Corbicula fluminea*, were conducted in four batches (Weston Solutions 2008). Mean survival in the control sediments (95% for all batches) indicated that test conditions and health of the organisms were acceptable for the batches 2, 3 and 4. Survivorship in batch 1 was generally low (Table 44). Clams in batch 1 were received from a source in the state of Virginia. Those organisms were collected and held in water for 24 hr and then shipped overnight to ERDC with damp paper towels on ice. It is speculated that those holding and shipping methods stressed the organisms, leading to reduced survival in all batch 1 dredged material, including the reference, where mean survival was 62%. Clams from batches 2, 3 and 4 were collected from a different source, in the state of Arkansas, held in an artificial stream, and transported to ERDC the same day, submerged in water. Mean survival in the reference sediment was 98%, and overall survival was high for clams from Arkansas used in batches 2, 3, and 4 (Table 44).

Because of the onset of mortality during the 28-day exposure period, sufficient tissue for all chemical analyses could not be obtained from every replicate chamber. Therefore, analyses of hexavalent chromium, volatile compounds, and organotins were not performed for most replicates. Analysis of Aroclors, semi-volatiles, and pesticides was not performed for a few of the total replicates (Table 45). The following prioritization sequence was developed to ensure that contaminants with greatest potential for bioaccumulation and toxicological relevance were analyzed.

1. Metals
2. Semi-volatile compounds, organochlorine pesticides, and PCBs
3. Organotins

4. Hexavalent chromium
5. Volative compounds

Whole-body chemical analysis of clams exposed to IHNC dredged material during the 28-day solid phase bioaccumulation tests revealed the presence of metals, organotins, organochorine pesticides, PCBs (measured as Aroclors), and semi-volatile compounds (Weston Solutions 2008). Tissues exposed to sediment from the reference area revealed the presence of metals, PCBs, and semi-volatile compounds (Weston Solutions 2008). Volatile compounds were only analyzed for DMMUs 4 NN and 7 NN. Those compounds did not bioaccumulate at detectable levels in the tissues of clams exposed to sediment from those dredged materials (Weston Solutions 2008).

6.1.1. Comparison with USFDA action levels and OEHHA fish contaminant goals

Concentrations of contaminants of concern in tissues of a benthic invertebrate (the freshwater clam, *Corbicula fluminea*) following dredged material exposure were compared to applicable USFDA Action or Tolerance, when such levels have been set for the contaminants of concern. Applicable USFDA Action Levels are only available for a few of the contaminant of concern (or mixture of compounds) that bioaccumulated at measurable levels in tissues of organisms exposed to sediment from the IHNC dredged material. The highest observed mean concentration of those compounds in the tissues of exposed clams adjusted to steady-stated body residues, according to USEPA and USACE (1998), were over three orders of magnitude lower than the USFDA levels and not statistically different from those levels (Table 46).

Concentrations of contaminants of concern in *Corbicula fluminea* were also compared with Fish Contaminant Goals (FCGs) developed by The California Office of Environmental Health Hazard Assessment (OEHHA). FCGs were developed for seven contaminants (http://www.oehha.org/fish/gtlsv/crnr062708.html). Those values are estimates of contaminant levels in fish that pose no significant health risk to individuals consuming sport fish at a standard consumption rate of eight ounces per week, prior to cooking, over a lifetime. The highest observed mean concentration of those compounds in the clams was over a factor of 60 lower than the FCGs and not statistically different from those goals (Table 46).

6.1.2. Statistical comparison with reference site bioaccumulation

Tissue concentrations of all contaminants either are statistically less than USFDA levels or OEHHA fish contaminant goals or there are no OEHHA or USFDA levels for the contaminants for comparison. Therefore, the information was insufficient to reach a conclusion with respect to benthic bioaccumulation of contaminants. The IHNC dredged material was further evaluated for bioaccumulation potential by comparing tissue contaminant concentrations for organisms similarly exposed to reference sediment.

Statistically elevated tissue residue relative to the reference was detected for at least one contaminant of concern for all IHNC dredged material investigated for bioaccumulation potential (Table 47). The DMMU with the highest number of exceedences was DMMU 3 F, with 15 exceedances. The DMMU with the least number of exceedances was DMMU 3 N (Table 47).

For DMMU 3 (3NN, 3 N and 3 F), four metals, several SVOCs, four pesticides, and total Aroclors were significantly elevated. For DMMU 4 (4 NN), three metals, one pesticide, one organotin, and one Aroclor were significantly elevated. For DMMU 4/5 N, five metals were significantly elevated. For DMMU 6 (6 NN, 6 N and 6 F) four metals, one semi-volatile compound, one pesticide, and total Aroclors were significantly elevated. For DMMU 8 (8 NN), four metals, one semi-volatile compound, and two pesticides were significantly elevated. In DMMU 9 (9-1 and 9-2,4 NN), four metals, three semi-volatile compounds, one pesticide, and one Aroclor were significantly elevated. For DMMU 10 (10 NN, 10 N and 10 F), seven metals were significantly elevated (Table 47).

The mean body residues for compounds of concern that were significantly higher in clams exposed to a IHNC dredged material relative to those in clams exposed to reference material are presented in Table 48. Mean body residues measured for the reference site are presented for comparison purposes.

6.1.3. Ecological significance of benthic bioaccumulation

To make conclusions regarding benthic bioaccumulation, compounds that bioaccumulated in clams exposed to IHNC dredged material at concentrations significantly higher than in clams exposed to reference sediment (Table 47) were evaluated for their toxicological importance, propensity to bioaccumulate in benthic and higher trophic level organisms within aquatic food webs, and the magnitude by which bioaccumulation in tissues of organisms exposed to dredged material exceed bioaccumulation in tissues of organisms exposed to sediment from the reference area.

All compounds with significant exceedance (Table 49) have some overall toxicological importance due to their potential adverse impact to benthic invertebrates when present in the sediment at above threshold concentrations. However, not all those compounds have the same importance as bioaccumulative chemicals, as their propensity to transfer to upper trophic level species preying on benthic organisms that bioaccumulate those compounds from the sediment exposures varies. It has been suggested that organic chemicals with a log octanol/water partitioning coefficient (log K_{ow}) value of or greater than 4.2 tend to bioaccumulate in aquatic receptors of concern (USEPA 2000). As a general rule, only inorganic compounds with a bioconcentration factor (BCF) of greater than 1000 tend to bioaccumulate at levels of concern (USEPA and USACE 1998, USEPA 2000). A list of organic and inorganic contaminants of concern considered important bioaccumulative compounds developed for use in sediment assessments is presented in USEPA (2000). Based on the criteria above, Table 49 indicates whether compounds with significant exceedances in this evaluation are important bioaccumulative compounds. The ecological and human health significance of benthic bioaccumulation of 4-methylphenol, diethyl phthalate, phenol, chromium, aluminum, barium, and tin is low. In addition, the magnitude of exceedance of reference values was low (factor of 7 or lower). Therefore, the potential adverse bioaccumualtive impacts by those compounds are not further discussed in this evaluation. Those compounds are ruled out as likely posing any potential detrimental ecological or human health effect to the disposal area.

The tissue concentrations of nickel and selenium in clams exposed to channel sediments exceed the concentration of those metals in clams exposed to reference sediment by factors of 2.0 and 1.3, respectively (Table 49). Despite their relatively high importance as bioaccumulative compounds, such low magnitude of difference in bioaccumulation levels suggests that the toxicological relevance of the measured statistical significant differences is negligible and does not warrant further examination of the ecological significance. Nickel and selenium are also ruled out as likely posing any potential detrimental ecological or human health effect to the disposal area.

The bioaccumulation of 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, Aroclor 1248, Aroclors (total), acenaphthene, anthracene, dibenzofuran, fluoranthene, phenanthrene, pyrene, tributyltin are not ruled out as potentially posing detrimental ecological effect to the Mississippi River disposal and are therefore further evaluated.

6.1.4. Bioaccumulation of PAHs

Evaluation of the potential ecological effects of the bioaccumulation of the PAHs anthracene, fluoranthene, phenanthrene, pyrene and dibenzofuran was done by direct comparison of total PAH tissue residues (sum concentration of acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) from clams exposed to sediment from each IHNC dredged material with the critical body residue (CBR) for nonpolar organic chemicals as described by McCarty et al. (1992). The CBR is the whole body molar concentration of a chemical that is associated with a given adverse biological response (Rand et al. 1995), *i.e.*, the ratio of number of molecules of the chemical/toxicant to the mass of the organism, above which adverse effects have been observed to occur. The acknowledged mode of toxicity for PAHs is general narcosis. According to McCarty et al. (1992), CBRs of PAHs ranging from 2,000 to 8,000 µmol/kg produce acute narcotic response, and CBRs of PAHs ranging from 200 to 800 µmol/kg are predicted to produce chronic narcotic response.

The total PAH level in tissues from clams in DMMUs evaluated for bioaccumulation potential ranged from 2 µmol/kg lipid to 67 µmol/kg lipid (Table 50), after adjusting to estimated steady-state. Using a lipid content of 1% for the freshwater clams used in the freshwater evaluation, the highest value is 400 times less than the levels at which chronic narcotic effects might be expected and 4,000 times less than the levels at which acute narcotic effect might be expected.

Further evaluation of the potential ecological effects of the bioaccumulation of PAHs was conducted by comparing the total PAH level in tissues from clams exposed IHNC dredge material to Narcosis Final Chronic Values (FCV) developed using the target lipid model (DiToro et al. 2000). The FAV is the concentration of chemical, based on experimental data, that will not (based on probability) have an acute narcotic effect on 95% of the organisms. Therefore, that value is protective of 95% of all species. The body residue in the tissues of the clams exposed to sediment from each IHNC dredged material evaluated was compared to the Narcosis FCV for PAHs (3,790 µmol/kg lipids). The highest mean sum PAH body residue (54 µmol/kg lipids) represents only 1.29% of the Narcosis FCV derived using the target lipid model.

Based on this evaluation, PAHs are ruled out as posing likely adverse ecological effect to the disposal area.

6.1.5. Bioaccumulation of Aroclors, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT and alpha-chlordane

The bioaccumulation of compounds with significant exceedance and a difference from the reference higher than a factor of two was evaluated for their potential to cause toxic effects in the benthos and their potential to bioaccumulate and cause toxic effects in predator pelagic freshwater fish. Information on the relationship between body residues and effects was obtained from the Environmental Residue Effects Database (ERED) database (http:www.wes.army.mil/el/ered).

Aroclor

The highest body residues for Aroclor Total were 381 µg/kg lipids or 3.81 µg/kg wet wt. using 1% lipid content and adjusting to steady-state. This concentration is over two orders of magnitude lower than no-observed-effect residue for a variety of freshwater invertebrates (1,200; 7,800; 1,400 µg/kg for midges, amphipods, and stoneflies, respectively). Lethal concentrations were not obtained for freshwater invertebrates. Therefore, the bioaccumulation of PCBs is not expected to result in adverse toxic effects to freshwater benthic invertebrates at the disposal site.

PCBs have high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-observed-effect residue for freshwater fish was 1,530 µg/kg, reported for lake trout. This concentration is over two orders of magnitude the highest concentration of Aroclor in freshwater clams evaluated for bioaccumulation. Therefore, even if the concentration of PCBs in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on freshwater benthic invertebrates at the disposal site.

4,4'-DDD

The highest body residues for 4,4'-DDD were 18.7 µg/kg lipids or 0.187 µg/kg wet wt. using 1% lipid content and adjusting to steady-state. This concentration is over four orders of magnitude lower than no-observed-effect residue (6,400 µg/kg) for a sensitive freshwater invertebrate, *Hyalella azteca*. The reported lethal tissue residues for that species are 12,800 µg/kg. Therefore, the bioaccumulation of DDD is not expected to result in adverse toxic effects to freshwater benthic invertebrates at the disposal site.

DDD has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-no-effect residue for freshwater fish was 5,000 µg/kg, reported for lake trout. This concentration is four orders of magnitude the highest concentration of DDD in freshwater clams evaluated for bioaccumulation. Therefore, even if the concentration of DDD in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on freshwater benthic invertebrates at the disposal site.

4,4'-DDE

The highest body residues for 4,4'-DDE were 12.4 µg/kg lipids or 0.124 µg/kg wet wt. using 1% lipid content and adjusting to steady-state. This concentration is six orders of magnitude lower than no-observed-effect residue (160,000 µg/kg) for a sensitive freshwater invertebrate, *Hyalella azteca*. The reported lethal tissue residues for that species is 320,000 µg/kg. Therefore, the bioaccumulation of DDE is not expected to result in adverse toxic effects to freshwater benthic invertebrates at the disposal site.

DDE has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-no-effect residue (whole body) for freshwater fish was 2,680 µg/kg, reported for lake trout. This concentration is four orders of magnitude the highest concentration of DDE in freshwater clams evaluated for bioaccumulation. Therefore, even if the concentration of DDE in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on freshwater benthic invertebrates at the disposal site.

4,4'-DDT

The highest body residues for 4,4'-DDT were 5.0 µg/kg lipids or 0.050 µg/kg wet wt. using 1% lipid content and adjusting for steady-state. This concentration is four orders of magnitude lower than no-observed-effect residue (320 µg/kg) for a sensitive freshwater invertebrate, *Hyalella azteca*. The reported lethal tissue residues for that species are 640 µg/kg. Therefore, the bioaccumulation of DDT is not expected to result in adverse toxic effects to freshwater benthic invertebrates at the disposal site.

DDT has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-no-effect residue (whole body) for freshwater fish was 180 µg/kg, reported for rainbow trout. This concentration is three orders of magnitude the highest concentration of DDT in freshwater clams evaluated for bioaccumulation. Therefore, even if the concentration of DDT in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on freshwater benthic invertebrates at the disposal site.

Alpha-chlordane

The highest body residues for alpha-chlordane were 13.8 µg/kg lipids or 0.138 µg/kg wet wt. using 1% lipid content and adjusting for steady state. This concentration is three orders of magnitude lower than no-observed-effect residue (4,500 µg/kg) for marine invertebrate, the oyster *Crassostrea virginica*. Critical body residue for alpha-chlordane is not available for freshwater invertebrate species. The bioaccumulation of alpha-chlordane is not expected to result in adverse toxic effects to freshwater benthic invertebrates at the disposal site.

Alpha-chlordane has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-observed-effect residue (whole body) for an estuarine fish was 1,380 µg/kg, reported for sheepshead minnow. This concentration is three orders of magnitude the highest concentration of alpha-chlordane in freshwater clams evaluated for bioaccumulation. Critical body residue for alpha-chlordane is not available for freshwater fish species. Even if the concentration of alpha-chlordane in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on freshwater benthic invertebrates at the disposal site

6.1.6. Bioaccumulation of tributyltin

The concentrations of tributyltin were not measured in DMMUs 3F, 4/5 N, 6 NN, 7 NN, 8 NN, 10 NN, 10 N, and 10 F due to shortage of tissue mass (Table 51). Except for DMMU 4 NN, the concentration of that compound in the dredged material in the clams exposed to dredged material evaluated for bioaccumulation was below detection limit. The highest measured concentration in dredged material used in bioaccumulation evaluation, 19 µg/kg, was measured for DMMU 4 NN (Table 51). The mean tissue residue in clams exposed to that sediment was 20 µg/kg (Table 51). Therefore, tissue concentration of tributyltin in clams was expected to be 20 µg/kg or less for all DMMUs evaluated for bioaccumulation potential. The body residue of 20 µg/kg is twenty lower than lowest-observed-effect residue (480 µg/kg) for a marine invertebrate, the polychaete *Armandia brevis*. Critical body residue for tributyltin is not available for freshwater invertebrate species. The bioaccumulation of tributyltin is not expected to result in adverse toxic effects to freshwater benthic invertebrates at the Mississippi River disposal site.

Tributyltin has some potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-observed-effect residue (whole body) for freshwater fish was 400 µg/kg, reported for rainbow trout, *Oncorhynchus mykiss*. This concentration is 20 times higher than the concentration of tributyltin in freshwater clams evaluated for bioaccumulation. Assuming the concentration of tributyltin in fish as the same as in prey invertebrates, body residues are substantially lower than the lowest reported critical body residues and are not expected to result in adverse toxic effects to fish preying on freshwater benthic invertebrates at the disposal site.

6.1.7. Conclusions

Tissue concentrations of all contaminants for DMMUs not predicted to be toxic to benthic organisms were either statistically less than USFDA action levels or there are no USFDA levels for the contaminants. For those DMMUs, tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceeded those of organisms exposed to the reference material. However, the IHNC DMMUs evaluated for bioaccumulation potential are not predicted to be toxic to benthic organisms and are not likely to have an unacceptable adverse effect on survival, growth, or reproduction of aquatic organisms due to bioaccumulation.

Table 44. ***Corbicula fluminea*** **28-day freshwater solid phase bioaccumulation tests.**

DMMU/Site	Percent Survival		Final Biomass (g)		Batch
	Mean	Std. Dev	Mean	Std. Dev	
3 NN	95	4	27.5	2.9	2
3 N	96	3	23.2	2.4	2
3 F	64	5	17.5	2.2	1
4 NN	91	6	24.3	3.3	3
5 NN	94	4	22.2	2	4
4/5 N	58	4	13.9	1.9	4
6 NN	58	10	18.4	3.5	1
6 N	83	4	25.5	3.2	2
6 F	96	4	29.4	8.2	2
7 NN	53	7	17.5	2.9	1
7 N	85	6	24	7.7	3
7 F	93	7	22.8	6.2	2
8 NN	85	5	20.2	4.8	4
9-1 NN	89	7	23.6	3.2	3
9 2-NN	73	27	18.8	6.8	4
10 1-NN	38	6	14	1.6	1
10 N	58	19	13.4	3.5	3
10 F	37	8	9.2	3.2	4
MR	64	5	20.1	8.5	1
MR	98	2	26.2	5.6	2, 3 and 4
Mean percent survival and biomass in exposure dredged material from IHNC DMMUs and sediment from the Mississippi River reference site.					

Table 45. *Corbicula fluminea* 28-day freshwater solid phase bioaccumulation tests.

DMMU/Site	Volatiles	Hexavalant Chromium	Organotins	Aroclors	Semi-volatiles and Pesticides
3 NN	1,2,3,4,5	1,2,3,5	5		
3 N	1,2,3,4,5	1,2,3,4,5	1,2,3,4		
3 F	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5		
4 NN	1,2,4,5	1,2,4,5			
5 NN	1,2,3,4,5	1,2,4,5	2,3	1	
4/5 N	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	2,3,4,5	
6 NN	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5		
6 N	1,2,3,4,5	1,3,4	3,4		
6 F	1,2,3,4,5	1,2,3,4,5	2,5		
7 NN	1,2,3,5	1,2,3,4,5	1,2,3,4,5		
7 N	1,2,3,4,5	2,3,4,5	3		
7 F	1,2,3,4,5	1,4,5	4,5		
8 NN	1,2,3,4,5	1,2,3,4,5	1,2,5	1	
9-1 NN	1,2,3,4,5	1,2,3,4	2,3,		
9-2,4 NN	1,3,4,5	1,2,3,4,5	1,4,5		
10 NN	1,2,3,4,5	1,2,3,4,5	2,3,4,5	3	
10 N	1,2,3,4,5	1,2,3,4,5	1,2,3,4,5	2,5	
10 F	1,2,3,4,5	1,2,3,4,5	1,3	1,3	1,3,5
MR	1,2,3,4,5	1,2,5	1,2,5		

Exposure replicates of dredged material from IHNC DMMUs and sediment from the Mississippi River reference site that were not analyzed for tissue concentration of select compounds or classes of compounds.

Table 46. *Corbicula fluminea* 28-day freshwater solid phase bioaccumulation potential evaluation.

Compound	Body Residue (µg/kg)		
	USFDA	OEHHA	IHNC
Chlordane	300	100	0.12
DDT + DDE	5000	N.A.	0.10
DDT + DDD + DDE	N.A.	1600	0.26
Dieldrin + Aldrin	300	N.A.	<0.4
Dieldrin	N.A.	160	<0.4
Heptachlor + Heptachlor Epoxide	300	N.A.	<0.3
PCBs	N.A.	63	3.0*
Selenium	N.A.	7400	860

Comparison of highest estimated steady-state body residue measured for tissues of clams exposed to IHNC dredged material DMMUs with USFDA Action Levels and fish consumption guidelines developed by OEHHA. * reported as Total Aroclor concentration. N.A. = not available.

Table 47. *Corbicula fluminea* 28-day freshwater solid phase bioaccumulation potential evaluation.

	Exceedance Factor															
Analyte	**DMMU/Site**															
	3NN	**3N**	**3F**	**4NN**	**4/5 N**	**6NN**	**6N**	**6F**	**7N**	**7F**	**8NN**	**9-1NN**	**9-2,4NN**	**10NN**	**10N**	**10F**
Aluminum		3			2	5	2		2		2			2	2	
Barium			4			4	3							3		
Chromium			2	1	2				1		1		1		1	2
Lead			2	1		3		2	2	2	2		2	2		1.4
Nickel					1	2									2	1.4
Selenium				1	1								1			1.3
Tin					6				7		5	7			7	
Tributyltin				**40**												
Aroclor 1248				3									9			
Aroclors (Total)			4			3										
4,4'-DDT			4													
4,4'-DDD	7		9	8		5					**13**		7			
4,4'-DDE			8								5					
alpha-Chlordane			**10**													
4-Methylphenol						5										
Diethyl phthalate													5			
Dibenzofuran			**71**													
Phenol			7													
Acenaphthene	4		**10**													
Anthracene	3		8													
Fluoranthene	**27**		**11**													
Phenanthrene	6		6								3	3				
Pyrene	**16**		**11**										2			

Exceedance factor for mean tissue body residue of clams exposed to IHNC dredge material DMMUs compared to body residues of clams exposed to reference material for compounds with statistically significant bioaccumulation. Numbers in bold indicate 10 times or higher difference.

Table 48. ***Corbicula fluminea*** **28-day freshwater solid phase bioaccumulation potential evaluation.**

Analyte	DMMU/Site															
	3NN	3N	3F	4NN	4/5N	6NN	6N	6F	7N	7F	8NN	9-1 NN	9-2,4 NN	10NN	10N	10F	MR
	Metals (mg/kg wet weight)																
Aluminum		58.7			49.1	106.6	51.0		54.7		56.0			51.4	52.0		22.9
Barium			3.6			4.1	2.4							3.1			0.9
Chromium			0.5	0.5	0.6				0.4		0.4		0.4		0.4	0.6	0.3
Lead			0.2	0.1		0.2		0.2	0.1	0.2	0.2		0.1	0.1		0.1	0.1
Nickel					0.2	0.3									0.2	0.2	0.1
Selenium				0.7	0.8								0.8			0.9	0.6
Tin					1.4						1.3	1.8			1.7		0.3
	Organotins (µg/kg wet weight)																
Tributyltin				20.0					1.7								0.5
	Pesticides and Semi-volatiles (µg/kg lipids)																
Aroclor 1248				23									66				7
Aroclors (Total)			114			98											31
4,4'-DDT			3														0.7
4,4'-DDD	5		6	5		3					9		5				0.7
4,4'-DDE			7								5						1.0
α-Chlordane			7														0.7
4-Methylphenol						624											120
Diethyl phthalate													1902				373
Dibenzofuran			1130														16
Phenol			247														33
Acenaphthene	106		235														24
Anthracene	73		197														24
Fluoranthene	642		298														24
Phenanthrene	283		247									435					47
Pyrene	390		271										1032				24

Mean body residue in clams exposed to IHNC dredge material DMMUs for compounds with statistically significant bioaccumulation.

Table 49. ***Corbicula fluminea*** **28-day freshwater solid phase bioaccumulation potential evaluation.**

Compound	**Partitioning Coefficient**	**Potential Concern as Bioaccumulative Compound**	**Highest Factor of Exceedance**	**Highest Body Residue**	**Estimated Highest Steady-state Body Residue**
Organochorine Pesticides	**Log K_{ow}**			**(µg/kg lipids)**	**(µg/kg lipids)**
4,4'-DDD	6.0	Yes	13.0	9.3	18.7
4,4'-DDE	5.7	Yes	8.0	7.4	12.4
4,4'-DDT	5.7	Yes	4.0	3.0	5.0
alpha-Chlordane	6.0	Yes	10.0	6.9	13.8
Aroclors	**Log K_{ow}**				
Aroclor 1248	>6	Yes	9.0	65.9	219.7
Aroclors (Total)	>6	Yes	4.0	114.2	380.6
PAHs	**Log K_{ow}**				
Acenaphthene	3.9	Yes	9.8	234.9	234.9
Anthracene	4.3	Yes	8.2	197.4	197.4
Dibenzofuran	4.1	Yes	71.0	1,29.9	1129.9
Fluoranthene	5.5	Yes	26.8	642.5	642.5
Phenanthrene	4.5	Yes	6.3	435.0	435.0
Pyrene	4.9	Yes	16.3	1,031.7	1146.3
Total PAHs		Yes	12.0	10,449.6	13062.0
Other Semi-volatiles	**Log K_{ow}**				
4-Methylphenol	2.0	No	5.0	624.0	624.0
Diethyl phthalate	1.4	No	5.0	1902.5	1902.5
Phenol	1.5	No	7.0	246.9	246.9
Organotin	**Log K_{ow}**			**(µg/kg)**	**(µg/kg)**
Tributyltin	3.7	Yes	40.0	20.0	20.0
Metals	**Log BCF**			**(mg/kg)**	**(mg/kg)**
Aluminum	< 2.5	No	3.0	106.64	106.6
Barium	2.1	No	4.0	4.10	4.1
Chromium	2.1	No	2.0	0.60	0.6
Lead	2.2	Yes	2.0	0.23	0.2
Nickel	1.7	Yes	2.0	0.31	0.3
Selenium	2.5	Yes	1.3	0.86	0.9
Tin	3.5	No	7.0	1.84	1.8

List of compounds significantly higher in IHNC dredged material DMMUs than in reference sediment, their associated partitioning coefficient (Log K_{ow} or Log BCF), potential concern as bioaccumulative compounds, and highest measured mean factor of exceedance, body residue and estimated steady-state body residue.

Table 50. *Corbicula fluminea* 28-day freshwater solid phase bioaccumulation tests.

DMMU/Site	Total PAHs (µmol/kg lipids)
3 NN	17
3 N	7
3 F	43
4 NN	54
4/5 N	58
6 NN	4
6 N	3
6 F	6
7 N	57
7 F	3
8 NN	61
9-1 NN	59
9-2,4 NN	67
10 NN	2
10 N	51
10 F	43
MR	43
Estimated mean total PAH steady-state body residue in clams exposed to dredged material from IHNC DMMUs and sediment from the Mississippi River reference site.	

Table 51. *Corbicula fluminea* 28-day freshwater solid phase bioaccumulation tests.

Sample	Sediment (µg/kg)	Tissue (µg/kg)
3 NN	2.3 U	1.2 U
3 N	2.5 U	1.2 U
3 F	1.9 U	ND
4 NN	19	20
5 NN	5.5	7
4,5 N	2.2 U	ND
6 NN	2.5 U	ND
6 N	2.6 U	1.2 U
6 F	2.3 U	1.2 U
7 NN	4.4	ND
7 N	2.1 U	1.2 U
7 F	2.1 U	1.2 U
8 NN	2.1 U	ND
9-1 NN	2.5 U	1.2 U
9-2,4 NN	2.6 U	1.2 U
10 NN	1.7 U	ND
10 N	2.3 U	ND
10 F	2.1 U	ND
MR	2.3 U	1.2 U
Mean total concentration of tributyltin in the tissues of clams exposed to dredged material from IHNC DMMUs and sediment from the Mississippi River reference site and concentration of those compounds in DMMUs dredged material and reference sediment. Values accompanied by "U" are reporting limits for not detected by chemical analysis. ND – concentration not determined due to shortage of tissue mass.		

6.2. Estuarine open water disposal evaluation

According to the conclusions of the benthic toxicity evaluation, DMMUs 3N, 4NN, 5NN, 8NN, and 9-1 NN were excluded from the bioaccumulation evaluation as they are predicted to be acutely toxic to estuarine benthic invertebrates. In addition, conclusions from the water column evaluation determined that DMMUs 3 N, 6 NN, 6 N, 6 F, 7 NN, 7 F, 10 NN, 10 N and 10 F are not considered for disposal at the mitigation site. Therefore, only bioaccumulation data from DMMU 9-2,4 N, 3 F, 4/5 N, and 7 N were evaluated for bioaccumulation potential at mitigation site disposal area.

Twenty-eight-day solid phase benthic bioaccumulation tests using the clam, *Macoma nasuta,* were conducted in four batches (Weston Solutions 2008). Mean survival in the control sediments (80% and higher) indicated that test conditions and health of the organisms were acceptable for batches 1, 2, and 3. Mean survival in the reference sediment was 78% and higher (Table 52). Low survival (below 80%) observed in DMMUs 4/5 N and 9-2,4 NN was likely caused by non-contaminant factors.

Because of the onset of clam mortality during the 28-day exposure period, sufficient tissue for all chemical analyses could not be obtained from every replicate chamber for DMMUs 3 F, 4/5 N, 7 N, and 9-2,4 N, as well as for the mitigation site. Therefore, analyses of organotins were not performed for most replicates, and the analyses of semi-volatiles and hexavalent chromium were not performed for one the replicates from each DMMU (Table 53).

Whole-body chemical analysis of clams exposed to dredged material from DMMUs 3 F, 4/5 N, 7 N, and 9-2,4 N and to the mitigation site sediment during the 28-day solid phase bioaccumulation tests revealed the presence of metals, organochorine pesticides, PCBs (measured as Aroclors), semi-volatile compounds, and volatile compounds (Weston Solutions 2008). Tissues exposed to sediment from the reference area revealed the presence of metals, organotins, PCBs, and semi-volatile compounds (Weston Solutions 2008).

6.2.1. Comparison with USFDA action levels and OEHHA fish contaminant goals

The benthic bioaccumulation evaluation revealed that tissue concentrations of all COC for DMMUs evaluated for bioaccumulation potential were substantially lower and statistically different than all available USFDA action levels and FCGs developed by OEHHA (Table 54). For contaminants with USFDA action levels, body burden in clams exposed to dredged material were lower than reported action levels by over three orders of magnitude.

Because there is no USFDA level for comparison of most compounds found in the tissue of IHNC dredged material, the contaminant concentration in tissues exposed to dredged material was compared to contaminant concentrations of tissues exposed to sediment from the reference area.

6.2.2. Statistical comparison with reference site bioaccumulation

Statistically elevated tissue residue relative to the reference was detected for at least one contaminant of concern for all DMMUs investigated for bioaccumulation potential, except for DMMU 6 N (Table 55). The DMMU with the highest number of exceedences was DMMU 7 N, with 10 exceedances.

For fill material from DMMU 3 (3F), three metals were significantly elevated. For native soil from DMMU 7 (7N), one metal, four pesticides and five semi-volatile compounds were significantly elevated. For non-native sediment from DMMU 9 (9-2,4 NN), one metal, three pesticides and three semi-volatile compounds were significantly elevated. No significantly elevated bioaccumulation was determined for native soil from DMMUs 4 and 5 (4/5N). For non-native sediment from the mitigation site, two metals were significantly elevated (Table 55).

The mean body residues for compounds of concern that were significantly higher in clams exposed to a DMMU dredged material relative to those in clams exposed to reference sediment are presented in Table 56.

6.2.3. Ecological significance of benthic bioaccumulation

To make conclusions regarding benthic bioaccumulation, compounds that bioaccumulated in clams exposed to IHNC dredged material at concentrations significantly higher than in clams exposed to reference sediment (Table 57) were evaluated for their toxicological importance, propensity to bioaccumulate in benthic and higher trophic level organisms within aquatic food webs, and the magnitude by which bioaccumulation in tissues of organisms exposed to dredged material exceed bioaccumulation in tissues of organisms exposed to sediment from the reference area.

All compounds with significant exceedances (Table 57) have some overall toxicological importance due to their potential adverse impact to benthic invertebrates when present in the sediment at above threshold concentrations. However, not all those compounds have the same importance as bioaccumulative chemicals, as their propensity to transfer to upper trophic level species preying on benthic organisms that bioaccumulate those compounds from the sediment exposures varies. Based on criteria stated in the freshwater benthic bioaccumulation evaluation section, Table 57 indicates whether compounds with significant exceedances in this evaluation are important bioaccumulative compounds.

The ecological and human health significance of benthic bioaccumulation of the semivolatiles 1,4-dichlorobenzene and 4-methylphenol is considered low. In addition, the magnitude of exceedance of reference values was low (factor of 4 or lower) for those compounds.

For metals, the observed bioaccumulation of aluminum (maximum exceedance = 3) and barium (maximum exceedance = 4) have low ecological significance, as these compounds are not likely to bioaccumulate in higher trophic levels. The tissue concentrations of lead in clams exposed to channel sediments exceed the concentration of that metal in clams exposed to reference sediment by a factor of

2.0 (Table 57). Despite its relatively high importance as bioaccumulative compound, such low magnitude of difference in bioaccumulation levels suggests that the toxicological relevance of the measured statistical significant difference is negligible and does not warrant further examination of the ecological significance. Lead is therefore ruled out as likely posing any potential detrimental ecological or human health effect to the disposal area.

Those metals and semivolatiles compounds are ruled out as likely posing any potential detrimental ecological or human health effect to the disposal area. The bioaccumulation of 4,4'-DDT, delta-BHC, dieldrin, endosulfan II, heptachlor epoxide, dibenzofuran, fluoranthene, fluorine, phenanthrene, and pyrene are not ruled out as potentially posing detrimental ecological effect to the Mississippi River disposal and are therefore further evaluated.

6.2.4. Bioaccumulation of PAHs

Evaluation of the potential ecological effects of the bioaccumulation of the PAHs dibenzofuran, fluoranthene, fluorine, phenanthrene, and pyrene was done by direct comparison of total PAH tissue residues (sum concentration of acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) from clams exposed to sediment from each IHMC dredged material with the critical body residue (CBR) for nonpolar organic chemicals as described in the freshwater bioaccumulation evaluation section.

The total PAH level in tissues from clams for DMMUs evaluated for bioaccumulation potential ranged from 2.0 µmol/kg lipid to 12.6 µmol/kg lipid (Table 58). Using a lipid content of 1% for the marine clams used in the estuarine evaluation, the highest value is approximately 24,000 times less than the levels at which chronic narcotic effects might be expected and 240,000 times less than the levels at which acute narcotic effect might be expected.

Further evaluation of the potential ecological effects of the bioaccumulation of PAHs was conducted by comparing the total PAH level in tissues from clams exposed to sediment in the DMMUs to Narcosis Final Chronic Values (FCV) developed using the target lipid model, as described in the freshwater bioaccumulation evaluation section. The body residue in the tissues of the clams exposed to sediment from a DMMU evaluated for bioaccumulation was compared to the Narcosis FCV for PAHs (3,790 µmol/kg lipids). The highest mean sum PAH body residue (12.6 µmol/kg lipids) represents only 0.3% of the Narcosis FCV derived using the target lipid model.

Based on this evaluation, PAHs are ruled out as posing likely adverse ecological effect to the mitigation site disposal area.

6.2.5. Bioaccumulation of 4,4'-DDT, delta-BHC, dieldrin, endosulfan II, and heptachlor epoxide

The bioaccumulation of compounds with significant exceedance and a difference from the reference higher than a factor of two was evaluated for their potential to cause toxic effects in the benthos and their potential to bioaccumulate and cause toxic effects in predator pelagic freshwater fish. Information on the relationship between body residues and effects was obtained from the Environmental Residue Effects Database (ERED) database (http:www.wes.army.mil/el/ered).

4,4'-DDT

The highest body residues for 4,4'-DDT were 8.0 µg/kg lipids or 0.080 µg/kg wet wt. using 1% lipid content and adjusting for steady-state. This concentration is over three orders of magnitude lower than no-observed-effect residue (320 µg/kg) for a sensitive freshwater invertebrate, *Hyalella azteca*. The reported lethal body burden for that species is 640 µg/kg. The lowest reported lethal body burden for marine or estuarine invertebrates was 1,000 µg/kg, for the blue crab, *Callinectes sapidus*. Therefore, the bioaccumulation of DDT is not expected to result in adverse toxic effects to estuarine benthic invertebrates at the disposal site.

DDT has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-no-effect residue (whole body) for freshwater fish was 180 µg/kg, reported for rainbow trout. This concentration is three orders of magnitude the highest concentration of DDT in freshwater clams evaluated for bioaccumulation. The lowest reported lethal body burden for marine or estuarine fish was 550 µg/kg, for pinfish, *Lagodon rhomboides*. Therefore, even if the concentration of DDT in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on estuarine benthic invertebrates at the disposal site.

Dieldrin

The body residues for dieldrin were 5.4 µg/kg lipids or 0.054 µg/kg wet wt. using 1% lipid content and adjusting for steady-state for DMMU 9-2,4 NN. This concentration is three orders of magnitude lower than lowest-observed-effect residue (80 µg/kg) for marine invertebrate, the pink shrimp, *Penaeus duorarum*, the lowest LOEC reported for this compound for aquatic invertebrates. The bioaccumulation of dieldrin is not expected to result in adverse toxic effects to estuarine benthic invertebrates at the disposal site.

Dieldrin has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-observed-effect residue (whole body) for fish was 110 µg/kg, reported for rainbow trout, *Oncorhynchus mykiss,* growth. This concentration, the lowest LOEC reported for fish for this compound, is three orders of magnitude the highest concentration of alpha-chlordane in estuarine clams evaluated for bioaccumulation. The lowest reported critical body burden (decrease in reproduction) for marine or estuarine fish was 260 µg/kg, for largemouth basss, *Micropterus salmoides*. Even if the concentration of dieldrin in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on estuarine benthic invertebrates at the disposal site.

Endosulfan II

The body residues for endosulfan II were 25.6 µg/kg lipids or 0.026 µg/kg wet wt. using 1% lipid content and adjusting for steady-state for DMMU 9-2,4 NN. This concentration is four orders of magnitude lower than lowest-observed-effect residue (480 µg/kg) for marine invertebrate, the grass shrimp, *Palaemonetes pugio,* the lowest critical body residue reported for this compound for aquatic invertebrates. The bioaccumulation of dieldrin is not expected to result in adverse toxic effects to estuarine benthic invertebrates at the disposal site.

Endosulfan II has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-observed-effect residue (whole body) for fish was 68 µg/kg, reported for spot, *Leiostomus xanthurus,* survival. This concentration, the lowest LOEC reported for fish for this compound, is three orders of magnitude the highest concentration of endosulfan II in estuarine clams evaluated for bioaccumulation. Even if the concentration of alpha-chlordane in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on estuarine benthic invertebrates at the disposal site.

Heptochlor epoxide

The highest body residues for heptochlor epoxide was 10.0 µg/kg lipids or 0.1 µg/kg wet wt. using 1% lipid content and adjusting for steady-state. This concentration is over three orders of magnitude lower than lowest-observed-effect residue (180 µg/kg) for marine invertebrate, the pink shrimp, *Penaeus duorarum*, the lowest critical body residue reported for this compound for aquatic invertebrates. The bioaccumulation of heptochlor epoxide is not expected to result in adverse toxic effects to estuarine benthic invertebrates at the disposal site.

Heptochlor epoxide has high potential to transfer from prey invertebrates to predator fish through the dietary pathway. The lowest-observed-effect residue (whole body) for fish was 720 µg/kg, reported for spot, *Leiostomus xanthurus*, survival. This concentration, the lowest LOEC reported for fish for this compound, is four orders of magnitude the highest concentration of heptochlor epoxide in estuarine clams evaluated for bioaccumulation. Even if the concentration of heptochlor epoxide in fish is biomagnified by a factor of 10, body residues are substantially lower than any reported critical body residues and are not expected to result in adverse toxic effects to fish preying on estuarine benthic invertebrates at the disposal site.

6.2.6. Conclusions

The disposal of dredged material from DMMUs 9-2,4 NN, 3 F, 4/5 N, and 7 N to the mitigation site disposal area is not likely to have an unacceptable adverse effect on survival, growth or reproduction of benthic invertebrates or fish due to bioaccumulation.

Tissue concentrations of all contaminants for DMMUs not predicted to be toxic to benthic organisms and further evaluated for open water placement at the mitigation site (DMMUs 4/5 N, DMMU 7 N, DMMU 9-2,4 NN) were either statistically less than USFDA action levels or there are no USFDA levels for the contaminants. For those DMMUs, tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceeded those of organisms exposed to the reference material, except for DMMU 4/5 N. However, the technical evaluation of the bioaccumulation data determined that DMMUs not predicted to be toxic to benthic organisms are not likely to have an unacceptable adverse effect on survival, growth or reproduction of aquatic organisms due to bioaccumulation.

Table 52. *Macoma nasuta* 28-day estuarine solid phase bioaccumulation tests.

Sample	Percent Survival		Batch
	Mean	Std. Dev	
3 F	89	8.4	1
4/5 N	43	15.3	3
7 N	86	10.6	2
9-2,4 NN	69.0	15.7	3
MIT	92.0	5.1	1
SB	90.0	6.7	1
SB	89.0	6.4	2
SB	78.0	6.1	3

Mean percent survival and biomass in exposure to dredged material from IHNC DMMUs and sediment from the San Bernard reference site and mitigation site.

Table 53. ***Macoma nasuta*** **28-day estuarine solid phase bioaccumulation tests.**

Sample	Organotins	Volatiles	Hexavalant Chromium
3 F			
4/5 N	1,3,4	1,3,4	1
7 N			
9-2,4 NN			
MIT		5	
SB - 1			
SB - 2			
SB - 3	5		
Exposure replicates of dredged material from IHNC DMMUs and sediment from the San Bernard reference site and mitigation site that were not analyzed for tissue concentration of select compounds or classes of compounds.			

Table 54. ***Macoma nasuta*** **28-day estuarine solid phase bioaccumulation evaluation.**

Compound	Body Residue (µg/kg)		
	USFDA	OEHHA	IHNC
Chlordane	300	100	0.02
DDT + DDE	5000		0.02
DDT + DDD + DDE		1600	0.04
Dieldrin + Aldrin	300		<0.2
Dieldrin		160	<0.2
Heptachlor + Heptachlor Epoxide	300		0.4
PCBs		63	< 0.18*
Selenium		7400	800
Comparison of highest estimated steady-state body residue measured for tissues of clams exposed to dredged material from IHNC DMMUs with USFDA Action Levels and fish consumption guidelines developed by OEHHA. * reported as Total Aroclor concentration.			

Table 55. ***Macoma nasuta*** **28-day estuarine solid phase bioaccumulation tests.**

Analyte	**Exceedance Factor**				
	DMMU/Site				
	3 F	**4/5 N**	**7 N**	**9-2,4 NN**	**MIT**
Aluminum	3				
Barium	3			4	3
Lead	2		1		5
4,4'-DDT			5		
delta-BHC			3		
Dieldrin			4	4	
Endosulfan II				3	
Heptachlor epoxide			6	8	
1,4-Dichlorobenzene			3		
4-Methylphenol			4		
Dibenzofuran			3		
Fluoranthene				**11**	
Fluorene			**20**		
Phenanthrene			2	3	
Pyrene				**11**	
Exceedance factor for mean tissue body residue of clams exposed to dredged material from IHNC DMMUs and mitigation site sediment compared to body residues of clams exposed to sediment from the San Bernard reference site for compounds with statistically significant bioaccumulation. Numbers in bold indicate 10 times or higher difference.					

Table 56. *Macoma nasuta* 28-day estuarine solid phase bioaccumulation tests.

Analyte	Mean Body Residue				
	DMMU/Site				
	3 F	4/5 N	7 N	9-2,4 NN	MIT
Metals (mg/kg wet weight)					
Aluminum	59.2				
Barium	1.2			1.8	1.3
Lead	0.4		0.4		1.1
Pesticides and Semi-volatiles (µg/kg lipids)					
4,4'-DDT			4.0		
delta-BHC			15.6		
Dieldrin			3.6	4.3	
Endosulfan II				25.6	
Heptachlor epoxide			5.7	8.0	
1,4-Dichlorobenzene			142.7		
4-Methylphenol			164.5		
Dibenzofuran			578.5		
Fluoranthene				393.1	
Fluorene			571.5		
Phenanthrene			603.3	84.5	
Pyrene				385.9	
Mean body residue in clams exposed to dredged material from IHNC DMMUs and mitigation site sediment for compounds with statistically elevated bioaccumulation.					

Table 57. *Macoma nasuta* 28-day estuarine solid phase bioaccumulation potential evaluation.

Compound	Partitioning coefficient	Potential concern as bioaccumulative compound	Maximum factor of exceedance	Highest body residue	Estimated highest steady-state body residue
Organochorine Pesticides	**Log K_{ow}**				
4,4'-DDT	6.0	Yes	5	4.0	8.0
delta-BHC	3.8	Yes	3	15.6	15.6
Dieldrin	5.5	Yes	4	4.3	5.4
Endosulfan II	4.5	Yes	3	25.6	25.6
Heptachlor epoxide	5.4	Yes	8	8.0	10.0
PAHs	**Log K_{ow}**				
Dibenzofuran	4.1	Yes	3	578.5	578.5
Fluoranthene	5.5	Yes	11	393.1	491.4
Fluorene	4.2	Yes	20	571.5	571.5
Phenanthrene	4.5	Yes	3	603.3	603.3
Pyrene	4.9	Yes	11	385.9	428.8
Other Semi-volatiles	**Log K_{ow}**				
1,4-Dichlorobenzene	2.0	No	3	142.7	142.7
4-Methylphenol	2.0	No	4	164.5	164.5
Metals	**Log BCF**				
Aluminum	2.5	No	3	59.2	59.2
Barium	2.1	No	4	1.8	1.8
Lead	2.2	Yes	2	0.4	0.4

List of compounds significantly higher in clams exposed to dredged material from IHNC DMMUs than in clams exposed to sediment from the San Bernard reference site, their associated partitioning coefficient (Log K_{ow} or Log BCF), potential concern as bioaccumulative compounds, and highest measured mean factor of exceedance, body residue and estimated steady-state body residue.

Table 58. *Macoma nasuta* 28-day estuarine solid phase bioaccumulation tests.

DMMU/Site	Total PAHs (µmol/kg lip)
3 F	2.5
4/5 N	2.0
7 N	12.6
9-2,4 NN	7.3
MIT	2.0
SB	1.6

Mean total PAH estimated steady-state body residue in clams exposed to dredged material from IHNC DMMUs, mitigation site sediment, and reference site.

7 Summary

7.1. Dredged material disposal plan

Two construction alternatives are being considered for the IHNC Lock replacement project: 1) a float-in-place alternative that would involve construction of lock modules at an off-site graving area and transportation (floating in) of each module for assembly at the IHNC construction site and 2) a cast-in-place alternative that would involve on-site construction. These alternatives differ with respect to dredging volumes and construction sequence, with the cast-in-place alternative requiring greater dredging dimensions (and dredged material volumes) to accommodate on-site construction. A summary of dredging volumes by DMMU for each alternative is presented in Table 59. Table 59 is the same as Table 36 and is presented here for convenience.

A preliminary dredged material disposal plan was presented in the report *Conceptual CDF Design for Inner Harbor Navigation Canal Lock Replacement Project* (ERDC 2008). The disposal plan was based on results from aquatic and benthic toxicity tests performed on the DMMUs and proposed disposal of dredged material primarily in the Mississippi River with some disposal in a CDF. The beneficial use of dredged material both as a source of backfill around the lock construction site and for wetland creation at the mitigation site was discussed. However, the focus of the report was on a conceptual design for the proposed CDF and therefore presented a more detailed discussion of the maximum capacity that might be required for the project, including separate cells within the CDF for temporary stockpiling of material and for material unsuitable for disposal in the Mississippi River, while limiting discussion on placement of material at the mitigation site. Dredged material volumes from the disposal plan described in that report are presented in Table 59 under the column “Volume to Selected Placements Alternative II”.

This sediment evaluation proposes a revised dredged material disposal plan that includes an open water disposal area in the Mississippi River, a wetland creation disposal site within the mitigation area, a CDF disposal site for material unsuitable for open water placement (restricted material), and a separate fill storage site within the CDF. Dredged material volumes from this alternative appear in Table 59 under the column “Volume to Selected Placements Proposed Alternative”. Results from aquatic and benthic toxicity tests and water column mixing zone analyses were evaluated to determine the suitability of DMMUs for discharge into the four disposal areas. That proposed alternative is summarized below.

Table 59. Dredging and disposal plan (revised 7 17 08).

DMMU/Location	Material Type[1]	Suitability (No Benthic Toxicity) FW[2]	Suitability (No Benthic Toxicity) SW[3]	Total Volume FIP	Total Volume CIP	Volume by Section FIP	Volume by Section CIP	Alt. II (ERDC 2008) Float in Place Open Water	Alt. II Float in Place Wetland	Alt. II Float in Place CDF Disposal	Alt. II Float in Place CDF Fill Storage	Alt. II Cast in Place Open Water	Alt. II Cast in Place Wetland	Alt. II Cast in Place CDF Disposal	Alt. II Cast in Place CDF Fill Storage	Proposed Alt. Float in Place Open Water	Proposed Alt. Float in Place Wetland	Proposed Alt. Float in Place CDF Disposal	Proposed Alt. Float in Place CDF Fill Storage	Proposed Alt. Cast in Place Open Water	Proposed Alt. Cast in Place Wetland	Proposed Alt. Cast in Place CDF Disposal	Proposed Alt. Cast in Place CDF Fill Storage	Float-in-Place	Required Fill Volumes (yd^3)	Cast-in-Place	Required Fill Volumes (yd^3)
D1-05-1 thru 6	NN	USm[4]	USm	48,100	48,100	48100	48100	0	0	48100	0	0	0	48100	0	0	0	48100	0	0	0	48100	0	7	106762n	6	354203n
D2-05-1 thru 6	NN	USm	USm	88,700	155,200	88700	155200	0	0	88700	0	0	0	155200	0	0	0	88700	0	0	0	155200	0	7		6	
D3-05-1 thru 3	F	S[5]	S			62850	196700		0	0	0		0	0	0	0	062850a	0	0		196700	0	0	2-3	None	2-3	None
D3-05-4 thru 6	NN	S	US	412,750	586,300	349900	389600	412750q	0	0	0	586300q	0	0	0	349900a	0	0	0	389600	0	0	0	2-3		2-3	
D3-05-1N thru 6N	N	S	US			a	a		0	0	0		0	0	0		0	0	0		0	0	0	2-3		2-3	
D4-05-1 thru 8	NN	S	US	152,800	257,800	152,800	257,800	152800	0	0	0	257800	0	0	0	152800	0	0	0	257800	0	0	0	2-3		2-3	
D5-05-1 thru 8	NN	US	US	143,400	245,200	78,500	83,500	0	0	78500	0	0	0	83500	0	0	0	78500	0	0	0	83500	0	2-3		2-3	
D4/5-05-1N-16N	N	S	S	b	b	64900h	161700h	64900q	0	0	0	161700q	0	0	0	0	64900	0	0	0	161700	0	0	2-3		2-3	
D6-05-1 & 2	NN	S	S																					1		1	
D6-05-3 thru 6	F	S	S	463,100	997,700	463,100	997,700	0	0	0	463100	346678	0	0	651022	59100	0	0	404000	346678	0	0	651022	1		1	
D6-05-1N thru 6N	N	S	S																					1		1	
D7-05-1 thru 4	NN	US	S			101500	152500	0	0	101500	0	0	0	152500	0	0	0	101500	0	0	0	152500	0	1		1	
D7-05-5 thru 9	F	S	S	413,000	620,900	228000	79400									228000	0				0			1		1	
D7-05-1N-4N	N	S	S			c	c	311500q	0	0	0	468400q	0	0	0			0	0	79400		0	0	1		1	
D7-05-5N-9N	N					83500	389000									0	83500				389000						
D8-05-1 thru 4	NN	S	US	132,000	162,000	132,000	162,000	132000	0	0	0	162000	0	0	0	132000	0	0	0	162000	0	0	0	7		7	
D9-05-1&3	NN	S	US	192,200	192,200	192,200	192,200	150000	0	0	0	150000	0	0	0	150000	0	0	0	150000	0	0	0	11		11	

Column groups: In-Situ Volumes by Location and Material Type (yd^3); Volume to Selected Placements Alternative II (ERDC 2008) (yd^3); Volume to Selected Placements Proposed Alternative (yd^3); Approximate Year Dredged.

Table 59. Dredging and disposal plan (revised 7 17 08).

In-Situ Volumes by Location and Material Type (yd^3)								Volume to Selected Placements Alternative II (ERDC 2008) (yd^3)								Volume to Selected Placements Proposed Alternative (yd^3)								Approximate Year Dredged			
DMMU/Location	Material Type[1]	Suitability (No Benthic Toxicity)		Total Volume		Volume by Section		Float in Place				Cast in Place				Float in Place				Cast in Place				Float-in-Place	Required Fill Volumes (yd^3)	Cast-in-Place	Required Fill Volumes (yd^3)
		FW[2]	SW[3]	FIP	CIP	FIP	CIP	Open Water	Wetland	CDF Disposal	CDF Fill Storage	Open Water	Wetland	CDF Disposal	CDF Fill Storage	Open Water	Wetland	CDF Disposal	CDF Fill Storage	Open Water	Wetland	CDF Disposal	CDF Fill Storage				
D9-05-2&4	NN	S	S					42200q	0	0	0	42200q	0	0	0	0	42200	0	0	0	42200	0	0	7		7	
D10-05-1	F	S	S			18300	18300																	7		7	
D10-05-2	F	d	d			e	e																	7		7	
D10-05-3&4	S	S	S	131,400	131,300	113100	113000	131,400	0	0	0	131,300				131,400	0	0	0	131,300				7	246825j	7	246825j
D10-05-1N	N	d	d			f	f																	7		7	
D10-05-2N	N	d	d			e	e																	7		7	
D10-05-3N&4N	N	S	S			g	g																	7		7	
D11-05-1&2	NN	d	d	38,782	38,782	38782i	38782i	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11		11	
Totals				2,216,232	3,435,482	2,216,232	3,435,482	1397550q	0	316800	463100	2306378q	0	439300	651022	1203200	253450	316800	404000	1516778	789600	439300	651022	Total	353587	Total	601028
								Grand Total			2,177,450	Grand Total			3,396,700	Grand Total			2,177,450	Grand Total			3,396,700	Capping Allowance	50000	Capping Allowance	50000
																								Grand Total	403587	Grand Total	651028

[1] Native/Non-native/Fill/Sediment, [2] Freshwater, [3] Saltwater, [4] Unsuitable, [5] Suitable, **a** Native volumes included with 1-3 and 4-6 volumes above, therefore wetland placement volume is overestimated by the volume underlying DMMU 1 Sites 1-3, and the open water volume is underestimated by the same amount, **b** 4/5 is a vertical designation, volume included with 4 and 5, **c** Native below project depth (at -36ft), **d** Unknown assumed S, **e** Site 2 not sampled, **f** Included with 1 above, **g** Included with 3&4 above, **h** DMMU 5 native volumes only, DMMU 4 volumes were estimated as NN to full project depth, **i** Not scheduled for dredging, **j** Letter report assumes 70K of material being dredged plus remainder from previously stockpiled goes to fill. However water management at the lock fill site would be a problem if dredging hydraulically due to the small size of the site and limited hydraulic retention time, **m** Not tested, assumed unsuitable, **n** Letter report specifies backfill of West Side of New lock after U/S and D/S approach - assumed here to correspond to main north channel, **q** shaded areas represent material proposed for open water disposal in Alternative II (ERDC 2008), portions of which are proposed for wetland placement in proposed alternative

- DMMUs 3 NN, 3 N, 4 NN, 7 F, 7 N (area underlying channel sediments), 8 NN, 9 NN (area south of the existing lock), 10 NN, 10 F, and 10 N would be placed in the Mississippi River.
- DMMUs 3 F, 4/5 N, 7 N (area underlying east bank fill), and 9 NN (area north of the existing lock) would be placed at the mitigation site for wetland creation. Note that the ERDC (2008) disposal plan proposed placement of these DMMUs into the Mississippi River.
- DMMUs 1 NN, 2 NN, 5 NN, and 7 NN would be placed in the CDF.
- DMMUs 6 NN, 6 F, and 6 N would be temporarily stockpiled in the CDF and later used as backfill at the construction site. Note that for the cast-in-place construction alternative, portions of DMMU 6 NN, 6 F, and/or 6 N would be placed in the Mississippi River.

7.2. Compliance of proposed discharges with water quality standards

7.2.1. Mississippi River disposal area

Effluent concentrations were used to evaluate potential for exceedances of water quality criteria during open water disposal in the Mississippi River (MR) disposal site. Louisiana State regulations provide specifications for mixing zones to assimilate effluent discharges. Dilution requirements were therefore calculated based on comparison of maximum effluent concentrations to water quality criteria. Table 60 summarizes all non-zero dilution ratios calculated for disposal at the Mississippi River disposal site based on standard elutriates. A maximum dilution of 69, for barium, was required to meet freshwater acute criteria, and a maximum dilution of 697, for Total PCBs, was required to meet freshwater chronic criteria.

Dilutions based on mean (geometric mean) elutriate concentrations resulted in a maximum dilution requirement of 18 to meet freshwater acute criteria and a dilution requirement of 90 to meet freshwater chronic criteria (both for barium) (Section 4.1).

Maximum dilutions obtained based on toxicity testing of freshwater elutriates ranged from 1 to 384 (Section 4.1).

Based on the modeling conducted for disposal in the Mississippi River disposal site, a 700-fold dilution could be met within 2,100 ft from the discharge point for low flow conditions and within 1,000 ft for high flow conditions. This will meet the most stringent dilution requirements based on comparison of elutriate concentrations to water quality criteria and will also satisfy the maximum dilution requirements based on the elutriate toxicity testing. This distance is consistent with the point at which non-detect concentrations have been observed during disposal operations in the past. Also, the dilutions required to be protective based on aquatic toxicity tests can be met within approximately 1,400 ft for worst case conditions (low flow, pipeline disposal), as the maximum dilution based on toxicity was less than 400. As these mixing zone dimensions appear to be reasonable and consistent with past operation, it appears that the proposed discharges of dredged material would comply with state water quality standards or with equivalent benchmarks. Further, evaluation of potential impacts on the St. Bernard Parish waterworks inlet indicates that dilution required to meet drinking water standards can be achieved within no more than 350 ft from the point of disposal for all scenarios.

7.2.2. Mitigation site

Due to present uncertainty regarding method of containment, estimated water column impacts associated with placement of dredged material at the mitigation site were evaluated based on both standard and modified elutriate tests. For the DMMUs selected for placement in the mitigation site, maximum dilution required to meet chronic water quality criteria was 170, for tributyltin (standard elutriate), and to meet acute criteria was 14, for cyanide (modified elutriate). Non-zero dilutions obtained for placement in the mitigation site based on standard and modified elutriates and location of maximums are summarized in Tables 61 and 62, respectively. Little flow information was available for the mitigation site. Available dilution in the mitigation site was estimated based on the best information available. Assuming an average maximum water depth of 2 ft, a six-inch tidal variation would therefore represent a daily exchange of approximately 25 percent of the maximum water volume or an effective flow rate of 111 cfs. This would yield an approximate dilution ratio of 4:1 for the effective discharge rate of a 24-in hydraulic dredge. This is insufficient to meet maximum dilution requirements for acute or chronic criteria, in addition to requiring an area larger than that specified for either a zone of initial dilution or a mixing zone under LA water quality regulations. However, suspended phase toxicity testing conducted on the marine elutriates did not result in significant toxicity even at full strength. If there are no other adverse effects anticipated with the placement, and given the interest and benefit associated with restoration of the wetland, this may be sufficient justification for a waiver from water quality criteria for this action.

7.2.3. CDF effluent

Effluent discharges from the CDF were evaluated based on modified elutriate tests. For discharge to the GIWW, a maximum dilution of 770, for copper, was required to meet marine acute criteria, and a maximum dilution of 3179, for tributyltin, was required to meet marine chronic criteria (Table 63). Due to apparent analytical problems, some of the highest values (associated with DMMU 10 sample C3_4-N) are considered unreliable, however. Maximum dilution based on the highest reliable sample concentration for copper (DMMU 4 sample 5-NN) resulted in a dilution ratio of 8 to meet acute (and chronic) criteria. A similar issue was noted for lead for which the highest reliable elutriate concentration (DMMU 4/5 sample 8-N) results in a dilution ratio of 8 to meet marine chronic criteria (and 0 to meet acute criteria). Maximum overall dilution remains at 3179 for marine chronic, due to the high concentration of tributyltin in the modified elutriate of DMMU 4 sample 4-NN. For that sample, the dilution ratio estimate is considered reliable.

Survival was not statistically different from control in toxicity testing conducted on estuarine standard elutriate (considered reasonably representative of toxicity expected with modified elutriates, based on comparison of elutriate concentrations), and no LC50 values resulted. Therefore, no dilution of effluent is considered necessary for discharge in the marine environment based on toxicity.

The maximum attainable dilution ratio in compliance with mixing zone restrictions in the GIWW is estimated to be approximately 120. Assuming maximum copper and lead dilution requirements are revised as previously discussed, adequate dilution will be attainable within the mixing zone for all constituents except tributyltin (dilution ratio 3179 chronic), total PCBs (dilution ratio 404 chronic), Aroclor 1016 (dilution ratio 321 chronic), and dieldrin (dilution ratio 128 chronic). Effluent treatment may be required to address elevated levels of these constituents when dredging certain areas of the IHNC. However, the mixing that is inherent in dredging will likely flatten peak concentrations somewhat. Based on the geometric mean elutriate concentrations (Section 4.2), all dilution requirements can be met within the prescribed mixing zone in the GIWW.

Activated carbon may be effective in reducing concentrations of organic concentrations in the effluent prior to discharge, thus reducing dilution requirements substantially. Bench testing will be required to evaluate effectiveness for different methods of application and to determine needed carbon dosage and contact time.

For discharge to Bayou Bienvenue, a maximum dilution of 226, for copper, was required to meet marine acute criteria (DMMU 10 sample C3&4-N), and a maximum dilution of 3105, for tributyltin, was required to meet marine chronic criteria (DMMU 4 sample 4-NN) (Table 63).

However, DMMU 10 sample C3&4-N results are considered unreliable, as previously discussed. Maximum dilution based on the highest reliable sample concentration (DMMU 4 sample 5-NN) resulted in a dilution ratio of 2.6 to meet acute criteria for copper (5.3 for chronic criteria). Lead dilution requirements were also relatively high to meet chronic criteria (180), but again the maximum elutriate concentration was associated with DMMU 10 sample C3&4-N.

Substitution of the highest reliable elutriate concentration for lead (DMMU 4/5 sample 8-N) results in a dilution ratio of 7 to meet marine chronic criteria (0 to meet acute). Maximum overall dilution remains at 3105 for marine chronic, due to the high concentration of tributyltin in DMMU 4 sample 4-NN. Dilutions based on mean (geometric mean) elutriate concentrations (Section 4.2) indicated all marine acute criteria were met without mixing, and a maximum dilution of 8 was required to meet marine chronic criteria.

Data regarding geometry and flow rate in Bayou Bienvenue was insufficient to permit modeling of a mixing zone as was done for the GIWW. Bayou Bienvenue is sufficiently small in depth and width and the flow rate is sufficiently low that discharge from the CDF would fully envelop and mix with the entire flow of Bayou Bienvenue within a couple hundred feet of the discharge. As such, the dilution achieved is simply a ratio of the flow of Bayou Bienvenue and the CDF discharge. Flow rate within Bayou Bienvenue was estimated based on available information and appears to be quite limited, consisting of tidal exchange, surface runoff, and stormwater pumping.

An attainable dilution ratio of 3:1 was estimated for effluent discharge in Bayou Bienvenue, which is inadequate to meet water quality criteria for the effluent pathway without treatment. For discharge of runoff, however, which could be released more gradually during periods of higher flow in Bayou Bienvenue, the dilution available was estimated to range from 44:1 to 380:1 or greater. This is adequate to meet dilution requirements for runoff without treatment (based on acute criteria) for both maximum and mean predicted concentrations. Dilution requirements for runoff from dried, oxidized material have not yet been determined but are expected to be somewhat higher due to increased solubilization of metals under oxidized conditions.

Table 60. Summary of non-zero dilution requirements for disposal in MR disposal site.

Contaminants	Maximum Elutriate Concentration (µg/L)	Dilution Ratios		Location of Maximum Concentration
		Meeting Acute Criteria	Meeting Chronic Criteria	
PCB Total	2.80	0.4	697	DMMU 5 sample 4-NN
p,p'-DDT (4,4')	0.062	0	432	DMMU 4 sample 5-NN
Barium	2590	69	339	DMMU 10 sample C3_4-FN
Cadmium	15.6	9	301	DMMU 10 sample C3_4-FN
Tributyltin	13.0	29	256	DMMU 4 sample 4-NN
Benzo(a)anthracene	1.00	1	94	DMMU 4 sample 5-NN
Aluminum	4690	5	61	DMMU 10 sample C3_4-FN
PCB(Aroclor-1254)	0.930	0.6	39	DMMU 4 sample 5-NN
gamma-Chlordane	0.074	0	39	DMMU 7 sample 2-NN
Heptachlor	0.100	0	38	DMMU 4 sample 5-NN
PCB(Aroclor-1016)	0.160	0	37	DMMU 4 sample 5-NN
4,4'-DDD	0.160	4	30	DMMU 7 sample 2-NN
Benzo(a)pyrene	0.370	0.90	28	DMMU 4 sample 5-NN
Heptachlor epoxide	0.054	0	20	DMMU 5 sample 4-NN
PCB(Aroclor-1248)	1.50	0.1	20	DMMU 5 sample 4-NN
Cyanide	14.2	0	17	DMMU 4 sample 5-NN
Beryllium	3.00	0	15	DMMU 10 sample C3_4-FN
Silver	1.25	0	14	DMMU 10 sample C3_4-FN
Selenium	61.2	2	14	DMMU 10 sample C3_4-FN
Lead	9.90	0	10	DMMU 10 sample C3_4-FN
Chromium III	693	1.25	8.78	DMMU 10 sample C3_4-FN
Ammonia-N	16900	0	8	DMMU 4 sample C1_3-NN
Mercury	0.170	0	6	DMMU 10 sample C3_4-FN
alpha-Chlordane	0.015	0	4	DMMU 5 sample 4-NN
Methoxychlor	0.072	NS	2	DMMU 4 sample 5-NN
Copper	14.1	0.52	1.45	DMMU 10 sample C3_4-FN
Bis(2-ethylhexyl) phthalate	5.70	0	1.0	DMMU 7 sample 4-NN
Anthracene	1.30	0	0.9	DMMU 4 sample 5-NN
Dieldrin	0.098	0	0.8	DMMU 7 sample 2-NN
Endrin	0.058	0	0.6	DMMU 4 sample 5-NN
Chromium VI	13.0	0	0.33	DMMU 10 sample C3_4-FN
Phenanthrene	6.90	0	0.1	DMMU 4 sample 5-NN

Table 61. Non-zero dilution ratios for placement in mitigation site based on standard elutriate testing.

Contaminants	DMMU3[a]		DMMU4/5[b]		DMMU7N[e]		DMMU9[i]	
	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic
Tributyltin	0	n	0	170	0	n	0	n
PCB Total	0	13	0	22	0	0	0	4
Cyanide	n	n	11	11	11	11	6	6
Silver	0.32	10m	0.32	10m	0.32	10m	0.32	10m
Mercury	0	n	0	6	0	n	0	n
p,p'-DDT (4,4')	0	n	0	5	0	n	0	0
Copper	0	0	2	2	0	0	n	n
Lead	0	0	0	2	0	0	0	2
Endrin	0	0	0	0.33	0	0	0	0
Dieldrin	0	7	0	0	0	0	0	7
gamma-Chlordane	0	4	0	0	0	0	0	0

[a] DMMU 3 C1-3 Land, [b] DMMU 4/5N Comp 1&11, Sites 4, 5, 7, 8, 12 &13 [e] DMMU 7N Comp 1-9, [i] DMMU 9 Comp 2&4, **m** Based on EPA Region IV Water Quality Screening Criteria for Hazardous Waste Sites, **n** Background Exceeds WQC and Elutriate Concentrations

Table 62. Non-zero dilution ratios for placement in mitigation site based on modified elutriate testing.

Contaminants	DMMU3[a]		DMMU4/5[b]		DMMU7N[e]		DMMU9[i]	
	Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic
Lead	0	0	0	26	0	n	0	0
p,p'-DDT (4,4')	0	4	0	n	0	1.31	0	n
Cyanide	11	11	14	14	n	n	3	3
Silver	0.32	10m	0.32	10m	0.32	10m	0.32	10m
Dieldrin	0	13	0	0	0	0	0	0
Endrin	0	1	0	0	0	0	0	0
gamma-Chlordane	0	0.83	0	0	0	0	0	0

[a] DMMU 3 C1-3 Land, [b] DMMU 4/5N Comp 1&11, Sites 4, 5, 7, 8, 12 &13 [e] DMMU 7N Comp 1-9, [i] DMMU 9 Comp 2&4, **m** Based on EPA Region IV Water Quality Screening Criteria for Hazardous Waste Sites, **n** Background Exceeds WQC and Elutriate Concentrations

Table 63. Maximum non-zero dilution ratio estimates for effluent discharge in the GIWW and Bayou Bienvenue based on modified elutriate.

Contaminants	Maximum Elutriate Concentration (µg/L)	GIWW (DMMU1) Dilution Ratios		Bayou Bienvenue Dilution Ratios		Location of Maximum
		Meeting Acute Criteria	Meeting Chronic Criteria	Meeting Acute Criteria	Meeting Chronic Criteria	
Tributyltin	6.7	16	3179	16	3105	DMMU 4 sample 4-NN
Copper	281	770	770	226	397	DMMU 10 sample C3_4-NF
PCB Total	2.2	0.10	404	0.10	547	DMMU 7 sample 2-NN
PCB(Aroclor-1016)	0.84	0g	321g	0g	41g	DMMU 7 sample 7-F
Lead	147	4	197	4	180	DMMU 10 sample C3_4-NF
Dieldrin	0.082	0	128	0	59	DMMU 7 sample 2-NN
PCB(Aroclor-1260)	1.6	0.53g	121g	0.53g	79g	DMMU 7 sample 2-NN
PCB(Aroclor-1254)	0.45	0g	114g	0g	21g	DMMU 7 sample 5-F
p,p'-DDT (4,4')	0.0059	0	43	0	34	DMMU 5 sample 4-NF
Cadmium	2.1	0	d	0	12	DMMU 10 sample C3_4-NF
Endosulfan II	0.039	0.20	31	0.33	10	DMMU 7 sample 2-NN
p,p'-DDD (4,4')	0.14	4	25	4	29	DMMU 7 sample 2-NN
gamma-Chlordane	0.066	0	19	0	81	DMMU 7 sample 2-NN
Nickel	133	0.81	17	0.84	27	DMMU 10 sample C3_4-NF
Mercury	0.28	0	17	0	17	DMMU 10 sample C3_4-NF
Zinc	522	9	11	8	9	DMMU 10 sample C3_4-NF
Ammonia-N	19600	0.78	11	0.78	11	DMMU 1 sample C1_6-NN
PCB(Aroclor-1248)	0.24	0g	8g	0g	11g	DMMU 9 sample C1_4-NN
Heptachlor	0.025	0	7	0	d,g	DMMU 6 sample 2-N
Chromium VI	42.0	2	3	2	3	DMMU 1 sample 1-NN
Cyanide	6.6	2	2	2	2	DMMU 6 sample 6-F
gamma-BHC (Lindane)	0.029	0	2.17g	0	1g	DMMU 1 sample 1-NN
Chromium III	216	0	1	0	1	DMMU 10 sample C3_4-NF
Methoxychlor	0.052	NS	0.77	NS	0.80	DMMU 1 sample C1_6-NN
Endrin	0.0027	0	0.44	0	0.40	DMMU 3 sample C1_3-F
alpha-Chlordane	0.0047	0	0.21	0	0.58	DMMU 3 sample C1_3-F
Arsenic	37.8	0	0.06	0	0.06	DMMU 10 sample C3_4-NF
Selenium	61.4	0	0	0	0	DMMU 1 sample C1_6-NN

NS - no standard

a As III, d assumed background concentration exceeds criteria, elutriate concentration near background concentration, dilution ratio cannot be calculated, g based on EPA Region IV screening water quality criteria for hazardous waste sites

7.3. Potential for contaminant-related impacts that would result in significant degradation of the aquatic ecosystem

Based on results from previous evaluations (Appendix A), poor survival of benthic organisms and proximity of sediment collection sites to suspected areas of contamination, dredged material from DMMUs 1 NN and 2 NN was determined to be unsuitable for freshwater and estuarine open water placement.

7.3.1. Mississippi River open-water disposal evaluation

Based on the results of the benthic toxicity evaluation (Table 64), IHNC non-native sediments from DMMU 5 and from DMMU 7 (DMMUs 5 NN and 7 NN) are predicted to be acutely toxic to freshwater benthic organisms as the survival of freshwater amphipods exposed to dredged material from those DMMUs was significantly lower than for the reference site in solid phase toxicity tests. Therefore, dredged material from DMMUs 5 NN and 7 NN is unsuitable for disposal in the Mississippi River. Dredged material from the remaining DMMUs is not predicted to be acutely toxic to freshwater benthic organisms and wasfurther evaluated for bioaccumulation potential using solid-phase exposures of a freshwater clam to dredged material.

The benthic bioaccumulation evaluation revealed that tissue concentrations of all contaminants of concern for DMMUs evaluated were either statistically less than USFDA action levels or there are no USFDA levels for the contaminants. For contaminants with USFDA action levels, body burden in clams exposed to dredged material was lower than reported action levels by over two orders of magnitude (Table 64). Moreover, tissue concentration associated with the DMMUs evaluated for bioaccumulation were statistically less than Fish Contaminant Goals (FCGs) developed by The California Office of Environmental Health Hazard Assessment (OEHHA) or there are no FCG for the contaminants.

Further evaluation revealed that statistically elevated tissue residue relative to the reference site was detected for at least one COC for all DMMUs investigated for bioaccumulation potential. The sample with the highest number of exceedences was fill material from DMMU 3 F, with 15 COC exceeding the Mississippi River reference. Compounds statistically elevated in tissue residue which are considered of low concern as bioaccumulative compounds were aluminum, barium, chromium, 4-methylphenol, diethyl phthalate and phenol. Compounds with high potential concern as bioaccumulative compounds were lead, nickel, selenium, tributyltin, PAHs, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane and PCBs. Despite their statistically elevated concentration, compounds with both low and high bioaccumulative potential are not likely to promote unacceptable adverse biological effects based on 1) the low magnitude of exceedence, 2) the small number of contaminants with potential to bioaccumulate in predator fish, and 3) prediction of no adverse biological effects associated with measured body residue in invertebrates and predicted body residue in predator fish. DMMUs proposed for discharge at the Mississippi River would therefore not result in adverse impacts to the aquatic ecosystem.

7.3.2. Mitigation site open water disposal evaluation

Based on the results of the solid phase toxicity tests (Table 65), IHNC dredged material from DMMUs 3NN,3 N, 4 NN, 5 NN, 8 NN, and 9 NN (portion south of the existing lock) are predicted to be acutely toxic to estuarine benthic organisms and are therefore unsuitable for open water disposal in the mitigation site. DMMUs predicted to be acutely toxic to estuarine benthic invertebrates were excluded from the bioaccumulation evaluation. In addition, DMMUs 3 N, 6 NN, 6 N, 6 F, 7 NN, 7 F, 10 NN, 10 N and 10 F were determined by the water column evaluation to require considerable dilution and were not further evaluated for disposal at the mitigation site.

Due to no apparent benthic or water column toxicity and minimal dilution requirements, DMMUs 3 F, 4/5 N, 7 N, and 9 NN (portion north of the existing lock) were evaluated for bioaccumulation potential at the mitigation site disposal area using solid phase exposures of a marine clam to dredged material.

The benthic bioaccumulation evaluation revealed that tissue concentrations of all contaminants of concern for DMMUs evaluated were either statistically less than USFDA action levels or there are no USFDA levels for the contaminants. For contaminants with USFDA action levels, body burden in clams exposed to dredged material was lower than reported action levels by over three orders of magnitude (Table 65). Moreover, tissue concentration associated with the DMMUs evaluated for bioaccumulation was statistically less than FCGs developed by OEHHA or there are no FCG for the contaminants.

Further evaluation revealed that statistically elevated tissue residue relative to the reference site was detected for at least one COC for DMMUs 3 F, 7 N, and 9 NN (north of the existing lock), but not for DMMU 4/5 N. The sample with the highest number of exceedences was native subsurface material from DMMU 7 N with 10 exceedances. Compounds statistically elevated in tissue residue which are considered of low concern as bioaccumulative compounds were aluminum, barium, 1.4-dichlorobenzene, and 4-methylphenol. Compounds with high potential concern as bioaccumulative compounds were lead, PAHs, 4,4'-DDT, delta-BHC, dieldrin, endosulfan II, and heptachlor epoxide. Despite their statistically elevated concentration, compounds with both low and high bioaccumulative potential are not likely to promote unacceptable adverse biological effects based on 1) the low magnitude of exceedence, 2) the small number of contaminants with potential to bioaccumulate in predator fish, and 3) prediction of no adverse biological effects associated with measured body residue in invertebrates and predicted body residue in predator fish. DMMUs proposed for discharge at the mitigation site would therefore not result in adverse impacts to the aquatic ecosystem.

Table 64. Summary of benthic toxicity and bioaccumulation evaluations for freshwater open water disposal.

DMMU	Benthic Toxicity	Bioaccumulation Potential			
		Number of COCs Significantly Elevated	Highest Exceedance	Comparison of Body Rresidue to USFDA Action Levels	Potential for Aadverse Effects to Benthos and Fish
3 NN	Not toxic	6	27	> 10^2 lower	Negligible
3 N	Not toxic	1	3	> 10^2 lower	Negligible
3 F	Not toxic	15	71	> 10^2 lower	Negligible
4 NN	Not toxic	6	40	> 10^2 lower	Negligible
5 NN	**Toxic**	Bioaccumulation Potential Not Evaluated			
4/5 N	Not toxic	5	6	> 10^2 lower	Negligible
6 NN	Not toxic	7	5	> 10^2 lower	Negligible
6 N	Not toxic	2	3	> 10^2 lower	Negligible
6 F	Not toxic	1	2	> 10^2 lower	Negligible
7 NN	**Toxic**	Bioaccumulation Potential Not Evaluated			
7 N	Not toxic	4	7	> 10^2 lower	Negligible
7 F	Not toxic	1	2	> 10^2 lower	Negligible
8 NN	Not toxic	7	13	> 10^2 lower	Negligible
9-1 NN	Not toxic	2	7	> 10^2 lower	Negligible
9 2,4-NN	Not toxic	7	9	> 10^2 lower	Negligible
10_1NN	Not toxic	3	3	> 10^2 lower	Negligible
10 N	Not toxic	4	7	> 10^2 lower	Negligible
10 F	Not toxic	4	2	> 10^2 lower	Negligible

Table 65. Summary of benthic toxicity and bioaccumulation evaluations for estuarine open water disposal.

DMMU	Benthic Toxicity	Bioaccumulation Potential			
		Number of COCs Significantly Elevated	Highest Exceedance	Comparison of Body Residue to USFDA Action Levels	Potential for Adverse Effects to Benthos and Fish
3 NN	**Toxic**	Bioaccumulation Potential Not Evaluated			
3 N	**Toxic**	Bioaccumulation Potential Not Evaluated			
3 F	Not toxic	3	3	> 10^3 lower	Negligible
4 NN	**Toxic**	Bioaccumulation Potential Not Evaluated			
5 NN	**Toxic**	Bioaccumulation Potential Not Evaluated			
4/5 N	Not toxic	0		> 10^3 lower	Negligible
6 NN	Not toxic	Bioaccumulation Potential Not Evaluated			
6 N	Not toxic	Bioaccumulation Potential Not Evaluated			
6 F	Not toxic	Bioaccumulation Potential Not Evaluated			
7 NN	Not toxic	Bioaccumulation Potential Not evaluated			
7 N	Not toxic	10	20		Negligible
7 F	Not toxic	Bioaccumulation Potential Not Evaluated			
8 NN	**Toxic**	Bioaccumulation Potential Not Evaluated			
9-1 NN	**Toxic**	Bioaccumulation Potential Not Evaluated			
9 2,4-NN	Not toxic	7	11	> 10^3 lower	Negligible
10_1NN	Not toxic	Bioaccumulation Potential Not Evaluated			
10 N	Not toxic	Bioaccumulation Potential Not Evaluated			
10 F	Not toxic	Bioaccumulation Potential Not Evaluated			

References

Buchman, M. F. 1999. *NOAA screening quick reference tables.* NOAA HAZMAT Report 99-1. Seattle, WA: Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration.

Burgess, R. M., M. C. Pelletier, K. T. Ho, J. R. Serbst, S. A. Ryba, A. Kuhn, M. M. Perron, P. Raczelowski and M. G. Cantwell. 2003. Removal of ammonia toxicity in marine sediment TIEs: A comparison of Ulva lactuca, zeolite and aeration methods. *Mar. Poll. Bull.* 46: 607-618.

Chase, D. 1994. *CDFATE user's manual. Draft.* Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station. *http://el.erdc.usace.army.mil/elmodels/pdf/cdfate.pdf*

DiToro D. M., J. A. McGrath, and D. J. Hansen. 2000. Technical basis for narcotic chemicals and polycyclic aromatic hydrocarbon criteria. I. Water and tissue. *Environmental Toxicology and Chemistry*, 19 (8): 1951-1970.

Engineer Research and Development Center (ERDC 2008). *Conceptual CDF Design for Inner Harbor Navigation Canal Lock Replacement Project*. Technical report prepared for the US Army Corps of Engineers District, New Orleans by Environmental Laboratory, Vicksburg, MS: US Army Corps of Engineer Research and Development Center.

Hartman Engineering, Inc. 2001. *Final feasibility study, Bayou Bienvenue Pump Station diversion and terracing Orleans and St. Barnard Parishes*. PO-25, XPO-74A. Report prepared for State of Louisiana Department of Natural Resources Coastal Restoration Division DNR Contract No. 2503-00-29.

Hockett, J. R. and D. R. Mount. 1996. Use of metal chelating agents to differentiate among sources of acute aquatic toxicity. *Environmental Toxicology and Chemistry,* 15: 1687-1693.

Manly, B.F. 2000. *Multivariate Statistical Methods - A Primer*. Boca Raton, FL: Chapman & Hall / CRC.

McCarty L. S., D. Mackay, A. D. Smith, G. W. Ozburn, and D. G. Dixon. 1992. Residue-Based Interpretation of Toxicity and Bioconcentration QSARs from Aquatic Bioassays: Neutral Narcotic Organics. *Environmental Toxicology and Chemistry,* 11 (7): 917-930.

National Marine Fisheries Service. 1999. *Proposed project information sheet: Bayou Bienvenue Pump Station diversions and terracing project*. U.S. Department of Commerce.

Price, R. A., and J. G. Skogerboe. 2000. *Simplified laboratory runoff procedure (SLRP): procedure and application*. Environmental Effects of Dredging Technical Note ERDC/TN EEDP-02-29. Vicksburg, MS: US Army Engineer Research and Development Center.

Rand G.M., P.G. Wells, and L.S. McCarty. 1995. Introduction to aquatic toxicology. In: G.M.Rand, ed. *Fundamentals of aquatic toxicology,* 2nd. edition. Washington, DC: Taylor and Francis.

U.S. Army Corps of Engineers (USACE). 1997. *Mississippi River – Gulf outlet new lock and connecting channels evaluation report; Appendix B: Engineering investigations.* New Orleans, LA: U.S.Army Engineer District, New Orleans.

USACE.2003. Evaluation *of dredged material proposed for disposal at island, nearshore, or upland confined disposal facilities — testing manual.* Technical Report ERDC/EL TR-03-1, Vicksburg, MS: U.S. Army Engineer Research and Development Center (ERDC).

U.S. Environmental Protection Agency (USEPA). 2000. *Bioaccumulation testing and interpretation for the purpose of sediment quality assessment: Status and needs.* EPA 823-R-00-001. Washington, DC: Office of Water.

U.S. Environmental Protection Agency and U.S. Army Corps of Engineers (USEPA and USACE). 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Inland Testing Manual).* EPA 823-B-98-004. Washington, DC: Office of Water.

Weston Solutions, Inc. 2008. *Inner Harbor Navigation Canal Evaluation of Material Generated from Lock Construction. New Orleans, Louisiana*. Prepared for the U.S. Army Engineer District, Tulsa, OK, and the U.S. Army Engineer District, New Orleans, LA. Contract No. W912BV-04-D-2026.

Appendix A: TIER I Evaluation – Potential Sources of Contamination

To fulfill the requirements of the EPA/USACE Implementation Memorandum for the ITM dated February 12, 1998, the CEMVN and EPA, Region VI developed a list of contaminants of concern (COC) that should be applied to all dredging projects that require testing according to the ITM. The list was finalized in March 2001 and includes the parameters that were determined to be the most likely contaminants of concern in sediments found in the area of the CEMVN. The COC list could be expanded based on a review of existing project-specific information. The primary source of the target detection limits (TDLs) for the parameters listed was EPA 823-B-95-001, *QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations*.

To initiate efforts on development of the SAP and the project-specific COC list, CEMVN performed a literature search of existing, historical information, i.e. prior reports, studies and sampling programs. Project specific biological testing (Tier III) was performed in the summer and fall of 2005 and provided additional information on sediments collected near the Florida Ave Bridge. The sources researched for this Tier I Evaluation included the following:

A. *Analyses of Native Water, Bottom Material, Elutriate Samples, and Dredged Material From Selected Southern Louisiana Waterways and Selected Areas in the Gulf of Mexico*, 1979-81, prepared by the U.S. Department of the Interior, Geological Survey in cooperation with the U.S. Army Corps of Engineers.

B. *Mississippi River-Gulf Outlet, New Lock and Connecting Channels Evaluation Report*. March 1997. The following volumes of the Evaluation Report were used for the Tier I investigation.

   a. *Volume 1. Main Report and Environmental Impact Statement.*
   b. *Volume 3, Appendix B. Engineering Investigations.*
   c. *Volume 5, Appendix C. Investigations of Potential Hazardous, Toxic, and Radiological Wastes.*
   d. *Volume 6, Appendix D. Environmental Studies.*

C. *A Land Use History of Areas Adjacent to the Inner Harbor Navigation Canal Lock, New Orleans*. Final Report. November 1992. (Prepared by R. Christopher Goodwin & Associates, Inc.)

D. *IHNC Lock Replacement Project, Orleans Parish, LA; Design Documentation Report No. 1 Site Preparation and Demolition. Volume 6*. February 1999.

E. *RECAP Submittal Report – Criteria Document IHNC EBIA New Orleans, LA*. June 2001

F. National Pollutant Discharge Elimination System (NPDES)/Louisiana Pollutant Discharge Elimination System (LPDES) Permit Files.

G. *Port of New Orleans Florida Avenue Bridge Dredged Material Assessment Sampling Report*. February 2001.

H. Lake Pontchartrain Basin Foundation (LPBF) and Holy Cross Neighborhood Association sampling and analysis results (letter dated May 22, 2001 to CEMVN from Carlton Dufrechou, Lake Pontchartrain Basin Foundation, Metairie, LA).

A. Analyses of Native Water, Bottom Material, Elutriate Samples, and Dredged Material From Selected Southern Louisiana Waterways and Selected Areas in the Gulf of Mexico

During the period of July 1979 to September 1981, the U.S. Geological Survey (USGS), in cooperation with the CEMVN, conducted water quality studies dealing with dredging activities in selected reaches of major navigable waterways of southern Louisiana. One of the waterways studied was the Inner Harbor Navigation Canal (IHNC) where elutriate studies were conducted. The elutriate studies were initiated to collect data for use in assessing possible environmental effects of proposed dredging activities in selected reaches of Louisiana waterways including the IHNC. Native water and bottom-material samples were collected, analyzed, and used to prepare elutriates for analysis. Samples were collected from three sites in the IHNC. Plate 9 of the USGS report displays the locations of these sites. Several dissolved metals, phenols and diazinon were detected in the elutriates.

B. *Mississippi River-Gulf Outlet, New Lock and Connecting Channels Evaluation Report***.**

The 1997 Evaluation Report included an existing water quality investigation and elutriate analysis presented in Volume 3, Appendix B. Within this investigation, several resources were used to assess the water quality conditions in and near the study area at that time. These resources included sampling stations of the CEMVN, USGS, the Louisiana Department of Health and Hospitals, and the Louisiana Department of Natural Resources. This investigation also included data from samples collected on May 10 and 11, 1993 by CEMVN at four locations within the IHNC.

The existing water quality data reviewed for the 1997 report indicated problems with dissolved oxygen concentrations, coliform, pH, heavy metals, organics, and some pesticides. The elutriate data collected from the four new sample locations for this report revealed the presence of several metals and organic compounds such as polycyclic aromatic hydrocarbons.

The 1997 Evaluation Report also provides an initial assessment of the existence or potential for hazardous, toxic, and radiological waste (HTRW) as well as a Sampling and Analysis Report for the Phase II (August 1995) investigation of the East Bank Industrial Area (EBIA) or the Total Environmental Restoration Contract Site (TERC) in Volume 5, Appendix C. The following are notes from the initial assessment:

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)

- There were 9 named Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites within the project vicinity. 2 Higher Priority, 4 Lower Priority, 3 No Further Action and 0 National Priority List. Page C-7 of the report displays a list with descriptions of each.

LARIS (Louisiana Department of Environmental Quality's {DEQ's} version of the EPA's CERCLIS)

- 6 sites identified that did not appear on CERCLIS list. .
- The report indicates the inability to locate the LARIS sites due to lack of record keeping by DEQ.

Spill Reports

- See Table 3 of the report for records (p. C-15) from ~1985 to 1993. All spills reported within ~1 to 2 miles from center of IHNC. Note, subsequent spill reports beyond 1993 were investigated for this Tier I investigation.

Resource Conservation and Recovery Act (RCRA) (Louisiana Records)

- Report says the RCRA only accounts for new compliance items and large facilities. CEMVN did not receive information (full history) from DEQ in time for inclusion in the report. The report only addressed sites on the canal or with a compliance history.
- See Table 7, p. C-28 for "RCRA Notifiers in Close Proximity to Project Area".
- See p. C-34 for description of researched sites.

Underground Storage Tanks (USTs)

- See Table 8, p. C-40 for active USTs w/in the project area.
- Most USTs on list are for gas and diesel storage.

Port of New Orleans

- Table 14 lists companies along the IHNC as recorded by the Port of New Orleans in 1990.

Land Use History

- Report focuses on areas of most probable excavation. See p. C-68 for detail of these.
- See A Land Use History of Areas Adjacent to the Inner Harbor Navigation Canal Lock, New Orleans. Final Report. November 1992. (Prepared by R. Christopher Goodwin & Associates, Inc.) for more detail of the land use history.

No new COCs were found in the documentation that did not already appear on the COC list.

C. ***A Land Use History of Areas Adjacent to the Inner Harbor Navigation Canal Lock, New Orleans***

This report was prepared in 1992 and compiled as much historical data of the project area as possible for identification of potential, adverse environmental conditions. The report authors researched the following for information: 1) Sanborn Fire Insurance Maps: 2) City Directories: and 3) records from environmental agencies.

The report summary indicates a concern that no information or records exists in environmental agencies (state or federal) for the following:

- Flintkote Asbestos Mill (1946 – 1957) @ block 854 near Galvez St. wharf
- Keasbey and Mattison (1946 – 1952) @ site of American Marine Corporation, which produced corrugated asbestos products.

Asbestos was detected in the EBIA surface soils (0-3 feet); therefore, asbestos was added to the SAP COC list. No other new COCs were found in the documentation that did not already appear on the COC list.

D. Inner Harbor Navigation Canal Lock Replacement Project – Design Documentation Report No.1, Site Preparation and Demolition, Volume 6

This report was completed prior to the TERC contract beginning. This report provided an initial site assessment for the designated TERC area. A COC list was developed for the TERC site. These compounds appear on the SAP COC list.

E. ***Risk Evaluation/Corrective Action Program (RECAP) Submittal Report – Criteria Document IHNC East Bank Industrial Area (EBIA) New Orleans, LA.*** June 2001

This report was prepared and submitted to DEQ in 2001 for the EBIA or TERC site. This document provided the framework for RECAP submittals that are being generated after sampling and analyzing the media at the six facilities that comprise the EBIA. Table 5 of the report lists the chemicals detected at the EBIA in the following media:

- Presence in Surface Soil 0-3 feet
- Presence in Potential Surface Soil 3-15 feet
- Presence in Sub-Surface Soil 15-36 feet
- Presence in Bank/Sediments
- Presence in Groundwater

Thirteen chemicals from Table 5 were added to the SAP COC list.

F. **National Pollutant Discharge Elimination System (NPDES)/Louisiana Pollutant Discharge Elimination System(LPDES) Permit Files**

Permit files were requested from DEQ in February of 2003. The request included current and historical facilities located on the IHNC and permitted to discharge into the IHNC. These files were received by CEMVN and reviewed for potential, additional COCs. The permit files did not reveal any COCs that were not already on the list.

G and H. Other Sampling Efforts

The results of sampling and analyses performed by the Port of New Orleans for the Florida Avenue Bridge Replacement and the Lake Pontchartrain Basin Foundation were reviewed for additional contaminants that should be added to the SAP COC list. The constituents detected by these other efforts already appear on the COC list; therefore, there were no new COCs to add to the list. In 2005, the CEMVN conducted additional Tier III tests on sediments collected in the IHNC near the Florida Ave Bridge (non-native sediments within IHNC lock replacement dredged material management units 1 and 2 NN). Based on poor survival of benthic organisms and proximity of sediment collection sites to suspected areas of contamination, sediment excavated as part of the lock replacement project from management units 1 and 2 were determined to be unsuitable for open water placement. Therefore, further Tier III benthic testing was not proposed as part of the lock replacement SAP.

Based on review of the aforementioned, existing information, a list of contaminants of concern has been developed and is included in this appendix (Table A1), and includes target detection limits for sediment, tissue and water.

Table A1. IHNC project-specific COC list and associated target detection limits for sediment, tissue and water. [a]

Contaminants of Concern (COC)	Target Detection Limits		
	Sediment	**Tissue**	**Water**
Metals and Cyanide	**(mg/kg)**	**(mg/kg)**	**(µg/L)**
Aluminum	50	1	40
Antimony (Total)	2.5	0.1	3
Arsenic (Total)	0.3[b]	0.1	1
Barium	2	10	10
Calcium	5[g]	350[b]	5000[g]
Beryllium (Total)	1[b]	0.1	0.2
Cadmium (Total)	0.1	0.1	0.01[c]
Chromium (Total)	1[b]	0.05[b]	1
Chromium +3	1	50	1
Chromium +6	1	50	1
Copper (Total)	1[b]	0.1	1
Cyanide (Total)	2	1	0.1[d]
Lead (Total)	0.3[b]	0.1	0.02[c]
Mercury (Total)	0.2	0.01	0.0002
Nickel (Total)	0.5[b]	0.1	1
Selinium (Total)	0.5[b]	0.2	2
Silver (Total)	0.2	0.1	1
Thallium (Total)	0.2	0.1	0.02[c]
Tin (Organotin)	0.01	0.01	0.01
Tin (Total)	0.01	0.01	0.01
Zinc (Total)	2[b]	0.1[b]	1
Base/Neutral compounds	(µg/kg)	(µg/kg)	(µg/L)
1,2,4-Trichlorobenzene	10	20	0.9[b]
1,2-Dichlorobenzene	20	20	0.8[b]
1,2-Diphenylhydrazine	10	100	1
1,3-Dichlorobenzene	20	20	0.9[b]
1,4-Dichlorobenzene	20	20	1[b]
2,4-Dinitrotoluene	200[b]	200	2[b]
2,6-Dinitrotoluene	200[b]	200	2[b]
2-Chloronapthalene	160[b]	160	0.8[b]
2-Methylnaphthalene	20[b]	20[b]	0.5[b]
3,3'-Dichlorobenzidine	300[b]	300	3[b]
4-Bromophenyl phenyl ether	160[b]	160	0.4[b]
4-Chlorophenyl phenyl ether	170[b]	170	0.6[b]
Acenaphthene	20	20	0.75[b]
Acenaphthylene	20	20	1.0[b]

Table A1. IHNC project-specific COC list and associated target detection limits for sediment, tissue and water. [a]

Contaminants of Concern (COC)	Target Detection Limits		
	Sediment	**Tissue**	**Water**
Base/Neutral compounds (cont)	(µg/kg)	(µg/kg)	(µg/L)
Anthracene	20	20	0.6[b]
Benzidine	5	5	1
Benzo(a)anthracene	20	20	0.4[b]
Benzo(a)pyrene	20	20	0.3[b]
Benzo(ghi)perylene	20	20	1.2[b]
Benzo(k)fluoranthene	20	20	0.6[b]
Bis(2-Chloroethoxy)methane	130[b]	130	1[b]
Bis(2-chloroethyl)ether	130[b]	130	0.9[b]
Bis(2-chloroisopropyl)ether	140[b]	200	0.7[b]
Bis(2-ethylhexyl)Phthalate	50	20	2[b]
Butyl Benzyl Phthalate	50	20	4[b]
Chrysene	20	20	0.3[b]
Dibenzo(a,h)anthracene	20	20	1.3[b]
Dibenzofuran	40[b]	100[b]	1[b]
Dimethyl Phthalate	50	20	1[b]
Di-n-butyl Phthalate	50	20	1[b]
Di-n-octyl Phthalate	50	20	3[b]
Fluoranthene	20	20	0.9[b]
Fluorene	20	20	0.6[b]
Hexachlorobenzene	10	20	0.4[b]
Hexachlorobutadiene	20	40	0.01
Hexachlorocyclopentadiene	300[b]	300	3.0[b]
Hexachloroethane	100	40	0.9[b]
Indeno(1,2,3-cd)pyrene	20	20	1.2[b]
Isophorone	10	100	1
Naphthalene	20	20	0.8[b]
Nitrobenzene	160[b]	160	0.9[b]
N-nitrosodimethylamine	100	100	3.1[b]
N-nitrosodi-n-propylamine	150[b]	150	0.9[b]
N-nitrosodiphenylamine	20	20	2.1[b]
Phenanthrene	20	20	0.5[b]
Pyrene	20	20	1.5[b]
Volatile compounds	(µg/kg)	(µg/kg)	(µg/L)
1,1,1-Trichloroethane	2		2
1,1,2,2-Tetrachloroethane	2		2
1,1,2-Trichloroethane	2		2
1,1-Dichloroethane	2		2

Table A1. IHNC project-specific COC list and associated target detection limits for sediment, tissue and water. [a]

Contaminants of Concern (COC)	Target Detection Limits		
	Sediment	Tissue	Water
Volatile compounds (cont)	(µg/kg)	(µg/kg)	(µg/L)
1,1-Dichloroethylene	2		2
1,2 Dichloroethene	2[b]		0.5[b]
1,2,4-Trimethylbenzene	2[b]		0.5[b]
1,2-Dichloroethane	2		2
1,2-Dichloropropane	2		2
1,3,5-Trimethylbenzene	2[b]		0.5[b]
1,3-Dichloropropylene	2		2
2-Butanone	2[b]		0.5[b]
2-Chloroethyl Vinyl Ether	100		2
2-hexanone (methyl-n-butyl ketone)	2[b]		0.5[b]
4-Methyl-2-pentanone	2[b]		0.5[b]
Acetone	5[b]		5[b]
Acrolein	100		100
Acrylonitrile	100		100
Benzene	2		2[b]
Bromoform	2		2
Carbon Disulfide	2[b]		0.5[b]
Carbon Tetrachloride	2		2
Chlorobenzene	5		5
Chlorodibromomethane	2		2
Chloroethane	2		2
Chloroform	2		2[b]
Cis-1,3-Dichloropropene	2[b]		0.5[b]
Dichlorobromomethane	2		2
Ethylbenzene	5		5
Isopropylbenzene	2[b]		0.5[b]
Methyl Bromide	5		5
Methyl Chloride	5		5
Methylene Chloride	5		5
p-Isopropyltoluene	2[b]		0.5[b]
sec-Butylbenzene	2[b]		0.5[b]
Styrene	2[b]		0.5[b]
Tetrachloroethylene	2		2b
Toluene	5		5
trans-1,2-Dichloroethylene	2		2
Trichloroethylene	2		2[b]
Vinyl Chloride	5		5

Table A1. IHNC project-specific COC list and associated target detection limits for sediment, tissue and water. [a]

Contaminants of Concern (COC)	Target Detection Limits		
	Sediment	**Tissue**	**Water**
Volatile compounds (cont)	(µg/kg)	(µg/kg)	(µg/L)
Xylene	2[b]		1[b]
2,4,6-Trichlorophenol	60	60	0.9[b]
2,4-Dichlorophenol	60	60	0.8[b]
2,4-Dimethylphenol	20	20	10
2,4-Dinitrophenol	500[b]	500	5[b]
2-Chlorophenol	110[b]	110	0.9[b]
2-Nitrophenol	200[b]	200	2[b]
4,6-Dinitro-o-Cresol	600	600	10
4-methylphenol	33[b]	20[b]	1[b]
4-Nitrophenol	500[b]	500	5[b]
Benzoic Acid	100[b]	100[b]	5[b]
Acid compounds	(µg/kg)	(µg/kg)	(µg/L)
p-Chloro-m-Cresol	140[b]	140	0.7[b]
Pentachlorophenol	100	100	0.2
Phenol	100	20	5
Pesticides / Hherbicides / PCBs / TPH	(µg/kg)	(µg/kg)	(µg/L)
2,4,5-T	20[e]		1.5[b]
2,4,5-TP	20[e]		1.5[b]
2,4-D	80[e]		15[b]
2,4-DB	80[e]		15[b]
4,4'-DDD [p,p-TDE]	2	10	0.0001
4,4'-DDE [p,p-DDX]	2	10	0.005
4,4'-DDT	2	10	0.00005
Aldrin	1	6[b]	0.01
Alpha -BHC	1	6[b]	0.01
Alpha-endosulfan	1	10	0.0009
Beta-BHC	1	6[b]	0.01
Beta-endosulfan	2	10	0.0009
BTEX (total)	3[b]		3[b]
Chlordane (alpha or gamma)	1	6[b]	0.0004
Dalapon	40[e]		2[e]
Delta-BHC	1	6[b]	0.01
Diazinon	48	0.1	0.1
Dicamba	40[e]		4.5[b]
Dichloroprop	10[b]		1.5[b]
Dieldrin	2	10	0.0002

Table A1. IHNC project-specific COC list and associated target detection limits for sediment, tissue and water. [a]

Contaminants of Concern (COC)	Target Detection Limits		
	Sediment	**Tissue**	**Water**
Pesticides / Hherbicides / PCBs / TPH (cont)	(µg/kg)	(µg/kg)	(µg/L)
Dinoseb	12[e]		3[b]
Endosulfan I	0.4[b]		0.01[b]
Endosulfan II	0.4[b]		0.01[b]
Endosulfan sulfate	2	10	0.0009
Endrin	2	10	0.0002
Endrin aldehyde	2	10	0.02
Gamma-BHC [Lindane]	1	6[b]	0.01
Heptachlor	1	6[b]	0.0004
Heptachlor epoxide	1	6[b]	0.0004
MCPA	50[b]		1[b]
MCPP	50[b]		400[e]
Methoxychlor	3.3[b]	10[b]	0.1[b]
PCB-1016	1	2	0.01
PCB-1221	1	2	0.01
PCB-1232	1	2	0.01
PCB-1242	1	2	0.01
PCB-1248	1	2	0.01
PCB-1254	1	2	0.01
PCB-1260	1	2	0.01
Total PCBs	1	2	0.01
Technical chlordane	20	20	0.2
Toxaphene	20	50	0.00002
TPH-D	30000[f]		250[f]
TPH-G	100[f]		100[f]
TPH-O	50000		1000
Conventional Parameters / Other	(µg/kg)	(µg/kg)	(µg/L)
Ammonia	0.1	-	0.03
Atterberg Limits	-	-	-
Dissolved Organic Carbon	-	-	-
Grain Size	1%	-	-
In Situ Solid Concentration	-	-	-
In Situ Water Content	-	-	-
Percent Solids/Total Solids	0.10%	-	-
Specific Gravity	-	-	-
TOC	0.10%	-	0.10%
Total Lipid (Tissue)	-	0.1%g	-

Table A1. IHNC project-specific COC list and associated target detection limits for sediment, tissue and water. [a]

Contaminants of Concern (COC)	Target Detection Limits		
	Sediment	**Tissue**	**Water**
Other	**MFL**		**MFL**
Asbestos	1		7

MFL=million fibers/liter
a The primary source of these TDLs was EPA 823-B-95-001, QA/QC Guidance for Sampling and Analysis of Sediments, Water and Tissues for Dredged Material Evaluations.
b These values are based on recommendations from the EPA Region 6 Laboratory in Houston and were based on data or other technical basis.
c The values in parentheses are based on EPA "clean techniques", (EPA 1660 series methods) which are applicable in instances where other TDLs are inadequate to assess EPA water quality criteria.
d This value recommended by Houston Lab using colorimetric method.
e Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd ed., December 1996.
f These values are based on recommendations from the EPA Region 8 Laboratory in Golden, Colorado.
g Sweat, M.J. 1999. USGS administrative report.

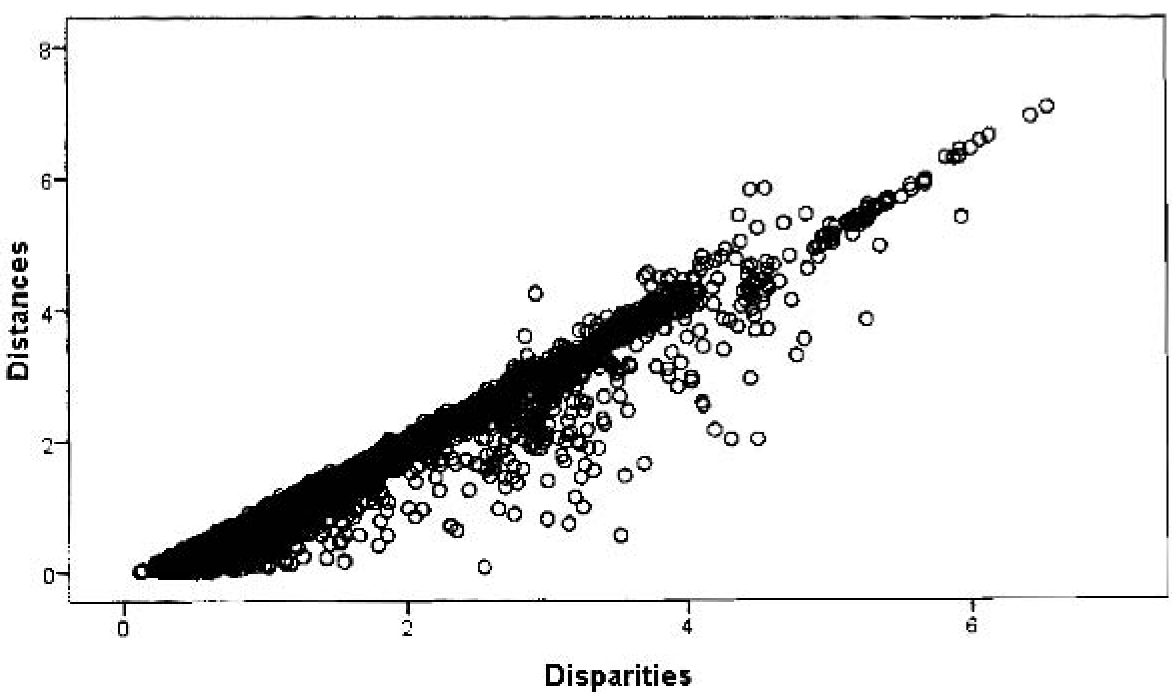
Appendix B: Multidemensional Scaling (MDS) – Data and Model Output

Alscal (Dataset 1 Metals)

```
Iteration history for the 2 dimensional solution (in squared distances)

                 Young's S-stress formula 1 is used.

               Iteration     S-stress      Improvement

                   1          .35815
                   2          .21075          .14740
                   3          .19792          .01282
                   4          .19717          .00076

                      Iterations stopped because
               S-stress improvement is less than   .001000


           Stress and squared correlation (RSQ) in distances

 RSQ values are the proportion of variance of the scaled data (disparities)
           in the partition (row, matrix, or entire data) which
           is accounted for by their corresponding distances.
             Stress values are Kruskal's stress formula 1.


                              For  matrix
               Stress  =    .15947      RSQ =  .95603
```

Scatterplot of Linear Fit

Euclidean distance model



Station ID		MDS Coordinates				Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS X	Inverse MDS Y	Aluminum	Antimony	Arsenic
1	1.01	0.7779	-0.0298	-0.7779	0.0298	-0.5779	-0.3221	-0.3289
2	1.02	-1.4566	0.5393	1.4566	-0.5393	-0.0592	0.6990	0.2392
3	1.03	-0.1903	-0.3482	0.1903	0.3482	0.4869	-0.3490	0.2392
4	1.04	-1.0582	-0.4772	1.0582	0.4772	0.9783	0.3407	0.8704
5	1.05	-1.9390	-0.3522	1.9390	0.3522	0.9510	0.8781	1.5016
6	1.06	-1.0528	-0.6025	1.0528	0.6025	0.3777	0.2511	0.4917
7	2.01	-2.8848	-0.1815	2.8848	0.1815	1.4152	0.4303	0.6811
8	2.02	-1.3337	-0.3705	1.3337	0.3705	1.1422	1.0573	0.8704
9	2.03	-0.7010	-0.6792	0.7010	0.6792	1.1968	-0.2504	1.1860
10	2.04	-0.4795	-0.5224	0.4795	0.5224	0.9237	-0.1071	0.6179
11	2.05	-0.6073	-0.4734	0.6073	0.4734	0.8145	-0.1071	0.6811
12	2.06	-0.4197	-0.3384	0.4197	0.3384	0.5688	0.1616	0.6811
13	3.01	1.5121	0.5062	-1.5121	-0.5062	-1.6018	-0.3310	-1.6544
14	3.02	1.5070	0.4703	-1.5070	-0.4703	-1.4762	-0.6087	-1.9700
15	3.03	1.8354	0.6897	-1.8354	-0.6897	-1.8011	-0.4833	-2.2856
16	3.04	-1.7054	-1.0118	1.7054	1.0118	2.4527	-0.1071	1.5647
17	3.05	-1.8386	-1.1726	1.8386	1.1726	2.8076	0.0720	1.7541
18	3.06	-0.5141	-0.4802	0.5141	0.4802	0.8964	0.1616	0.5548
19	4.01	-0.8528	-0.1959	0.8528	0.1959	0.5415	-0.4564	1.0598
20	4.02	-1.1839	-0.5056	1.1839	0.5056	1.6063	0.0720	1.3754
21	4.03	-0.8424	-0.5517	0.8424	0.5517	1.4152	-0.0176	0.8704
22	4.04	-0.1259	3.1803	0.1259	-3.1803	-0.9410	0.9677	-1.2125
23	4.05	-1.7245	2.7720	1.7245	-2.7720	-0.7390	0.6094	-0.2657
24	4.06	-2.2825	1.9986	2.2825	-1.9986	-0.7117	4.0130	0.9335
25	4.07	0.8968	0.8025	-0.8968	-0.8025	-1.1649	0.0720	-1.4019
26	4.08	0.3245	0.7917	-0.3245	-0.7917	-0.6571	-0.1071	-1.0232
27	5.01	-1.0946	-0.4991	1.0946	0.4991	1.5790	0.1616	0.9335
28	5.02	-0.6781	-0.6501	0.6781	0.6501	1.7155	-0.0176	1.0598
29	5.03	-0.5722	-0.3787	0.5722	0.3787	0.5688	-0.5371	0.8704
30	5.04	-0.5810	0.5565	0.5810	-0.5565	-0.6707	-0.4654	0.5548

	Analyte Z-Scores								
DMMU.Site	Barium	Berylium	Cadmium	Calcium	Chromium	Trivalent Chrom	Copper	Lead	Mercury
1.01	-0.4821	-0.8379	-0.7546	-0.2388	-0.6046	-0.6040	-0.4078	-0.4037	-0.5025
1.02	1.5655	-0.3734	2.8765	-0.3041	0.6430	0.6994	0.6474	0.6005	1.6124
1.03	0.3479	0.0910	0.1268	-0.2468	0.1814	0.2171	-0.1153	-0.1378	0.2961
1.04	2.2040	0.5555	0.9376	-0.2815	0.6929	0.7515	0.1417	0.0848	0.6471
1.05	3.5950	0.5555	1.8189	-0.3535	1.2918	1.3771	0.5271	0.6005	1.7002
1.06	3.5494	0.2768	0.9023	-0.3261	0.1939	0.2302	0.1007	0.0427	0.7349
2.01	0.4186	0.8341	0.7613	-0.2468	2.4521	2.5891	-0.0169	2.2759	0.8226
2.02	1.0616	0.6948	1.1491	-0.3615	1.2045	1.2858	0.2264	0.9139	1.6124
2.03	0.8062	0.7877	0.5851	-0.2388	0.8177	0.8618	-0.0716	0.0200	0.3838
2.04	-0.0968	0.6484	0.2325	-0.2211	0.3686	0.4126	-0.0442	0.5140	0.7349
2.05	0.9772	0.6019	0.6556	-0.2449	0.4559	0.5039	0.0542	0.0773	0.6471
2.06	0.7857	0.0910	0.3030	0.7061	0.4060	0.4517	-0.1180	0.3010	0.4716
3.01	-0.7653	-1.9990	-1.1071	-0.1614	-1.3781	-1.4120	-0.7304	-0.4783	-0.7570
3.02	-0.7724	-1.5345	-1.0366	-0.1949	-1.2035	-1.2295	-0.7058	-0.4881	-0.8184
3.03	-0.8223	-2.2312	-1.3891	-0.3840	-1.4904	-1.5293	-0.7577	-0.5918	-0.8623
3.04	1.0662	2.1346	1.8189	-0.3688	1.9156	2.0287	0.3358	0.3118	0.7349
3.05	1.2896	2.1346	1.4311	-0.3291	1.9156	2.0287	0.3604	0.4491	0.7349
3.06	-0.1082	1.0199	0.4793	-0.1174	0.6181	0.6733	-0.0497	0.1400	0.3838
4.01	1.7024	0.2304	0.9729	-0.4408	0.7054	0.7645	0.5107	0.1843	0.4716
4.02	1.2304	1.1128	0.6203	-0.4963	1.1047	1.1816	0.9181	0.1983	0.4716
4.03	1.0571	1.2057	0.6908	-0.3035	0.8302	0.8948	0.1799	0.3129	0.7349
4.04	2.2040	-0.9307	0.1268	-0.1540	-0.2802	-0.2651	0.5709	0.1162	0.2961
4.05	2.1812	-0.9772	0.4441	-0.2596	1.8408	1.9505	7.4982	4.0163	0.7349
4.06	2.0900	-0.6985	0.7261	-0.1052	3.8245	4.0228	3.4796	3.0110	1.5246
4.07	-0.1264	-1.4416	-0.6841	-0.3877	-0.6046	-0.6040	0.4478	-0.3670	-0.6078
4.08	0.2658	-1.3023	-0.1905	-0.4469	0.4434	0.4908	0.9345	0.1865	-0.4849
5.01	1.7024	0.6484	0.8318	-0.3950	1.2169	1.2989	0.1499	0.3054	0.8226
5.02	0.7333	0.8341	0.5498	-0.3303	0.5183	0.5690	0.0050	0.0016	0.4716
5.03	1.1870	0.3233	0.2678	-0.3340	0.6680	0.7254	0.0870	0.0135	0.6471
5.04	-0.1857	-0.4663	0.1973	-0.2279	0.2438	0.2823	1.7737	0.6221	2.1389

	Analyte Z-Scores							
DMMU.Site	Nickel	Selenium	Silver	Thalium	Tin	Tributyl Tin	Zinc	Cyanide
1.01	-1.4484	0.5893	-0.3047	-0.2874	-0.0884	-0.2598	-0.5964	-0.2337
1.02	-0.2319	1.5159	1.2847	0.2535	1.3086	1.5341	0.8511	-0.2027
1.03	-0.3144	1.0526	0.5254	0.4337	0.3671	-0.2303	0.0386	-0.3074
1.04	0.2216	1.6703	0.8291	0.9745	0.3671	0.2949	0.4021	-0.2415
1.05	1.0670	1.9792	1.2341	0.9745	0.8530	0.1061	0.8511	-0.2221
1.06	-0.0258	1.8248	0.7785	0.4337	0.2153	-0.2126	0.2310	-0.2453
2.01	0.3660	1.5159	0.4242	0.6140	7.3825	-0.2244	0.4021	0.7323
2.02	0.4072	1.8248	0.4748	0.4337	0.0938	-0.2185	0.8511	1.0039
2.03	0.4278	1.5159	0.3736	0.7943	-0.0884	-0.2185	0.0600	-0.1173
2.04	0.2216	1.5159	0.1711	0.6140	0.2760	-0.2244	-0.1421	-0.1794
2.05	0.1598	1.5159	0.3736	0.4337	0.1849	-0.2185	0.1455	-0.1794
2.06	-0.0464	1.3615	0.1711	0.4337	-0.1188	-0.2362	0.0600	-0.2376
3.01	-1.6752	-0.5072	-0.3452	-1.7295	-0.2706	-0.2421	-0.8370	-0.3113
3.02	-1.2628	-0.5072	-0.5173	-2.2703	-0.4650	-0.2421	-0.7985	-0.2628
3.03	-2.1494	-0.7079	-0.6034	-2.4506	-0.4589	-0.2421	-0.9417	-0.3268
3.04	1.9329	0.7437	1.1329	1.8759	0.2760	-0.2185	0.8725	-0.1096
3.05	1.9329	1.0526	0.7785	1.8759	0.2153	0.0943	0.8511	2.4393
3.06	0.5309	0.4349	0.3230	0.9745	0.1242	-0.2244	0.1990	-0.1794
4.01	0.6134	0.1260	0.6267	0.4337	0.0331	0.7080	0.8725	-0.2221
4.02	0.6752	-0.7697	0.8798	0.7943	0.2760	0.1651	1.0756	1.4306
4.03	0.7165	-0.8160	0.2217	0.9745	0.0331	-0.1594	0.4876	0.7711
4.04	-0.5412	-1.0631	-0.3857	-0.8282	-0.2099	9.0874	0.3379	-0.2550
4.05	-0.6443	-1.1866	-0.1832	-0.8282	0.1849	2.1242	1.8347	-0.2570
4.06	0.1598	-0.8315	-0.1326	-0.8282	0.1546	2.1242	0.9901	-0.2395
4.07	-1.4072	-1.2947	-0.4515	-1.5492	0.0331	0.6372	0.3166	0.0728
4.08	-1.1597	-0.0284	-0.2845	-1.5492	0.2153	0.0707	0.1883	1.1203
5.01	0.2629	1.3615	0.4748	0.7943	0.1242	-0.1535	0.5945	-0.2453
5.02	0.2629	1.3615	0.3230	0.7943	-0.0277	-0.1594	0.1027	-0.1600
5.03	0.7165	0.2804	0.3230	0.6140	-0.1188	-0.2126	0.6052	-0.2259
5.04	0.4072	-0.0284	-0.1326	-0.1071	0.3064	-0.1948	0.7976	0.3831

Station ID		MDS Coordinates				Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS X	Inverse MDS Y	Aluminum	Antimony	Arsenic
31	5.05	-1.7848	1.7925	1.7848	-1.7925	-0.3049	-0.4296	-0.2657
32	5.06	-2.4207	1.3147	2.4207	-1.3147	-0.0046	0.5199	0.4286
33	5.07	-0.0822	-0.4689	0.0822	0.4689	0.8418	0.0720	0.3655
34	5.08	1.6171	1.1532	-1.6171	-1.1532	-2.2188	0.3407	-2.2225
35	6.01	0.4792	-0.0637	-0.4792	0.0637	-0.2994	-0.1250	-0.3920
36	6.02	0.7213	-0.0976	-0.7213	0.0976	-0.5643	-0.3221	-0.0133
37	6.03	0.0045	-0.7286	-0.0045	0.7286	0.2685	-0.0176	1.2491
38	6.04	0.4540	-0.2757	-0.4540	0.2757	0.0227	-0.1430	-0.2657
39	6.05	0.7358	-0.0832	-0.7358	0.0832	-0.2612	-0.4475	-0.9601
40	6.06	0.4685	0.0707	-0.4685	-0.0707	-0.5670	-0.2504	0.3023
41	7.01	0.7162	0.7088	-0.7162	-0.7088	-1.4106	0.3407	-0.2026
42	7.02	-2.3841	1.3769	2.3841	-1.3769	0.0773	4.7296	0.1761
43	7.03	-0.9296	1.9580	0.9296	-1.9580	-1.2960	3.2069	-0.5182
44	7.04	-1.1116	0.3294	1.1116	-0.3294	1.0875	0.2511	0.3655
45	7.05	0.6117	0.0613	-0.6117	-0.0613	-0.9137	-0.1071	-0.2657
46	7.06	1.8141	2.5841	-1.8141	-2.5841	-1.0284	0.1616	-1.4650
47	7.07	0.6626	-0.0371	-0.6626	0.0371	-0.4250	-0.1967	-0.8338
48	7.08	0.2909	-0.0935	-0.2909	0.0935	-0.1138	0.0720	0.0499
49	7.09	0.0733	-0.2073	-0.0733	0.2073	0.0500	-0.0176	0.1130
50	8.01	-0.5691	-0.6453	0.5691	0.6453	1.2787	-0.0176	0.2392
51	8.02	-0.9183	-0.7102	0.9183	0.7102	1.6063	-0.1340	1.1860
52	8.03	-1.2889	-0.5944	1.2889	0.5944	1.4971	0.2511	0.9967
53	8.04	-0.7889	-0.5172	0.7889	0.5172	1.2787	-0.1340	0.7442
54	9.02	0.4780	-0.2622	-0.4780	0.2622	-0.4004	-0.6535	-0.0133
55	9.04	-0.8928	-2.5941	0.8928	2.5941	0.5415	-0.3848	0.8073
56	10.01	0.2543	-0.1696	-0.2543	0.1696	-0.6271	-0.2236	-0.3289
57	10.03	1.5260	0.5544	-1.5260	-0.5544	-1.8338	-0.6893	-1.7806
58	10.04	2.2470	1.1882	-2.2470	-1.1882	-2.2816	-0.7162	-2.9799
59	3.01N	0.6999	-0.1099	-0.6999	0.1099	-0.4496	-0.2236	-0.5182
60	3.02N	0.4259	-0.3856	-0.4259	0.3856	0.2412	-0.4744	-0.5813

	Analyte Z-Scores								
DMMU.Site	Barium	Berylium	Cadmium	Calcium	Chromium	Trivalent Chrom	Copper	Lead	Mercury
5.05	-0.3521	1.6701	-0.2258	-0.2193	0.1565	0.1911	3.0149	0.3821	0.9981
5.06	1.2075	0.0446	1.8189	-0.1626	2.0778	2.1982	0.9454	5.6701	4.0695
5.07	-0.5049	0.1839	-0.1200	-0.0991	0.1814	0.2171	-0.1044	-0.4070	-0.1427
5.08	-0.6828	-2.7421	-1.5301	-0.1052	-0.9165	-0.9298	-0.3313	-0.3184	-0.6429
6.01	-0.4069	-0.0019	-0.0847	-0.0991	-0.2927	-0.2781	-0.3395	-0.4794	-0.5639
6.02	-0.6167	-0.6521	-0.3668	-0.0503	-0.8666	-0.8776	-0.4680	-0.5562	-0.6166
6.03	-0.2267	1.6701	0.1973	-0.2285	-0.2428	-0.2260	-0.2438	-0.3670	-0.5727
6.04	-0.5505	0.4626	-0.4020	-0.0930	-0.4175	-0.4085	-0.3887	-0.4891	-0.5727
6.05	-0.5939	-0.2805	-0.5783	-0.1522	-0.7543	-0.7603	-0.3860	-0.5281	-0.5902
6.06	-0.6007	-0.6985	-0.4020	0.1388	-0.7918	-0.7994	-0.0224	-0.1897	0.6471
7.01	-0.1469	-1.4881	-0.7193	-0.3462	-0.4798	-0.4736	-0.3531	-0.2232	-0.5815
7.02	1.1186	0.4626	2.8765	-0.0564	1.9031	2.0157	0.5599	2.1895	0.9104
7.03	0.5372	-1.0701	2.5240	0.0473	-0.0681	-0.0435	-0.0524	2.0057	0.6471
7.04	1.4287	0.8806	0.1973	1.7859	1.1421	1.2207	0.2948	2.1570	0.2961
7.05	-0.5733	-0.4663	-0.3315	0.1327	-0.8042	-0.8125	-0.2356	-0.4697	-0.1427
7.06	-0.5346	-0.9772	-0.7193	9.0697	-0.9539	-0.9689	-0.5527	-0.5086	-0.5727
7.07	-0.6212	0.0446	-0.2610	-0.1357	-0.6795	-0.6821	-0.3723	-0.5248	-0.4762
7.08	-0.5619	0.4161	0.0915	0.5780	-0.3551	-0.3433	-0.2821	-0.2157	0.0328
7.09	-0.5619	0.8806	-0.0142	0.2181	0.0816	0.1129	-0.2165	0.1702	-0.0549
8.01	-0.4570	0.7412	0.4441	-0.2169	0.4185	0.4648	-0.1481	0.0881	2.0512
8.02	1.0297	0.8806	1.0786	-0.4078	0.8801	0.9470	0.1007	-0.0589	0.1206
8.03	1.0821	0.6019	1.2901	-0.4584	1.7534	1.8593	0.0022	0.4059	0.9104
8.04	1.4743	0.6948	1.2549	-0.4682	0.6929	0.7515	-0.0060	-0.0243	0.2961
9.02	-0.5961	-0.2341	-0.5430	0.0534	-0.3800	-0.3694	-0.3258	-0.4146	-0.5639
9.04	0.4847	0.4626	0.4793	-0.2797	0.5807	0.6342	-0.0552	-0.1130	0.2083
10.01	-0.6053	0.0446	0.5146	-0.2834	0.0317	0.0607	-0.3668	-0.4340	-0.2392
10.03	-0.7389	-1.8132	-1.1071	0.0229	-1.4655	-1.5032	-0.5718	-0.5043	-0.7219
10.04	-0.8784	-2.5098	-1.4949	2.4569	-1.8273	-1.8812	-0.7769	-0.5421	-0.8535
3.01N	-0.6007	-0.4663	-0.5783	-0.1052	-0.8167	-0.8255	-0.4379	-0.5367	-0.6253
3.02N	-0.5574	0.6484	-0.4373	-0.0625	-0.3925	-0.3824	-0.3696	-0.5259	-0.6517

DMMU.Site	Analyte Z-Scores							
	Nickel	Selenium	Silver	Thalium	Tin	Tributyl Tin	Zinc	Cyanide
5.05	2.3246	-0.1828	-0.1832	-0.2874	4.3759	-0.2067	4.9671	-0.1794
5.06	0.6958	-0.3373	0.2723	0.2535	1.2479	0.4248	1.9843	-0.2531
5.07	0.6752	0.7437	0.1711	0.6140	-0.0884	-0.2067	-0.3313	-0.2259
5.08	-1.9844	-1.2947	-0.6287	-2.7931	-0.1188	-0.2421	-0.4254	-0.2647
6.01	0.0361	-0.8315	-0.3604	-0.1071	-0.3314	-0.2008	-0.3933	-0.2337
6.02	-0.6031	-0.0284	-0.3149	0.0732	-0.4437	-0.2244	-0.7055	-0.2434
6.03	1.0051	-0.6307	-0.2946	0.6140	-0.3010	-0.2126	-0.4831	-0.2434
6.04	0.4072	0.7388	-0.3604	0.4337	-0.3162	-0.2244	-0.5686	-0.2473
6.05	-0.5824	0.1260	-0.3250	-0.1071	-0.4255	-0.2244	-0.6264	-0.2550
6.06	-0.0258	-0.0284	-0.3351	-0.4676	-0.2403	-0.2303	-0.1324	-0.2570
7.01	-0.2526	-0.6770	0.6084	-1.7295	-0.3010	-0.1004	1.3215	-0.2453
7.02	0.6958	-0.8932	0.3736	-0.4676	0.4886	0.1297	3.3421	3.5644
7.03	-0.6855	-0.4917	0.0192	-1.0084	0.2153	0.1179	4.3470	-0.2201
7.04	0.4691	-0.5844	0.3230	0.2535	0.2457	-0.1299	1.0328	0.3056
7.05	0.6958	-0.8315	-0.4870	-0.2874	0.0331	-0.2303	-0.3260	-0.2473
7.06	-1.1804	-1.6654	-0.5325	-0.4676	-0.4255	-0.2244	-0.7600	-0.2492
7.07	0.1082	-0.7388	-0.3857	-0.1071	-0.3951	-0.2126	-0.6114	-0.2453
7.08	0.3660	-0.8160	-0.2997	0.0732	-0.2403	-0.2185	-0.2885	-0.2473
7.09	0.6546	-0.7697	-0.2339	0.2535	-0.3010	-0.2126	-0.0576	-0.2415
8.01	0.4484	1.0526	0.0699	0.9745	-0.1188	-0.1689	-0.3302	-0.2182
8.02	0.8402	1.5159	0.5254	1.1548	0.0634	-0.0001	0.3059	-0.1794
8.03	0.8195	1.5159	0.9304	1.1548	0.3368	-0.2185	0.1990	-0.1794
8.04	0.3247	1.0526	0.6267	0.6140	0.0027	-0.2185	0.3273	-0.2841
9.02	0.3660	-0.3373	-0.2845	0.9745	-0.3435	-0.2126	-0.3655	-0.2376
9.04	0.9020	-0.1828	0.3736	1.1548	-0.0277	-0.1712	0.3166	8.3363
10.01	0.5928	-0.5844	0.0192	0.2535	-0.1795	-0.2539	-0.3783	-0.2337
10.03	-1.4690	-0.8623	-0.4920	-1.7295	-0.4437	-0.2244	-0.6969	-0.2550
10.04	-3.1184	-1.6654	-0.6439	-2.5768	-0.5136	-0.2421	-0.9909	-0.2725
3.01N	-0.4381	0.4349	-0.3300	0.0732	-0.3800	-0.2008	-0.7033	-0.3074
3.02N	0.3660	0.5893	-0.2845	0.2535	-0.3891	-0.2008	-0.6028	-0.2162

Station ID		MDS Coordinates				Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS X	Inverse MDS Y	Aluminum	Antimony	Arsenic
61	3.03N	0.8547	0.0000	-0.8547	0.0000	-0.5752	-0.3848	-0.6445
62	3.04N	0.0645	-0.6529	-0.0645	0.6529	1.0329	-0.5908	0.8073
63	3.05N	0.8038	-0.0965	-0.8038	0.0965	-0.0865	-0.7162	-0.2026
64	3.06N	0.5775	-0.3026	-0.5775	0.3026	0.3504	-0.5281	-0.2026
65	45.01N	1.6297	0.6376	-1.6297	-0.6376	-1.3533	-0.1519	-1.1494
66	45.02N	1.0089	0.1079	-1.0089	-0.1079	-0.4578	-0.5639	-0.2657
67	45.03N	1.1526	0.2223	-1.1526	-0.2223	-0.7008	-0.6624	-0.0133
68	45.04N	0.4343	-0.1988	-0.4343	0.1988	-0.0592	-0.4744	-0.0133
69	45.05N	0.1705	-0.4566	-0.1705	0.4566	0.4596	-0.2863	0.7442
70	45.06N	-0.5205	-1.2560	0.5205	1.2560	1.1149	-0.3042	2.0697
71	45.07N	0.4855	-0.3186	-0.4855	0.3186	0.2139	-0.4654	-0.1395
72	45.08N	0.2575	-0.4645	-0.2575	0.4645	0.9510	-0.3131	0.4286
73	45.09N	0.6750	-0.2064	-0.6750	0.2064	0.7326	-0.5460	-0.2657
74	45.10N	0.7266	-0.2043	-0.7266	0.2043	0.5142	-0.6177	0.0499
75	45.11N	1.7713	0.6932	-1.7713	-0.6932	-1.4762	-0.1071	-1.2757
76	45.12N	0.6130	-0.1031	-0.6130	0.1031	-0.5179	-0.8147	-0.0133
77	45.13N	0.7774	-0.0254	-0.7774	0.0254	-0.6953	-0.6804	-0.3920
78	45.15N	0.5426	-0.2554	-0.5426	0.2554	0.0227	-0.7610	-0.0133
79	45.16N	0.5028	-0.3232	-0.5028	0.3232	-0.1738	-0.6983	0.6811
80	6.01N	0.4582	-0.2690	-0.4582	0.2690	0.0227	-0.1877	-0.2657
81	6.02N	0.5674	-0.2346	-0.5674	0.2346	-0.1575	-0.3490	-0.0133
82	6.03N	0.0562	-0.7446	-0.0562	0.7446	0.7326	-0.2146	-0.4551
83	6.04N	0.4661	-0.2034	-0.4661	0.2034	-0.0319	-0.0176	-0.5182
84	6.05N	0.4955	-0.2518	-0.4955	0.2518	-0.0319	-0.4027	0.0499
85	6.06N	0.4581	-0.2789	-0.4581	0.2789	0.1593	-0.5012	-0.0764
86	7.01N	0.6963	-0.0917	-0.6963	0.0917	-1.1049	-0.2236	-0.3289
87	7.02N	0.4055	0.2048	-0.4055	0.2048	-0.8045	0.0720	0.6179
88	7.03N	0.4953	-0.1103	-0.4953	0.1103	-0.9165	-0.3221	0.1761
89	7.05N	0.5035	-0.2020	-0.5035	0.2020	-0.6598	-0.5012	-0.0133
90	7.06N	0.4364	-0.2899	-0.4364	0.2899	-0.1411	-0.0176	-0.2026

DMMU.Site	Analyte Z-Scores								
	Barium	Berylium	Cadmium	Calcium	Chromium	Trivalent Chrom	Copper	Lead	Mercury
3.03N	-0.6531	-0.7914	-0.6136	-0.1528	-0.9165	-0.9298	-0.5199	-0.5626	-0.6780
3.04N	-0.6942	1.2057	-0.4020	-0.1174	0.1565	0.1911	-0.3449	-0.4686	-0.6078
3.05N	-0.7790	-0.1876	-1.0718	-0.2882	-0.4299	-0.4215	-0.5308	-0.5637	-0.7921
3.06N	-0.7742	0.4626	-1.0366	-0.1449	-0.2553	-0.2390	-0.4543	-0.5518	-0.7833
45.01N	-0.8499	-1.7203	-1.7487	-0.2821	-1.1536	-1.1774	-0.7441	-0.6080	-0.7745
45.02N	-0.7968	-0.4199	-1.2481	0.0351	-0.6171	-0.6170	-0.5718	-0.5637	-0.7306
45.03N	-0.8166	-0.7450	-1.3186	0.7732	-0.7044	-0.8385	-0.5855	-0.5778	-0.7043
45.04N	-0.1401	0.2768	-0.5430	0.0534	-0.3676	-0.3563	-0.2821	-0.4567	-0.3621
45.05N	-0.5505	0.7877	-0.4725	0.0839	-0.1430	-0.1217	-0.0798	-0.3832	0.1206
45.06N	-0.3955	1.6701	0.2325	0.4194	0.4309	0.4778	-0.0196	-0.3162	-0.3972
45.07N	-0.6258	0.4626	-0.6136	0.0961	-0.3052	-0.2912	-0.3258	-0.5237	-0.6429
45.08N	-0.4958	-0.0019	-0.4020	-0.0320	-0.2054	-0.1869	-0.3285	-0.4935	-0.6341
45.09N	-0.7558	-0.2805	-0.8956	-0.3072	-0.3052	-0.2912	-0.5308	-0.5518	-0.6166
45.10N	-0.7651	-0.3734	-1.0013	-0.2584	-0.4299	-0.4215	-0.5308	-0.5551	-0.6517
45.11N	-0.9024	-1.9525	-1.7910	-0.6018	-1.2409	-1.2686	-0.7906	-0.6167	-0.8974
45.12N	-0.6144	-0.6521	-0.5078	0.0412	-0.6171	-0.6170	-0.2383	-0.5281	-0.5990
45.13N	-0.6600	-0.8379	-0.7546	0.0473	-0.7044	-0.7082	-0.4133	-0.4286	-0.6166
45.15N	-0.6167	-0.0483	-0.7193	0.0778	-0.4050	-0.3954	-0.3860	-0.4870	-0.6429
45.16N	-0.6144	-0.4199	-0.6841	0.0595	-0.4299	-0.4215	-0.3613	-0.5324	-0.6078
6.01N	-0.5984	0.5090	-0.1905	0.0351	-0.4299	-0.4215	-0.3340	-0.5248	-0.5902
6.02N	-0.6440	-0.2805	-0.5783	0.0778	-0.6545	-0.6561	-0.3860	-0.5335	-0.6517
6.03N	-0.4434	1.6701	0.3735	-0.2041	-0.1056	-0.0826	-0.1782	-0.4848	-0.5376
6.04N	-0.5460	0.3697	-0.1905	-0.0991	-0.5297	-0.5258	-0.3176	-0.5183	-0.4937
6.05N	-0.5642	0.1375	-0.2963	-0.0503	-0.6545	-0.6561	-0.3559	-0.5248	-0.5551
6.06N	-0.5756	0.2304	-0.2258	-0.1113	-0.6046	-0.6040	-0.2985	-0.4945	-0.4849
7.01N	-0.6167	-0.6521	-0.2610	0.0839	-0.8916	-0.9037	-0.3094	-0.5140	-0.6692
7.02N	-0.5711	-0.1412	-0.2963	0.0717	-0.5422	-0.5388	-0.2493	-0.3205	-0.7570
7.03N	-0.5300	-0.2805	-0.1905	0.0290	-0.6919	-0.6952	-0.2930	-0.3324	-0.5639
7.05N	-0.6281	-0.0483	-0.3668	0.0290	-0.5921	-0.5909	-0.2657	-0.3919	-0.6341
7.06N	-0.5414	0.7412	-0.0847	-0.1357	-0.6420	-0.6431	-0.3012	-0.5335	-0.5990

	Analyte Z-Scores							
DMMU.Site	Nickel	Selenium	Silver	Thalium	Tin	Tributyl Tin	Zinc	Cyanide
3.03N	-0.6443	0.1260	-0.3958	-0.4676	-0.4194	-0.2008	-0.7547	-0.2686
3.04N	0.5309	0.2804	-0.1832	0.2535	0.0027	-0.2008	-0.3805	-0.2259
3.05N	-0.9329	-0.1828	-0.3705	-0.8282	-0.4285	-0.2126	-0.6873	-0.2434
3.06N	-0.4381	0.1260	-0.3199	-0.1071	-0.3951	-0.2244	-0.6445	-0.2473
45.01N	-2.7473	-0.9396	-0.3300	-2.2703	-0.5136	-0.2244	-0.9193	-0.3385
45.02N	-1.2834	-1.1249	-0.6186	-1.0084	-0.4377	-0.2126	-0.6542	-0.2376
45.03N	-1.5102	-1.2484	-0.6844	-1.1887	-0.4589	-0.2126	-0.7076	-0.2453
45.04N	0.3866	-0.8315	-0.4617	0.2535	-0.3982	-0.2185	-0.3912	-0.2453
45.05N	0.5928	-0.8623	-0.4617	0.7943	-0.3830	-0.2185	-0.3516	-0.2376
45.06N	2.2628	-0.4917	-0.2339	2.2364	-0.3435	-0.2185	-0.1613	-0.2473
45.07N	0.4484	-0.9859	-0.4566	0.6140	-0.4134	-0.2185	-0.4318	-0.2376
45.08N	0.2010	0.4349	-0.1832	0.6140	-0.3496	-0.2126	-0.5590	-0.2376
45.09N	-0.9742	-0.0284	-0.3351	-0.4676	-0.4012	-0.2126	-0.7183	-0.2453
45.10N	-1.0979	0.2804	-0.3300	-0.6479	-0.4194	-0.2126	-0.7375	-0.2356
45.11N	-3.0978	-0.9087	-0.6540	-2.2703	-0.5227	-0.2303	-0.9866	-0.3385
45.12N	0.1392	-0.3373	-0.3553	0.2535	-0.3830	-0.2126	-0.1111	-0.3346
45.13N	-0.2113	-0.4917	-0.4009	-0.1071	-0.4832	-0.2244	-0.5515	0.2668
45.15N	0.2216	-0.4917	-0.3604	0.4337	-0.4042	-0.2185	-0.4810	-0.2395
45.16N	0.4691	-0.3373	-0.3553	0.6140	-0.4285	-0.2126	-0.4746	-0.2376
6.01N	0.5309	-0.8932	-0.3553	0.4337	-0.3830	-0.2067	-0.5793	-0.2376
6.02N	-0.0670	0.2804	-0.3047	0.4337	-0.4619	-0.2185	-0.6232	-0.2434
6.03N	1.3968	-0.3373	-0.2339	0.9745	-0.3496	-0.1830	-0.5141	-0.2104
6.04N	0.0155	-0.3373	-0.3807	0.4337	-0.3192	-0.2008	-0.5932	-0.2162
6.05N	-0.2319	0.4349	-0.2339	0.0732	-0.4225	-0.1948	-0.6178	-0.2221
6.06N	-0.3557	0.4349	-0.2339	0.2535	-0.4012	-0.1889	-0.5579	-0.2124
7.01N	0.4484	-0.5226	-0.2845	0.7943	-0.3435	-0.2067	-0.4681	-0.2318
7.02N	0.6340	-0.3373	-0.1832	0.6140	-0.3496	-0.2067	-0.1934	-0.2337
7.03N	0.4072	-0.3373	-0.2339	0.4337	-0.3708	-0.2067	-0.0683	-0.2298
7.05N	0.6134	-0.5226	-0.1832	0.6140	-0.3374	-0.2067	-0.2843	-0.2259
7.06N	0.5928	-0.1828	-0.3655	0.0732	-0.4194	-0.1948	-0.6028	-0.2065

Station ID		MDS Coordinates				Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS X	Inverse MDS Y	Aluminum	Antimony	Arsenic
91	7.07N	0.8821	0.0535	-0.8821	-0.0535	-1.2578	-0.4385	-0.8969
92	7.08N	0.2369	-0.4529	-0.2369	0.4529	0.1320	-0.0176	-0.3920
93	7.09N	0.2737	-0.3508	-0.2737	0.3508	0.1047	-0.0176	-0.5182
94	10.01N	-0.1317	-0.6331	0.1317	0.6331	1.0056	-0.2773	0.0499
95	10.03N	0.7444	-0.0461	-0.7444	0.0461	-0.9902	-0.4564	-0.9601
96	10.04N	1.1016	0.2035	-1.1016	-0.2035	-0.8291	-0.4744	-1.3388
97	BL	1.0851	0.1129	-1.0851	-0.1129	-0.8428	-0.7341	-0.2657
98	MR	1.1767	0.3636	-1.1767	-0.3636	-0.9793	-0.6893	-1.8437
99	MT	-4.8040	0.4693	4.8040	-0.4693	0.6507	5.7148	3.9002
100	SB	0.0247	-1.1694	-0.0247	1.1694	0.8145	-0.1967	0.2392
				Correlation with Inverse MDS X		0.6353	0.6447	0.7769
				Correlation with Inverse MDS Y		0.6049	-0.3745	0.4605

	Analyte Z-Scores								
DMMU.Site	Barium	Berylium	Cadmium	Calcium	Chromium	Trivalent Chrom	Copper	Lead	Mercury
7.07N	-0.6007	-0.6521	-0.5430	-0.1296	-1.0538	-1.0731	-0.3477	-0.5454	-0.6517
7.08N	-0.5369	1.2057	0.1973	-0.2089	-0.3925	-0.3824	-0.1372	-0.4978	-0.5464
7.09N	-0.5483	1.1592	0.0563	0.4072	-0.3676	-0.3563	-0.1919	-0.4654	-0.2304
10.01N	-0.5597	0.9735	0.3383	-0.3486	0.8926	0.9600	-0.3395	-0.4340	-0.3357
10.03N	-0.6645	-0.2805	-0.4020	-0.0198	-0.8666	-0.8776	-0.3231	-0.4978	-0.6078
10.04N	-0.6851	-0.9772	-1.0013	-0.0869	-0.8916	-0.9037	-0.5883	-0.5735	-0.7394
BL	-0.6645	-0.6056	-0.9661	-0.6238	-1.0038	-1.0210	-0.5609	-0.5897	-0.6517
MR	-0.7238	-1.3023	-0.4725	-0.2657	-0.6919	-0.6952	-0.6238	-0.5443	-0.7570
MT	-0.5300	1.2057	3.9341	-0.3804	2.9262	0.4517	1.3883	2.1570	5.3858
SB	-0.7827	1.2057	-0.4373	-0.2498	0.0442	0.0738	-0.3914	-0.5378	-0.5113
Inverse X Corr	0.6695	0.6088	0.8876	-0.2342	0.9298	0.8617	0.5633	0.7332	0.8507
Inverse Y Corr	-0.0852	0.5689	0.0551	-0.3318	0.0444	0.0618	-0.4368	-0.4013	-0.1139

	Analyte Z-Scores							
DMMU.Site	Nickel	Selenium	Silver	Thalium	Tin	Tributyl Tin	Zinc	Cyanide
7.07N	-0.2319	-0.1828	-0.3452	-0.1071	-0.4134	-0.2067	-0.5815	-0.2356
7.08N	0.4691	0.5893	-0.2845	0.4337	-0.3891	-0.2185	-0.5109	-0.1600
7.09N	0.6752	0.1260	-0.2895	0.2535	-0.3860	-0.2303	-0.4959	-0.1988
10.01N	0.7783	-1.0785	-0.0820	0.7943	-0.1795	-0.2067	-0.2875	-0.2997
10.03N	0.2423	-0.3373	-0.2845	0.2535	-0.4103	-0.2126	-0.4810	-0.2376
10.04N	-0.5412	-1.2021	-0.6287	-0.8282	-0.4498	-0.2303	-0.6777	-0.3074
BL	-1.0154	-0.6616	-0.4313	-1.5492	-0.5014	-0.2480	-0.8028	-0.3307
MR	-0.9329	-0.7079	-0.4161	-1.7295	-0.3557	-0.2185	-0.7172	-0.2453
MT	1.4587	2.9058	8.8270	0.7943	3.3130	0.0117	1.9202	-0.0048
SB	0.3866	3.5235	-0.2845	-0.2874	-0.3526	-0.0237	-0.6274	0.1504
Inverse X Corr	0.6524	0.5405	0.7006	0.5547	0.6452	0.1727	0.7198	0.2776
Inverse Y Corr	0.4372	0.4414	0.0894	0.6197	-0.1289	-0.5208	-0.3527	0.2606

Alscal (Dataset 2 Semi-Volatiles)

Iteration history for the 2 dimensional solution (in squared distances)

Young's S-stress formula 1 is used.

Iteration	S-stress	Improvement
1	.11225	
2	.07081	.04144
3	.06900	.00181
4	.06897	.00003

Iterations stopped because
S-stress improvement is less than .001000

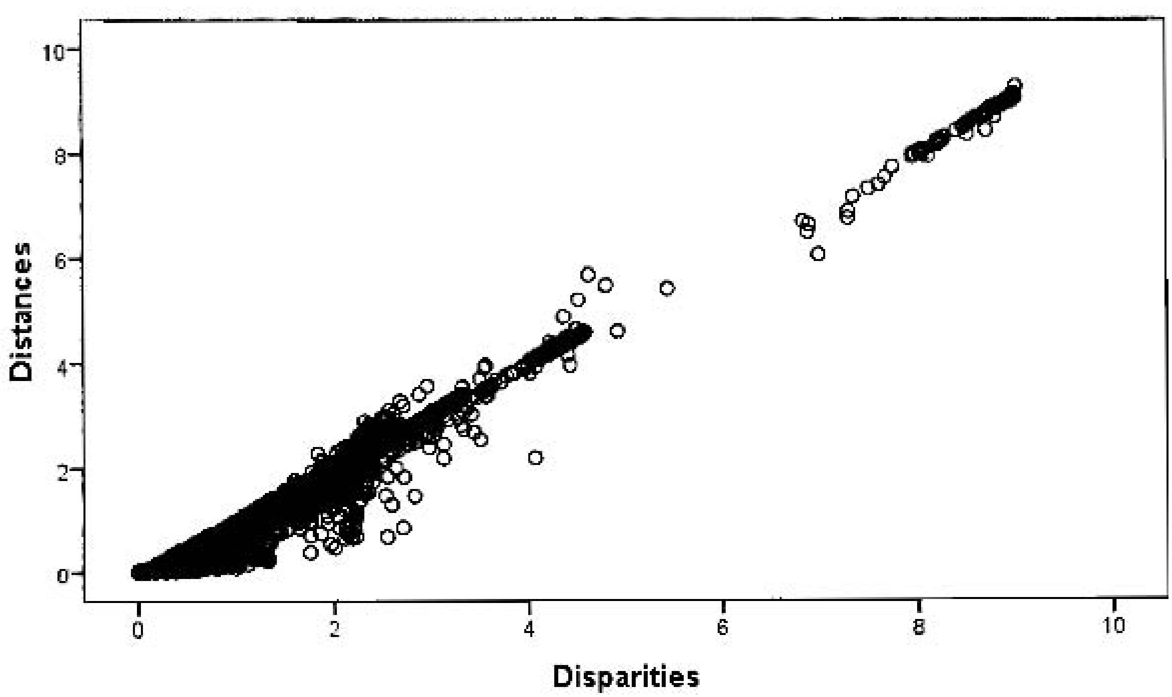
Stress and squared correlation (RSQ) in distances

RSQ values are the proportion of variance of the scaled data (disparities)
in the partition (row, matrix, or entire data) which
is accounted for by their corresponding distances.
Stress values are Kruskal's stress formula 1.

For matrix
Stress = .13181 RSQ = .97716

Scatterplot of Linear Fit

Euclidean distance model



Station ID		MDS Coordinates			Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS Y	1,4-Dichlorobenzene	2-Methylnaphthalene	4-Methylphenol
1	1.01	-0.2241	-0.6626	0.6626	-0.4455	-0.2736	1.1479
2	1.02	2.1421	-1.3626	1.3626	2.3306	0.3640	-0.2855
3	1.03	0.4219	-0.8395	0.8395	1.1036	0.2454	-0.6642
4	1.04	0.2642	-1.1526	1.1526	1.5637	-0.2440	1.8241
5	1.05	0.7165	-1.1099	1.1099	0.0300	-0.0512	1.8241
6	1.06	0.1444	-1.1499	1.1499	1.4104	-0.2440	1.6888
7	2.01	0.1083	-0.9595	0.9595	1.1803	-0.2736	1.4184
8	2.02	0.5081	-1.0585	1.0585	1.4104	-0.0808	1.6888
9	2.03	0.0054	-0.9898	0.9898	1.1803	-0.1624	1.4184
10	2.04	1.4721	-0.9984	0.9984	1.1036	1.4910	1.4184
11	2.05	0.7086	-0.8738	0.8738	1.2570	0.0971	1.4184
12	2.06	0.7022	-0.6966	0.6966	1.0269	-0.1401	-0.7183
13	3.01	-0.7393	0.3723	-0.3723	-1.1663	-0.3893	-0.5966
14	3.02	-0.7352	0.4009	-0.4009	-1.1433	-0.3871	-0.5695
15	3.03	-0.7466	0.3712	-0.3712	-1.1663	-0.3893	-0.5966
16	3.04	0.9690	-0.8709	0.8709	1.2570	0.0081	1.5536
17	3.05	2.0194	-0.6682	0.6682	1.3337	-0.0215	1.5536
18	3.06	-0.5934	0.3646	-0.3646	-1.0896	-0.3062	-0.5289
19	4.01	0.3456	0.3205	-0.3205	-0.2461	0.0823	-0.0151
20	4.02	1.1269	0.5906	-0.5906	0.3367	0.1268	-0.7183
21	4.03	0.1604	0.2147	-0.2147	0.3367	-0.1401	-0.7588
22	4.04	1.7790	0.1707	-0.1707	-0.1234	0.1119	-0.7183
23	4.05	3.6325	1.1248	-1.1248	0.1834	1.0462	-0.6101
24	4.06	8.1593	1.9991	-1.9991	0.7969	3.5671	-0.6912
25	4.07	0.8481	0.8245	-0.8245	-0.3228	-0.1253	-0.8697
26	4.08	0.5282	-0.4078	0.4078	0.0300	-0.0660	1.1479
27	5.01	0.3031	-1.0946	1.0946	1.4104	-0.2291	1.6888
28	5.02	0.3200	-0.7505	0.7505	0.1834	-0.1253	1.5536
29	5.03	1.4438	1.1593	-1.1593	-0.6909	1.0462	0.0390
30	5.04	0.5414	-0.5916	0.5916	0.0300	0.1861	1.1479
31	5.05	1.0501	-1.5347	1.5347	0.3367	0.1861	-0.1503
32	5.06	0.6730	-0.7574	0.7574	0.4901	0.0230	1.4184
33	5.07	-0.5370	0.0677	-0.0677	-0.3841	-0.3403	-0.1773
34	5.08	-0.3739	0.3800	-0.3800	-1.0896	-0.3255	-0.1368

DMMU Site	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene
	Analyte Z-Scores						
1.01	-0.1601	-0.2388	-0.2197	-0.2940	-0.2957	-0.2967	-0.257'
1.02	0.3832	2.7755	0.1768	1.0357	1.4090	1.6104	1.8703
1.03	-0.2814	1.6072	-0.0988	0.1076	0.2858	0.1752	0.2905
1.04	-0.1940	0.3454	-0.1340	-0.0440	0.0612	0.0965	0.1501
1.05	-0.126'	1.1165	-0.0069	0.3349	0.5854	0.6273	0.6416
1.06	-0.223'	0.2052	-0.1952	-0.1576	-0.1135	-0.1001	-0.1307
2.01	-0.0922	0.2753	-0.1141	-0.0818	-0.0137	-0.0215	-0.0254
2.02	0.2377	0.7193	0.2993	0.2023	0.2359	0.2735	0.2203
2.03	-0.3832	-0.0752	-0.2029	-0.2334	-0.1884	-0.2181	-0.2010
2.04	2.9058	3.4765	0.8810	0.7516	0.9647	0.5684	0.6767
2.05	1.2564	0.9296	0.1768	0.2970	0.4606	0.3914	0.2554
2.06	0.2377	0.9520	0.0390	0.6948	0.6602	0.5684	0.2554
3.01	-0.5249	-0.6547	-0.2722	-0.4171	-0.4654	-0.4992	-0.4818
3.02	-0.5079	-0.6757	-0.2626	-0.4020	-0.4655	-0.4776	-0.4537
3.03	-0.5147	-0.6617	-0.2734	-0.4304	-0.4979	-0.5071	-0.4958
3.04	1.4990	0.9296	0.1921	0.5432	0.6852	0.7453	0.7469
3.05	1.5475	1.8409	0.4830	1.6229	1.8084	2.0036	2.1160
3.06	-0.0582	-0.5098	-0.2212	-0.3432	-0.4006	-0.4029	-0.4061
4.01	-0.1358	0.3220	-0.0222	0.3917	0.5854	0.6470	0.6416
4.02	0.0922	0.5557	0.3146	1.0547	1.3841	1.3744	1.7299
4.03	-0.0534	0.7894	-0.0682	0.1455	0.2858	0.2735	0.5012
4.04	0.77'3	0.1117	0.3756	1.8123	1.8334	1.6104	1.7299
4.05	2.3237	0.6258	1.7077	3.8960	3.2062	3.3798	2.8532
4.06	6.2531	2.5419	9.3620	7.6843	6.9502	6.7221	6.8202
4.07	-0.1261	-0.2388	-0.0528	0.9031	1.4090	1.2172	1.8001
4.08	-0.1504	-0.1687	-0.0682	0.4675	0.6353	0.5487	0.6767
5.01	-0.2523	0.1818	0.1156	-0.0061	0.0612	0.0965	0.0799
5.02	-0.0534	0.4389	-0.0682	0.1076	0.1880	0.1555	0.2203
5.03	3.0029	0.8828	0.8504	0.4296	0.3857	0.4504	0.2905
5.04	1.1594	0.5090	0.1002	0.2591	0.2609	0.3128	0.1852
5.05	0.4803	0.2286	0.0084	0.2402	0.3358	0.3718	0.2905
5.06	-0.0825	0.5557	1.1412	0.3159	0.4606	0.5290	0.4661
5.07	-0.4851	-0.5963	-0.2549	-0.3679	-0.4031	-0.4068	-0.3870
5.08	-0.4657	-0.4725	-0.2503	-0.1955	-0.0886	-0.0804	-0.0254

DMMU.Site	Analyte Z-Scores						
	Benzo(k)fluoranthene	Benzoic acid	bis(2-Ethylhexyl)phthalate	Butyl benzyl phthalate	Chrysene	Dibenz(a,h)anthracene	Bibenzofuran
1.01	-0.2529	1.1954	0.0046	-0.3123	-0.2742	-0.3525	-0.3781
1.02	1.8741	1.8883	5.0948	0.9342	1.4736	1.4025	0.0400
1.03	0.1495	1.3686	0.6409	0.8353	0.1004	0.1583	-0.3582
1.04	0.1495	1.6408	0.5793	-0.4310	-0.0245	0.0797	-0.3230
1.05	0.6199	1.8883	1.0719	1.1321	0.4214	0.4857	-0.2411
1.06	-0.1431	1.6161	0.0456	1.0332	-0.1672	-0.1167	0.6840
2.01	-0.0072	1.4429	-0.2212	0.8353	-0.0958	-0.1167	-0.3230
2.02	0.2018	1.6408	0.1482	1.0332	0.2252	0.1059	-0.1240
2.03	-0.1693	1.4676	-0.1391	0.8353	-0.2385	-0.3001	0.5669
2.04	0.6199	1.3686	-0.1186	0.8353	0.6711	0.3679	-0.2762
2.05	0.4631	1.4924	-0.1186	0.8353	0.2787	0.2369	0.1570
2.06	0.5676	1.3439	-0.0981	0.7364	0.5997	0.3286	-0.2879
3.01	-0.4724	-0.4379	-0.4152	-0.6387	-0.4489	-0.5110	-0.4647
3.02	-0.4671	-0.4131	-0.4269	-0.6189	-0.4365	-0.4704	-0.4472
3.03	-0.4870	-0.4379	-0.4336	-0.6387	-0.4525	-0.5306	-0.4565
3.04	0.5153	1.5171	-0.0160	0.9342	0.4749	0.7477	0.0634
3.05	1.4560	1.5666	0.1482	0.9342	1.6520	2.0574	0.1805
3.06	-0.4096	-0.3884	-0.4203	-0.5893	-0.3794	-0.4900	-0.2294
4.01	0.6199	0.1065	0.1072	-0.5299	0.4214	0.6036	-0.2294
4.02	1.1947	-0.7398	0.2714	-0.1935	1.1883	1.7955	-0.0420
4.03	0.2540	0.0818	0.0661	-0.2232	0.1717	0.3810	-0.2294
4.04	1.7173	-0.6309	1.8108	0.6375	1.8303	2.0574	0.5200
4.05	3.4418	-0.0419	3.0423	-0.3716	3.9704	3.2362	2.7916
4.06	6.7864	-0.2844	1.3592	0.6375	7.3590	6.9034	6.8899
4.07	1.1947	-0.6507	0.2303	-0.7733	0.9564	1.6645	-0.1825
4.08	0.5676	-0.7695	0.2098	0.6375	0.4570	0.6953	-0.1240
5.01	0.0450	1.6408	0.1893	1.0332	0.0290	0.0666	-0.1942
5.02	0.1495	-0.7299	-0.0160	0.9342	0.1539	0.1714	-0.0069
5.03	0.5153	0.1313	0.1277	-0.2331	0.4392	0.2893	5.1335
5.04	0.3586	1.1459	0.4356	0.6375	0.2965	0.1976	-0.1240
5.05	0.4108	-0.5666	6.5316	0.6375	0.3322	0.2107	0.5903
5.06	0.5153	1.3686	0.2509	0.8353	0.3679	0.4464	-0.0888
5.07	-0.3887	-0.0667	0.2303	-0.3320	-0.3901	-0.4769	-0.4308
5.08	-0.0595	-0.7398	-0.1802	-0.7080	-0.1493	-0.0513	-0.3347

	Analyte Z-Scores								
DMMU.Site	Di-n-butyl phthalate	Di-n-octyl phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	Phenol
1.01	0.9713	0.9671	-0.3036	-0.2127	-0.2934	-0.0778	-0.2659	-0.2849	0.9633
1.02	1.7835	1.7772	0.9165	0.0341	1.7726	1.0613	0.1248	1.2284	2.1195
1.03	1.2420	1.2371	-0.0080	-0.2167	0.2205	0.4152	-0.2373	0.2350	1.1673
1.04	1.6481	1.6422	-0.0898	-0.2246	0.1515	-0.1628	-0.2373	-0.0064	1.5754
1.05	1.6481	1.6422	0.2247	-0.1848	0.6344	0.0752	-0.1134	0.3836	1.6434
1.06	1.5127	1.5072	-0.1967	-0.2605	-0.0899	-0.2649	-0.2373	-0.1457	1.4393
2.01	1.2420	1.2371	-0.1527	-0.2008	-0.0210	-0.1288	-0.1992	-0.1178	1.2353
2.02	1.5127	1.5072	0.1618	0.0739	0.1860	0.0412	0.0771	0.3464	1.4393
2.03	1.2420	1.2371	-0.2973	-0.3082	-0.2141	-0.0098	-0.2564	-0.2106	1.2353
2.04	1.2420	1.2371	0.3505	1.5069	0.5309	0.1432	1.4397	1.0428	1.1673
2.05	1.2420	1.2371	0.1115	0.6710	0.2895	0.7552	0.4106	0.3743	1.3033
2.06	1.1067	1.1021	0.6649	0.0341	0.3240	0.0412	0.2486	0.7642	1.7114
3.01	-0.7747	-0.7747	-0.4313	-0.3894	-0.4797	-0.5301	-0.3431	-0.5022	-0.8459
3.02	-0.7477	-1.1069	-0.4275	-0.3755	-0.4590	-0.5573	-0.3288	-0.4901	-0.8255
3.03	-0.7747	-0.7747	-0.4332	-0.3843	-0.4935	-0.5301	-0.3402	-0.5031	-0.8459
3.04	1.3774	1.3722	0.7278	0.7904	0.5999	0.2112	0.4392	0.8571	1.3033
3.05	1.3774	1.3722	1.7970	0.8302	1.7036	0.4492	0.9633	1.8784	1.3713
3.06	-0.7071	-0.7072	-0.3350	-0.1610	-0.4210	-0.3941	-0.2087	-0.3685	-0.7779
4.01	-0.7883	-0.1941	0.2876	-0.1132	0.6689	0.2112	-0.0086	0.4857	-0.4514
4.02	-0.1115	-0.1671	0.9794	0.1933	1.7381	0.3812	0.4678	0.7642	-0.6554
4.03	-0.8153	-0.2076	0.1555	-0.0933	0.4964	0.0072	-0.1516	0.1143	-0.2610
4.04	0.9713	0.9671	1.4825	0.5516	1.8760	0.7893	0.7727	1.1356	0.9633
4.05	0.1592	-0.3292	3.3693	2.2234	2.8418	3.7816	3.2501	3.5496	-0.5058
4.06	0.9713	0.9671	7.7089	7.9554	7.0496	6.5018	8.3954	6.8920	0.8952
4.07	-0.8424	-0.3292	0.6021	-0.1291	1.6691	-0.0268	0.1534	0.6714	-0.3970
4.08	0.9713	0.9671	0.3505	-0.1092	0.6344	0.0072	0.0485	0.3557	0.8952
5.01	1.5127	1.5072	0.0800	-0.1012	0.0825	0.0412	-0.1039	0.0586	1.4393
5.02	1.3774	1.3722	0.1492	-0.0853	0.2205	0.1092	-0.0277	0.1236	1.3713
5.03	-0.7883	-0.1401	0.7278	3.5370	0.3584	0.6532	2.0114	0.9499	-0.1929
5.04	0.9713	0.9671	0.4134	0.6312	0.2550	0.3472	0.0771	0.4857	0.8952
5.05	0.9713	0.9671	0.2876	0.1933	0.2895	1.0613	0.0676	0.3928	0.9633
5.06	1.2420	1.2371	0.2876	0.1137	0.4619	0.2452	0.1248	0.4857	1.1673
5.07	-0.3551	-0.3562	-0.4067	-0.3767	-0.3866	-0.4179	-0.3421	-0.4242	-0.3970
5.08	-0.8966	-0.3157	-0.2533	-0.3441	-0.0210	-0.4043	-0.1897	-0.0900	-0.3970

Station ID		MDS Coordinates			Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	inverse MDS Y	1,4-Dichlorobenzene	2-Methylnaphthalene	4-Methylphenol
35	6.01	-0.7064	0.3682	-0.3882	-1.1510	-0.3878	-0.5830
36	6.02	-0.7389	0.3621	-0.3621	-1.1433	-0.3871	-0.5695
37	6.03	-0.5537	0.2770	-0.2770	-0.2154	-0.4056	-0.8264
38	6.04	-0.7470	0.3787	-0.3787	-1.1587	-0.3885	-0.5830
39	6.05	-0.6185	0.1604	-0.1604	0.0300	-0.3403	-0.8292
40	6.06	-0.4364	0.4051	-0.4051	-0.4915	0.0230	-0.1503
41	7.01	0.1467	0.3697	-0.3697	-0.4148	0.2143	-0.7453
42	7.02	0.4136	0.1337	-0.1337	0.4901	0.1268	-0.1368
43	7.03	1.8104	0.6111	-0.6111	0.4901	0.2899	-0.7913
44	7.04	2.2143	0.7748	-0.7748	0.6435	-0.0512	-0.4748
45	7.05	-0.0951	0.3741	-0.3741	-0.9669	-0.3922	0.8995
46	7.06	-0.9134	0.1411	-0.1411	-0.7062	-0.4086	-0.9454
47	7.07	-0.6983	0.3835	-0.3835	-0.7522	-0.4041	-0.7507
48	7.08	-0.5456	0.2036	-0.2036	-0.8749	-0.3463	-0.5289
49	7.09	-0.2800	1.7741	-1.7741	-0.7820	6.5329	0.1202
50	8.01	-0.1193	-0.7955	0.7955	0.8735	-0.2440	1.1479
51	8.02	0.4370	-0.9760	0.9760	1.2570	0.2899	1.5535
52	8.03	0.1065	-0.9597	0.9597	1.1803	-0.1995	1.4184
53	8.04	0.6536	-0.9684	0.9684	1.1803	0.8386	1.4184
54	9.02	-0.5133	0.0787	-0.0787	-0.3228	-0.3403	-0.1638
55	9.04	0.7959	0.4106	-0.4106	0.1834	-0.0650	-0.1368
56	10.01	-0.4421	0.3589	-0.3589	0.3367	-0.1253	-0.8400
57	10.03	-0.4856	0.5218	-0.5218	0.2921	-0.3848	-0.9238
58	10.04	-0.7339	0.3424	-0.3424	-0.2921	-0.3878	-0.5695
59	3.01N	-0.7468	0.3792	-0.3792	-1.1740	-0.3900	-0.5966
60	3.02N	-0.7567	0.4051	-0.4051	-1.1433	-0.3871	-0.5695
61	3.03N	-0.7451	0.3756	-0.3756	-1.1663	-0.3893	0.5830
62	3.04N	0.7420	0.3815	-0.3815	-1.1663	-0.3893	-0.5966
63	3.05N	-0.7397	0.3631	-0.3631	-1.1433	-0.3871	-0.5695
64	3.06N	-0.7421	0.3724	-0.3724	-1.1510	-0.3878	-0.5830
65	45.01N	-0.6686	0.2368	-0.2368	-0.5375	-0.3804	-0.1638
66	45.02N	-0.6252	0.3743	-0.3743	-0.5375	-0.3403	-0.8562
67	45.03N	-0.6655	0.1804	-0.1804	-0.5375	-0.3403	-0.1232
68	45.04N	-0.6248	0.1610	-0.1610	-0.3995	-0.3403	-0.1368

DMMU.Site	Analyte Z-Scores						
	Acenaphthene	Acenaphthylene	Anthracene	Banzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene
6.01	-0.5225	-0.6524	-0.2762	-0.4152	-0.4630	-0.4776	-0.4502
6.02	-0.5222	-0.6512	-0.2773	-0.4516	-0.5199	-0.5364	-0.5403
6.03	-0.5215	-0.3323	-0.2595	-0.2826	-0.3257	-0.3164	-0.3449
6.04	-0.5227	-0.6535	-0.2775	-0.4545	-0.5306	-0.5448	-0.5406
6.05	-0.5069	-0.5776	-0.2725	-0.4285	-0.4954	-0.5031	-0.5190
6.06	0.2377	-0.5379	-0.1845	-0.3376	-0.4230	-0.4225	-0.4572
7.01	-0.0922	0.6959	-0.0375	0.1455	0.3657	0.4307	0.3256
7.02	0.1892	1.3735	0.3605	0.3728	0.4106	0.5880	0.0097
7.03	0.8684	2.0745	0.2227	1.1304	1.6087	1.8070	2.2564
7.04	0.1892	5.1122	0.3452	0.8653	2.4574	2.5934	1.8703
7.05	-0.4754	-0.6103	-0.2580	-0.4209	-0.4954	-0.5071	-0.4958
7.06	-0.5244	-0.6313	-0.2672	-0.4398	-0.5104	-0.5208	-0.4994
7.07	-0.5230	-0.4491	-0.2626	-0.4304	-0.4904	-0.5090	-0.4537
7.08	-0.4972	0.3921	-0.2365	-0.3584	-0.3731	-0.4166	-0.3344
7.09	-0.1358	-0.5893	-0.1937	-0.3413	-0.3856	-0.4658	-0.3905
8.01	0.1892	-0.0519	-0.1906	-0.2334	-0.3057	-0.3164	-0.3309
8.02	1.1109	0.2987	0.0084	0.0508	0.0113	0.0965	-0.0254
8.03	-0.1504	0.3220	-0.1340	-0.1197	-0.0886	-0.0608	-0.1307
8.04	2.2752	0.4389	0.0696	0.1265	0.0862	0.1358	-0.0254
9.02	-0.4560	-0.5379	-0.2549	-0.3527	-0.3706	-0.3360	-0.4116
9.04	2.0811	0.9296	0.4217	0.6190	0.4356	0.6667	0.2203
10.01	-0.1552	-0.4491	-0.2151	-0.2334	-0.3681	-0.3360	-0.3554
10.03	-0.5166	-0.5986	-0.2610	-0.1576	-0.0886	-0.1001	-0.0254
10.04	-0.5302	-0.6524	-0.2774	-0.4455	-0.5194	-0.5326	-0.5404
3.01N	-0.5232	-0.6559	-0.2776	-0.4580	-0.5351	-0.5480	-0.5410
3.02N	-0.5222	-0.6512	-0.2773	-0.4554	-0.5316	-0.5452	-0.5443
3.03N	-0.5230	-0.6547	-0.2776	-0.4546	-0.5299	-0.5460	-0.5408
3.04N	-0.5171	-0.6547	-0.2777	-0.4469	-0.5184	-0.5326	-0.5408
3.05N	-0.5222	-0.6512	-0.2773	-0.4543	-0.5295	-0.5457	-0.5403
3.06N	-0.5220	-0.6524	-0.2783	-0.4531	-0.5296	-0.5458	-0.5404
45.01N	-0.4366	-0.5776	-0.2626	-0.4304	-0.5054	-0.5149	-0.5194
45.02N	-0.4900	-0.6220	-0.2595	-0.3470	-0.3881	-0.4068	-0.3905
45.03N	-0.4900	-0.5776	-0.2725	-0.4484	-0.5216	-0.5381	-0.5292
45.04N	-0.4317	-0.5776	-0.2396	-0.4114	-0.5004	-0.5090	-0.5134

	Analyte Z-Scores						
DMMU.Site	Benzo(k)fluoranthene	Benzoic acid	bis(2-Ethylhexyl)phthalate	Butyl benzyl phthalate	Chrysene	Dibenz(a,h)anthracene	Bibenzofuran
6.01	-0.4671	-0.4379	-0.4018	-0.7080	-0.4365	-0.4953	-0.2996
6.02	-0.5147	-0.4131	-0.4265	-0.6189	-0.4802	-0.5182	-0.2938
6.03	-0.2581	-0.6903	-0.3464	-0.3320	-0.3295	-0.3525	-0.4460
6.04	-0.5225	-0.4379	-0.4141	-0.7080	-0.4824	-0.5195	-0.2996
6.05	-0.4781	-0.7101	-0.4059	-0.8069	-0.4525	-0.4769	-0.1006
6.06	-0.3887	-0.7150	-0.2828	-0.7871	-0.3491	-0.4586	0.2156
7.01	0.3063	-0.6161	-0.2664	-0.3024	0.1717	0.4202	-0.2879
7.02	-0.4959	-0.6012	0.8461	-0.1540	0.3857	0.4071	0.2273
7.03	1.6128	-0.4725	1.8108	-0.3123	1.2239	1.6645	0.4498
7.04	3.0238	-0.5517	0.0251	-0.5101	1.2953	2.1884	0.0517
7.05	-0.4849	-0.6952	-0.3423	-0.0155	-0.4489	-0.3787	-0.3921
7.06	-0.5129	-0.7150	-0.0775	3.4075	-0.4668	-0.5195	-0.4507
7.07	-0.4933	-0.7249	-0.3854	-0.6189	-0.4596	-0.3525	-0.4553
7.08	-0.5129	-0.6804	-0.3608	0.0637	-0.3954	-0.2346	-0.4214
7.09	-0.4985	-0.6754	-0.3485	0.0241	-0.3295	-0.1822	-0.1942
8.01	-0.3417	1.1954	-0.3628	0.6375	-0.2385	-0.3918	-0.3582
8.02	0.0450	1.4924	-0.2417	0.9342	0.1004	0.0273	-0.0771
8.03	-0.0438	1.4676	-0.1391	0.8353	-0.0958	-0.1429	-0.2528
8.04	0.0973	1.4676	-0.1596	0.8353	0.1182	-0.0120	1.0352
9.02	-0.2790	-0.0419	-0.3669	-0.3222	-0.3312	-0.4769	-0.4366
9.04	0.5676	-0.0172	-0.2438	-0.3024	0.8316	0.1583	0.0400
10.01	-0.3417	-0.6804	-0.0570	-0.7475	-0.2207	-0.4049	-0.2762
10.03	-0.0752	-0.7858	-0.4018	-0.8366	-0.2028	-0.1167	-0.4483
10.04	-0.5126	-0.8096	-0.3998	-0.8326	-0.4727	-0.5188	-0.4659
3.01N	-0.5134	-0.4379	-0.4371	-0.6090	-0.4826	-0.5208	-0.3055
3.02N	-0.5220	-0.4131	-0.4273	-0.6189	-0.4825	-0.5182	-0.2938
3.03N	-0.5131	-0.4379	-0.4297	-0.6288	-0.4825	-0.5201	-0.2996
3.04N	-0.5131	-0.4379	-0.4152	-0.6387	-0.4802	-0.5201	-0.3055
3.05N	-0.5123	-0.4131	-0.4131	-0.6189	-0.4822	-0.5182	-0.2938
3.06N	-0.5126	-0.4379	-0.4141	-0.6288	-0.4825	-0.5188	-0.2996
45.01N	-0.4938	-0.7299	-0.4018	-0.6882	-0.4418	-0.4769	-0.4120
45.02N	-0.3940	-0.7927	-0.4141	-0.7891	-0.3598	-0.3656	-0.4120
45.03N	-0.4959	-0.7863	-0.4203	-0.8069	-0.4796	-0.4769	-0.4390
45.04N	-0.4959	-0.0172	-0.3115	-0.8168	-0.4472	-0.4769	-0.3465

	Analyte Z-Scores								
DMMU.Site	Di-n-butyl phthalate	Di-n-octyl phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	Phenol
6.01	-0.7612	-0.7612	-0.4376	-0.3906	-0.4659	-0.5267	-0.3583	-0.4873	-0.8323
6.02	-0.7477	-0.7477	-0.4629	-0.3904	-0.5268	-0.5250	-0.3688	-0.5299	-0.8255
6.03	-0.5717	-0.4102	-0.3854	-0.3831	-0.3555	-0.4961	-0.3316	-0.4437	-0.8255
6.04	-0.7612	-0.7612	-0.4652	-0.3908	-0.5271	-0.5284	-0.3686	-0.5328	-0.8391
6.05	-0.3010	-0.3022	-0.4495	-0.3779	-0.5004	-0.4179	-0.3602	-0.5124	0.0519
6.06	-0.3281	-0.9827	-0.2847	0.1535	-0.4417	0.5852	-0.0753	-0.3685	-0.7506
7.01	-0.3145	-0.3157	0.0738	-0.1729	0.4274	-0.0948	-0.1611	0.6714	-0.3970
7.02	0.1321	-0.3157	0.7278	0.1933	0.0825	0.1092	0.2296	0.3093	-0.2066
7.03	-0.3010	-0.3292	1.7970	0.4321	1.7726	1.6053	0.3153	2.5283	-0.2066
7.04	-0.4093	-0.0456	0.9794	-0.0256	2.2554	0.7552	0.2868	1.5998	-0.2746
7.05	-0.5446	-0.9746	-0.4288	-0.3751	-0.4693	-0.4757	-0.3555	-0.4994	-0.8323
7.06	-0.5176	-1.0610	-0.4527	-0.3922	-0.4762	-0.5437	-0.3615	-0.5198	-0.8391
7.07	-0.5446	-1.0124	-0.4533	-0.3859	-0.4452	-0.5403	-0.3612	-0.5143	-0.8323
7.08	-0.4905	-1.0016	-0.4080	-0.3600	-0.3417	-0.4281	-0.3364	-0.4558	0.2151
7.09	-0.1656	-0.3697	-0.4275	-0.2127	-0.4004	0.5512	-0.1611	-0.4242	-0.4650
8.01	0.9713	0.9671	-0.1715	0.0739	-0.3417	-0.2989	-0.0753	-0.2292	0.9633
8.02	1.3774	1.3722	0.4134	0.3923	0.0480	-0.0268	0.2963	0.2721	1.3033
8.03	1.2420	1.2371	-0.0457	-0.2207	-0.1244	-0.1628	-0.1897	-0.0342	1.2353
8.04	1.2420	1.2371	0.3505	1.7457	0.0480	0.0072	0.4392	0.2443	1.2353
9.02	-0.3416	-0.3427	-0.3350	-0.3691	-0.4038	-0.4179	-0.3431	-0.2476	-0.3970
9.04	-0.3145	-0.3157	1.2939	1.1088	0.2205	0.1772	0.7727	1.5070	-0.3970
10.01	-0.9686	-0.7612	-0.2281	-0.1928	-0.3693	-0.0948	-0.0658	-0.2106	-0.3426
10.03	-0.7477	-1.0880	-0.3602	-0.3894	-0.0210	-0.4995	-0.3307	-0.3592	-0.9547
10.04	-0.7477	-0.7477	-0.4602	-0.3906	-0.5269	-0.5675	-0.3640	-0.5226	-0.8323
3.01N	-0.7747	-0.7747	-0.4649	-0.3912	-0.5274	-0.5318	-0.3686	-0.5331	-0.8527
3.02N	-0.7477	-1.1231	-0.4615	-0.3904	-0.5342	-0.5250	-0.3664	-0.5302	-0.8255
3.03N	-0.7612	-0.7612	-0.4622	-0.3954	-0.5273	-0.5301	-0.3645	-0.5301	-0.8459
3.04N	-0.7747	-0.7747	-0.4545	-0.3934	-0.5252	-0.5301	-0.3661	-0.5217	-0.8459
3.05N	-0.7477	-0.7477	-0.4624	-0.3904	-0.5268	-0.5250	-0.3676	-0.5303	-0.8255
3.06N	-0.7612	-0.7612	-0.4609	-0.3930	-0.5269	-0.5267	-0.3628	-0.5276	-0.8323
45.01N	-0.8966	-0.3427	-0.4388	-0.3281	-0.5038	-0.4859	-0.3297	-0.4985	-0.3970
45.02N	-0.8966	-0.3292	-0.3728	-0.3600	-0.3659	-0.5267	-0.3050	-0.4567	-0.6418
45.03N	-0.3010	-0.3022	-0.4564	-0.3703	-0.5159	-0.4179	-0.3593	-0.5245	-0.3970
45.04N	-0.8695	-0.3157	-0.3854	-0.3082	-0.4969	-0.4179	-0.2897	-0.4762	-0.3970

Station ID		MDS Coordinates			Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS Y	1,4-Dichlorobenzene	2-Methylnaphthalene	4-Methylphenol
69	45.05N	-0.6341	0.2746	-0.2746	-0.4301	-0.3403	-0.8832
70	45.06N	-0.5859	0.1401	-0.1401	-0.6142	-0.3270	-0.1368
71	45.07N	-0.6836	0.2550	-0.2550	-0.5682	-0.3403	-0.1638
72	45.08N	-0.3131	-0.5939	0.5939	0.0300	-0.1995	1.1479
73	45.09N	-0.2758	-0.8334	0.8334	0.8735	-0.1921	1.1479
74	45.10N	-0.2781	-0.8340	0.8340	0.8735	-0.1921	1.1479
75	45.11N	-0.6493	0.2240	-0.2240	-0.9516	-0.3403	-0.1368
76	45.12N	-0.6081	0.0381	-0.0381	0.1834	-0.3403	-0.1368
77	45.13N	-0.6056	0.0474	-0.0474	0.4901	-0.3403	-0.1232
78	45.15N	-0.5947	0.0137	-0.0137	0.1834	-0.3403	-0.1638
79	45.16N	-0.2798	-0.8162	0.8162	0.7969	-0.1995	1.1479
80	6.01N	-0.7368	0.3402	-0.3402	-0.7829	-0.3893	-0.5830
81	6.02N	-0.7400	0.3637	-0.3637	-1.1433	-0.3871	-0.5695
82	6.03N	-0.7370	0.0615	-0.0615	-0.8442	-0.3900	-0.6101
83	6.04N	-0.7384	0.3576	-0.3576	-1.1433	-0.3871	-0.5695
84	6.05N	-0.6734	0.2535	-0.2535	-0.4455	-0.3403	-0.1638
85	6.06N	-0.1848	1.3105	-1.3105	-0.4762	1.1945	-0.9076
86	7.01N	-0.7276	0.2310	-0.2310	1.2570	-0.3871	-0.5695
87	7.02N	-0.6734	0.2834	-0.2834	0.6435	-0.3552	-0.5830
88	7.03N	-0.7307	0.3089	-0.3089	0.7969	-0.3871	-0.5695
89	7.05N	-0.6929	0.3430	-0.3430	0.4901	-0.4041	-0.5966
90	7.06N	-0.7783	0.1729	-0.1729	-0.8442	-0.4086	-0.7940
91	7.07N	-0.7340	0.2461	-0.2461	0.3367	-0.3885	-0.9563
92	7.08N	-0.7006	0.2541	-0.2541	-0.6755	-0.4026	-0.7183
93	7.09N	-0.5226	1.4924	-1.4924	-0.8749	5.3466	-0.7183
94	10.01N	-0.2226	0.5609	-0.5609	0.4901	-0.0067	-0.6371
95	10.03N	-0.7614	0.4256	-0.4256	-0.3228	-0.4056	-0.8589
96	10.04N	-0.7558	0.4210	-0.4210	-0.4301	-0.3900	-0.8805
97	BL	-0.7440	0.3742	-0.3742	-1.1587	-0.3885	-0.5830
98	MR	-0.7424	0.3732	-0.3732	-1.1510	-0.4011	-0.5830
99	MT	1.1913	-3.7266	3.7266	5.0146	-0.0363	4.7991
100	SB	-0.5191	-0.1731	0.1731	-0.2001	-0.2959	0.2283
			Correlation with MDS X		0.4455	0.4022	0.2116
			Correlation with Inverse MDS Y		0.7150	-0.3152	0.8132

	Analyte Z-Scores						
DMMU.Site	Acenaphthene	Acenaphthylene	Anthracene	Banzo(a)anthracane	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene
45.05N	-0.4851	-0.5776	-0.2473	-0.3735	-0.4705	-0.4835	-0.4923
45.06N	-0.4415	-0.5776	0.0543	-0.4057	-0.4854	-0.4933	-0.4923
45.07N	-0.5186	-0.5776	-0.2725	-0.4398	-0.5141	-0.5248	-0.5169
45.08N	-0.4900	-0.3556	-0.2580	-0.3432	-0.4979	-0.4147	-0.3940
45.09N	-0.4584	-0.3439	-0.2572	-0.4294	-0.4967	-0.5198	-0.4941
45.10N	-0.4584	-0.3439	-0.2572	-0.4294	-0.4967	-0.5360	-0.4941
45.11N	-0.5069	-0.5776	-0.2725	-0.4342	-0.4929	-0.5071	-0.4994
45.12N	-0.4512	-0.5776	-0.2684	-0.4285	-0.5216	-0.5071	-0.5029
45.13N	-0.4269	-0.5776	-0.2641	-0.4285	-0.5216	-0.5051	-0.5064
45.15N	-0.5045	-0.5776	-0.2725	-0.4431	-0.5216	-0.5307	-0.5264
45.16N	-0.4609	-0.3556	-0.2580	-0.4304	-0.4979	-0.5208	-0.4958
6.01N	-0.5293	-0.6547	-0.2776	-0.4546	-0.5299	-0.5454	-0.5439
6.02N	-0.5222	-0.6512	-0.2773	-0.4543	-0.5295	-0.5457	-0.5403
6.03N	-0.5232	-0.6337	-0.2776	-0.4506	-0.5129	-0.4972	-0.4818
6.04N	-0.5222	-0.6512	-0.2773	-0.4543	-0.5295	-0.5457	-0.5403
6.05N	-0.5069	-0.5776	-0.2725	-0.4484	-0.5289	-0.5423	-0.5422
6.06N	0.3832	-0.5893	-0.2365	-0.4247	-0.5196	-0.5267	-0.5281
7.01N	-0.5278	-0.6512	-0.2773	-0.4501	-0.5295	-0.5248	-0.5292
7.02N	-0.4657	-0.6220	-0.2488	-0.4190	-0.4904	-0.4972	-0.5029
7.03N	-0.5142	-0.6512	-0.2773	-0.4448	-0.5295	-0.5326	-0.5327
7.05N	-0.4415	-0.6571	-0.2610	-0.4001	-0.4929	-0.4972	-0.5099
7.06N	-0.5181	-0.6535	-0.2788	-0.4545	-0.5339	-0.5417	-0.5264
7.07N	-0.5302	-0.6535	-0.2775	-0.4545	-0.5297	-0.5454	-0.5406
7.08N	-0.5254	-0.6127	-0.2672	-0.4529	-0.5264	-0.5407	-0.5169
7.09N	-0.3202	-0.5940	-0.2503	-0.3849	-0.4280	-0.4776	-0.4011
10.01N	1.4020	-0.4024	-0.1753	-0.2732	-0.4106	-0.4029	-0.3765
10.03N	-0.5268	-0.6547	-0.2776	-0.4546	-0.5299	-0.5377	-0.5408
10.04N	-0.5278	-0.6874	-0.2796	-0.4472	-0.5129	-0.5307	-0.5208
BL	-0.5227	-0.6535	-0.2775	-0.4545	-0.5297	-0.5459	-0.5406
MR	-0.5293	-0.6524	-0.2782	-0.4467	-0.5156	-0.5458	-0.5359
MT	-0.3274	1.8409	-0.1432	-0.1197	-0.0137	0.0769	0.4309
SB	-0.4924	-0.5075	-0.2679	-0.4427	-0.5141	-0.5336	-0.5187
Correlation X	0.8474	0.7391	0.8515	0.9568	0.9721	0.9724	0.9629
Inverse Y Corr	-0.0791	0.2833	-0.2162	-0.1575	-0.1098	-0.0981	-0.0820

	Analyte Z-Scores						
DMMU.Site	Benzo(k)fluoranthene	Benzoic acid	bis(2-Ethylhexyl)phthalate	Butyl benzyl phthalate	Chrysene	Dibenz(a,h)anthracene	Bibenzofuran
45.05N	-0.4567	-0.8002	-0.4182	-0.7851	-0.4044	-0.4992	-0.3968
45.06N	-0.4724	-0.0172	-0.4039	-0.8326	-0.4258	-0.4769	-0.2762
45.07N	-0.4959	-0.8046	-0.4080	-0.8049	-0.4668	-0.4769	-0.4425
45.08N	-0.3835	-0.7645	-0.3998	0.6375	-0.3723	-0.3525	0.4498
45.09N	-0.4436	1.1707	-0.4141	0.6375	-0.4588	-0.3459	0.4498
45.10N	-0.4436	1.1707	-0.4224	0.6375	-0.4588	-0.3459	0.4498
45.11N	-0.4859	-0.7546	-0.4182	-0.7278	-0.4579	-0.4769	-0.1064
45.12N	-0.4948	-0.0172	-0.3895	-0.7555	-0.4561	-0.4769	-0.4354
45.13N	-0.4959	-0.7794	-0.3916	-0.2925	-0.4489	-0.4769	-0.4343
45.15N	-0.4959	-0.0419	-0.4203	-0.3222	-0.4707	-0.4769	-0.1161
45.16N	-0.4462	1.1459	-0.2828	0.6375	-0.4596	-0.3525	0.4498
6.01N	-0.5131	-0.7101	-0.4018	-0.6090	-0.4825	-0.5201	-0.4565
6.02N	-0.5123	-0.4131	-0.4131	-0.6189	-0.4822	-0.5182	-0.2938
6.03N	-0.4807	-0.7398	-0.3156	2.0225	-0.4543	-0.5208	-0.4659
6.04N	-0.5123	-0.4131	-0.4131	-0.5497	-0.4822	-0.5182	-0.2938
6.05N	-0.4959	-0.7249	-0.3998	-0.5299	-0.4766	-0.4769	-0.1181
6.06N	-0.5011	-0.6754	-0.3505	-0.3419	-0.4489	-0.4835	0.8011
7.01N	-0.5123	-0.7794	-0.4141	-0.6090	-0.4778	-0.5182	-0.4553
7.02N	-0.4828	-0.7299	-0.2930	-0.7475	-0.4436	-0.5188	-0.4015
7.03N	-0.5105	-0.7987	-0.3751	-0.8227	-0.4748	-0.5182	-0.4565
7.05N	-0.4671	-0.7848	-0.3957	-0.8128	-0.4168	-0.5208	-0.4448
7.06N	-0.5129	-0.6556	-0.3669	2.0225	-0.4824	-0.5195	-0.4483
7.07N	-0.5129	-0.7546	-0.3998	0.7364	-0.4824	-0.5195	-0.4600
7.08N	-0.5204	-0.6309	-0.3649	-0.5497	-0.4809	-0.5083	-0.4530
7.09N	-0.4671	-0.6804	-0.3998	-0.6189	-0.3758	-0.5182	-0.4284
10.01N	-0.3940	-0.7695	-0.2910	-0.7080	-0.3098	-0.4049	-0.1591
10.03N	-0.5131	-0.7447	-0.4162	-0.6288	-0.4773	-0.5201	-0.4565
10.04N	-0.5126	-0.8041	-0.4244	-0.6387	-0.4775	-0.5208	-0.4589
BL	-0.5129	-0.4379	-0.4141	-0.6288	-0.4824	-0.5195	-0.2996
MR	-0.5126	-0.4379	-0.4273	-0.6288	-0.4718	-0.5188	-0.2996
MT	0.0450	4.6104	-0.0981	5.9795	-0.0958	0.1845	2.0305
SB	-0.4802	0.3045	-0.4162	-0.0353	-0.4712	-0.4376	0.0517
Correlation X	0.9659	0.3126	0.5369	0.2937	0.9664	0.9598	0.7732
Inverse Y Corr	-0.1050	0.8132	0.2203	0.6808	-0.1425	-0.1237	-0.1041

DMMU.Site	Analyte Z-Scores Di-n-butyl phthalate	Di-n-octyl phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene	Phenol
45.05N	-0.3416	-0.3427	-0.3791	-0.3480	-0.4831	-0.4179	-0.3021	-0.4678	-0.3970
45.06N	-0.3145	-0.3157	-0.4042	-0.1649	-0.4797	-0.4315	-0.2468	-0.4883	-0.3970
45.07N	-0.8695	-0.3427	-0.4464	-0.3779	-0.5049	-0.4179	-0.3497	-0.5161	-0.3970
45.08N	0.9713	0.9671	-0.3602	-0.3401	-0.3831	-0.0948	-0.3240	-0.4242	0.8952
45.09N	0.9713	0.9671	-0.4520	-0.3381	-0.4814	-0.0778	-0.3574	-0.5170	0.9633
45.10N	0.9713	0.9671	-0.4545	-0.3381	-0.4814	-0.0778	-0.3593	-0.5208	0.9633
45.11N	-0.3145	-0.3157	-0.4539	-0.3779	-0.4866	-0.4179	-0.3612	-0.5152	-0.3970
45.12N	-0.3145	-0.3157	-0.4382	-0.3560	-0.4969	-0.4179	-0.3507	-0.4966	-0.3970
45.13N	-0.3010	-0.3022	-0.4332	-0.3122	-0.4969	-0.4179	-0.3393	-0.4864	-0.3970
45.15N	-0.3416	-0.3427	-0.4527	-0.3851	-0.5183	-0.4179	-0.3612	-0.5152	-0.3970
45.16N	0.9713	0.9671	-0.4571	-0.3401	-0.4831	-0.0948	-0.3626	-0.5208	0.8952
6.01N	-0.5717	-0.7612	-0.4602	-0.3950	-0.5273	-0.5301	-0.3653	-0.5333	-0.8459
6.02N	-0.7477	-0.7477	-0.4650	-0.3904	-0.5268	-0.5250	-0.3675	-0.5325	-0.8255
6.03N	-0.4364	-0.1131	-0.4564	-0.3938	-0.5004	-0.5318	-0.3650	-0.5304	-0.8527
6.04N	-0.7477	-0.7477	-0.4650	-0.3904	-0.5268	-0.5250	-0.3675	-0.5325	-0.8255
6.05N	-0.3416	-0.9665	-0.4633	-0.3779	-0.5159	-0.4179	-0.3645	-0.5319	-0.6690
6.06N	-0.3687	-0.8693	-0.3916	0.1535	-0.5204	4.4616	-0.0944	-0.4734	-0.5058
7.01N	-0.8695	-0.7477	-0.4608	-0.3904	-0.5268	-0.5233	-0.3643	-0.5217	-0.8187
7.02N	-0.8424	-0.7612	-0.4288	-0.3600	-0.4935	-0.4417	-0.3421	-0.4762	-0.8051
7.03N	-1.0021	-0.7477	-0.4527	-0.3926	-0.5211	-0.5267	-0.3625	-0.5040	-0.9003
7.05N	-1.0048	-0.7747	-0.3979	-0.3600	-0.4969	-0.5301	-0.3212	-0.4242	-0.9003
7.06N	-0.5176	-0.6802	-0.4610	-0.3879	-0.4969	-0.5573	-0.3620	-0.5287	-0.8391
7.07N	-0.9453	-0.9692	-0.4651	-0.3908	-0.5271	-0.5284	-0.3658	-0.5326	-0.7098
7.08N	-0.4093	-0.8153	-0.4644	-0.3882	-0.4866	-0.5471	-0.3645	-0.5321	-0.2066
7.09N	-0.5717	-0.9692	-0.4483	-0.2645	-0.4486	0.4492	-0.2468	-0.4808	-0.8459
10.01N	-1.0238	-0.7747	0.0675	0.5516	-0.3969	0.3132	1.0586	-0.0250	-0.3018
10.03N	-1.0238	-1.0691	-0.4616	-0.3946	-0.5273	-0.5607	-0.3617	-0.5264	-0.9139
10.04N	-1.0482	-0.7747	-0.4622	-0.3946	-0.5087	-0.5811	-0.3634	-0.5273	-0.9547
BL	-0.7612	-0.7612	-0.4651	-0.3908	-0.5271	-0.5284	-0.3676	-0.5326	-0.8391
MR	-0.7612	-0.7612	-0.4571	-0.3958	-0.5180	-0.5641	-0.3624	-0.5268	-0.8323
MT	4.6259	4.6128	-0.2093	-0.2306	0.1515	0.8403	-0.2468	-0.2756	4.6359
SB	0.0509	0.0489	-0.4611	-0.3660	-0.5055	-0.3159	-0.3617	-0.5268	0.0111
Correlation X	0.4649	0.4754	0.9572	0.8569	0.9642	0.8270	0.8929	0.9675	0.4609
Inverse Y Corr	0.8232	0.8306	-0.1626	-0.1957	-0.1092	-0.1738	-0.2389	-0.1220	0.8334

Alscal (Dataset 3 PCBs, Pesticides, TPH)

Iteration history for the 2 dimensional solution (in squared distances)

Young's S-stress formula 1 is used.

Iteration	S-stress	Improvement
1	.35841	
2	.15584	.20257
3	.13651	.01932
4	.13556	.00095

Iterations stopped because
S-stress improvement is less than .001000

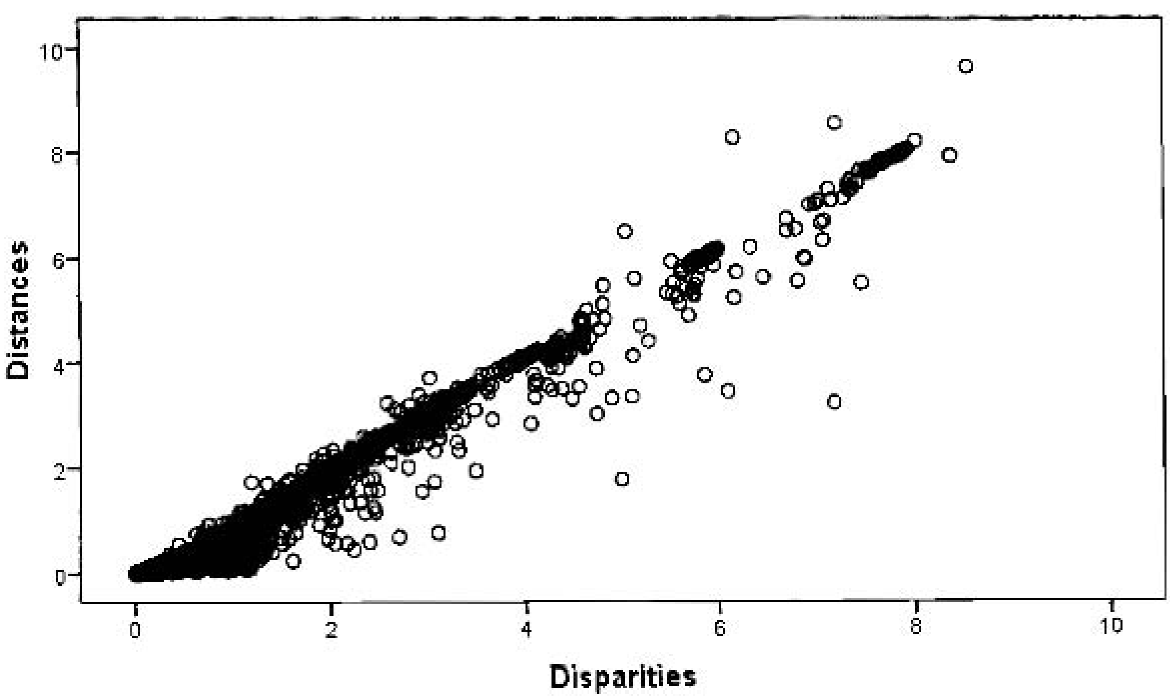
Stress and squared correlation (RSQ) in distances

RSQ values are the proportion of variance of the scaled data (disparities)
in the partition (row, matrix, or entire data) which
is accounted for by their corresponding distances.
Stress values are Kruskal's stress formula 1.

For matrix
Stress = .14289 RSQ = .98011

Scatterplot of Linear Fit

Euclidean distance model



Station ID		MDS Coordinates				Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS X	Inverse MDS Y	Aroclor 1248	Aroclor 1254	Aroclor 1260
1	1.01	0.4006	0.0080	-0.4006	-0.0080	0.0750	-0.4123	0.0384
2	1.02	-1.9561	-0.3087	1.9561	0.3087	2.9412	-0.4030	1.8066
3	1.03	0.2507	-0.0706	0.2507	0.0706	0.1759	-0.4100	0.0871
4	1.04	-0.7728	-0.4940	0.7728	0.4940	1.3668	-0.4054	0.7197
5	1.05	-2.3250	0.5976	2.3250	-0.5976	3.5467	3.4086	-0.2673
6	1.06	-0.2138	0.0840	0.2138	-0.0840	0.8622	1.0854	-0.2698
7	2.01	-0.4165	0.1200	0.4165	-0.1200	0.8218	1.2547	-0.2722
8	2.02	-0.9552	0.1584	0.9552	-0.1584	1.3870	1.7162	-0.2698
9	2.03	0.1972	0.0400	-0.1972	-0.0400	0.2163	0.4547	-0.2722
10	2.04	0.2152	0.0478	-0.2152	-0.0478	-0.0057	0.1623	0.1358
11	2.05	-0.9970	4.2334	0.9970	-4.2334	1.0842	1.2547	-0.2722
12	2.06	-0.2324	0.1644	0.2324	-0.1644	0.8824	1.0701	-0.2738
13	3.01	0.3825	-0.1581	-0.3825	0.1581	-0.4578	-0.4130	-0.2763
14	3.02	0.4929	-0.0593	-0.4929	0.0593	-0.4568	-0.4123	-0.2754
15	3.03	0.5577	-0.0145	-0.5577	0.0145	-0.4578	-0.4130	-0.2763
16	3.04	-1.0865	-0.5797	1.0865	0.5797	0.4787	0.9162	-0.2714
17	3.05	-0.9613	-0.1358	0.9613	0.1358	1.2659	1.1008	-0.2706
18	3.06	-0.3451	-0.0324	0.3451	0.0324	0.4787	0.6547	-0.2722
19	4.01	0.2726	-0.1125	-0.2726	0.1125	-0.4518	-0.4084	-0.2714
20	4.02	-0.8995	-4.0368	0.8995	4.0368	-0.4508	-0.4077	-0.2706
21	4.03	0.0945	-0.4101	-0.0945	0.4101	-0.4528	-0.4092	-0.2722
22	4.04	-1.4931	0.7363	1.4931	-0.7363	2.5375	2.3316	1.3037
23	4.05	-1.3239	-0.5764	1.3239	0.5764	-0.4578	0.6701	-0.2763
24	4.06	-2.5995	1.3026	2.5995	-1.3026	1.7301	2.0239	2.1310
25	4.07	-0.1221	-0.4737	0.1221	0.4737	0.4578	-0.4130	-0.2763
26	4.08	0.3242	-0.0338	-0.3242	0.0338	-0.4578	-0.4130	-0.2763
27	5.01	0.3562	-0.0705	-0.3562	0.0705	-0.4498	-0.4069	-0.2698
28	5.02	0.3414	-0.0638	-0.3414	0.0638	-0.4508	-0.4077	-0.2706
29	5.03	0.2893	-0.0947	-0.2893	0.0947	-0.4508	-0.4077	-0.2706
30	5.04	-1.6857	-0.8397	1.6857	0.8397	-0.4578	0.9624	0.2655
31	5.05	-0.4534	0.0847	0.4534	-0.0847	1.5283	0.2239	0.0060
32	5.06	-3.5160	0.6092	3.5160	-0.6092	4.7578	3.5624	2.6176
33	5.07	0.3779	0.0251	-0.3779	-0.0251	-0.1874	-0.1915	-0.0913
34	5.08	0.3296	0.0965	-0.3296	-0.0965	-0.1268	-0.1915	-0.0427
35	6.01	-1.0564	2.4588	1.0564	-2.4588	-0.4568	6.1779	-0.2754
36	6.02	0.6209	0.0080	-0.6209	-0.0080	-0.4568	-0.4123	-0.2754
37	6.03	0.5031	0.2352	-0.5031	-0.2352	-0.4568	-0.4123	1.0442
38	6.04	0.5057	-0.0661	-0.5057	0.0661	-0.4568	-0.4123	-0.2754
39	6.05	0.5909	0.0323	-0.5909	-0.0323	-0.4568	-0.4123	-0.1238

	Analyte Z-Scores							
DMMU Site	Total Aroclors	4,4'-DDD	4,4'-DDE	4,4'-DDT	gamma-BHC (Lindane)	gamma-Chlordane	TPH-Diesel	TPH-Gasoline
1.01	-0.1408	-0.2517	-0.3574	-0.3599	-0.2730	-0.1268	-0.4670	-0.1236
1.02	0.6965	1.7393	2.4636	-0.2069	0.2469	0.6804	-0.3400	-0.1073
1.03	-0.1142	-0.0115	-0.0162	-0.2544	-0.0989	-0.0240	-0.5261	-0.1141
1.04	0.2295	0.8871	0.7801	1.5611	-0.1681	0.0714	-0.4788	-0.1141
1.05	1.1969	2.1266	1.4626	-0.2174	0.0164	0.2034	-0.3311	-0.1158
1.06	0.2628	0.5772	0.2341	-0.2385	-0.0413	-0.0387	-0.5084	-0.1178
2.01	0.2962	1.0421	0.5981	-0.3494	-0.1450	-0.0497	-0.5468	-0.0869
2.02	0.4630	1.4294	0.8938	-0.3388	-0.0643	0.0530	-0.1184	-0.0852
2.03	0.0059	0.1899	-0.1754	-0.3441	-0.2315	-0.1158	-0.3754	-0.1176
2.04	-0.0007	-0.0270	-0.1982	-0.3494	-0.0528	-0.1451	-0.3636	-0.0835
2.05	0.3295	0.5772	0.3933	-0.3441	-0.0989	-0.0461	-0.2661	9.8811
2.06	0.2628	0.4223	0.0976	-0.3494	-0.1335	-0.0828	0.2067	-0.1166
3.01	-0.2990	-0.5151	0.5753	0.2206	-0.2488	-0.2075	-0.4611	-0.1249
3.02	-0.2988	-0.5228	-0.3574	-0.1699	0.0452	-0.2027	-0.2956	-0.1256
3.03	-0.2990	-0.5151	-0.4257	-0.2544	-0.2257	-0.2141	-0.4168	-0.1256
3.04	0.1627	1.5843	1.4171	1.5611	0.7541	-0.0901	0.5022	-0.0886
3.05	0.3295	1.1970	1.1896	0.0676	0.2181	0.0016	0.8568	-0.1022
3.06	0.0960	0.3448	0.4161	0.0412	0.0164	-0.1194	1.0931	-0.0971
4.01	-0.2980	0.1899	0.1886	-0.2438	-0.1681	-0.1671	0.1476	-0.1073
4.02	-0.2978	0.6547	0.5981	0.5584	0.4659	9.3030	0.2067	-0.0971
4.03	-0.2981	0.3448	0.2796	0.5056	0.6964	0.0934	-0.4198	-0.0988
4.04	1.0968	0.4998	1.1441	-0.2702	-0.1508	0.0310	0.2658	-0.0869
4.05	0.0293	0.3448	1.0986	0.4000	0.5350	0.0567	3.5457	0.1388
4.06	1.0968	0.6547	0.7573	-0.2755	-0.1565	0.0200	5.6141	0.3086
4.07	-0.2990	-0.0425	1.0986	0.4000	0.5812	0.0567	0.6795	-0.1107
4.08	-0.2990	-0.2672	-0.3574	-0.2755	-0.1565	-0.1635	1.9796	-0.1236
5.01	-0.2976	-0.1432	-0.0617	-0.3388	-0.0298	-0.2002	0.1771	-0.1107
5.02	-0.2978	-0.2052	-0.1982	-0.2385	-0.1220	-0.1653	0.6204	-0.1192
5.03	-0.2978	0.0040	-0.2778	-0.2385	0.0625	-0.1653	0.7090	-0.1124
5.04	0.1294	4.4507	0.5298	0.3156	-0.1565	0.0787	0.8272	-0.0665
5.05	0.2628	0.1899	0.2113	-0.2702	0.1662	-0.1763	0.8863	-0.0835
5.06	2.0643	2.2041	2.6911	0.5056	0.6964	0.0934	2.3637	0.0709
5.07	-0.1575	-0.3756	-0.5190	-0.2016	-0.1623	-0.1800	0.0885	-0.1246
5.08	-0.1375	-0.4144	-0.5394	-0.3599	-0.2488	-0.2075	0.8568	-0.1205
6.01	1.1302	0.8871	-0.3461	-0.2702	-0.1508	0.2034	-0.1184	-0.1158
6.02	-0.2988	-0.5964	-0.5281	-0.3546	-0.2430	-0.2057	-0.5379	-0.1246
6.03	-0.0274	-0.6495	-0.5804	-0.4269	-0.3075	-0.2308	-0.4138	-0.1195
6.04	-0.2988	-0.4454	-0.3461	-0.0327	-0.1508	-0.1763	-0.4345	-0.1183
6.05	-0.2676	-0.5771	-0.5281	-0.3546	-0.3006	-0.2057	-0.4463	-0.1193

Station ID		MDS Coordinates				Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS X	Inverse MDS Y	Aroclor 1248	Aroclor 1254	Aroclor 1260
40	6.06	0.4800	0.0879	-0.4800	-0.0879	-0.0864	-0.4130	0.0709
41	7.01	-1.2761	-1.2236	1.2761	1.2236	-0.4568	0.9931	-0.2754
42	7.02	-4.1941	3.8491	4.1941	-3.8491	0.1759	0.0700	8.4573
43	7.03	0.3321	-0.0781	-0.3321	0.0781	-0.4578	-0.4130	-0.2763
44	7.04	-0.3824	-0.7501	0.3824	0.7501	-0.4467	-0.4046	-0.2673
45	7.05	0.4893	-0.0640	-0.4893	0.0640	-0.4568	-0.4123	-0.2754
46	7.06	0.5666	-0.0177	-0.5666	0.0177	-0.4578	-0.4130	-0.2763
47	7.07	0.5529	-0.0023	-0.5529	0.0023	-0.4568	-0.4123	-0.2754
48	7.08	0.4653	-0.0455	-0.4653	0.0455	-0.4568	-0.4123	-0.2389
49	7.09	0.2505	0.0854	-0.2505	-0.0854	-0.4589	-0.4138	0.1358
50	8.01	0.3502	0.0259	-0.3502	-0.0259	-0.2681	-0.4123	-0.1076
51	8.02	0.0581	-0.0319	-0.0581	0.0319	0.3576	-0.4084	0.4277
52	8.03	-0.0521	0.0881	0.0521	-0.0881	0.5594	0.8239	-0.2722
53	8.04	-0.0234	-0.0349	0.0234	0.0349	0.5594	-0.4092	0.3953
54	9.02	0.5529	0.0560	-0.5529	-0.0560	-0.2883	-0.2223	-0.2763
55	9.04	-0.1991	-0.4783	0.1991	0.4783	-0.4568	-0.4123	-0.2754
56	10.01	0.3879	0.0068	-0.3879	-0.0068	-0.1470	-0.4123	0.0547
57	10.03	0.6304	0.0631	-0.6304	-0.0631	-0.4568	-0.4123	-0.2754
58	10.04	0.6668	0.0591	-0.6668	-0.0591	-0.4568	-0.4123	-0.2754
59	3.01N	0.5275	-0.1027	-0.5275	0.1027	-0.4589	-0.4138	-0.2771
60	3.02N	0.3875	-0.0745	-0.3875	0.0745	-0.4568	-0.4123	-0.2754
61	3.03N	0.5399	-0.0708	-0.5399	0.0708	-0.4578	-0.4130	-0.2763
62	3.04N	0.5872	0.0317	-0.5872	-0.0317	-0.4578	-0.4130	-0.2763
63	3.05N	0.6205	0.0253	-0.6205	-0.0253	-0.4639	-0.4177	-0.2811
64	3.06N	0.6217	0.0306	-0.6217	-0.0306	-0.4568	-0.4123	-0.2754
65	45.01N	0.6220	0.0278	-0.6220	-0.0278	-0.4578	-0.4130	-0.2763
66	45.02N	0.6617	0.0522	-0.6617	-0.0522	-0.4578	-0.4130	-0.2763
67	45.03N	0.6181	0.0269	-0.6181	-0.0269	-0.4568	-0.4123	-0.2754
68	45.04N	0.5575	0.1319	-0.5575	-0.1319	-0.4568	0.3316	-0.2754
69	45.05N	0.6710	0.0578	-0.6710	-0.0578	-0.4578	-0.4130	-0.2763
70	45.06N	0.6685	0.0598	-0.6685	-0.0598	-0.4568	-0.4123	-0.2754
71	45.07N	0.6738	0.0587	-0.6738	-0.0587	-0.4578	-0.4130	-0.2763
72	45.08N	0.6452	0.0353	-0.6452	-0.0353	-0.4578	-0.4130	-0.2763
73	45.09N	0.6057	0.0117	-0.6057	-0.0117	-0.4568	-0.4123	-0.2860
74	45.10N	0.6100	0.0143	-0.6100	-0.0143	-0.4578	-0.4130	-0.2827
75	45.11N	0.6752	0.0603	-0.6752	-0.0603	-0.4568	-0.4123	-0.2754
76	45.12N	0.5573	0.0906	-0.5573	-0.0906	0.0548	-0.3223	-0.2471
77	45.13N	0.5310	0.0091	-0.5310	-0.0091	-0.2479	-0.3761	-0.2746
78	45.15N	0.6269	0.0692	-0.6269	-0.0692	-0.3065	-0.3854	-0.2763

DMMU.Site	Analyte Z-Scores							
	Total Aroclors	4,4'-DDD	4,4'-DDE	4,4'-DDT	gamma-BHC (Lindane)	gamma-Chlordane	TPH-Diesel	TPH-Gasoline
6.06	-0.1609	-0.4531	-0.6850	-0.4275	-0.3225	-0.2064	-0.0888	-0.1258
7.01	0.0059	1.2745	2.4636	2.8277	0.3391	0.7538	0.2953	-0.1188
7.02	9.0366	0.6547	1.0303	-0.3599	0.1777	-0.2075	3.2502	0.0370
7.03	-0.2990	-0.0193	0.1658	-0.2755	-0.1220	-0.1782	-0.0888	-0.1056
7.04	-0.2971	0.1512	1.6674	0.6639	1.2728	0.1484	0.2067	-0.0920
7.05	-0.2988	-0.5228	-0.4257	0.3051	-0.2695	-0.2075	-0.2661	-0.1188
7.06	-0.2990	-0.6003	-0.5394	0.0412	-0.2776	-0.2075	-0.4286	-0.1192
7.07	-0.2988	-0.5073	-0.5281	-0.1277	-0.2684	-0.2057	-0.3518	-0.1190
7.08	-0.2913	-0.3446	-0.5690	0.1784	-0.2257	-0.2075	-0.1184	-0.1178
7.09	-0.2142	-0.2439	-0.3688	-0.2807	-0.1623	-0.1800	1.4477	-0.0886
8.01	-0.2309	-0.0193	-0.0844	-0.3599	-0.2488	-0.1745	-0.2365	0.1728
8.02	-0.0141	0.3448	0.0748	-0.3441	0.2238	-0.1121	-0.5379	-0.1022
8.03	0.1294	0.5772	0.2341	-0.3494	-0.1796	-0.0791	-0.5202	-0.1073
8.04	0.0093	0.5772	0.2568	-0.3441	-0.0067	-0.1048	-0.5054	-0.1124
9.02	-0.2242	-0.5383	-0.5849	-0.3599	-0.2488	-0.2075	-0.4582	-0.1234
9.04	-0.2988	-0.0425	1.0986	0.4000	0.5812	0.0567	1.0340	-0.1090
10.01	-0.1742	-0.3989	-0.0162	-0.2702	-0.1911	-0.1763	-0.5409	-0.1186
10.03	-0.2988	-0.6313	-0.6839	-0.4269	-0.3220	-0.2308	-0.2661	-0.1215
10.04	-0.2988	-0.6495	-0.6839	-0.4269	-0.3087	-0.2308	-0.5350	-0.1224
3.01N	-0.2991	-0.6003	-0.5394	0.6111	-0.2488	-0.2075	-0.4582	-0.1181
3.02N	-0.2988	0.0195	-0.4712	-0.0960	-0.0528	-0.1158	-0.0297	-0.1227
3.03N	-0.2990	-0.6003	-0.5394	0.4000	-0.2488	-0.2075	-0.4582	-0.1220
3.04N	-0.2990	-0.4531	-0.5986	-0.3990	-0.2488	-0.2075	-0.3754	-0.1166
3.05N	-0.3000	-0.6135	-0.5281	-0.3546	-0.2430	-0.2057	-0.5409	-0.1236
3.06N	-0.2988	-0.6003	-0.5394	-0.3599	-0.2488	-0.2273	-0.5498	-0.1253
45.01N	-0.2990	-0.6003	-0.5394	-0.3599	-0.2488	-0.2075	-0.5586	-0.1231
45.02N	-0.2990	-0.6011	-0.7082	-0.4275	-0.2591	-0.2310	-0.5619	-0.1251
45.03N	-0.2833	-0.5964	-0.5281	-0.3546	-0.2430	-0.2057	-0.5731	-0.1249
45.04N	-0.1375	-0.4608	-0.6839	-0.4269	-0.3006	-0.1635	-0.5702	-0.1207
45.05N	-0.2990	-0.6499	-0.6850	-0.4275	-0.2960	-0.2310	-0.5707	-0.1198
45.06N	-0.2988	-0.6359	-0.6839	-0.4269	-0.3220	-0.2308	-0.5527	-0.1212
45.07N	-0.2990	-0.6499	-0.6850	-0.4275	-0.3052	-0.2310	-0.5835	-0.1192
45.08N	-0.2990	-0.6073	-0.6668	-0.3494	-0.2488	-0.2075	-0.5699	-0.1248
45.09N	-0.3010	-0.6003	-0.5394	-0.3599	-0.1104	-0.2075	-0.5409	-0.1244
45.10N	-0.3003	-0.6003	-0.5394	-0.3599	-0.1335	-0.2075	-0.5557	-0.1249
45.11N	-0.2988	-0.6495	-0.6839	-0.4269	-0.3220	-0.2308	-0.5843	-0.1208
45.12N	-0.1809	-0.6189	-0.6668	-0.4290	-0.3243	-0.2315	-0.4552	-0.1158
45.13N	-0.2509	-0.5771	-0.3347	-0.3705	-0.1450	-0.1745	-0.5439	-0.1185
45.15N	-0.2609	-0.6406	-0.7028	-0.4116	-0.3168	-0.2315	-0.4434	-0.1141

Station ID		MDS Coordinates				Analyte Z-Scores		
MDS Var Number	DMMU.Site	MDS X	MDS Y	Inverse MDS X	Inverse MDS Y	Aroclor 1248	Aroclor 1254	Aroclor 1260
79	45.16N	0.6523	0.0488	-0.6523	-0.0488	-0.4578	-0.4130	-0.2763
80	6.01N	0.6455	0.0458	-0.6455	-0.0458	-0.4578	-0.4130	-0.2763
81	6.02N	0.6194	0.0251	-0.6194	-0.0251	-0.4568	-0.4123	-0.2754
82	6.03N	0.4908	-0.0636	-0.4908	0.0636	-0.4589	-0.4138	-0.2771
83	6.04N	0.4781	-0.0485	-0.4781	0.0485	-0.4568	-0.4123	-0.2754
84	6.05N	0.5226	-0.0346	-0.5226	0.0346	-0.4578	-0.4130	-0.2763
85	6.06N	0.6404	0.0480	-0.6404	-0.0480	-0.4589	-0.4138	-0.2771
86	7.01N	0.6715	0.0609	-0.6715	-0.0609	-0.4568	-0.4123	-0.2754
87	7.02N	0.6341	0.0615	-0.6341	-0.0615	-0.4568	-0.4123	-0.2754
88	7.03N	0.6593	0.0590	-0.6593	-0.0590	-0.4568	-0.4123	-0.2754
89	7.05N	0.6423	0.0603	-0.6423	-0.0603	-0.4578	-0.4130	-0.2211
90	7.06N	0.3569	-0.2031	-0.3569	0.2031	-0.4578	-0.4130	-0.2763
91	7.07N	0.4785	-0.0778	-0.4785	0.0778	-0.4568	-0.4123	-0.1952
92	7.08N	0.3509	-0.2031	-0.3509	0.2031	-0.4488	-0.4061	-0.2690
93	7.09N	0.3548	-0.1056	-0.3548	0.1056	-0.4558	-0.4115	-0.2746
94	10.01N	0.5848	0.0293	-0.5848	-0.0293	-0.4578	-0.4130	-0.2763
95	10.03N	0.6111	0.0154	-0.6111	-0.0154	-0.4578	-0.4130	-0.2763
96	10.04N	0.6549	0.0497	-0.6549	-0.0497	-0.4578	-0.4130	-0.2763
97	BL	0.6671	0.0554	-0.6671	-0.0554	-0.4578	-0.4130	-0.2763
98	MR	0.5035	-0.0534	-0.5035	0.0534	-0.4568	-0.4123	-0.2195
99	MT	-6.4124	-3.7559	6.4124	3.7559	4.3541	-0.3707	1.8066
100	SB	-0.1626	-0.5650	0.1626	0.5650	-0.3963	-0.3661	-0.2268
				Correlation with Inverse MDS X		0.7803	0.5059	0.6616
				Correlation with Inverse MDS Y		0.0021	-0.3607	-0.3498

DMMU.Site	Analyte Z-Scores							
	Total Aroclors	4,4'-DDD	4,4'-DDE	4,4'-DDT	gamma-BHC (Lindane)	gamma-Chlordane	TPH-Diesel	TPH-Gasoline
45.16N	-0.2990	-0.6483	-0.6919	-0.4116	-0.2142	-0.2281	-0.5114	-0.1107
6.01N	-0.2990	-0.6057	-0.6850	-0.3282	-0.3156	-0.2310	-0.5054	-0.1190
6.02N	-0.2988	-0.5964	-0.5281	-0.3546	-0.2430	-0.2057	-0.5696	-0.1239
6.03N	-0.2991	-0.4299	-0.5394	0.3051	-0.2488	-0.2075	-0.2661	-0.1141
6.04N	-0.2988	-0.4531	-0.3461	0.0517	-0.2257	-0.1763	-0.2661	-0.1163
6.05N	-0.2990	-0.4763	-0.5394	0.1045	-0.2488	-0.2075	-0.3252	-0.1164
6.06N	-0.2991	-0.6166	-0.6862	-0.3282	-0.3260	-0.2312	-0.4404	-0.1212
7.01N	-0.2988	-0.6567	-0.6839	-0.4269	-0.3156	-0.2308	-0.5557	-0.1164
7.02N	-0.2988	-0.6495	-0.6555	-0.4269	-0.2580	-0.2308	-0.3843	-0.0580
7.03N	-0.2988	-0.6495	-0.6839	-0.4269	-0.2949	-0.2308	-0.4936	-0.1158
7.05N	-0.2876	-0.6034	-0.6691	-0.4275	-0.2730	-0.2310	-0.5173	-0.1073
7.06N	-0.2990	-0.0348	-0.3574	0.8222	-0.1565	-0.1782	-0.3843	-0.1141
7.07N	-0.2823	-0.4531	-0.4029	0.3051	-0.2568	-0.1084	-0.4523	-0.1141
7.08N	-0.2975	-0.1897	-0.4939	1.0333	-0.2672	-0.2002	0.0294	-0.1107
7.09N	-0.2986	-0.4221	-0.2209	0.4528	-0.2499	-0.2057	0.2953	-0.1124
10.01N	-0.2990	-0.5151	-0.4029	-0.4275	-0.2626	-0.2310	-0.4759	-0.1124
10.03N	-0.2990	-0.5771	-0.5394	-0.2438	-0.2776	-0.2075	-0.5764	-0.1192
10.04N	-0.2990	-0.6173	-0.6850	-0.3684	-0.3018	-0.2310	-0.5379	-0.1203
BL	-0.2990	-0.6499	-0.6828	-0.4100	-0.3035	-0.2249	-0.5557	-0.1225
MR	-0.2873	-0.4066	-0.5417	-0.0960	0.0394	-0.1158	-0.4670	-0.1225
MT	0.9300	5.9226	6.3312	8.5273	9.4567	2.8820	3.2502	-0.1039
SB	-0.2888	0.0737	1.4399	0.5584	0.7541	0.1117	-0.2661	-0.0852
Inverse X Corr	0.6568	0.8616	0.8777	0.6219	0.6793	0.3340	0.7017	0.1183
Inverse Y Corr	-0.4726	0.2502	0.3095	0.5335	0.4684	0.5744	-0.0274	-0.4941

Appendix C: Comparison of Dredged Elutriate Results to Standards and Calculation of Mixing Zones

Objectives

The dredging elutriate test (DRET) is described in DiGiano, Miller and Yoon (1995). The DRET test was developed for the assessment of water quality impacts associated with release of contaminants during dredging at the dredging site. Point of disposal versus point of dredging differs with respect to concentration of suspended solids, which in turn affects the distribution of contaminants between solid and aqueous phases. The maximum TSS concentration at the point of dredging is typically less than 10,000 mg/L (DiGiano, Miller and Yoon (1995) or a solids to water volumetric ratio of 1:250 (as compared to roughly 1:4 for the standard elutriate test and 1:17 for the modified elutriate test). The DRET test is similar to the other two elutriate tests in that site water is used to slurry the in-situ sediments, the slurry is aerated for a specified period, and the supernatant is measured for total and dissolved contaminant concentrations and TSS. An initial concentration of 10 g/L was used for the IHNC sediments.

According to the ITM (USEPA/USACE 1998), “material re-suspended during normal dredging operations is considered “de minimus” and is not regulated under Section 404 as a dredged material discharge. The potential impact of re-suspension due to dredging can be addressed under NEPA.” Of particular concern to the community with respect to the IHNC dredging is the potential for transport of suspended solids and contaminants to Lake Ponchartrain during dredging. Results of the DRET test were used in conjunction with modeling of SS using the DREDGE[1] model, in order to predict distance to compliance with applicable water quality criteria from the point of dredging.

Data evaluation and dilution requirements

Dredging elutriates were prepared for both freshwater and marine locations of the IHNC and analyzed by Test America (Weston 2008) for total and dissolved contaminant concentrations. Results obtained for total and dissolved elutriate fractions are summarized here. The raw data for both total and dissolved fractions are reported in Weston (2008).

Dissolved phase elutriate concentrations were compared to applicable WQC for all contaminants (both organic compounds and metals) as this is considered to be the bioavailable phase. Toxicity testing was not conducted on Dredging elutriates; however, toxicity testing conducted on freshwater and marine standard

[1] http://el.erdc.usace.army.mil/products.cfm?Topic=model&Type=drgmat

elutriates could be considered conservatively representative of the Dredging elutriates. The SE toxicity testing would be considered to be conservative because of the higher suspended solids concentrations in the SE test (~150 g/L vs. 10 g/L in the Dredging elutriate) and the higher initial dilution expected at the dredge. A reasonable interpretation might be to multiply the dilution obtained using the LC50 from the SE toxicity tests by .15 (the ratio of the initial solids concentrations) or by the ratio of the measured elutriate concentrations. The ratio of dredge to standard elutriates concentrations was as follows: mean 0.73, geometric mean 0.88, maximum 0.45. Since we are using the maximum dilution obtained in the standard elutriate testing, the ratio of the maximum concentrations was selected (0.45). Applying the factor to the maximum LC50 obtained in the freshwater SE testing (384) yields a maximum dilution requirement for the freshwater dredging elutriate of 195. For the marine elutriates, no LC50 could be calculated (LC50 was predicted to be greater than the 100% dilution).

In this case, some sites that are presently marine in character are expected be freshwater when dredging takes place (once the old lock is opened permanently). This may impact portions of DMMUs 9 and 10 in particular. The importance of this is that the higher ionic strength of saltwater limits the activity of contaminants to some degree, which may in turn result in reduced dissolved concentrations in the elutriate testing. The magnitude of this effect is expected to be range from approximately 5% to 20%, based on a preliminary evaluation using the Setschenow equation and Setschenow constants available for contaminants present in the IHNC. This is not enough to alter dilution requirements any more than the sediment variability itself, but is mentioned here for completeness.

Mean (arithmetic and geometric) and maximum contaminant concentrations were determined for each constituent, utilizing the dredging elutriate results obtained from all DMMUs (Tables C1 through C4). Data was rejected in the data validation for eight samples and seven compounds (Table C5). As for the other elutriate tests, a value of half the reporting limit (0.5RL) was assumed for all non-detects in calculating the means. Where the maximum elutriate concentration was less than the laboratory reporting limit (RL) for that sample, the highest qualified value was taken as the maximum. Where the maximum elutriate concentration was less than the RL *and* there were no qualified values (all samples were non-detect), the compound was assumed not to be present, and dilutions were not reported. Partitioning analysis could be used to predict dissolved concentrations in those cases, but the assumption of 0.5RL should be conservative, since the results would not have been qualified as a non-detect if the compound were detected above 0.5RL. Dilutions calculated using 0.5RL as the maximum confirmed that they were not controlling, and these were therefore not included in the report.

The DREDGE model enables determination of the dilution available within a water body based on evaluation of predicted TSS in the water column, without settling. The results of the model are applied to calculate TSS remaining in the water as a function of distance from the dredge, taking into account both effects of dilution and settling. A partitioning coefficient, calculated using the maximum Dredging elutriate data and the sediment chemistry, allows determination of the fraction dissolved and can be used with the predicted TSS level to calculate a new equilibrium concentration at the point of interest.

Flow conditions and geometry specific to the IHNC were used in the model, based on information provided by MVN. The following were the model assumptions used:

- Water depth 11 m
- Velocity 0.61 cm/sec
- Lateral diffusion coefficient 60 cm^2/sec
- Vertical diffusion coefficient of 5 cm^2/sec
- Modeling domain 400 m long and 100 m wide
- Source rate 0.22 kg/sec of solids
- Production rate 900 cy/hr
- Solids loss 0.1%

Concentrations were estimated at the bottom of the water column and one meter above the bottom. Distance to compliance with the most conservative of acute and chronic Federal marine or State of Louisiana marine or brackish water quality criteria was calculated. Where no such criteria existed, EPA Region 4 water quality screening criteria for hazardous waste sites were used, if available. Distance to achieve a dilution of 195, as extrapolated from the freshwater SE toxicity testing, was also calculated.

Mixing

Distance to compliance with water quality criteria for marine dredging elutriates are listed in Table C6 and for freshwater dredging elutriates in Table C7. For marine elutriates, maximum distance to meet acute criteria was less than 25 m (total Cyanide), and maximum distance to meet chronic criteria was <350 m (total PCBs).

For freshwater elutriates, maximum distance to meet acute criteria was less than 1 m for most constituents. Maximum distance to meet chronic criteria for freshwater elutriates was <38 m (mercury). Maximum distance to achieve a dilution ratio of 195 required based on freshwater toxicity (extrapolated to dredging elutriate from standard elutriate) was <200 m (for both 0 m and 1 m above the bottom).

Turbidity limits for estuarine lakes, bays, bayous, and canals are given in LAC 33:IX.§1113.B.9 (a) and (b)(ii). It is specified that “turbidity other than that of natural origin shall not cause substantial visual contrast with the natural appearance of the waters of the state or impair any designated water use. Turbidity shall not significantly exceed background; background is defined as the natural condition of the water. Determination of background will be on a case-by-case basis”. The numerical turbidity limit for these water bodies is 50 NTU.

Background TSS was measured as part of the surface water quality analysis and ranged from 3.6 mg/L to 30.8 mg/L. Correspondence of TSS to turbidity was evaluated in the column settling tests reported in Weston (2008). The relationship is linear according to the following equation:

$$TSS = xTurbidity$$

Where

TSS = total suspended solids concentration (mg/L)
Turbidity = measured turbidity (NTU)

For the sediments tested, the coefficient x ranges from 0.819 to 1.64. To meet a turbidity limit of 50 NTU, maximum allowable TSS would therefore range from 42.5 mg/L to 82.0 mg/L. Based on the DREDGE modeling, at 0 depth above the bottom, TSS will be <45 mg/L at 100 m from the dredge. At a depth of 1 m above the bottom, TSS are predicted to be <32 mg/L 100 m from the dredge. (Differences in salinity could be considered in modeling movement of suspended solids away from the dredge, but in this case there is no data available to suggest that there is a significant salinity gradient within the IHNC or to permit estimation of effects on settling rate. Salinity considerations should be of secondary importance since the goal is primarily estimation of dissolved contaminant concentration, and this is more strongly a function of source strength and partitioning than settling. No adjustments were therefore made in the DREDGE modeling to account for salinity differences in the different locations of the IHNC.)

Although background TSS will be exceeded for a moderate distance from the dredge location, turbidity induced by a hydraulic dredge will not be visible at the surface and should not “cause substantial visual contrast” in violation of LA WQC. In addition, LAC 33:IX.§1113.B.9 (c) specifies: “The administrative authority may exempt for short periods certain activities permitted under Sections 402 or 404 and certified under Section 401 of the Clean Water Act, such as maintenance dredging of navigable waterways or other short-term activities that the state determines are necessary to accommodate legitimate uses or emergencies or to protect the public health and welfare.” Based on this and expected dilution of dissolved constituents, water column impacts associated with the dredging should not be unacceptable from a regulatory perspective.

Conclusions

Based on evaluation of the dredged elutriate results and anticipated dilution in the IHNC, water column impacts associated with dredging should not be unacceptable from an environmental or regulatory perspective. For marine elutriates, maximum distance to meet acute criteria was < 25 m (from the dredge) and to meet chronic criteria <350 m. For freshwater elutriates, maximum distance to meet acute criteria was < 1 m (from the dredge) and to meet chronic criteria < 30m. TSS objectives, and by inference turbidity objectives, are expected to be met within 100 m of the dredge and may be exempted from State criteria for purposes of dredging in any case, as specified in the State water quality regulations. Maximum distance to meet a dilution of 195 (based on toxicity testing) was <200 m at the bottom and at one m above the bottom.

References

DiGiano, F.A., C.T. Miller, and J. Yoon. 1995. *Dredging elutriate test (DRET) development.* Contract Report D-95-1, Vicksburg, MS: U.S. Army Corps of Engineers, Waterways Experiment Station.

U.S. Environmental Protection Agency and U.S. Army Corps of Engineers (USEPA and USACE). 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Inland Testing Manual).* EPA 823-B-98-004. Washington, DC: Office of Water.

Weston Solutions, Inc. 2008. *Inner Harbor Navigation Canal Evaluation of Material Generated from Lock Construction. New Orleans, Louisiana*. Prepared for the U.S. Army Engineer District, Tulsa, OK, and the U.S. Army Engineer District, New Orleans, LA. Contract No. W912BV-04-D-2026.

Table C1. Dredging elutriate results - dissolved fraction (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Maximum Value Above RL								
Aldrin	0.00791	0.00496	0.014	µg/L	0.00053	0.0025	PG N	10_C3&4 - FN
Aluminum	707	435	1930	µg/L	6.1	150	J	10_C3&4 - FN
Ammonia as Nitrogen	0.260	0.220	0.4	mg/L	0.0094	0.1	J	9_1 - NN
Barium	99.7	99.2	115	µg/L	0.38	50		9_C2&4 - NN
Calcium	49240	46858	84400	µg/L	31.3	500		9_C2&4 - NN
gamma-BHC (Lindane)	0.00378	0.00319	0.0066	µg/L	0.00075	0.0026	PG N	9_C2&4 - NN
Heptachlor	0.0108	0.00317	0.047	µg/L	0.00066	0.0025	PG N	10_1 - NN
pH	8.00	8.00	8.2	No Units				10_C3&4 - FN
Total Organic Carbon	3.64	3.63	3.8	mg/L				10_C3&4 - FN
Total Suspended Solids	4.40	3.84	7	mg/L	3.4	4		9_C2&4 - NN
TPH (as Diesel)	80.0	71.9	140	µg/L	47	100	B	9_C2&4 - NN
Chromium III	5.64	5.45	7.5	µg/L	0.27	2		9_1 - NN
Group II: Maximum Value <RL, Some Qualified Values Reported								
4,4'-DDD	0.00112	0.00107	0.00056[a]	µg/L	0.00038	0.0026	J	9_C2&4 - NN
4,4'-DDT	0.00160	0.00155	0.0023	µg/L	0.00065	0.0025	J PG	10_1 - NN
Arsenic	3.02	2.95	4.2	µg/L	0.7	5	B	10_C3&4 - FN
bis(2-Ethylhexyl) phthalate	0.298	0.264	0.51	µg/L	0.11	0.96	J	10_1 - NN
Chromium	5.54	5.38	6.9	µg/L	0.56	10	B J	9_C2&4 - NN
Copper	3.02	2.82	4.7	µg/L	0.7	10	B	10_C3&4 - FN
Cyanide, Total	4.56	4.36	5.5	µg/L	1.7	10	B J	9_1 - NN
Endrin	0.00124	0.00124	0.0011	µg/L	0.00036	0.0025	J PG	10_1 - NN
gamma-Chlordane	0.00152	0.00146	0.0025	µg/L	0.00036	0.0025	PG	10_C3&4 - FN
Lead	0.890	0.646	1.8	µg/L	0.1	5	B J	10_C3&4 - FN
Mercury	0.0918	0.0900	0.059	µg/L	0.055	0.2	B	9_C2&4 - NN

Table C1. Dredging elutriate results - dissolved fraction (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Nickel	2.30	2.18	3.2	µg/L	0.36	5	B	10_C3&4 - FN
Phenanthrene	0.0922	0.0915	0.071	µg/L	0.054	0.2	J	10_C3&4 - F
Selenium	4.48	3.70	10.1	µg/L	1	25	B	9_C2&4 - NN
Thallium	1.088	0.448	0.2	µg/L	0.09	5	B J	9_C2&4 - NN
TPH (as Gasoline)	43.4	42.6	50	µg/L	28	100	J	10_C3&4 - F
Zinc	11.6	10.9	17.3	µg/L	3	25	B	10_C3&4 - F
Group III: All Samples Non-Detect								
1,2,4-Trichlorobenzene	0.0980	0.0980	0.1	µg/L	0.039	0.2	U	
1,2-Dichlorobenzene	0.0980	0.0980	0.1	µg/L	0.031	0.2	U	
1,2-Diphenylhydrazine	0.0980	0.0980	0.1	µg/L	0.044	0.2	U	
1,3-Dichlorobenzene	0.0980	0.0980	0.1	µg/L	0.036	0.2	U	
1,4-Dichlorobenzene	0.0980	0.0980	0.1	µg/L	0.047	0.2	U	
2,2'-oxybis(1-Chloropropane)	0.0980	0.0980	0.1	µg/L	0.025	0.2	U	
2,4,5-T	0.500	0.500	0.5	µg/L	0.17	1	U	
2,4,5-TP (Silvex)	0.500	0.500	0.5	µg/L	0.16	1	U	
2,4,6-Trichlorophenol	0.488	0.488	0.5	µg/L	0.058	1	U	
2,4-D	2.00	2.00	2	µg/L	1.5	4	U	
2,4-DB	2.00	2.00	2	µg/L	0.59	4	U	
2,4-Dichlorophenol	0.0980	0.0980	0.1	µg/L	0.048	0.2	U	
2,4-Dimethylphenol	0.488	0.488	0.5	µg/L	0.053	1	U	
2,4-Dinitrophenol	2.46	2.46	2.55	µg/L	1.3	5.1	U	
2,4-Dinitrotoluene	0.488	0.488	0.5	µg/L	0.046	1	U	
2,6-Dinitrotoluene	0.488	0.488	0.5	µg/L	0.052	1	U	
2-Chloronaphthalene	0.0980	0.0980	0.1	µg/L	0.043	0.2	U	
2-Chlorophenol	0.488	0.488	0.5	µg/L	0.046	1	U	

Table C1. Dredging elutriate results - dissolved fraction (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
2-Methylnaphthalene	0.0980	0.0980	0.1	µg/L	0.046	0.2	U	
2-Nitrophenol	0.488	0.488	0.5	µg/L	0.055	1	U	
3,3'-Dichlorobenzidine	0.488	0.488	0.5	µg/L	0.042	1	U	
4,4'-DDE	0.00127	0.00127	0.0013	µg/L	0.00033	0.0026	U	
4,6-Dinitro-2-methylphenol	2.46	2.46	2.55	µg/L	1.4	5.1	U	
4-Bromophenyl phenyl ether	0.488	0.488	0.5	µg/L	0.051	1	U	
4-Chloro-3-methylphenol	0.488	0.488	0.5	µg/L	0.06	1	U	
4-Chlorophenyl phenyl ether	0.488	0.488	0.5	µg/L	0.043	1	U	
4-Methylphenol	0.488	0.488	0.5	µg/L	0.075	1	U	
4-Nitrophenol	2.46	2.46	2.55	µg/L	0.072	5.1	U	
Acenaphthene	0.0980	0.0980	0.1	µg/L	0.051	0.2	U	
Acenaphthylene	0.0980	0.0980	0.1	µg/L	0.045	0.2	U	
alpha-BHC	0.00127	0.00127	0.0013	µg/L	0.00075	0.0026	U	
alpha-Chlordane	0.00127	0.00127	0.0013	µg/L	0.00056	0.0026	U	
Anthracene	0.0980	0.0980	0.1	µg/L	0.05	0.2	U	
Antimony	5.00	5.00	5	µg/L	0.24	10	U	
Aroclor 1016	0.00970	0.00970	0.01	µg/L	0.005	0.02	U	
Aroclor 1221	0.00970	0.00970	0.01	µg/L	0.0049	0.02	U	
Aroclor 1232	0.00970	0.00970	0.01	µg/L	0.0058	0.02	U	
Aroclor 1242	0.00970	0.00970	0.01	µg/L	0.0037	0.02	U	
Aroclor 1248	0.00970	0.00970	0.01	µg/L	0.0045	0.02	U	
Aroclor 1254	0.00970	0.00970	0.01	µg/L	0.0045	0.02	U	
Aroclor 1260	0.00970	0.00970	0.01	µg/L	0.0027	0.02	U	
Aroclors (Total)	0.00970	0.00970	0.01	µg/L	0.0058	0.02	U	
Benzidine	9.80	9.80	10	µg/L	5.5	20	U	

Table C1. Dredging elutriate results - dissolved fraction (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Benzo(a)anthracene	0.0980	0.0980	0.1	µg/L	0.04	0.2	U	
Benzo(a)pyrene	0.0980	0.0980	0.1	µg/L	0.043	0.2	U	
Benzo(b)fluoranthene	0.0980	0.0980	0.1	µg/L	0.031	0.2	U	
Benzo(ghi)perylene	0.0980	0.0980	0.1	µg/L	0.027	0.2	U	
Benzo(k)fluoranthene	0.0980	0.0980	0.1	µg/L	0.039	0.2	U	
Benzoic acid	2.46	2.46	2.55	µg/L	0.43	5.1	U	
Beryllium	2.50	2.50	2.5	µg/L	0.34	5	U	
beta-BHC	0.00127	0.00127	0.0013	µg/L	0.00072	0.0026	U	
bis(2-Chloroethoxy)methane	0.488	0.488	0.5	µg/L	0.12	1	U	
bis(2-Chloroethyl) ether	0.0980	0.0980	0.1	µg/L	0.045	0.2	U	
Butyl benzyl phthalate	0.488	0.488	0.5	µg/L	0.14	1	U	
Cadmium	2.50	2.50	2.5	µg/L	0.53	5	U	
Chlordane (technical)	0.0122	0.0122	0.0125	µg/L	0.0074	0.025	U	
Chrysene	0.0980	0.0980	0.1	µg/L	0.035	0.2	U	
Chromium VI	0.00500	0.00500	0.005	mg/L	0.0026	0.01	U	
Dalapon	1.00	1.00	1	µg/L	0.52	2	U	
delta-BHC	0.00127	0.00127	0.0013	µg/L	0.00047	0.0026	U	
Diazinon	0.486	0.486	0.5	µg/L	0.12	1	U	
Dibenz(a,h)anthracene	0.0980	0.0980	0.1	µg/L	0.034	0.2	U	
Dibenzofuran	0.488	0.488	0.5	µg/L	0.055	1	U	
Dibutyltin	0.0190	0.0190	0.0195	µg/L	0.01	0.039	U	
Dicamba	1.00	1.00	1	µg/L	0.33	2	U	
Dichlorprop	2.00	2.00	2	µg/L	0.72	4	U	
Dieldrin	0.00127	0.00127	0.0013	µg/L	0.0004	0.0026	U	
Diethyl phthalate	0.488	0.488	0.5	µg/L	0.25	1	U	

Table C1. Dredging elutriate results - dissolved fraction (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Dimethyl phthalate	0.488	0.488	0.5	µg/L	0.043	1	U	
Di-n-butyl phthalate	0.488	0.488	0.5	µg/L	0.047	1	U	
Di-n-octyl phthalate	0.488	0.488	0.5	µg/L	0.043	1	U	
Dinoseb	0.3	0.3	0.3	µg/L	0.26	0.6	U	
Endosulfan I	0.00127	0.00127	0.0013	µg/L	0.00037	0.0026	U	
Endosulfan II	0.00127	0.00127	0.0013	µg/L	0.00075	0.0026	U	
Endosulfan sulfate	0.00127	0.00127	0.0013	µg/L	0.00079	0.0026	U	
Endrin aldehyde	0.00127	0.00127	0.0013	µg/L	0.0006	0.0026	U	
Fluoranthene	0.0980	0.0980	0.1	µg/L	0.048	0.2	U	
Fluorene	0.0980	0.0980	0.1	µg/L	0.053	0.2	U	
Heptachlor epoxide	0.00127	0.00127	0.0013	µg/L	0.00049	0.0026	U	
Hexachlorobenzene	0.0980	0.0980	0.1	µg/L	0.043	0.2	U	
Hexachlorobutadiene	0.0980	0.0980	0.1	µg/L	0.037	0.2	U	
Hexachlorocyclopentadiene	0.488	0.488	0.5	µg/L	0.082	1	U	
Hexachloroethane	0.488	0.488	0.5	µg/L	0.044	1	U	
Indeno(1,2,3-cd)pyrene	0.0980	0.0980	0.1	µg/L	0.047	0.2	U	
Isophorone	0.488	0.488	0.5	µg/L	0.048	1	U	
MCPA	200	200	200	µg/L	94	400	U	
MCPP	200	200	200	µg/L	130	400	U	
Methoxychlor	0.00244	0.00244	0.0025	µg/L	0.00091	0.005	U	
Monobutyltin	0.248	0.248	0.255	µg/L	0.05	0.51	U	
Naphthalene	0.0980	0.0980	0.1	µg/L	0.042	0.2	U	
Nitrobenzene	0.0980	0.0980	0.1	µg/L	0.063	0.2	U	
N-Nitrosodimethylamine	0.488	0.488	0.5	µg/L	0.046	1	U	
N-Nitrosodi-n-propylamine	0.0980	0.0980	0.1	µg/L	0.058	0.2	U	

Table C1. Dredging elutriate results - dissolved fraction (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
N-Nitrosodiphenylamine	0.0980	0.0980	0.1	µg/L	0.048	0.2	U	
Pentachlorophenol	0.488	0.488	0.5	µg/L	0.085	1	U	
Phenol	0.0980	0.0980	0.1	µg/L	0.022	0.2	U	
Pyrene	0.0980	0.0980	0.1	µg/L	0.055	0.2	U	
Silver	2.50	2.50	2.5	µg/L	0.39	5	U	
Tetrabutyltin	0.0248	0.0248	0.0255	µg/L	0.0086	0.051	U	
Tin	12.5	12.5	12.5	µg/L	3.8	25	U	
Toxaphene	0.00127	0.00127	0.0013	µg/L	0.00075	0.0026	U	
Tributyltin	0.0220	0.0220	0.0225	µg/L	0.012	0.045	U	

[a] Where the highest qualified value has been selected as the maximum, the mean is sometimes higher than the selected maximum value as a result of being inflated by the assumption of ½ the RL for non-detects. This occurs in cases where RL's vary from sample to sample and are lower for the qualified sample.

Table C2. Dredging elutriate results - dissolved fraction (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Maximum Value Above RL								
4,4'-DDT[1]	0.00158	0.00143	0.0031	µg/L	0.00066	0.0025		3_C1_3 - F
Aldrin	0.00521	0.00256	0.039	µg/L	0.0022	0.01	PG	10_C1_6 - NN
alpha-Chlordane[1]	0.00166	0.00148	0.0044	µg/L	0.00054	0.0025	PG	3_C1_3 - F
Aluminum	157	118	994	µg/L	6.1	150		7_6 - F
Ammonia as Nitrogen	0.386	0.334	1.8	mg/L	0.0094	0.1		6_2 - N
Aroclor 1248	0.0974	0.0163	1.9	µg/L	0.0044	0.019		5_6 - NN
Aroclor 1254	0.0840	0.0153	2.5	µg/L	0.0044	0.019		5_6 - NN
Aroclor 1260	0.0505	0.0140	1.3	µg/L	0.0026	0.019		5_6 - NN
Aroclors (Total)	0.216	0.0181	4.7	µg/L	0.0056	0.019		5_6 - NN
Arsenic	6.93	6.48	12.7	µg/L	0.7	5	J	10_C1_6 - NN
Barium	134	131	228	µg/L	0.38	50		6_4 - FN
beta-BHC	0.00325	0.00180	0.024	µg/L	0.00069	0.0025		6_2 - N
bis(2-Ethylhexyl) phthalate	0.540	0.479	1.4	µg/L	0.11	0.95		7_9 - F
Calcium	123000	122000	152000	µg/L	31.3	500		6_5 - F
Cyanide, Total	5.15	3.88	63.6	µg/L	1.7	10		6_2 - NN
delta-BHC	0.00735	0.00278	0.043	µg/L	0.00045	0.0025	PG N	6_5 - FN
Dibutyltin	0.0235	0.0207	0.15	µg/L	0.01	0.039		3_C4_6 - NN
Endosulfan II	0.00534	0.00322	0.019	µg/L	0.00072	0.0025	PG N	6_2 - N
Endosulfan sulfate	0.00162	0.00142	0.0071	µg/L	0.00076	0.0025	PG N	6_5 - FN
Endrin	0.00166	0.00138	0.0085	µg/L	0.00037	0.0025	PG N	3_C1_3 - F
Endrin aldehyde[1]	0.00158	0.00144	0.0027	µg/L	0.00057	0.0025		6_6 - F
gamma-BHC (Lindane)	0.00278	0.00239	0.0095	µg/L	0.00073	0.0025		7_9 - F
gamma-Chlordane	0.00277	0.00223	0.0084	µg/L	0.00036	0.0025		6_2 - N

Table C2. Dredging elutriate results - dissolved fraction (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Heptachlor	0.0101	0.00518	0.053	µg/L	0.00066	0.0025	PG N	7_4 - NN
Heptachlor epoxide	0.00235	0.00164	0.028	µg/L	0.00047	0.0025	PG N	3_C1_3 - F
Nickel	4.04	2.98	59.5	µg/L	0.36	5		6_6 - FN
pH	7.80	7.79	8.5	No Units				4/5_C2_10 - N
Phenol	0.101	0.0994	0.27	µg/L	0.021	0.19		7_5 - F
Selenium	35.0	31.9	57.2	µg/L	1	25	E	10_C1_6 - NN
Tetrabutyltin	0.0252	0.0249	0.065	µg/L	0.0086	0.058	P	8_C1_4 - NN
Total Organic Carbon	2.91	2.89	5.1	mg/L				6_6 - F
Total Suspended Solids	5.21	3.56	36	mg/L	3.4	4		6_1 - N
TPH (as Diesel)	80.8	68.7	390	µg/L	47	100		3_C1_3 - F
Tributyltin	0.0341	0.0270	0.24	µg/L	0.012	0.043		4_4 - NN
Chromium III	6.58	6.34	9.8	µg/L	0.27	2		7_5 - F
Zinc	9.12	7.71	43.4	µg/L	3	25		3_C4_6 - N
Group II: Maximum Value <RL, Some Qualified Values Reported								
2-Methylnaphthalene	0.0967	0.0965	0.067	µg/L	0.044	0.19	J	7_9 - F
4,4'-DDD	0.00153	0.00140	0.0019	µg/L	0.00037	0.0025	J PG	5_6 - NN
4,4'-DDE	0.00149	0.00135	0.0021	µg/L	0.00032	0.0025	J PG	6_6 - F
4-Methylphenol	0.478	0.471	0.11	µg/L	0.069	0.94	J	6_1 - N
Acenaphthene	0.0964	0.0961	0.058	µg/L	0.052	0.2	J	2_C1_6 - NN
alpha-BHC	0.00159	0.00145	0.0021	µg/L	0.00072	0.0025	J	6_2 - N
Antimony	1.87	1.22	2	µg/L	0.24	10	B	6_4 - FN
Beryllium	1.41	1.24	2.6	µg/L	0.34	5	B	7_C1_9 - N
Butyl benzyl phthalate	0.479	0.473	0.14	µg/L	0.13	0.94	J	6_1 - N
Cadmium	1.92	1.68	1.5	µg/L	0.53	5	B	6_4 - FN
Chromium	6.64	6.43	9.8	µg/L	0.56	10	B J	7_5 - F

Table C2. Dredging elutriate results - dissolved fraction (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Copper	2.70	2.62	5.5	µg/L	0.7	10	B	6_2 - NN
Dalapon	0.979	0.974	1	µg/L	0.52	2	J COL	4/5_5 - N
Dichlorprop	1.98	1.96	0.84	µg/L	0.72	4	J COL	5_5 - NN
Dieldrin	0.00153	0.00139	0.0021	µg/L	0.00038	0.0025	J PG	3_C1_3 - F
Endosulfan I	0.00147	0.00132	0.0018	µg/L	0.00035	0.0025	J PG N	6_6 - F
Fluoranthene	0.0969	0.0968	0.077	µg/L	0.048	0.19	J	4_4 - NN
Fluorene	0.0970	0.0969	0.087	µg/L	0.055	0.2	J	5_C1_3 - NN
Lead	0.618	0.527	1.4	µg/L	0.1	5	B	7_6 - F
Mercury	0.0993	0.0992	0.067	µg/L	0.055	0.2	B	3_C1_3 - FN
Phenanthrene	0.0960	0.0954	0.13	µg/L	0.056	0.2	J	5_C1_3 - NN
Thallium	1.38	0.834	1.9	µg/L	0.09	5	B J	3_C1_3 - FN
Tin	11.5	11.1	13.3	µg/L	3.8	25	B	3_C1_3 - FN
TPH (as Gasoline)	43.4	42.3	58	µg/L	28	100	J B	6_2 - NN
Group III: All Samples Non-Detect								
1,2,4-Trichlorobenzene	0.0973	0.0972	0.115	µg/L	0.045	0.23	U	
1,2-Dichlorobenzene	0.0973	0.0972	0.115	µg/L	0.036	0.23	U	
1,2-Diphenylhydrazine	0.0973	0.0972	0.115	µg/L	0.051	0.23	U	
1,3-Dichlorobenzene	0.0973	0.0972	0.115	µg/L	0.042	0.23	U	
1,4-Dichlorobenzene	0.0973	0.0972	0.115	µg/L	0.055	0.23	U	
2,2'-oxybis(1-Chloropropane)	0.0973	0.0972	0.115	µg/L	0.03	0.23	U	
2,4,5-T	0.500	0.500	0.5	µg/L	0.17	1	U	
2,4,5-TP (Silvex)	0.500	0.500	0.5	µg/L	0.16	1	U	
2,4,6-Trichlorophenol	0.485	0.485	0.55	µg/L	0.065	1.1	U	
2,4-D	2.00	2.00	2	µg/L	1.5	4	U	
2,4-DB	2.00	2.00	2	µg/L	0.59	4	U	

Table C2. Dredging elutriate results - dissolved fraction (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
2,4-Dichlorophenol	0.0973	0.0972	0.115	µg/L	0.055	0.23	U	
2,4-Dimethylphenol	0.485	0.485	0.55	µg/L	0.059	1.1	U	
2,4-Dinitrophenol	2.44	2.44	2.85	µg/L	1.5	5.7	U	
2,4-Dinitrotoluene	0.485	0.485	0.55	µg/L	0.051	1.1	U	
2,6-Dinitrotoluene	0.485	0.485	0.55	µg/L	0.058	1.1	U	
2-Chloronaphthalene	0.0973	0.0972	0.115	µg/L	0.05	0.23	U	
2-Chlorophenol	0.485	0.485	0.55	µg/L	0.052	1.1	U	
2-Nitrophenol	0.485	0.485	0.55	µg/L	0.062	1.1	U	
3,3'-Dichlorobenzidine	0.485	0.485	0.55	µg/L	0.047	1.1	U	
4,6-Dinitro-2-methylphenol	2.44	2.44	2.85	µg/L	1.6	5.7	U	
4-Bromophenyl phenyl ether	0.485	0.485	0.55	µg/L	0.056	1.1	U	
4-Chloro-3-methylphenol	0.485	0.485	0.55	µg/L	0.067	1.1	U	
4-Chlorophenyl phenyl ether	0.485	0.485	0.55	µg/L	0.049	1.1	U	
4-Nitrophenol	2.44	2.44	2.85	µg/L	0.08	5.7	U	
Acenaphthylene	0.0973	0.0972	0.115	µg/L	0.053	0.23	U	
Anthracene	0.0973	0.0972	0.115	µg/L	0.058	0.23	U	
Aroclor 1016	0.0115	0.0105	0.0405	µg/L	0.02	0.081	U	
Aroclor 1221	0.0115	0.0105	0.0405	µg/L	0.02	0.081	U	
Aroclor 1232	0.0115	0.0105	0.0405	µg/L	0.024	0.081	U	
Aroclor 1242	0.0115	0.0105	0.0405	µg/L	0.015	0.081	U	
Benzidine	9.73	9.72	11.5	µg/L	6.4	23	U	
Benzo(a)anthracene	0.0973	0.0972	0.115	µg/L	0.047	0.23	U	
Benzo(a)pyrene	0.0973	0.0972	0.115	µg/L	0.05	0.23	U	
Benzo(b)fluoranthene	0.0973	0.0972	0.115	µg/L	0.036	0.23	U	
Benzo(ghi)perylene	0.0973	0.0972	0.115	µg/L	0.031	0.23	U	

Table C2. Dredging elutriate results - dissolved fraction (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Benzo(k)fluoranthene	0.0973	0.0972	0.115	µg/L	0.045	0.23	U	
Benzoic acid	2.44	2.44	2.85	µg/L	0.48	5.7	U	
bis(2-Chloroethoxy)methane	0.485	0.485	0.55	µg/L	0.14	1.1	U	
bis(2-Chloroethyl) ether	0.0973	0.0972	0.115	µg/L	0.052	0.23	U	
Chlordane (technical)	0.0144	0.0132	0.05	µg/L	0.03	0.1	U	
Chrysene	0.0973	0.0972	0.115	µg/L	0.041	0.23	U	
Chromium VI	0.00500	0.00500	0.005	mg/L	0.0026	0.01	U	
Diazinon	0.481	0.481	0.5	µg/L	0.12	1	U	
Dibenz(a,h)anthracene	0.0973	0.0972	0.115	µg/L	0.04	0.23	U	
Dibenzofuran	0.485	0.485	0.55	µg/L	0.061	1.1	U	
Dicamba	1.00	1.00	1	µg/L	0.33	2	U	
Diethyl phthalate	0.485	0.485	0.55	µg/L	0.28	1.1	U	
Dimethyl phthalate	0.485	0.485	0.55	µg/L	0.048	1.1	U	
Di-n-butyl phthalate	0.485	0.485	0.55	µg/L	0.053	1.1	U	
Di-n-octyl phthalate	0.485	0.485	0.55	µg/L	0.049	1.1	U	
Dinoseb	0.3	0.3	0.3	µg/L	0.26	0.6	U	
Hexachlorobenzene	0.0973	0.0972	0.115	µg/L	0.05	0.23	U	
Hexachlorobutadiene	0.0973	0.0972	0.115	µg/L	0.043	0.23	U	
Hexachlorocyclopentadiene	0.485	0.485	0.55	µg/L	0.091	1.1	U	
Hexachloroethane	0.485	0.485	0.55	µg/L	0.05	1.1	U	
Indeno(1,2,3-cd)pyrene	0.0973	0.0972	0.115	µg/L	0.054	0.23	U	
Isophorone	0.485	0.485	0.55	µg/L	0.054	1.1	U	
MCPA	200	200	200	µg/L	94	400	U	
MCPP	200	200	200	µg/L	130	400	U	
Methoxychlor	0.00289	0.00264	0.01	µg/L	0.0037	0.02	U	

Table C2. Dredging elutriate results - dissolved fraction (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Monobutyltin	0.245	0.244	0.29	µg/L	0.05	0.58	U	
Naphthalene	0.0973	0.0972	0.115	µg/L	0.049	0.23	U	
Nitrobenzene	0.0973	0.0972	0.115	µg/L	0.073	0.23	U	
N-Nitrosodimethylamine	0.485	0.485	0.55	µg/L	0.052	1.1	U	
N-Nitrosodi-n-propylamine	0.0973	0.0972	0.115	µg/L	0.068	0.23	U	
N-Nitrosodiphenylamine	0.0973	0.0972	0.115	µg/L	0.056	0.23	U	
Pentachlorophenol	0.485	0.485	0.55	µg/L	0.095	1.1	U	
Pyrene	0.0973	0.0972	0.115	µg/L	0.064	0.23	U	
Silver	2.50	2.50	2.5	µg/L	0.39	5	U	
Toxaphene	0.00150	0.00137	0.0055	µg/L	0.0031	0.011	U	
[1] Maximum value was <RL, but next highest value was >RL								

Table C3. Dredging elutriate results – total (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Maximum Value Above RL								
4,4'-DDD	0.00144	0.00129	0.0028	µg/L	0.00037	0.0025	PG N	10_C3&4 - FN
Aldrin	0.00750	0.00477	0.013	µg/L	0.00053	0.0025	PG N	10_C3&4 - F
alpha-BHC	0.00198	0.00164	0.0049	µg/L	0.00074	0.0025		9_C2&4 - NN
Aluminum	7790	7670	9360	µg/L	6.1	150		10_C3&4 - F
Ammonia as Nitrogen	0.312	0.272	0.48	mg/L	0.0094	0.1		10_1 - NN
Arsenic	4.56	4.35	6	µg/L	0.7	5		10_1 - NN
Barium	159	159	177	µg/L	0.38	50		9_C2&4 - NN
Calcium	54300	51900	91400	µg/L	31.3	500	J	9_C2&4 - NN
Chromium	15.3	14.7	23.4	µg/L	0.56	10	J	10_C3&4 - F
Copper	11.6	11.5	14.4	µg/L	0.7	10	J	10_C3&4 - F
delta-BHC	0.00270	0.00183	0.0085	µg/L	0.00046	0.0025	PG N	9_C2&4 - NN
Endosulfan II	0.00615	0.00324	0.014	µg/L	0.00073	0.0025	PG	10_C3&4 - FN
gamma-BHC (Lindane)	0.00265	0.00227	0.0058	µg/L	0.00074	0.0025	PG	9_C2&4 - NN
Heptachlor	0.00719	0.00323	0.025	µg/L	0.00067	0.0025	PG N	10_1 - NN
Lead	8.46	8.25	10.5	µg/L	0.1	5		10_C3&4 - F
Nickel	10.9	10.8	14.5	µg/L	0.36	5		10_C3&4 - F
pH	8.02	8.02	8.2	No Units				10_C3&4 - FN
Total Organic Carbon	3.58	3.56	4	mg/L				10_C3&4 - F
Total Suspended Solids	149	135	246	mg/L	3.4	4		9_1 - NN
TPH (as Diesel)	88.4	77.1	150	µg/L	47	100	B	9_1 - NN
Chromium III	15.3	14.7	23.4	µg/L	0.27	2		10_C3&4 - F
Zinc	63.9	60.4	107	µg/L	3	25	J	9_C2&4 - NN

Table C3. Dredging elutriate results – total (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Group II: Maximum Value <RL, Some Qualified Values Reported								
4,4'-DDE	0.00113	0.00109	0.00063	µg/L	0.00032	0.0025	J	9_1 - NN
4,4'-DDT	0.00140	0.00137	0.002	µg/L	0.00067	0.0025	J	10_1 - NN
Acenaphthene	0.0912	0.0902	0.066	µg/L	0.052	0.2	J	9_1 - NN
Antimony	4.34	4.03	1.7	µg/L	0.24	10	B	10_C3&4 - F
Aroclor 1254	0.0105	0.0101	0.016	µg/L	0.0044	0.019	J	10_1 - NN
Aroclors (Total)	0.0105	0.0101	0.016	µg/L	0.0057	0.019	J	10_1 - NN
Beryllium	2.17	1.82	2.9	µg/L	0.34	5	B	10_C3&4 - F
bis(2-Ethylhexyl) phthalate	0.515	0.481	0.91	µg/L	0.12	0.98	J	10_C3&4 - FN
Cadmium	2.58	2.58	2.9	µg/L	0.53	5	B	10_C3&4 - F
Cyanide, Total	4.56	4.45	5	µg/L	1.7	10	B J	9_1 - NN
Mercury	0.0866	0.0849	0.071	µg/L	0.055	0.2	B	9_1 - NN
Phenanthrene	0.104	0.0991	0.16	µg/L	0.055	0.2	J	9_1 - NN
Selenium	4.40	3.95	7.8	µg/L	1	25	B J	9_C2&4 - NN
Thallium	1.128	0.540	0.35	µg/L	0.09	5	B	10_C3&4 - F
TPH (as Gasoline)	47.0	45.7	56	µg/L	28	100	J	10_1 - NN
Group III: All Samples Non-Detect								
1,2,4-Trichlorobenzene	0.0980	0.0980	0.1	µg/L	0.039	0.2	U	
1,2-Dichlorobenzene	0.0980	0.0980	0.1	µg/L	0.031	0.2	U	
1,2-Diphenylhydrazine	0.0980	0.0980	0.1	µg/L	0.044	0.2	U	
1,3-Dichlorobenzene	0.0980	0.0980	0.1	µg/L	0.036	0.2	U	
1,4-Dichlorobenzene	0.0980	0.0980	0.1	µg/L	0.047	0.2	U	
2,2'-oxybis(1-Chloropropane)	0.0980	0.0980	0.1	µg/L	0.025	0.2	U	
2,4,5-T	0.500	0.500	0.5	µg/L	0.17	1	U	
2,4,5-TP (Silvex)	0.500	0.500	0.5	µg/L	0.16	1	U	

Table C3. Dredging elutriate results – total (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
2,4,6-Trichlorophenol	0.488	0.488	0.5	µg/L	0.057	1	U	
2,4-D	2.00	2.00	2	µg/L	1.5	4	U	
2,4-DB	2.00	2.00	2	µg/L	0.59	4	U	
2,4-Dichlorophenol	0.0980	0.0980	0.1	µg/L	0.048	0.2	U	
2,4-Dimethylphenol	0.488	0.488	0.5	µg/L	0.052	1	U	
2,4-Dinitrophenol	2.44	2.44	2.5	µg/L	1.3	5	U	
2,4-Dinitrotoluene	0.488	0.488	0.5	µg/L	0.045	1	U	
2,6-Dinitrotoluene	0.488	0.488	0.5	µg/L	0.051	1	U	
2-Chloronaphthalene	0.0980	0.0980	0.1	µg/L	0.043	0.2	U	
2-Chlorophenol	0.488	0.488	0.5	µg/L	0.045	1	U	
2-Methylnaphthalene	0.0980	0.0980	0.1	µg/L	0.046	0.2	U	
2-Nitrophenol	0.488	0.488	0.5	µg/L	0.054	1	U	
3,3'-Dichlorobenzidine	0.488	0.488	0.5	µg/L	0.041	1	U	
4,6-Dinitro-2-methylphenol	2.44	2.44	2.5	µg/L	1.4	5	U	
4-Bromophenyl phenyl ether	0.488	0.488	0.5	µg/L	0.05	1	U	
4-Chloro-3-methylphenol	0.488	0.488	0.5	µg/L	0.059	1	U	
4-Chlorophenyl phenyl ether	0.488	0.488	0.5	µg/L	0.043	1	U	
4-Methylphenol	0.488	0.488	0.5	µg/L	0.074	1	U	
4-Nitrophenol	2.44	2.44	2.5	µg/L	0.069	5	U	
Acenaphthylene	0.0980	0.0980	0.1	µg/L	0.045	0.2	U	
alpha-Chlordane	0.00125	0.00125	0.00125	µg/L	0.00055	0.0025	U	
Anthracene	0.0980	0.0980	0.1	µg/L	0.05	0.2	U	
Aroclor 1016	0.00960	0.00960	0.01	µg/L	0.0049	0.02	U	
Aroclor 1221	0.00960	0.00960	0.01	µg/L	0.0049	0.02	U	
Aroclor 1232	0.00960	0.00960	0.01	µg/L	0.0057	0.02	U	

Table C3. Dredging elutriate results – total (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Aroclor 1242	0.00960	0.00960	0.01	µg/L	0.0036	0.02	U	
Aroclor 1248	0.00960	0.00960	0.01	µg/L	0.0045	0.02	U	
Aroclor 1260	0.00960	0.00960	0.01	µg/L	0.0027	0.02	U	
Benzidine	9.80	9.80	10	µg/L	5.5	20	U	
Benzo(a)anthracene	0.0980	0.0980	0.1	µg/L	0.04	0.2	U	
Benzo(a)pyrene	0.0980	0.0980	0.1	µg/L	0.043	0.2	U	
Benzo(b)fluoranthene	0.0980	0.0980	0.1	µg/L	0.031	0.2	U	
Benzo(ghi)perylene	0.0980	0.0980	0.1	µg/L	0.027	0.2	U	
Benzo(k)fluoranthene	0.0980	0.0980	0.1	µg/L	0.039	0.2	U	
Benzoic acid	2.44	2.44	2.5	µg/L	0.42	5	U	
beta-BHC	0.00125	0.00125	0.00125	µg/L	0.0007	0.0025	U	
bis(2-Chloroethoxy)methane	0.488	0.488	0.5	µg/L	0.12	1	U	
bis(2-Chloroethyl) ether	0.0980	0.0980	0.1	µg/L	0.045	0.2	U	
Butyl benzyl phthalate	0.488	0.488	0.5	µg/L	0.14	1	U	
Chlordane (technical)	0.012	0.012	0.012	µg/L	0.0072	0.024	U	
Chrysene	0.0980	0.0980	0.1	µg/L	0.035	0.2	U	
Chromium VI	0.05	0.05	0.05	mg/L	0.013	0.05	U G	
Dalapon	1.00	1.00	1	µg/L	0.52	2	U	
Diazinon	0.483	0.483	0.49	µg/L	0.11	0.98	U	
Dibenz(a,h)anthracene	0.0980	0.0980	0.1	µg/L	0.034	0.2	U	
Dibenzofuran	0.488	0.488	0.5	µg/L	0.053	1	U	
Dibutyltin	0.0190	0.0190	0.0195	µg/L	0.01	0.039	U	
Dicamba	1.00	1.00	1	µg/L	0.33	2	U	
Dichlorprop	2.00	2.00	2	µg/L	0.72	4	U	
Dieldrin	0.00125	0.00125	0.00125	µg/L	0.00039	0.0025	U	

Table C3. Dredging elutriate results – total (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Diethyl phthalate	0.488	0.488	0.5	µg/L	0.24	1	U	
Dimethyl phthalate	0.488	0.488	0.5	µg/L	0.042	1	U	
Di-n-butyl phthalate	0.488	0.488	0.5	µg/L	0.046	1	U	
Di-n-octyl phthalate	0.488	0.488	0.5	µg/L	0.043	1	U	
Dinoseb	0.300	0.300	0.3	µg/L	0.26	0.6	U	
Endosulfan I	0.00125	0.00125	0.00125	µg/L	0.00036	0.0025	U	
Endosulfan sulfate	0.00125	0.00125	0.00125	µg/L	0.00077	0.0025	U	
Endrin	0.00125	0.00125	0.00125	µg/L	0.00037	0.0025	U	
Endrin aldehyde	0.00125	0.00125	0.00125	µg/L	0.00058	0.0025	U	
Fluoranthene	0.0980	0.0980	0.1	µg/L	0.048	0.2	U	
Fluorene	0.0980	0.0980	0.1	µg/L	0.053	0.2	U	
gamma-Chlordane	0.00125	0.00125	0.00125	µg/L	0.00037	0.0025	U	
Heptachlor epoxide	0.00125	0.00125	0.00125	µg/L	0.00048	0.0025	U	
Hexachlorobenzene	0.0980	0.0980	0.1	µg/L	0.043	0.2	U	
Hexachlorobutadiene	0.0980	0.0980	0.1	µg/L	0.037	0.2	U	
Hexachlorocyclopentadiene	0.488	0.488	0.5	µg/L	0.08	1	U	
Hexachloroethane	0.488	0.488	0.5	µg/L	0.043	1	U	
Indeno(1,2,3-cd)pyrene	0.0980	0.0980	0.1	µg/L	0.047	0.2	U	
Isophorone	0.488	0.488	0.5	µg/L	0.047	1	U	
MCPA	200	200	200	µg/L	94	400	U	
MCPP	200	200	200	µg/L	130	400	U	
Methoxychlor	0.00241	0.00241	0.00245	µg/L	0.0009	0.0049	U	
Monobutyltin	0.247	0.247	0.255	µg/L	0.05	0.51	U	
Naphthalene	0.0980	0.0980	0.1	µg/L	0.042	0.2	U	
Nitrobenzene	0.0980	0.0980	0.1	µg/L	0.063	0.2	U	

Table C3. Dredging elutriate results – total (freshwater).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
N-Nitrosodimethylamine	0.488	0.488	0.5	µg/L	0.045	1	U	
N-Nitrosodi-n-propylamine	0.0980	0.0980	0.1	µg/L	0.058	0.2	U	
N-Nitrosodiphenylamine	0.0980	0.0980	0.1	µg/L	0.048	0.2	U	
Pentachlorophenol	0.488	0.488	0.5	µg/L	0.083	1	U	
Phenol	0.0980	0.0980	0.1	µg/L	0.022	0.2	U	
Pyrene	0.0980	0.0980	0.1	µg/L	0.055	0.2	U	
Silver	2.50	2.50	2.5	µg/L	0.39	5	U	
Tetrabutyltin	0.0247	0.0247	0.0255	µg/L	0.0086	0.051	U	
Tin	12.5	12.5	12.5	µg/L	3.8	25	U	
Toxaphene	0.00125	0.00125	0.00125	µg/L	0.00073	0.0025	U	
Tributyltin	0.0220	0.0220	0.023	µg/L	0.012	0.046	U	

Table C4. Dredging elutriate results – total (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Group I: Maximum Value Above RL								
4,4'-DDD	0.00179	0.00158	0.0067	µg/L	0.00039	0.0026	PG	6_6 - F
4,4'-DDE[1]	0.00155	0.00135	0.0039	µg/L	0.00032	0.0025	PG	3_C1_3 - F
4,4'-DDT	0.00181	0.00155	0.0074	µg/L	0.00069	0.0026		6_6 - F
Aldrin	0.00719	0.00390	0.027	µg/L	0.0022	0.011		8_C1_4 - NN
alpha-BHC	0.00200	0.00155	0.021	µg/L	0.00074	0.0025	PG N	6_4 - FN
alpha-Chlordane	0.00201	0.00162	0.011	µg/L	0.00055	0.0025	PG N	6_4 - FN
Aluminum	5950	5720	11600	µg/L	6.1	150		5_7_ - NN
Ammonia as Nitrogen	0.352	0.319	1.1	mg/L	0.0094	0.1		10_C1_6 - NN
Aroclor 1248	0.0135	0.0113	0.077	µg/L	0.0044	0.019		5_4 - NN
Aroclor 1254[1]	0.0117	0.0107	0.022	µg/L	0.0044	0.019		5_4 - NN
Aroclors (Total)	0.0141	0.0113	0.098	µg/L	0.0056	0.019		5_4 - NN
Arsenic	6.99	6.67	11.8	µg/L	0.7	5		6_4 - FN
Barium	174	170	281	µg/L	0.38	50	J	10_C1_6 - NN
beta-BHC	0.0113	0.00283	0.079	µg/L	0.0007	0.0025	PG N	4/5_6 - N
bis(2-Ethylhexyl) phthalate	0.603	0.456	2	µg/L	0.11	0.95		4/5_13 - N
Cadmium	2.03	1.77	5.8	µg/L	0.53	5		7_C1_9 - N
Calcium	125000	124000	154000	µg/L	31.3	500		7_4 - NN
Chromium	13.5	13.2	18.5	µg/L	0.56	10	J	6_4 - F
Copper	10.2	9.69	23	µg/L	0.7	10		5_8 - NN
Chromium VI	0.0220	0.0103	0.18	mg/L	0.0026	0.01		3_C4_6 - N
delta-BHC	0.0134	0.00262	0.39	µg/L	0.00046	0.0025	PG N	6_4 - FN
Dibutyltin	0.0321	0.0240	0.25	µg/L	0.01	0.039		4/5_5 - N
Dieldrin	0.00158	0.00137	0.0059	µg/L	0.0004	0.0026		6_6 - F

Table C4. Dredging elutriate results – total (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Endosulfan II	0.00862	0.00364	0.064	µg/L	0.00073	0.0025	PG N	4/5_8 - N
Endosulfan sulfate[1]	0.00160	0.00142	0.0054	µg/L	0.0008	0.0026	PG N	6_5 - FN
Fluoranthene	0.100	0.0987	0.21	µg/L	0.048	0.19		4_6 - NN
gamma-BHC (Lindane)	0.00287	0.00229	0.012	µg/L	0.00074	0.0025	PG N	6_4 - FN
gamma-Chlordane	0.00257	0.00197	0.02	µg/L	0.00037	0.0025	PG N	6_4 - FN
Heptachlor	0.00910	0.00466	0.043	µg/L	0.00067	0.0025	PG N	5_7_ - NN
Heptachlor epoxide	0.00233	0.00167	0.027	µg/L	0.00047	0.0025	PG N	3_C1_3 - F
Lead	8.36	7.21	25.5	µg/L	0.1	5		5_8 - NN
Nickel	8.88	8.63	14.4	µg/L	0.36	5		6_4 - F
pH	7.87	7.86	8.7	No Units				5_7_ - NN
Selenium	33.7	30.8	58.2	µg/L	1	25	J	6_5 - F
Tetrabutyltin	0.0257	0.0253	0.069	µg/L	0.0086	0.051	P	8_C1_4 - NN
Total Organic Carbon	2.81	2.80	3.3	mg/L				6_2 - NN
Total Suspended Solids	147	118	427	mg/L	3.4	4		6_6 - F
TPH (as Diesel)	89.5	77.8	230	µg/L	47	100		7_2 - NN
Tributyltin	0.0315	0.0251	0.26	µg/L	0.012	0.043		4_4 - NN
Chromium III	12.9	12.3	18.5	µg/L	0.27	2		6_4 - F
Zinc	42.2	38.8	110	µg/L	3	25	J	5_8 - NN
Group II: Maximum Value <RL, Some Qualified Values Reported								
2-Methylnaphthalene	0.0976	0.0976	0.079	µg/L	0.045	0.19	J	7_9 - F
4-Methylphenol	0.482	0.474	0.089	µg/L	0.073	0.99	J	7_6 - F
Acenaphthene	0.0967	0.0965	0.089	µg/L	0.052	0.2	J	5_C1_3 - NN
Anthracene	0.0967	0.0963	0.079	µg/L	0.049	0.19	J	4_6 - NN
Antimony	2.13	1.51	3.8	µg/L	0.24	10	B	7_2 - NN
Benzo(a)anthracene	0.0973	0.0972	0.068	µg/L	0.041	0.2	J	7_6 - F

Table C4. Dredging elutriate results – total (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Benzo(a)pyrene	0.0974	0.0972	0.07	µg/L	0.043	0.2	J	7_6 - F
Beryllium	1.78	1.64	4.7	µg/L	0.34	5	B	7_C1_9 - N
Butyl benzyl phthalate	0.471	0.460	0.18	µg/L	0.14	0.98	J	6_3 - FN
Chrysene	0.0973	0.0971	0.067	µg/L	0.035	0.2	J	7_6 - F
Cyanide, Total	3.92	3.65	3	µg/L	1.7	10	B J	6_3 - FN
Dalapon	0.989	0.988	1	µg/L	0.52	2	J COL	4_4 - NN
Dibenzofuran	0.481	0.470	0.062	µg/L	0.053	0.99	J	5_C1_3 - NN
Di-n-butyl phthalate	0.474	0.456	0.099	µg/L	0.046	0.99	J	7_6 - F
Endrin	0.00149	0.00135	0.0026	µg/L	0.00038	0.0026		6_6 - F
Fluorene	0.0983	0.0982	0.12	µg/L	0.053	0.19	J	4_6 - NN
Indeno(1,2,3-cd)pyrene	0.0971	0.0968	0.056	µg/L	0.047	0.2	J	7_6 - F
MCPA	199	198	130	µg/L	94	400	J	5_5 - NN
Mercury	0.0939	0.0928	0.098	µg/L	0.055	0.2	B	6_5 - FN
Phenanthrene	0.0997	0.0986	0.17	µg/L	0.053	0.19	J	4_6 - NN
Pyrene	0.0970	0.0962	0.15	µg/L	0.055	0.19	J	4_6 - NN
Thallium	0.933	0.516	1.8	µg/L	0.09	5	B J	3_C1_3 - FN
Tin	11.6	11.2	15.4	µg/L	3.8	25	B	3_C1_3 - FN
TPH (as Gasoline)	42.3	40.9	91	µg/L	28	100	J	3_C4_6 - N
Group III: All Samples Non-Detect								
1,2,4-Trichlorobenzene	0.0979	0.0979	0.105	µg/L	0.041	0.21	U	
1,2-Dichlorobenzene	0.0979	0.0979	0.105	µg/L	0.032	0.21	U	
1,2-Diphenylhydrazine	0.0979	0.0979	0.105	µg/L	0.046	0.21	U	
1,3-Dichlorobenzene	0.0979	0.0979	0.105	µg/L	0.038	0.21	U	
1,4-Dichlorobenzene	0.0979	0.0979	0.105	µg/L	0.05	0.21	U	
2,2'-oxybis(1-Chloropropane)	0.0979	0.0979	0.105	µg/L	0.027	0.21	U	

Table C4. Dredging elutriate results – total (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
2,4,5-T	0.500	0.500	0.5	µg/L	0.17	1	U	
2,4,5-TP (Silvex)	0.500	0.500	0.5	µg/L	0.16	1	U	
2,4,6-Trichlorophenol	0.490	0.490	0.5	µg/L	0.057	1	U	
2,4-D	2.00	2.00	2	µg/L	1.5	4	U	
2,4-DB	2.00	2.00	2	µg/L	0.59	4	U	
2,4-Dichlorophenol	0.0979	0.0979	0.105	µg/L	0.05	0.21	U	
2,4-Dimethylphenol	0.490	0.490	0.5	µg/L	0.052	1	U	
2,4-Dinitrophenol	2.45	2.45	2.6	µg/L	1.3	5.2	U	
2,4-Dinitrotoluene	0.490	0.490	0.5	µg/L	0.045	1	U	
2,6-Dinitrotoluene	0.490	0.490	0.5	µg/L	0.051	1	U	
2-Chloronaphthalene	0.0979	0.0979	0.105	µg/L	0.046	0.21	U	
2-Chlorophenol	0.490	0.490	0.5	µg/L	0.045	1	U	
2-Nitrophenol	0.490	0.490	0.5	µg/L	0.054	1	U	
3,3'-Dichlorobenzidine	0.490	0.490	0.5	µg/L	0.041	1	U	
4,6-Dinitro-2-methylphenol	2.45	2.45	2.6	µg/L	1.5	5.2	U	
4-Bromophenyl phenyl ether	0.490	0.490	0.5	µg/L	0.05	1	U	
4-Chloro-3-methylphenol	0.490	0.490	0.5	µg/L	0.059	1	U	
4-Chlorophenyl phenyl ether	0.490	0.490	0.5	µg/L	0.043	1	U	
4-Nitrophenol	2.45	2.45	2.6	µg/L	0.072	5.2	U	
Acenaphthylene	0.0979	0.0979	0.105	µg/L	0.048	0.21	U	
Aroclor 1016	0.0114	0.0105	0.0405	µg/L	0.02	0.081	U	
Aroclor 1221	0.0114	0.0105	0.0405	µg/L	0.02	0.081	U	
Aroclor 1232	0.0114	0.0105	0.0405	µg/L	0.024	0.081	U	
Aroclor 1242	0.0114	0.0105	0.0405	µg/L	0.015	0.081	U	
Aroclor 1260	0.0114	0.0105	0.0405	µg/L	0.011	0.081	U	

Table C4. Dredging elutriate results – total (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Benzidine	9.79	9.79	10.5	µg/L	5.8	21	U	
Benzo(b)fluoranthene	0.0979	0.0979	0.105	µg/L	0.032	0.21	U	
Benzo(ghi)perylene	0.0979	0.0979	0.105	µg/L	0.028	0.21	U	
Benzo(k)fluoranthene	0.0979	0.0979	0.105	µg/L	0.041	0.21	U	
Benzoic acid	2.45	2.45	2.6	µg/L	0.44	5.2	U	
bis(2-Chloroethoxy)methane	0.490	0.490	0.5	µg/L	0.12	1	U	
bis(2-Chloroethyl) ether	0.0979	0.0979	0.105	µg/L	0.047	0.21	U	
Chlordane (technical)	0.0143	0.0131	0.05	µg/L	0.03	0.1	U	
Diazinon	0.486	0.486	0.5	µg/L	0.12	1	U	
Dibenz(a,h)anthracene	0.0979	0.0979	0.105	µg/L	0.036	0.21	U	
Dicamba	1.00	1.00	1	µg/L	0.33	2	U	
Dichlorprop	2.00	2.00	2	µg/L	0.72	4	U	
Diethyl phthalate	0.490	0.490	0.5	µg/L	0.24	1	U	
Dimethyl phthalate	0.490	0.490	0.5	µg/L	0.042	1	U	
Di-n-octyl phthalate	0.490	0.490	0.5	µg/L	0.043	1	U	
Dinoseb	0.3	0.3	0.3	µg/L	0.26	0.6	U	
Endosulfan I	0.00150	0.00137	0.0055	µg/L	0.0015	0.011	U	
Endrin aldehyde	0.00150	0.00137	0.0055	µg/L	0.0024	0.011	U	
Hexachlorobenzene	0.0979	0.0979	0.105	µg/L	0.045	0.21	U	
Hexachlorobutadiene	0.0979	0.0979	0.105	µg/L	0.039	0.21	U	
Hexachlorocyclopentadiene	0.490	0.490	0.5	µg/L	0.08	1	U	
Hexachloroethane	0.490	0.490	0.5	µg/L	0.043	1	U	
Isophorone	0.490	0.490	0.5	µg/L	0.047	1	U	
MCPP	200	200	200	µg/L	130	400	U	
Methoxychlor	0.00286	0.00263	0.01	µg/L	0.0037	0.02	U	

Table C4. Dredging elutriate results – total (marine).

Component Name	Mean	Geomean	Maximum	Units	MDL	RL	Qualifier	Sample
Monobutyltin	0.248	0.248	0.285	µg/L	0.05	0.57	U	
Naphthalene	0.0979	0.0979	0.105	µg/L	0.044	0.21	U	
Nitrobenzene	0.0979	0.0979	0.105	µg/L	0.066	0.21	U	
N-Nitrosodimethylamine	0.490	0.490	0.5	µg/L	0.045	1	U	
N-Nitrosodi-n-propylamine	0.0979	0.0979	0.105	µg/L	0.061	0.21	U	
N-Nitrosodiphenylamine	0.0979	0.0979	0.105	µg/L	0.05	0.21	U	
Pentachlorophenol	0.490	0.490	0.5	µg/L	0.083	1	U	
Phenol	0.0979	0.0979	0.105	µg/L	0.023	0.21	U	
Silver	2.50	2.50	2.5	µg/L	0.39	5	U	
Toxaphene	0.00150	0.00137	0.0055	µg/L	0.0031	0.011	U	

[1] Maximum value was <RL, but next highest value was >RL

Table C5. Dredging elutriate data validation rejects.

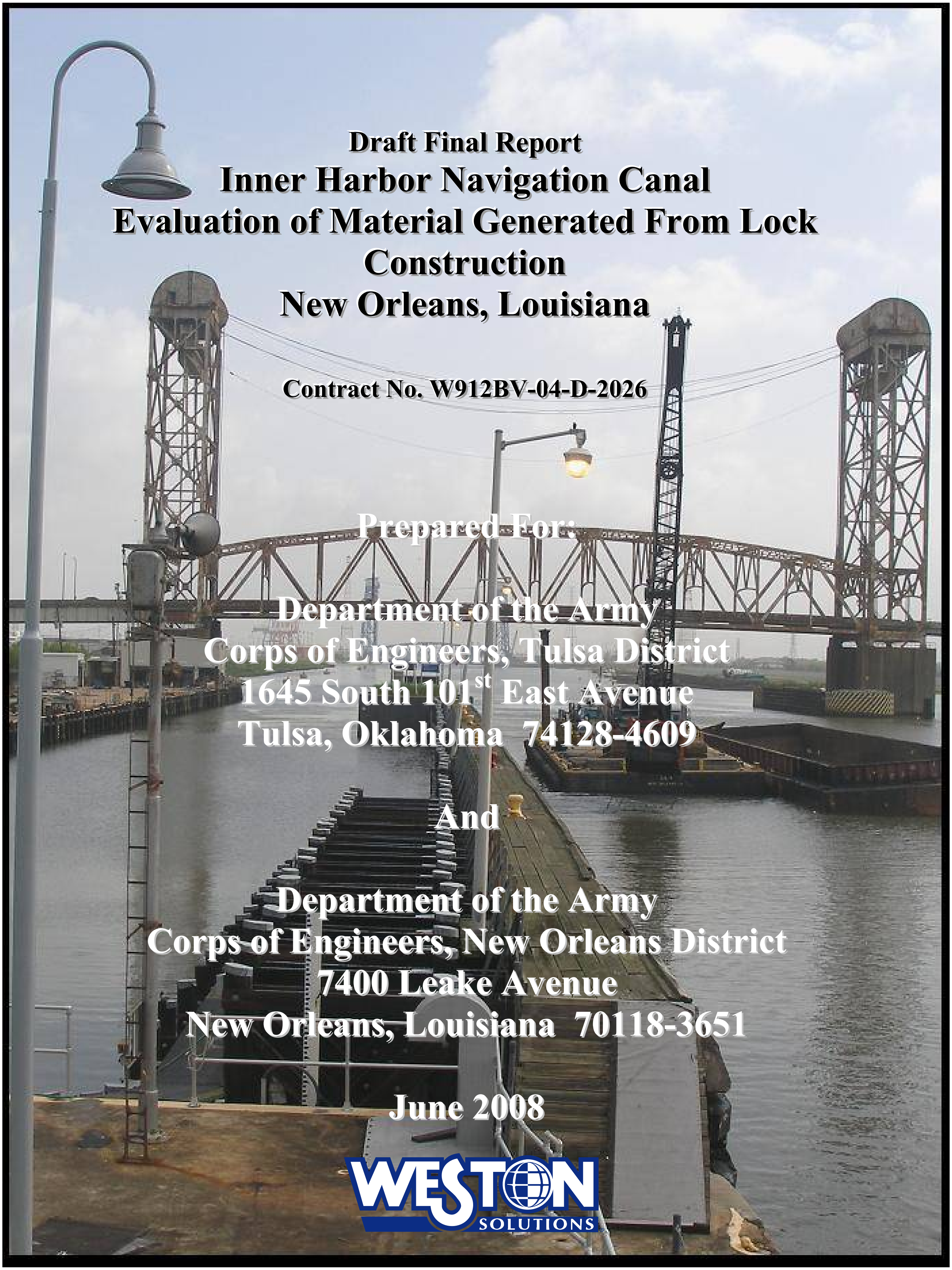
Sample	Compound	Phase
3_C1_3 - FN	Dibutyltin	Total
3_C1_3 - FN	Monobutyltin	Total
3_C1_3 - FN	Tetrabutyltin	Total
3_C1_3 - FN	Tributyltin	Total
6_6 - F	Dicamba	Dissolved
6_6 - F	Dinoseb	Dissolved
6_4 - FN	Dicamba	Dissolved
6_4 - FN	Dinoseb	Dissolved
6_4 -F N	Monobutyltin	Dissolved
6_4 - FN	Monobutyltin	Total
6_5 - FN	Monobutyltin	Dissolved
6_6 - FN	Monobutyltin	Dissolved
7_C1_9 - N	Monobutyltin	Dissolved
10_1 - NN	Monobutyltin	Dissolved
10_1 - NN	Endrin aldehyde	Total
10_1 - NN	Monobutyltin	Total
10_C3&4 - F	Monobutyltin	Total

Table C6. Distance to compliance with (marine) water quality criteria - marine dredging elutriate.

Location of Maximum Concentration	Contaminant	Acute WQS (µg/L)	Chronic WQS (µg/L)	Bulk Sediment Concentration (mg/kg)	Initial Elutriate TSS Concentration (kg/L)	Maximum Elutriate Concentration			Fraction Dissolved	Partitioning Coefficient	Distance to Compliance with Criteria			
											0 m Above Bottom		1 m Above Bottom	
						Dissolved (µg/L)	Total (µg/L)	Solids Associated (µg/mg)		K_d (L/kg)	Acute (m)	Chronic (m)	Acute (m)	Chronic (m)
5_6 - NN	4,4'-DDD	0.03	0.006	0.037	0.01	0.0019	0.37	3.68E-05	0.005	19400	<1	<1	<1	<1
3_C1_3 - F	4,4'-DDT	0.13	0.001	0.0012	0.01	0.0031	0.012	8.90E-07	0.258	287	<1	<9	<1	<1
2_C1_6 - NN	Acenaphthene	970	710	0.2	0.01	0.058	2	1.94E-04	0.029	3350	<1	<1	<1	<1
10_C1_6 - NN	Aldrin	1.3		0.0061	0.01	0.039	0.061	2.20E-06	0.639	56.4	<1	N/A	<1	N/A
3_C1_3 - F	alpha-Chlordane	0.09	0.004	0.0008	0.01	0.0044	0.008	3.60E-07	0.550	81.8	<1	<2	<1	<1
5_6 - NN	Aroclors (Total)	2	0.014	0.71	0.01	4.7	7.1	2.40E-04	0.662	51.1	<4	<350	<1	<350
10_C1_6 - NN	Arsenic	69	36	9.4	0.01	12.7	94	8.13E-03	0.135	640	<1	<1	<1	<1
6_4 - FN	Cadmium	40	1.57	0.53	0.01	1.5	5.3	3.80E-04	0.283	253	<1	<2	<1	<1
7_5 - F	Chromium III	310	103	12.4	0.01	9.8	124	1.14E-02	0.079	1170	<1	<1	<1	<1
6_2 - NN	Copper	3.63	3.1	16.6	0.01	5.5	166	1.61E-02	0.033	2918	<15	<22	<9	<14
6_2 - NN	Cyanide, Total	1	1	0.385	0.01	63.6	3.85	-5.98E-03	1.000	0.0	<7	<7	<25	<25
3_C1_3 - F	Dieldrin	0.2374	0.0019	0.0011	0.01	0.0021	0.011	8.90E-07	0.191	424	<1	<2	<1	<1
6_6 - F	Endosulfan I	0.034	0.0087	0.00016	0.01	0.0018	0.0016	-2.00E-08	1.000	0.0	<1	<1	<1	<1
6_2 - N	Endosulfan II	0.034	0.0087	0.00074	0.01	0.019	0.0074	-1.16E-06	1.000	0.0	<1	<1	<1	<1
3_C1_3 - F	Endrin	0.037	0.0023	0.0008	0.01	0.0085	0.008	-5.00E-08	1.000	0.0	<1	<4	<1	<1
7_9 - F	gamma-BHC (Lindane)	0.16		0.00155	0.01	0.0095	0.0155	6.00E-07	0.613	63.2	<1	N/A	<1	N/A
6_2 - N	gamma-Chlordane	0.09	0.004	0.00085	0.01	0.0084	0.0085	1.00E-08	0.988	1.19	<1	<3	<1	<1
7_4 - NN	Heptachlor	0.053	0.0036	0.0105	0.01	0.053	0.105	5.20E-06	0.505	98.1	<2	<26	<1	<20
3_C1_3 - F	Heptachlor epoxide	0.053	0.0036	0.0008	0.01	0.028	0.008	-2.00E-06	1.000	0.0	<1	<3	<1	<1
7_6 - F	Lead	30	1.2	17.4	0.01	1.4	174	1.73E-02	0.008	12300	<1	<19	<1	<12
3_C1_3 - FN	Mercury	1.8	0.012	0.045	0.01	0.067	0.45	3.83E-05	0.149	572	<1	<26	<1	<19
6_6 - FN	Nickel	74	8.2	19.4	0.01	59.5	194	1.35E-02	0.307	226	<1	<20	<1	<14
7_5 - F	Phenol	580	290	0.0033	0.01	0.27	0.033	-2.37E-05	1.000	0.0	<1	<1	<1	<1
10_C1_6 - NN	Selenium	290	71	2.3	0.01	57.2	23	-3.42E-03	1.000	0.0	<1	<1	<1	<1
3_C1_3 - FN	Thallium	2130		0.23	0.01	1.9	2.3	4.00E-05	0.826	21.1	<1	N/A	<1	N/A
4_4 - NN	Tributyltin	0.42	0.0074	0.08	0.01	0.24	0.8	5.60E-05	0.300	233	<1	<80	<1	<60
3_C4_6 - N	Zinc	64	58	56.1	0.01	43.4	561	5.18E-02	0.077	1190	<1	<1	<1	<1

Table C7. Distance to compliance with (freshwater) water quality criteria - freshwater dredging elutriate.

Location of Maximum Concentration	Contaminant	Acute WQS (µg/L)	Chronic WQS (µg/L)	Bulk Sediment Concentration (mg/kg)	Initial Elutriate TSS Concentration (kg/L)	Maximum Elutriate Concentration			Fraction Dissolved	Partitioning Coefficient	Distance to Compliance with Criteria			
											0 m Above Bottom		1 m Above Bottom	
						Dissolved (µg/L)	Total (µg/L)	Solids Associated (µg/mg)		Kd (L/kg)	Acute (m)	Chronic (m)	Acute (m)	Chronic (m)
10_C3&4 - FN	Arsenic	339.8	150	5.3	0.01	4.2	53	0.005	0.079	1162	<1	<1	<1	<1
9_1 - NN	Chromium III	570	74	18.7	0.01	7.5	187	0.018	0.040	2393	<1	<1	<1	<1
10_C3&4 - FN	Copper	13	9	18.4	0.01	4.7	184	0.018	0.026	3815	<1	<1	<1	<1
10_C3&4 - FN	Lead	65	2.5	14.4	0.01	1.8	144	0.014	0.013	7900	<1	<1	<1	<1
9_C2&4 - NN	Mercury	1.4	0.012	0.073	0.01	0.059	0.73	0.000	0.081	1137	<1	<38	<1	<28
10_C3&4 - FN	Nickel	470	52	21.4	0.01	3.2	214	0.021	0.015	6588	<1	<1	<1	<1
9_C2&4 - NN	Selenium	20	5	1.2	0.01	10.1	12	0.000	0.842	19	<1	<1	<1	<1
9_C2&4 - NN	Thallium	110	12	0.28	0.01	0.2	2.8	0.000	0.071	1300	<1	<1	<1	<1
10_C3&4 - F	Zinc	120	120	38.9	0.01	17.3	389	0.037	0.044	2149	<1	<1	<1	<1
9_1 - NN	Cyanide, Total	22	5.2	0.16	0.01	5.5	1.6	0.000	1.000	0	<1	<1	<1	<1
9_C2&4 - NN	gamma-BHC (Lindane)	0.95	0.21	0.0008	0.01	0.0066	0.008	0.000	0.825	21	<1	<1	<1	<1
10_C3&4 - FN	gamma-Chlordane	2.4	0.0043	0.000165	0.01	0.0025	0.00165	0.000	1.000	0	<1	<1	<1	<1
9_C2&4 - NN	4,4'-DDD	0.03	0.006	0.002	0.01	0.00056	0.02	0.000	0.028	3471	<1	<1	<1	<1
10_1 - NN	4,4'-DDT	1.1	0.001	0.00165	0.01	0.0023	0.0165	0.000	0.139	617	<1	<10	<1	<1
10_1 - NN	Endrin	0.086	0.036	0.00165	0.01	0.0011	0.0165	0.000	0.067	1400	<1	<1	<1	<1
10_1 - NN	Heptachlor	0.52	0.0038	0.00165	0.01	0.047	0.0165	0.000	1.000	0	<1	<5	<1	<1



Draft Final Report

Inner Harbor Navigation Canal
Evaluation of Material Generated From Lock Construction
New Orleans, Louisiana

Contract No. W912BV-04-D-2026

Prepared For:

Department of the Army
Corps of Engineers, Tulsa District
1645 South 101st East Avenue
Tulsa, Oklahoma 74128-4609

And

Department of the Army
Corps of Engineers, New Orleans District
7400 Leake Avenue
New Orleans, Louisiana 70118-3651

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WESTON SOLUTIONS

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Corps of Engineers, New Orleans District
7400 Leake Avenue
New Orleans, Louisiana 70118-3651

Prepared By:

Weston Solutions, Inc.
2433 Impala Drive
Carlsbad, California 92010

June 2008

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
BCH	hexachlorocyclohexane
BP	bioaccumulation potential
CCC	critical continuous concentration
CDF	confined disposal facility
CEMVN	Army Corps of Engineers New Orleans District
COC	chain-of-custody
CMC	critical maximum concentration
CVAA	cold vapor atomic absorption
DDE	dichloro-diphenyl- dichloroethylene
DDD	dichloro-diphenyl-dichloroethane
DDT	dichloro-diphenyl-trichloroethane
DMMU	dredge material management units
DO	dissolved oxygen
DRET	Dredging Elutriate Test
ECD	electron capture director
EDTA	ethylenediamine tetraacetic acid
EL/ERDC	Environmental Laboratory / Engineer Research and Development Center
ERDC	Engineer Research and Development Center
ER-L	effects-range low
ER-M	effects-range medium
FPD	flame photometric detector
FSP	Field Sampling Plan
FW	freshwater
GC/MS	gas chromatography/mass spectrometry
GPS	Global Positioning System
ICP/MS	inductively coupled plasma mass spectrometry
IHNC	Inner Harbor Navigation Canal
ID	identification
ITM	Inland Testing Manual
LC_{50}	median lethal concentration
MDL	method detection limit
MET	modified elutriate test
MLG	Mean-low-Gulf
MR-GO	Mississippi River – Gulf Outlet
MRL	method reporting limit
NOAA	National Oceanographic and Atmospheric Administration
NOEC	no observed effect concentration
ODW	oven dry weight
OP	organophosphate
OTM	Ocean Testing Manual
PAH	Polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEL	probable effects level
pH	Hydrogen ion concentration
PVC	polyvinyl chloride
QA/QC	quality assurance and quality control
QAPP	quality assurance project plan
RIA	Regional Implementation Agreement

RL	reporting limit
RO	reverse osmosis
SET	standard elutriate test
SIM	selective ion monitoring
SLRP	Simplified Laboratory Runoff Procedure
SM	standard methods
SOP	standard operating procedure
SOW	Scope of Work
SP	solid phase
SPE	solid phase extraction
SPP	suspended particulate phase
SQG	Sediment Quality Guidelines
STL	Severn Trent Laboratories
SVOC	semivolatile organic compounds
SW	seawater
TBA	tetrabutyl ammonium sulfite
TBT	tributyltin
TDL	target detection limit
TDS	total dissolved solids
TEL	threshold effects level
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TRE	toxicity reduction evaluation
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UTM	Upland Testing Manual
VOC	volatile organic compound
WAAS	Wide Area Augmentation System
Weston	Weston Solutions, Inc.
WQC	Water Quality Criteria
YCT	yeast; CEROPHYL®; trout chow
ZSV	zone settling velocity

UNITS OF MEASURE

a	acre
cm	centimeter
cy	cubic yards
°C	centigrade
ft	feet or foot
ft/hr	feet or foot/hour
g/L	grams per liter
gal	gallon
kg	kilogram
L	liter
m	meter
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
mm	millimeter
MPa	
µg/L	microgram per liter
µg/kg	microgram per kilogram
µm	micrometer; micron
ng/L	nanogram per liter
ppt	part per thousand
%	percent

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1.0 INTRODUCTION

The Inner Harbor Navigation Canal (IHNC) serves as a major navigational channel for ships transiting between the Mississippi River and Gulf of Mexico in New Orleans, Louisiana (Figure 1). To allow ship traffic to transit through this area, the Industrial Canal Lock was constructed in 1921 bridging the Gulf with the higher elevation Mississippi River. Due to the age of this lock as well as the increased traffic load and size of newer ships it serves, the U.S. Army Corps of Engineers (USACE), New Orleans District (CEMVN) has been authorized by Congress to replace the existing Industrial Canal Lock with a larger, more efficient system. As part of the construction project, sediment and soil from the area will be dredged to accommodate the new lock, allow bypass traffic during construction, and to deepen the current channel for navigational purposes through this canal (described in the scope of work [SOW], CEMVN and Engineer Research and Development Center [ERDC] 2007). The material to be removed will consist of sediments from the existing canal and upland soils from the east and west banks of the canal. Sediments from the existing canal will be dredged to construct the new lock and increase the navigational depth. Soils from the east bank of the canal will be excavated to create a temporary bypass channel for ships during construction of the new lock while soils from the west bank will be removed as part of the new lock construction.

Prior to construction and dredging activities, the CEMVN must determine the management strategies for the material that will be generated. To complete the IHNC construction project, it is estimated that 2,177,450 cy or 3,396,700 cy of material will be dredged or excavated, depending on if the Float-in-Place or Cast-in-Place options are used, respectively (Engineer Research and Development Center [ERDC] 2008)[1]. Several placement or disposal options have been identified (Mississippi River-Gulf Outlet [MR-GO], New Lock and Connecting Channels Evaluation Report 1997) and include:

- **Mississippi River Disposal Site** – This is an in-water disposal site in the main channel of the Mississippi River adjacent to the IHNC. It is located in water depths below the 50-ft contour.
- **Mitigation Site** – Placement at the Mitigation site will result in the enhancement of a 400-a shallow, brackish water habitat. The Mitigation site is located northeast of the new lock construction site, bounded by Bayou Bienvenue (Main Outfall Canal) on the north and west, the 9th Ward Back Protection Levee on the south, and a landfill and sewerage treatment plant on the east.
- **Mississippi River – Gulf Outlet (MR-GO) Disposal Site** – This is an existing confined disposal facility (CDF) located between Bayou Bienvenue and the MR-GO, near the intersection of the MR-GO and the IHNC.
- **IHNC Backfill Site** – Material will be needed for construction fill on both sides of the new lock within the canal.

CEMVN has determined that the proposed dredged material has potential to be contaminated; therefore, the material must be evaluated to determine the appropriate placement site alternatives. Material to be considered for placement at the Mississippi River Disposal Site, the Mitigation Site, and the IHNC Backfill Site must meet criteria for open water placement in accordance with the 404(b)(1) guidelines. Material was tested in accordance with the protocols specified in the national guidance, *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual* (ITM; U.S.

[1] These dredge volumes from ERDC do not include Dredged Material Management Unit (DMMU) 11 because upon sampling this area, stations were found to be already at dredge depth.

Environmental Protection Agency [USEPA]/USACE 1998). Material found not to meet criteria for open water placement must be placed within the MR-GO Disposal Site. In addition, dredged material may be stored as backfill material for lock construction purposes. Therefore, material was also tested in accordance with the relevant protocols specified in the *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities –Upland Testing Manual* (UTM; USACE 2003).

Background

The evaluation of material for the IHNC improvements was originally initiated in 2005 based on a Master SOW prepared by CEMVN in May of 2005. However, the sampling (conducted by Weston Solutions, Inc. [Weston]) and testing (conducted by the ERDC and Severn Trent Laboratories [STL]) was interrupted by Hurricane Katrina. A field report and a data package were generated for the sampling and testing effort that was completed. Physical, chemical, and biological analyses were conducted on a small subset of samples which were often composites instead of discrete samples specified in the original SOW.

A mandatory evacuation was ordered on August 27, 2005 due to the impending storm. Hurricane Katrina made landfall just east of New Orleans, causing extensive damage throughout the northern Gulf Coast. In addition to destroying infrastructure, the storm caused shoaling throughout the IHNC, which limited the safe navigation of deep draft vessel traffic. In order to ensure safe navigation within the IHNC, CEMVN directed maintenance dredging activities to be conducted in the area.

As part of the IHNC maintenance dredging, sediment and water samples were collected and analyzed and provided to CEMVN for the determination of an environmentally acceptable management strategy for its disposal. At that time, sediment from the IHNC was also collected for CEMVN as reconnaissance for the present study.

1.1 Objective

The objective of this investigation was to evaluate the physical, chemical, and biological characteristics of material (non-native sediment and fill and native subsurface soil) to be dredged or excavated as part of the IHNC lock construction project. The information reported here will facilitate the development of an environmentally acceptable management strategy for material generated from the IHNC lock construction dredging project. Specifically, these results will provide scientific evidence to support decisions regarding the placement of IHNC excavated and dredged material at one of the proposed disposal options described above.

1.2 Report Organization

This report includes the following information:

- Introduction
- Methods – for field sampling, and biological, chemical, and physical tests
- Results - for field sampling, and biological, chemical, and physical tests
    - Includes summary tables with comparison to relevant sediment quality guidelines (SQGs) or water quality criteria (WQC) where appropriate (Appendix A)
- References

Figure 1. Overview of Project Area, Project Site Locations, and Reference Site Locations

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2.0 METHODS

This section describes the procedures and results associated with the collection of sediment, soil, and water samples for physical, chemical and biological testing.

2.1 Field Collection Program Overview

Sampling in the IHNC was conducted on July 9 – September 10, 2007. Non-native sediment and fill, and native subsurface soil were collected from the IHNC channel and adjacent banks. Reference sediment was also collected from the Mississippi River, Bayou Bienvenue, and the Mitigation Site located in Orleans Parish, LA, and the Marine Reference and Bayou La Loutre Reference Areas, located in St. Bernard Parish, LA (Figure 1 and Figure 2). Brackish water samples were collected from the IHNC channel, the Mitigation Site and Bayou Bienvenue, and freshwater samples from the Mississippi River. All sampling and testing was conducted in accordance with protocols described in *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual* (ITM, USEPA/USACE, 1998), *Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities –Testing Manual* (UTM, USACE, 2003), and Standard Operating Procedures (SOPs), unless otherwise indicated.

2.2 Field Sampling Overview

For the purposes of sampling and analysis activities, the IHNC construction project was divided into 16 DMMUs (Figure 2). These unit divisions were created based on sediment characteristics (i.e., non-native sediment or fill versus native subsurface soil), depth of dredging, and known or suspected areas of contamination (Table 1). Non-native sediment is unconsolidated material that has deposited naturally within the canal since the IHNC was constructed in the 1920s, while non-native fill is material that was placed adjacent to the canal for industrial development since construction of the IHNC. Native subsurface soil is the material at or below the depth of the original canal cut and consists of clays and alluvial formations. As shown in Table 1, six of the DMMUs were sub-divided vertically with top, non-native material overlying a bottom, native (N) layer of material.

In addition to the vertical stratification of sediments and soils at some DMMUs, eight DMMUs contained both waterside and upland sample locations (DMMUs 3, 3N, 6, 6N, 7, 7N, 10, and 10N). The waterside sample locations were located within the existing canal, from immediately north of Florida Avenue to just south of the IHNC lock, while the upland stations were positioned on the east and west banks of the canal. Dredged material was collected to varying depths in the different DMMUs depending on the IHNC construction activities associated with the particular DMMU.

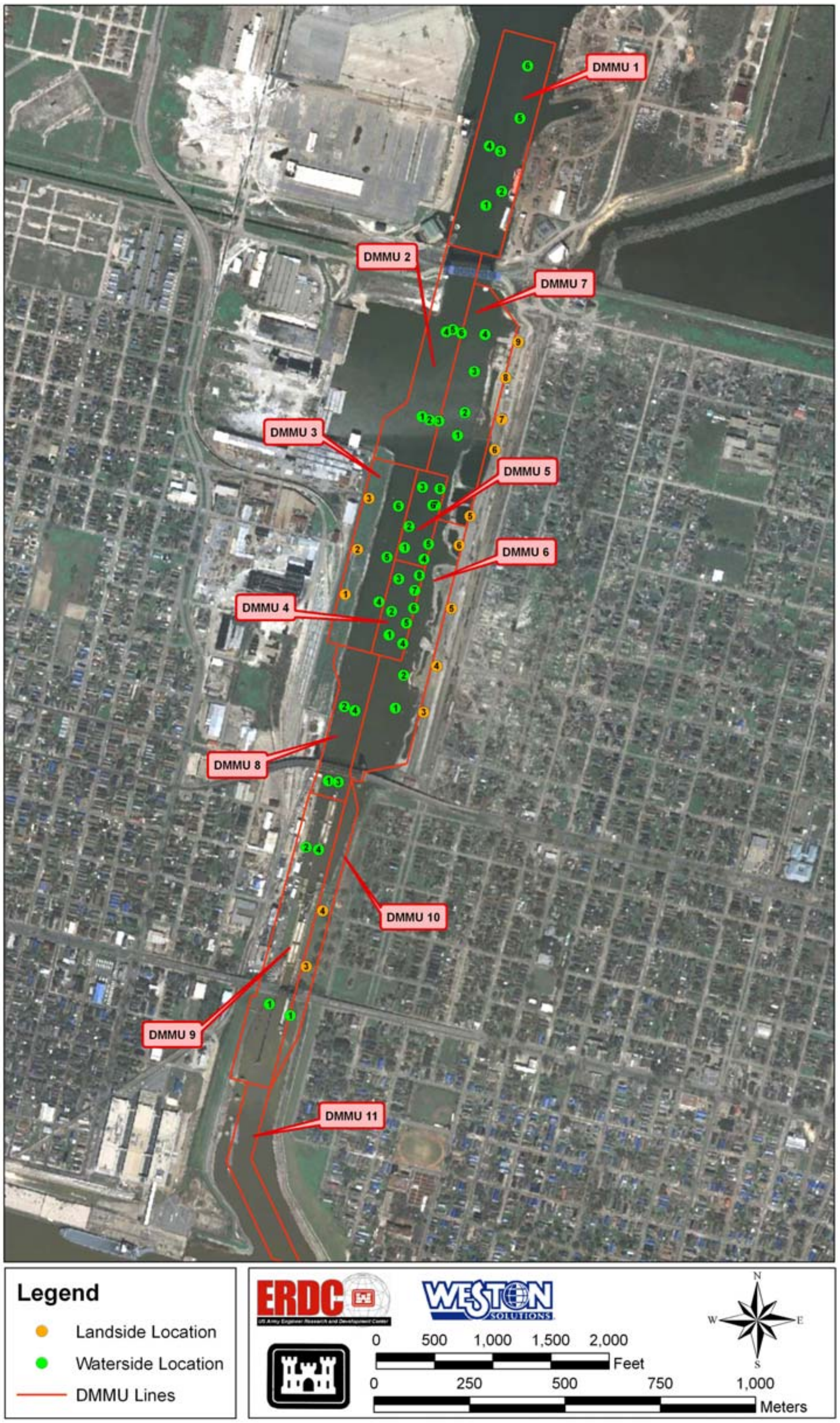

Figure 2. Project Site and Station Map

Table 1. Target Boring Depths and Sediment Characteristics for Dredged Material Management Units

Dredge Material Management Unit	Boring Depth (feet Mean Low Gulf)	Substrate Characteristics
DMMU 1	-40	Non-native sediment and native subsurface soils
DMMU 2	-40	Non-native sediment and native subsurface soils
DMMU 3	-45	Non-native fill and sediment
DMMU 3N	-18 to -45	Native subsurface soils
DMMU 4	-34 to -64	Non-native sediment
DMMU 5	-34 to -64	Non-native sediment
DMMU 4/5N	-34 to -64	Native subsurface soils
DMMU 6	-25 to -34	Non-native fill and sediment
DMMU 6N	-25 to -34	Native subsurface soils
DMMU 7	-25 to -34	Non-native fill and sediment
DMMU 7N	-25 to -34	Native subsurface soils
DMMU 8	-40	Non-native sediment and native subsurface soils
DMMU 9	-40	Non-native sediment and native subsurface soils
DMMU 10	-15	Non-native fill and sediment
DMMU 10N	-15	Native subsurface soils
DMMU 11	-40	Non-native sediment and native subsurface soils

2.3 Field Sample Collection Program for Dredged Material

2.3.1 Sampling Locations and Depths

Construction and navigation dredging for the IHNC includes the waterside areas within the boundaries of the existing canal and selected adjacent upland locations on the banks of the canal. Within this project area, sediment and soil samples were collected from 15 of the proposed 16 DMMUs with 2 to 16 stations per DMMU as described in the Field Sampling Plan (FSP; Weston 2007a). DMMU 11 was eliminated from the sampling program after soundings determined the area was already at project depth. The bottom material within the existing canal consisted of non-native sediment which in some areas was overlying native subsurface soils, while the upland locations had non-native fill material overlying native subsurface soils.

Due to substrate stratification in many of the DMMUs, two samples were required from each sampling location within these particular DMMUs: a top non-native fill or sediment sample and a bottom native soil sample (Table 1). Individual dredged material samples and composite samples were analyzed for chemical and physical constituents. In addition, sediment or soil within a given DMMU were composited according to the detailed Compositing and Analysis Plan (Appendix B) and analyzed for column settling tests and biological analysis including solid phase (SP), suspended particulate phase (SPP), and bioaccumulation potential (BP) testing. Elutriate chemistry analyses were performed on both individual samples and composite samples depending on the DMMU.

The proposed DMMU, station and sample identification (ID), location, water and project depths, estimated target core length, number of cores, and volume requirements for each sample station are provided in Table 2. Prior to sampling, the estimated lengths of these cores were based on the bathymetric data collected in May 1998 in all areas except the upland area on the west bank of the canal (DMMU 3) which was based on a survey conducted in 2003. In most of the DMMUs, the actual lengths of the cores differed slightly from predicted target core lengths because the bathymetry encountered at the time of sample collection varied from the previous survey. All sediment and soil cores were collected to the target sampling depth with the exception of one site in which refusal was encountered (detailed in Section 3.1). Due to the large sediment volumes required for all testing and archives, multiple cores per location were necessary to ensure sufficient material was collected.

In addition to the project site material, reference material samples were collected from four locations: the Mississippi River Reference Site, the Mitigation Site, the Marine Reference Site, and the Bayou La Loutre Reference Site (Figure 1). Reference sediment was collected with a Van Veen surface grab sampler deployed from an air boat and reference soil was collected with a stainless steel shovel. Site water was collected from each DMMU within the IHNC channel, the Mitigation Site, Bayou Bienvenue, and the Mississippi River Disposal Area with a food-grade, high-pressure pump from below the water surface. The water was analyzed for chemistry and used to generate elutriate samples.

Field quality assurance and quality control (QA/QC) sediment samples were collected and analyzed for metals and semivolatile organic compounds (SVOCs) by PACE Laboratories at the request of the Lake Pontchartrain Basin Foundation. The QA/QC samples were collected in an identical manner to project samples from sampling stations D2-05-1, D4-05-6, D5-05-6, and D7-05-3. The samples were placed in appropriate glass containers, labeled, and shipped to PACE Laboratories.

Table 2. Target Core Locations, Core Lengths, Number of Cores, Composite ID, and Volumes for Core Samples

Dredge Material Management Unit	Station ID	Latitude (NAD83)	Longitude (NAD83)	Water Depth (feet MLG)	Project Depth (feet MLG)	Target core Length (feet)	No. of Cores per Location for Required Sample Volume	Sample ID	Required Volume (L) for Top Non-Native Material Samples	Required Volume (L) for Native Material Samples
DMMU 1	D1-05-1	29° 58.938'	-90° 01.287'	-34	-40	6	4	D1-05-1	335	None
	D1-05-2	29° 58.956'	-90° 01.262'	-33	-40	7	4	D1-05-2		
	D1-05-3	29° 59.017'	-90° 01.261'	-34	-40	6	4	D1-05-3		
	D1-05-4	29° 59.022'	-90° 01.279'	-34	-40	6	4	D1-05-4		
	D1-05-5	29° 59.059'	-90° 01.225'	-30	-40	10	4	D1-05-5		
	D1-05-6	29° 59.134'	-90° 01.216'	-31	-40	9	4	D1-05-6		
DMMU 2	D2-05-1	29° 58.640'	-90° 01.400'	-30	-40	10	4	D2-05-1	335	None
	D2-05-2	29° 58.636'	-90° 01.387'	-32	-40	8	4	D2-05-2		
	D2-05-3	29° 58.633'	-90° 01.373'	-33	-40	7	4	D2-05-3		
	D2-05-4	29° 58.765'	-90° 01.360'	-26	-40	14	4	D2-05-4		
	D2-05-5	29° 58.761'	-90° 01.346'	-32	-40	8	4	D2-05-5		
	D2-05-6	29° 58.758'	-90° 01.332'	-34	-40	6	4	D2-05-6		
DMMU 3 Land	D3-05-1	29° 58.392'	-90° 01.533'	5	-18	23	6	D3-05-1; D3-05-1N	386	390
	D3-05-2	29° 58.455'	-90° 01.511'	5	-18	23	6	D3-05-2; D3-05-2N		
	D3-05-3	29° 58.527'	-90° 01.490'	5	-18	23	6	D3-05-3; D3-05-3N		
DMMU 3 Water	D3-05-4	29° 58.379'	-90° 01.477'	-28	-45	17	7	D3-05-4; D3-05-4N	386	
	D3-05-5	29° 58.443'	-90° 01.463'	-25	-45	20	7	D3-05-5; D3-05-5N		
	D3-05-6	29° 58.515'	-90° 01.441'	-26	-45	19	7	D3-05-6; D3-05-6N		
DMMU 4	D4-05-1	29° 58.334'	-90° 01.464'	-29	-64	35	4	D4-05-1; D4/5-05-1N	537	785
	D4-05-2	29° 58.366'	-90° 01.458'	-29	-45	16	4	D4-05-2; D4/5-05-2N		
	D4-05-3	29° 58.411'	-90° 01.445'	-30	-45	15	4	D4-05-3; D4/5-05-3N		
	D4-05-4	29° 58.320'	-90° 01.441'	-18	-34	16	4	D4-05-4; D4/5-05-4N		
	D4-05-5	29° 58.346'	-90° 01.432'	-15	-34	19	4	D4-05-5; D4/5-05-5N		
	D4-05-6	29° 58.369'	-90° 01.422'	-10	-34	24	4	D4-05-6; D4/5-05-6N		
	D4-05-7	29° 58.393'	-90° 01.418'	-17	-34	17	4	D4-05-7; D4/5-05-7N		
	D4-05-8	29° 58.417'	-90° 01.410'	-8	-34	26	4	D4-05-8; D4/5-05-8N		
DMMU 5	D5-05-1	29° 58.456'	-90° 01.434'	-32	-45	13	4	D5-05-1; D4/5-05-9N	537	
	D5-05-2	29° 58.485'	-90° 01.427'	-30	-45	15	4	D5-05-2; D4/5-05-10N		
	D5-05-3	29° 58.542'	-90° 01.403'	-32	-64	32	4	D5-05-3; D4/5-05-11N		
	D5-05-4	29° 58.438'	-90° 01.402'	-5	-34	29	4	D5-05-4; D4/5-05-12N		
	D5-05-5	29° 58.459'	-90° 01.395'	-8	-34	26	4	D5-05-5; D4/5-05-13N		
	D5-05-6	29° 58.514'	-90° 01.386'	-11	-34	23	4	D5-05-6; D4/5-05-14N		
	D5-05-7	29° 58.514'	-90° 01.382'	-13	-34	21	4	D5-05-7; D4/5-05-15N		
	D5-05-8	29° 58.539'	-90° 01.374'	-11	-34	23	4	D5-05-8; D4/5-05-16N		
DMMU 6 Water	D6-05-1	29° 58.229'	-90° 01.456'	-15	-34	19	10	D6-05-1; D6-05-1N	530	527
	D6-05-2	29° 58.275'	-90° 01.441'	-20	-34	14	10	D6-05-2; D6-05-2N		
DMMU 6 Land	D6-05-3	29° 58.222'	-90° 01.435'	3	-25	28	5	D6-05-3; D6-05-3N	530	
	D6-05-4	29° 58.287'	-90° 01.412'	5	-25	30	5	D6-05-4; D6-05-4N		
	D6-05-5	29° 58.368'	-90° 01.400'	5	-25	30	5	D6-05-5; D6-05-5N		
	D6-05-6	29° 58.457'	-90° 01.365'	2	-25	27	5	D6-05-6; D6-05-6N		
DMMU 7 Water	D7-05-1	29° 58.611'	-90° 01.341'	-5	-34	29	6	D7-05-1; D7-05-1N	649	357
	D7-05-2	29° 58.645'	-90° 01.330'	-20	-34	14	6	D7-05-2; D7-05-2N		
	D7-05-3	29° 58.700'	-90° 01.312'	-25	-34	9	6	D7-05-3; D7-05-3N		
	D7-05-4	29° 58.755'	-90° 01.293'	-23	-34	11	6	D7-05-4; D7-05-4N		
DMMU 7 Land	D7-05-5	29° 58.498'	-90° 01.352'	-2	-25	23	5	D7-05-5; D7-05-5N	649	
	D7-05-6	29° 58.591'	-90° 01.333'	4	-25	29	5	D7-05-6; D7-05-6N		
	D7-05-7	29° 58.638'	-90° 01.302'	5	-25	30	5	D7-05-7; D7-05-7N		

Dredge Material Management Unit	Station ID	Latitude (NAD83)	Longitude (NAD83)	Water Depth (feet MLG)	Project Depth (feet MLG)	Target core Length (feet)	No. of Cores per Location for Required Sample Volume	Sample ID	Required Volume (L) for Top Non-Native Material Samples	Required Volume (L) for Native Material Samples
	D7-05-8	29° 58.693’	-90° 01.284’	4	-25	29	5	D7-05-8; D7-05-8N		
	D7-05-9	29° 58.749’	-90° 01.265’	4	-25	29	5	D7-05-9; D7-05-9N		
DMMU 8	D8-05-1	29° 58.131’	-90° 01.570’	-18	-40	22	4	D8-05-1	340	None
	D8-05-2	29° 58.232’	-90° 01.538’	-26	-40	14	4	D8-05-2		
	D8-05-3	29° 58.127’	-90° 01.552’	-34	-40	6	4	D8-05-3		
	D8-05-4	29° 58.227’	-90° 01.520’	-29	-40	11	4	D8-05-4		
DMMU 9	D9-05-1	29° 57.816’	-90° 01.681’	-9	-40	31	3	D9-05-1	379	None
	D9-05-3	29° 57.810’	-90° 01.658’	-34	-40	6	3	D9-05-3		
	D9-05-2	29° 58.036’	-90° 01.607’	-13	-40	27	3	D9-05-2	379	
	D9-05-4	29° 58.030’	-90° 01.584’	-31	-40	9	3	D9-05-4		
DMMU 10 Water	D10-05-1	29° 57.789’	-90° 01.639’	-7	-15	8	18	D10-05-1; D10-05-1N	419	419
	D10-05-2	29° 58.055’	-90° 01.542’	-5	-15	10	18	D10-05-2; D10-05-2N		
DMMU 10 Land	D10-05-3	29° 57.867’	-90° 01.612’	9	-15	24	8	D10-05-3; D10-05-3N	419	419
	D10-05-4	29° 57.945’	-90° 01.583’	8	-15	23	8	D10-05-4; D10-05-4N		
DMMU 11	D11-05-1	29° 57.579’	-90° 01.723’	-34	-40	6	14	D11-05-1	333	None
	D11-05-2	29° 57.652’	-90° 01.711’	-34	-40	6	14	D11-05-2		
Reference	Miss River	29° 55.285’	-90° 08.333’	-	-	Surface (sediment)	20 Grabs	Miss River Reference	137	None
		29° 55.284'	-90° 8.144'							
Reference	Mitigation Site	29° 59.050’	-90° 00.123’	-	-	Surface (sediment)	20 Grabs	Mitigation Site Reference	112	None
Reference	Marine/SB	29° 59.232’	-89° 55.973’	-	-	Surface (sediment)	20 Grabs	Marine Reference	205	None
Reference	Bayou La Loutre	29° 49.456’	-89° 35.349’	-	-	Surface (soil)	Shovel	Bayou La Loutre Reference	124	None
Disposal	Bayou Bienvenue	29° 59.216’	-89° 59.874’	-	-	Water	Grab	Bayou Bienvenue Disposal	-	-
Disposal	Miss River Disposal Area	29° 57.382’	-90° 01.728’	-	-	Water	Grab	Miss River Disposal Area	-	-
		29°57.343’	-90°01.619’							

2.3.2 Core Collection

2.3.2.1 Vibracore and Boxcore Sampling

Dredged material from waterside sample locations within the existing channel of the IHNC was collected using a P3 or P5 electric vibracore (Figure 3) or boxcore (Figure 4). The sampling equipment was deployed from a 70-ft crane barge, owned and operated by N and N Construction based in Chalmette, Louisiana. The vibracore was equipped with a four-inch outer diameter aluminum barrel lined with a food grade polyethylene tubing (with a thickness of 0.5 mm) and stainless steel cutter head. The boxcore, made of stainless steel, had six inch square sides and was capable of collecting 4 ft long cores.

All sampling equipment was cleaned prior to sampling and a new liner was used for each sediment core sample. For waterside sampling activities, sampling equipment and the deck of the vessel were rinsed with site water between stations.

Figure 3. P3 Electric Vibracore

Figure 4. Sediment Boxcore

2.3.2.2 Drill Rig Sampling

Land side soil sampling was conducted using a CME-75 truck mounted drilling rig owned and operated by Soil Testing Engineers (Figure 5). The soil borings were advanced initially by dry auger procedures using rotary type drilling equipment to the approximate depth of water or caving soils. Rotary wash drilling methods were used thereafter to the termination depth of the borings. Discrete samples were obtained continuously for the entire boring depth using either 5 inch diameter thin-walled tube or a 4 inch diameter split barrel sampler. The borings were back-filled with bentonite chips. Cholesterol free vegetable oil for lubrication was required and used to prevent analytical interference in subsequent chemical analyses.

Figure 5. CME-75 Mobile Drill Rig

2.3.3 Navigation

For all cores, station locations were pre-plotted (Table 2). Locations were determined using a Garmin Wide Area Augmentation System (WAAS) enabled Global Positioning System (GPS) accurate to ± 3 m. All final station locations were recorded in the field using positions from the GPS.

2.3.4 Core Handling and Geologic Description

Once collected, a representative core from each sample location was photographed and then a geologist experienced in the classification of sediments recorded the core description into a field computer according to the Unified Soil Classification System. The geologic description of each core included the texture, odor, color, length, approximate grain size distribution, plasticity characteristics of the fine-grained fraction, and any evident stratification of the sediment. Additional stratification beyond the expected native and non-native materials was not observed; therefore additional sample splits were not conducted. The samples were placed into clean, food-grade–quality plastic bags, labeled (project name, date, sample ID, analysis, and preservative where applicable), placed into a cooler with ice, and then delivered to a sample processing station on site with chain-of-custody (COC) forms (section 2.3.8).

2.3.5 Sample Processing and Storage

The sediment and soil samples were stored at 4 °C in a refrigerated container until processed. At the processing station (Figure 6), each sample was homogenized to a uniform consistency using a stainless steel mixing apparatus. The samples were processed as described in the Compositing and Analysis Plan (Appendix B): subsamples were packaged for shipping to testing laboratories and/or further homogenized (with the stainless steel mixing apparatus) with other samples within or between DMMUs to create the appropriate composites. Material from each homogenized sample or composite was then placed into appropriate sample containers (i.e., certified clean glass, plastic jars, epoxy-lined 55-gal drums) for chemical, physical and biological analyses. A sub-sample from each core, as well as the composite, was archived frozen in the event that further delineation of chemical contamination was required. The remainder of the composite sample was analyzed for toxicity.

Before creating each composite, all stainless steel utensils (stainless steel bowls, spoons, spatulas, mixers, and other utensils) were cleaned with soap (Alconox), rinsed with acetone, and then rinsed three times with deionized water. Pre-cleaned sample containers with chemical preservatives if needed were stored at the sample processing site until used. All sediment, soil, and water samples were split as necessary among preserved containers appropriate to the parameters to be determined. Each container was provided with a pre-printed sample label identifying the project name, sample identification information, and preservation method. The date and time of collection of the sample was entered on the label in the field. After a label was completed and affixed to the sample container, the label was covered with clear tape.

COC forms were initiated in the field upon collection of samples and delivered to the sample processing station with the samples (section 2.3.8). A second set of COCs were generated once the samples were homogenized or composited and placed into sample containers for delivery to a laboratory for analysis. The sample kits (coolers, COC forms, custody seals, sample containers, preservatives, and packing material) were prepared by TestAmerica Laboratories, Inc. (TestAmerica, formerly STL) in Pittsburgh, PA. The type of containers used for specific analyses, preservation techniques, and holding times for sediment, soil, and water samples are described in detail in the FSP (Weston 2007a).

Figure 6. On-site Sample Processing Station

2.3.6 Sample Nomenclature

Each sample was given a unique ID based on information pertaining to the collection, matrix, and analysis of the material to be evaluated. The sample nomenclature description followed on this project contained 14 characters with the general format of AB-CDEFGH-I-J-KL-MN. These characters specifically refer to the following sample information: DMMU - Site Number - Source - Native or Non-native - Sample Type - Sample Derivative Type. The sample nomenclature definitions are detailed in Table 3.

Table 3. Sample Nomenclature Description

Character	Description	Valid Values and Legend	
AB	DMMU/ Location	01 = DMMU 01	08 = DMMU 08
		02 = DMMU 02	09 = DMMU 09
		03 = DMMU 03[1]	10 = DMMU 10[1]
		04 = DMMU 04	11 = DMMU 11
		05 = DMMU 05	BL = Bayou La Loutre
		45 = DMMU 4/5[1,2]	BB = Bayou Bienvenue
		06 = DMMU 06[1]	MR = Mississippi River
		07 = DMMU 07[1]	MT = Mitigation Site
		SB = Marine Reference Site near Saint Bernard Parish	
CDEFGH	Site Number	000001	00006N
		000002	00007N
		000003	00008N
		000004	00009N

Character	Description	Valid Values and Legend	
		000005	00010N
		000006	00011N
		000007	00012N
		000008	00013N
		000009	00014N
		00001N	00015N
		00002N	00016N
		00003N	000000 or 00000W = water[3]
		00004N	00000R = reference sediment or soil
		00005N	*C* = composites[4]
I	Source	W = waterside	B = both (composites which include both water and landside locations)
		L=landside	
J	Native or non-native	N = native	T = top/non-native
		O = no distinction	
KL	Sample Type	WA = water	SD = sediment
		SO = soil from reference	FI = fill from bank
		SS = subsurface soil	TS = tissue
MN	Field Collected Samples [6]	SC = sediment chemistry	PZ = Physical analysis
		WC = water chemistry	WZ = water chemistry split
		ES = combined elutriate sediment	SZ = sediment chemistry split
		EW = combined elutriate water	ZZ = composite sample (55 gallon drum)
		WQ = water chemistry for PACE Analytical	EZ = suspended particulate phase dilution water (estuarine)
		SQ = sediment chemistry for PACE Analytical	FZ = suspended particulate phase dilution water (freshwater)
		PS = Suspended Particulate Phase Sediment	
	Lab derived samples	CS = Column settling	SE = Standard Elutriate
		CN = Consolidation	MB = Marine bioaccumulation
		SL = Simplified laboratory runoff procedure	FB = Freshwater bioaccumulation
		FE = Freshwater Suspended Particulate Phase Elutriate	EB = Earthworm bioaccumulation
		EE = Estuarine Suspended Particulate Phase Elutriate	UP = Upland plant bioaccumulation
		MS = Marine Solid Phase	WP = Wetland plant bioaccumulation
		FS = Freshwater Solid Phase	MD = Modified Elutriate –Dissolved Fraction
		MT = Modified Elutriate – Total Fraction	DD = Dredging Elutriate – Dissolved Fraction
		DT = Dredging Elutriate – Total Fraction	PZ = Water from leaching of sediment for plant/earthworm tests

1. DMMUs with native layer resulting in a total of 16 DMMUs to be sampled.
2. DMMU 4/5 was the native layer for DMMUs 4 and 5 combined into one DMMU.
3 Water samples collected from within the DMMU for purposes of water chemistry, preparation of elutriates, or elutriate testing
4. Composites were collected in accordance with the Compositing and Analysis Plan (Appendix B). There are a total of 26 composite samples listed in Appendix B. The DMMU and Site Numbers for these 26 composites are listed in Table 2 of the SOW (CEMVN 2004).

2.3.7 Shipping

For samples to be analyzed immediately by TestAmerica, sample containers were placed in sealable plastic bags and securely packed inside the cooler with ice packs or crushed ice. The original signed COC forms were protected in a sealable plastic bag and placed inside each cooler. The cooler lids were securely taped shut and then delivered by FedEx to TestAmerica in Pittsburgh, PA.

In order for samples to be analyzed or processed by ERDC, they were placed in 55-gal drums. The drums were held on site in a refrigerator container and shipped to ERDC in Vicksburg, MS, by refrigerated transport every few weeks during the field sampling effort. Prior to shipping, drums were labeled, lids securely fastened, and COC forms completed and included in the delivery driver's manifest. Sample splits were then sent from ERDC to Weston's bioassay laboratory in Carlsbad, CA and Newfield's bioassay laboratory in Pt. Gamble, WA, via FedEx.

The split QA/QC samples were sent to Pace Laboratories for analysis. Table 4 lists the point of contact and pertinent shipping information for each laboratory as well as the particular analyses performed by each.

Table 4. Analytical Laboratories, Points of Contact, and Shipping Information

Laboratory	Analyses Performed	Point of Contact	Shipping Information
US Army Engineer Research and Development Center Waterways Experiment Station Environmental Laboratory	Toxicity tests: Freshwater and estuarine suspended particulate phase and freshwater solid phase toxicity tests Freshwater and upland bioaccumulation tests Physical analyses: Column settling and consolidation tests	Dr. Jeffery Steevens	Environmental Laboratory U.S. Army Engineer Research and Development Center Waterways Experiment Station 3909 Halls Ferry Road Vicksburg, MS 39180-6199 (601)634-4199
TestAmerica, Pittsburgh, PA (formerly STL)	Water and sediment chemistry Physical analyses: Total organic content, Black Carbon, specific gravity, grain size and Atterberg Limits	Tara Martz	450 William Pitt Way, Building 6 Pittsburgh, PA 15238 Phone: (412)820-8380 Fax: (412)820-2080
Weston Solutions, Inc.	Toxicity test: Marine amphipod solid phase tests	Dr. David Moore	2433 Impala Drive Carlsbad, Ca 92010 Phone (760)795-6956 Fax (760)931-1580
NewFields Northwest	Toxicity test: Marine benthic bioaccumulation with	Susie Watts	4729 NE View Drive Port Gamble, WA 98364

Laboratory	Analyses Performed	Point of Contact	Shipping Information
	Macoma		Phone (360)297-6080 FAX (360)297-7268
PACE Laboratories	QA/ QC samples: metals and SVOCs	Debra James-Deslatte	1000 Riverbend Blvd. Ste F St. Rose, LA 70087 (504)305-3634

2.3.8 Documentation and Chain-of-Custody

COC procedures, described in the FSP (Weston 2007a), were initiated during sample collection. A COC record was provided with each sample or sample group (sample form provided in Weston's FSP). Each person who had custody of the samples signed the form and ensured that the samples were not left unattended unless properly secured. The COC form was signed by the person transferring custody of the samples. The condition of the samples was recorded by the receiver. COC records documenting from field collection to the compositing area are included in Appendix C.

2.4 Physical and Chemical Analyses

Physical and chemical analytes to be measured in this testing program were selected to provide data on potential chemicals of concern in IHNC sediments, as specified in the FSP (Weston 2007a) and the quality assurance project plan (QAPP, Weston 2007b). All analytical methods used to obtain contaminant concentrations follow USEPA or Standard Methods (SM). In addition, chemical and physical measures selected for this evaluation were consistent with those recommended for assessing dredged material in the state of Louisiana (Ocean Testing Manual [OTM] USEPA/USACE 1991; Regional Implementation Agreement [RIA], USEPA Region VI/USACE Galveston and New Orleans Districts 2003).

2.4.1 Physical Analyses

2.4.1.1 Geotechnical Analyses

Physical properties of the sediment were measured to support environmental and operational analyses required for the dredging and disposal permitting process. Physical characterization was conducted on bulk sediment samples, using standardized testing methods and, for hard carbon analysis, a method obtained from peer-reviewed literature as described in Table 5.

Table 5. Physical and Geotechnical Measurements

Procedure	Method
Grain size distribution	ASTM D422-63 (2002)
Classification of soils and sediments	ASTM D2487/2488 (2000)
Atterberg limits	ASTM D4318 (2000)
Moisture content	ASTM D2216 (2005)
Organic content	ASTM D2974 (2000)
Specific gravity	ASTM D854 (2002)
pH	Meter
Hard carbon (soot)	Gustafsson et al. (1997)

As described in Weston's QAPP (Weston 2007b), grain size analysis and determination of soil constants was conducted according to either American Society for Testing and Materials (ASTM) D422 (dry sample preparation) or ASTM D2217 (wet sample preparation), as appropriate for the test and the material. Method D2217 was used to prepare almost all samples for determination of Atterberg limits, while Method D421 was used for preparation for the other test methods. Specific gravity was determined using ASTM D854 for moist or dry soils. Moisture content determination was evaluated using ASTM D2216 for soil, rock and similar materials or ASTM D2974 for organic soils.

2.4.1.2 Simplified Laboratory Runoff Procedure (SLRP)

The Simplified Laboratory Runoff Procedure (SLRP) method was performed according to methods described in detail in the QAPP (Weston 2007b) and was in accordance with the background, rationale, and tiered framework for application discussed in Chapter 5 of the main text of the UTM (USACE 2003). Briefly, SLRP was conducted on each sample composite considered for separate upland placement. A subsample of each sediment sample was measured for sediment moisture content and another subsample was air-dried to less than 5% moisture for three weeks and was evaluated in the SLRP for organics and nutrients. Chemical oxidation was performed using 30 percent hydrogen peroxide (H_2O_2) to determine the formation of sulfuric acids and a significant reduction of hydrogen ion concentration (pH). These sediment subsamples were then brought back to dryness, reground, and used to prepare runoff samples.

SLRP Runoff Water Preparation and Extraction. The SLRP requires the preparation of simulated runoff water using wet, unoxidized and dry, and oxidized sediment using sediment:water ratios corresponding to the suspended solids concentrations shown in Table 6. Each ratio for the sediment condition was replicated three times. Sample volumes for each of the sediment conditions described below were dependent on the required chemical analysis and sufficient volume to evaluate the selected contaminants of concern. Nomenclature for sample extracts was provided in the QAPP (Weston 2007b), but was modified as described in the table below (Table 7). This nomenclature key refers to the characters used to identify SLRP samples after the first fourteen characters used according to the nomenclature key provided in Table 3. Only filtered (dissolved) samples were required for chemical analysis.

Table 6. Sediment to Water Ratios and Corresponding Suspended Solids Concentrations.

Sediment Condition	1:20	1:200	1:2,000	1:20,000
Wet	50,000 mg l^{-1}	5,000 mg l^{-1}	500 mg l^{-1}	-
Dry	-	5,000 mg l^{-1}	500 mg l^{-1}	50 mg l^{-1}

Table 7. Nomenclature Key to SLRP Samples

Sample ID	Sediment Condition	TSS, mg/L
SLW500_REP1 to _REP3	Wet	500
SLW5K_REP1 to _REP3	Wet	5000
SLW50K_REP1 to _REP3	Wet	50000
SLD50_REP1 to _REP3	Dry	50
SLD500_REP1 to _REP3	Dry	500
SLD5K_REP1 to _REP3	Dry	5000

2.4.1.3 Column Settling Tests

Column settling tests were conducted by the ERDC Hazardous Waste Research Center, according to the procedures outlined in Appendix B of the UTM (USACE 2003). Data obtained from column settling tests were used to determine the size of disposal area required in order for adequate clarification to occur.

Conversely, if the size of the disposal area was fixed, production constraints could be determined from the analysis. Predicted suspended solids concentrations from the column settling test were also used with data obtained from effluent elutriate tests (USACE 2003), to obtain predicted total contaminant concentrations in the effluent.

Material designated for column settling tests were stored at 4°C until needed for testing, in order to minimize changes in the organic components of the sediment. Salinity of the site water was measured (or calculated from total dissolved solids [TDS]) and slurry was made up with tap water adjusted to the correct salinity with Instant Ocean® sea salt mix (Aquarium Systems, Inc., Mentor, Ohio). Slurry concentrations were based upon the grain size distribution of the material if that information was available, or the default value of 150 g/L was used, as specified in the procedure. Tests were conducted at ambient temperature. Eight-inch diameter plexiglass columns with staggered sampling ports, as described in the UTM and SETTLE model documentation, were used in the testing. Columns were cleaned with tap water to assure all residual solids from previous testing were cleared from the column and all sampling ports. Similarly, tanks, mixers and pumps used to prepare and transfer slurry were cleaned and/or purged with tap water to eliminate solids from previous testing. Salinity and turbidity meters were properly cleaned and calibrated prior to use according to manufacturer recommendations. Filtration equipment and filter papers used for determination of suspended solids were prepared according to the procedures outlined in the SETTLE model documentation. Immediately after filling the column, slurry samples were obtained from the column sampling ports at 1 ft intervals. These samples were measured for total solids and turbidity. The mean total solids concentration was taken to be the starting slurry solids concentration of the column. In addition to obtaining total solids concentrations on all subsequent samples taken over the course of the testing, turbidity was also measured as a check against the total solids concentrations obtained. Raw data and relevant observations were recorded on laboratory data sheets and then transferred to electronic spreadsheets. Left-over materials were properly manifested and disposed of in an appropriate disposal facility, following completion of the column settling tests.

2.4.2 Chemical Analyses

Chemical analyses were conducted on sediments, elutriates, site waters, and tissue samples for the contaminants listed in the QAPP (Weston 2007b). The project target detection limits (TDLs) and laboratory method detection limits (MDLs), and laboratory reporting limits (RLs) were also presented in the QAPP. A detailed explanation of these detection limits (i.e., TDLs, MDLs and RLs) and whether analytical results are below these detection limits is presented in Appendix D. All inorganic and organic compounds for this project were analyzed using the methods listed in Table 8. All analytical methods followed USEPA or ASTM procedures, with the exception of organotins and carbon solid phase extraction (SPE), which followed the analytical laboratory's SOP.

Priority pollutant metals (except mercury) were determined utilizing Inductively Coupled Plasma mass spectrometry (ICP/MS) in accordance with SW846 Method 6020, including the use of trace ICP. Mercury was analyzed by Cold Vapor Atomic Absorption (CVAA) in accordance with SW846 Methods 7471A (sediment and tissue) and 7470A (water). Volatile organic compounds (VOCs) were determined on tissue samples utilizing gas chromatography/mass spectrometry (GC/MS) with selective ion monitoring (SIM) in accordance with modified USEPA 1624. SVOCs were determined utilizing GC/MS with SIM in accordance with SW846 Method 8270C. Organochlorine pesticides were determined utilizing GC/electron capture detector (ECD) in accordance with SW846 Method 8081A. Polychlorinated biphenyls (PCBs) were analyzed and quantified as Aroclors utilizing GC/ECD in accordance with SW846 Method 8082. Herbicides were determined utilizing GC/ECD in accordance with SW846 Method 8151A. Organotins were determined on tissue samples utilizing GC/flame photometric detector (FPD) in accordance with Krone et al. 1989. Organotins were determined on sediment and water samples utilizing GC/FPD in accordance with TestAmerica's in-house method derived from the National Oceanic and

Atmoshperic Administration (NOAA) Status and Trends Program Document (1984-1992). Total cyanide and hexavalent chromium were determined using an automated colorimetric measurement in accordance with SW846 Methods 9012A and 7196A, respectively. Nitrogen and ammonia were determined utilizing an automated colorimetric measurement in accordance with USEPA 350.1. Total organic carbon (TOC) in sediments was determined using the 1988 USEPA Region II combustion procedure (the Lloyd Kahn procedure). TOC in water was determined using USEPA 415.1.

Table 8. Analytical Methods

Parameter	Method	Method #	Matrix	Reference
Organic – Extraction Cleanup				
Sulfuric Acid Cleanup	Liquid-liquid Partitioning	3650B or 3665A	S	USEPA 1997
Sulfur Cleanup	Treatment with copper or mercury or TBA (tetrabutyl ammonium sulfite)	3660A/B	S	USEPA 1997
Silica Gel Cleanup	Adsorption Column Chromatography	3630C	T	USEPA 1997
Carbon Solid Phase Extraction SOP (Pittsburgh)	CarboPrep SPE	SOP	S	PITT-OP-0001
Gel-Permeation Cleanup	Size Exclusion Chromatography	3640A	T	USEPA 1997
Organics				
Volatile Organic Compounds	Gas Chromatography / Mass Spectrometry	8260B	S,W	USEPA 1997
Volatile Organic Compounds	Gas Chromatography / Mass Spectrometry	1624 Mod.	T	USEPA 1997
Semivolatiles Organic Compounds	Gas Chromatography / Mass Spectrometry	8270C	S,W,T	USEPA 1997
Organochlorine Pesticides	Gas Chromatography – ECD	8081A	S,W,T	USEPA 1997
Organotins	Gas Chromatography – FPD	TestAmerica SOP	S,W,T	----
PCB Aroclors	Gas Chromatography – ECD	8082	S,W,T	USEPA 1997
Herbicides	Gas Chromatography – ECD	8151A	S,W	USEPA 1997
Metals				
Aluminum	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Antimony	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Arsenic	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Beryllium	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Cadmium	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Chromium	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Cobalt	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Copper	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Iron	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Lead	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Mercury	Atomic Absorption – Cold Vapor	7471A	S,T	USEPA 1997
Mercury	Atomic Absorption – Cold Vapor	7470A	W	USEPA 1997
Manganese	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Nickel	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Selenium	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Silver	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Thallium	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Tin	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Zinc	Atomic Emission – ICP/MS	6020	S,T,W	USEPA 1997
Inorganic Nonmetals				

Parameter	Method	Method #	Matrix	Reference
Cyanide, Total	Colorimetric – Automated	9012A	S,W,T	USEPA 1997
Total Organic Carbon	Combustion Oxidation	Lloyd Kahn	S	USEPA 1988
Total Organic Carbon		415.1	W	USEPA 1997
Nitrogen, Ammonia	Colorimetric – Automated	350.1	S,W	USEPA 1997
Hexavalent Chromium	Colorimetric – Automated	7196A	S,W,T	USEPA 1997
Grain Size (sieve and hydrometer)	------	D422	S	ASTM, 2007
Specific Gravity	------	D854	S	USEPA 1979
Total Solids	Gravimetric	160.3 Mod.	S	USEPA 1997
Matrix codes: S = sediment, W = water, T = tissue				

2.4.2.1 Sediment, subsurface soil, fill and soil

Project sediment, subsurface soil, fill, and soil were analyzed for contaminants listed in the QAPP (Weston 2007b), according to methods described in Section 2.4.2. In addition to the analyses performed on tissue and water samples, total solids were measured on sediment samples to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis. Total solids analysis was performed using a gravimetric procedure in accordance with modified USEPA 160.3. Black carbon was also measured using the Lloyd Kahn TOC method.

Prior to chemical analyses of test sediments, various cleanup methods were performed to eliminate potential interferences (Table 8). To separate acid analytes from base/neutral analytes, a sulfuric acid cleanup was performed utilizing liquid-liquid partitioning in accordance with SW846 Method 3650B. When elevated baselines prevented accurate quantitation of PCBs, a sulfuric acid cleanup was performed utilizing liquid-liquid partitioning in accordance with SW846 Method 3665A. The solubility of sulfur in various solvents is similar to the organochlorine pesticide, therefore a sulfur cleanup was performed utilizing copper, mercury or tetrabutyl ammonium sulfite (TBA) in accordance with SW846 Method 3660A/B. Carbon SPE was also performed following CarboPrep SPE method in accordance with TestAmerica's Pittsburgh laboratory's SOP.

2.4.2.2 Water

Site water was analyzed for contaminants listed in the QAPP (Weston 2007b), according to methods described in Section 2.4.2. Samples were also analyzed for dissolved organic carbon in accordance with USEPA 415.1.

2.4.2.3 Standard Elutriate

The Standard Elutriate Test (SET) was used to predict the release of contaminants to the water column resulting from open water disposal of dredged material. To prepare the standard elutriate, the dredged material and site water were combined in a sediment-to-water ratio of 1:4 on a volume basis. The mixture was vigorously mixed for 30 minutes and allowed to settle for 1 hour. The supernatant (liquid phase) was siphoned off and centrifuged to remove particulates. The liquid phase after centrifugation was the standard elutriate. The standard elutriate was analyzed for contaminants listed in the QAPP (Weston 2007b).

2.4.2.4 Modified Elutriate – dissolved and total fractions

The Modified Elutriate Test (MET) was used to predict the quality of effluent discharged from the confined dredge material disposal areas during the initial dewatering phase that follows placement of dredged material. To prepare the modified elutriate, the dredged material and site water were combined in a 4-L cylinder at a concentration of 150 g/L (based on dry weight). Water and sediment were vigorously mixed for 1 hour via aeration. The mixture was then allowed to settle for 24 hours. The supernatant was siphoned off, creating the total fraction, and a portion was centrifuged, creating the dissolved fraction. The total and dissolved fractions were analyzed for contaminants listed in the QAPP (Weston 2007b).

2.4.2.5 Dredged Elutriate – dissolved and total fractions

The Dredging Elutriate Test (DRET) was used to predict the concentration of contaminants in the water column at the point of dredging. The dredged elutriate was prepared according to procedures described in *Dredging Elutriate Test Development* (DiGiano, et al., 1995). To prepare the dredged elutriate, the dredged material and site water were combined in a 4-L graduated cylinder at an initial total suspended solids (TSS) concentration of 10 g/L. Water and sediment were mixed for 1 hour via aeration and then allowed to settle for 1 hour. The supernatant was siphoned off and split for total and dissolved chemical analyses and TSS. The total and dissolved fractions were analyzed for contaminants listed in the QAPP (Weston 2007b).

2.4.2.6 Tissue

Tissue analyses were performed to determine the availability of sediment contaminants taken up by the test organisms (plants, clams, and worms). Tissue samples were stored frozen and removed to thaw prior to analyses. Tissues were analyzed for contaminants listed in the QAPP (Weston 2007b), according to methods described in Section 2.4.2. Tissue samples were analyzed for the same contaminants as the water and sediment samples, with the exception of herbicides, which were not performed. In addition to the analyses performed on water and sediment samples, percent lipids were analyzed to normalize organic chemical concentrations. Tissue composites from each replicate were analyzed separately.

Prior to analyses of tissues, various cleanup methods were performed to eliminate potential interferences (Table 8). A silica gel cleanup was performed utilizing adsorption column chromatography in accordance with SW846 Method 3630C. This cleanup method was used to separate analytes from interfering compounds of different chemical polarity. A gel-permeation cleanup was performed utilizing size exclusion chromatography in accordance with SW846 Method 3640A. This cleanup method was used in the separation of synthetic macromolecules.

Mortality in bioaccumulation potential tests of some replicates resulted in insufficient tissue mass for chemical analyses of all IHNC contaminants of concern. Therefore, a prioritization was developed to ensure the most appropriate (most likely bioavailable) contaminants were analyzed (Appendix E). The prioritization differs between plant and animals and/or aquatic and upland due to differing biological response by organisms and/or physicochemical differences between aquatic and upland sediment/soils. The selection order was based on the professional experience of ERDC scientists.

For plants, the contaminant prioritization was as follows:

1. Metals (including mercury and total chromium)
2. Organotins
3. SVOCs
4. Organochlorine Pesticides
5. VOCs
6. PCBs

For animals, the contaminant prioritization was as follows:

1. Metals
2. SVOCs / Organochlorine Pesticides / PCBs
3. Lipids
4. Organotins

5. Chromium (hexavalent)
6. VOCs

2.4.2.7 Statistical Analyses of Tissue Chemistry

Bioaccumulation data were analyzed by statistically comparing chemical concentrations in the tissues of the organisms that were exposed to reference sediments to the tissues of the organisms that were exposed to the project material. Statistical tests, including analysis of variance, *t*-tests, or non-parametric tests, were used to analyze data. Tissue organic chemical concentrations were normalized to lipid concentrations prior to statistical analyses. If there was not enough tissue mass to analyze for percent lipids, statistical analyses was performed on data with and without normalization.

2.4.3 Comparison of Results to Water Quality Standards or Sediment Quality Guidelines

2.4.3.1 Non-native Sediment, Non-native Fill, and Native Subsurface Soil

There are no sediment quality standards promulgated by USEPA or by the State of Louisiana. However, the National Oceanic and Atmospheric Administration (NOAA) has developed a set of sediment quality benchmarks known as Screening Quick Reference Tables, or SQuiRTs (Buchman 1999), which present sediment benchmarks for inorganic and organic contaminants in sediment. These benchmarks are available at http://response.restoration.noaa.gov/cpr/sediment/sediment.html. These benchmarks, while not criteria or standards, provide a basis on which to evaluate relative sediment quality. As a consequence, non-native sediment, non-native fill, and native subsurface soil chemistry results were compared to the following sediment quality guidelines (SQGs): threshold effects levels [TEL], probable effects levels [PEL], effects-range low [ER-L] and effects-range median [ER-M] benchmarks for those parameters tested. Whether -native sediment, non-native fill, and native subsurface soil chemistry results were compared to within freshwater or marine SQGs dependedupon the salinity at stations within the DMMUs. Specifically, DMMU 9 station 1 and DMMU 10 station 1 were freshwater sediment coring locations, while all other sample locations were estuarine. TEL and PEL values were developed by MacDonald et al. (1996). ER-L and ER-M values were developed by Long et al. (1995). These benchmarks are defined as:

- **ER-L**: The ER-L represents the lower 10th percentile of chemical concentrations observed or predicted to be associated with biological effects.
- **ER-M**: The ER-M benchmark represents the median of chemical concentrations observed or predicted to be associated with biological effects.
- **TEL**: The TEL represents the geometric mean of the 15th percentile concentration of the toxic effects data set and the median of the no-effect data set, and represents the concentration below which adverse effects are expected to occur only rarely.
- **PEL**: The PEL represents the geometric mean of the 50% of impacted, toxic samples and the 85% of the non-impacted samples, and represents the level above which adverse effects are frequently expected.

2.4.3.2 Water

Water chemistry results were compared to both acute and chronic USEPA WQC (USEPA 2006) and Louisiana Numerical Criteria for Specific Toxic Substances (Louisiana Department of Environmental Quality 2007); freshwater stations (DMMU 9 station 1 and DMMU 10 station 1) were compared to freshwater criteria while all other stations within DMMUs were compared to marine criteria.

2.4.3.3 Elutriates

Standard (open water) elutriate chemistry results were compared to the freshwater acute and chronic USEPA and Louisiana criteria as described in the SOW (CEMVN 2007).

Modified elutriate dissolved fraction chemistry results were compared to the marine acute and chronic USEPA and Louisiana criteria as described in the SOW (CEMVN 2007).

Dredging elutriate dissolved fraction chemistry results were compared to both acute and chronic USEPA WQC and Louisiana Numerical Criteria for Specific Toxic Substances; freshwater stations (DMMU 9 station 1 and DMMU 10 station 1) and stations on the Lock (DMMU 10, stations 3&4) were compared to freshwater criteria while all other stations within DMMUs and stations on the Lock were compared to marine criteria.

2.4.4 Data Validation of Chemistry Results

MECX, LP (MECX) was contracted by Weston Solutions, Inc. (Weston) to provide definitive data validation for 10% of the chemical analyses performed on sediment, water, elutriate and tissue samples collected by Weston in and around the IHNC. The samples were analyzed by TestAmerica, Inc. in accordance with the QAPP (Weston 2007). The samples were analyzed at All samples were analyzed by methodology specified in accordance with the QAPP. MECX validated three (3) site water samples and one (1) trip blank, 26 elutriate samples and one (1) elutriate blank, 13 sediment samples and seven (7) tissue samples in accordance with standard data validation procedures.

The data evaluated during validation included: holding times, instrument tuning, calibration, blanks, interference check samples, blank spikes and laboratory control samples, laboratory duplicates, matrix spike/matrix spike duplicates, serial dilutions, internal standards, field QC samples including elutriate blanks and trip blanks, surrogate recovery, compound identification, compound quantification, reported detection limits, and system performance as appropriate to each method and target analyte. All raw data and supporting documentation were evaluated as part of the definitive validation process. The aforementioned areas are evaluated to assess the data quality requirements of the project which include precision, accuracy, representativeness, completeness, comparability, and sensitivity. This summary of the data validation and data usability is based upon the 10% definitive data validation of randomly chosen samples and as such is assumed to be representative of the entire body of data. However, individual data outliers may exist which do not fall within the population validated.

2.5 Biological Tests

Testing for this project included two SPP toxicity tests, two SP toxicity tests, and five BP tests. Specific bioassays performed for this project are summarized in Table 9.

Table 9. Toxicity Testing on Sediments or Soils Collected from IHNC, New Orleans

Test Type	Type of Organism	Taxon	Project Sediments	Control	Reference[1] Sediment	Reference[1] Toxicant	Ammonia[1] Reference Toxicant
Suspended Particulate Phase (SPP)	Freshwater Fish	*Pimephales promelas*	X[2]	Dilution Water		X	
	Marine Fish	*Cyprinodon variegatus*	X[2]			X	
Solid Phase (SP)	Freshwater Amphipod	*Hyalella azteca*	X	Control Sediment	X	X	
	Marine Amphipod	*Ampelisca abdita*	X		X	X	X
Bioaccumulation (BP)	Freshwater Bivalve	*Corbicula fluminea*	X	Control Sediment	X		
	Marine Bivalve	*Macoma nasuta*	X		X		
	Earthworm	*Eisenia fetida*	X		X		
	Wetland Plant	*Spartina alterniflora*	X		X		
	Upland Plant	*Cyperus esculentus*	X		X		

[1] Shaded areas indicate tests or treatments that were not applicable to the selected tests.
[2] Sediment elutriates of project material was tested.

2.5.1 Suspended Particulate Phase Tests

SPP tests were performed to estimate the potential impact of dredged material on organisms that live in the water column. Elutriate tests were conducted using a marine fish (*Cyprinodon variegatus*) and a freshwater fish (*Pimephales promelas*); both were recommended benchmark test species for elutriate exposures (USEPA/USACE, 1991, 1998). Elutriate preparation was conducted according to standard guidance (USEPA/USACE, 1998). Elutriates were prepared from each sample by combining sediment from each area with site water (or culture water where appropriate) in a 1:4 ratio by volume, vigorously agitating for 30 minutes, and then allowing the material to settle for approximately 1 hour at room temperature (20°–23°C). After particulates had settled, the supernatant was gently decanted. This supernatant represented the 100% test concentration and was used to create dilutions. Testing was conducted in accordance with procedures outlined in the ITM (USPA/USACE, 1998) and USEPA (2002).

2.5.1.1 Freshwater – Pimephales promelas

Sediment elutriates were tested in a 4-day acute SPP test using the freshwater fish *P. promelas*. Test animals were supplied by Aquatic Biosystems, Fort Collins, Colorado, and acclimated for three days. Elutriates for this test were prepared using dechlorinated tap water due to site water salinity exceeding test species tolerance range. Three elutriate concentrations (10, 50, and 100%) were prepared from the 100% elutriate and dechlorinated tap water. In addition, a control treatment was tested using culture water (dechlorinated tap water). Each treatment concentration was run with five replicates containing 200 mL exposure volume in 300 mL glass beakers. An environmental chamber was used to maintain temperature. At test initiation, test organisms were randomly distributed to test chambers. Initial stocking densities were 10 organisms per replicate. The chambers were covered to minimize evaporation. The test was run under static conditions at a temperature of 20 ± 1°C with a 16-hour light: 8-hour dark photoperiod. Fish were supplied a feeding ration of *Artemia* nauplii 48-hours following initiation of exposure

(USEPA/USACE, 1998). Water quality parameters (i.e., temperature, pH, dissolved oxygen [DO], conductivity, ammonia) were measured from each replicate chamber at experiment initiation and termination. Environmental chamber temperature was monitored and recorded daily. The endpoint assessed was survivorship, defined as lack of motility, determined by use of a blunt probe as necessary. Test acceptability criterion was greater than 90 percent mean control survival. The *P. promelas* SPP test was performed in three batches. A summary of test conditions is provided in Table 10.

Ammonia was a potential contaminant in some samples. An ammonia toxicity reduction was conducted using zeolite (Hockett *et al.* 1996, Burgess *et al.*, 2003). Since zeolite may remove some metals, ethylenediamine tetraacetic acid (EDTA) was used to complex metals in a separate treatment to control for this. EDTA should not alter ammonia concentrations. Separate aliquots of elutriate samples suspected of ammonia toxicity were treated with zeolite and EDTA. These separate treatments were run side-by side with the untreated elutriate. A conclusion matrix based on the toxicity reduction evaluation is presented in Table 11.

A reference toxicant test was conducted using potassium chloride with concentrations of 0, 0.17, 0.34, 0.68, 1.35, and 2.70 g KCl/L to establish sensitivity of test organisms used in the evaluation of project sediment.

Table 10. Test Conditions for the 96-hour Suspended Particulate Phase Test Using *Pimephales promelas*

Test Conditions: *Pimephales promelas* SPP Test				
		Batch 1	Batch 2	Batch 3
Sample Identification		0100C1_6WOSDFE, 0200C1_6WOSDFE, 0300C4_6WTSDFE, 030C1_6NBNSSFE, 0300C1_3LTFIFE, 0800C1_4WOSDFE	0600C1&2WTSDFE, 0600C3_6LTFIFE, 060C1_6NBNSSFE, 0700C1_4WTSDFE, 0700C5_9LTFIFE, 070C1_9NBNSSFE, 10000001WTSDFE, 1000C3&4LTFIFE, 100C3&4NLNSSFE	0400C1_8WTSDFE, 0500C1_8WTSDFE, 45C1_16NWNSSFE, 09000001WOSDFE, 0900C2&4WOSDFE
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*P. promelas*	*P. promelas*	*P. promelas*
Supplier		**Aquatic Biosystems, Fort Collins, Colorado**	**Aquatic Biosystems, Fort Collins, Colorado**	**Aquatic Biosystems, Fort Collins, Colorado**
Date acquired		**August 3, 2007**	**August 24, 2007**	**September 14, 2007**
Acclimation/holding time		**3 days**	**3 days**	**3 days**
Age class		**3 days (at time of testing)**	**3 days (at time of testing)**	**3 days (at time of testing)**
Test Procedures		ITM (USEPA/USACE, 1998), USEPA (2002)	ITM (USEPA/USACE, 1998), USEPA (2002)	ITM (USEPA/USACE, 1998), USEPA (2002)
Test location		**US Army ERDC, Building 6008, Chamber 1**	**US Army ERDC, Building 6008, Chamber 1**	**US Army ERDC, Building 6008, Chamber 3**
Test type/duration		**Static – Acute SPP / 96 hours**	**Static – Acute SPP / 96 hours**	**Static – Acute SPP / 96 hours**
Test dates		**August 6 - 10, 2007**	**August 27 - 31, 2007**	**September 17 - 21, 2007**
Control water		**Dechlorinated tap, Vicksburg municipal**	**Dechlorinated tap, Vicksburg municipal**	**Dechlorinated tap, Vicksburg municipal**
Test temperature	**Target: Mean 20 ± 1°C (instantaneous: 20 ± 3°C)**	**Actual: Mean: 20.3 ± 0.3°C Range: 19.9 – 21.8°C**	**Actual: Mean: 20.6 ± 0.5°C Range: 19.8 – 22.0°C**	**Actual: Mean: 19.9 ± 0.5°C Range: 19.2 – 21.3°C**
Test conductivity	**Target: No recommended value**	**Actual: Mean: 753.2 ± 469 µS/cm Range: 300 – 1,920 µS/cm**	**Actual: Range: 250 – <7,000 µS/cm**	**Actual: Range: 250 – < 3,000 µS/cm**
Test dissolved oxygen	**Target: > 40% saturation, equivalent to > 4.0 mg/L**	**Actual: Mean: 7.8 ± 0.7 mg/L Range: 5.9 – 9.0 mg/L**	**Actual: Mean: 7.2 ± 0.6 mg/L Range: 4.9 – 9.6 mg/L**	**Actual: Mean: 8.1 ± 0.9 mg/L Range: 5.6 – 9.6 mg/L**
Test pH	**Target: Watch for pH Drift**	**Actual: Mean: 8.13 ± 0.26 Range: 7.17 – 8.92**	**Actual: Mean: 8.15 ± 0.16 Range: 7.25 – 8.54**	**Actual: Mean: 8.21 ± 0.18 Range: 7.81 – 8.90**
Test total ammonia	**No recommended concentration**	**Actual: <1 – 5 mg/L**	**Actual: <1 - >8 mg/L***	**Actual: <1 – >8 mg/L***
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**300 mL**	**300 mL**	**300 mL**
Replicates/SPP concentration/treatment		**5**	**5**	**5**
SPP concentrations		**100%, 50%, 10%, 0% (control)**	**100%, 50%, 10%, 0% (control)**	**100%, 50%, 10%, 0% (control)**
Organisms/replicate		**10**	**10**	**10**
Exposure volume		**200 mL**	**200 mL**	**200 mL**
Feeding		**~1000 freshly hatched *Artemia* nauplii per replicate - day 2**	**~1000 freshly hatched *Artemia* nauplii per replicate – day 2**	**~1000 freshly hatched *Artemia* nauplii per replicate – day 2**
Water renewal		**None**	**None**	**None**
Deviations from Test Protocol		**Elutriates prepared using dechlorinated tap water due to site water salinity exceeding test species tolerance range (USEPA/USACE 1998).**	**Elutriates prepared using dechlorinated tap water due to site water salinity exceeding test species tolerance range (USEPA/USACE 1998).**	**Elutriates prepared using dechlorinated tap water due to site water salinity exceeding test species tolerance range (USEPA/USACE 1998).**

* 8 mg/L was kit maximum.

Table 11. Conclusion Matrix Based on Toxicity Reduction Evaluation[2]

Scenario	Untreated Elutriate	Zeolite-treated Elutriate	EDTA-treated Elutriate	Conclusion
1	**Non-toxic**	**Non-toxic**	**Non-toxic**	**The elutriate sample was not toxic**
2	**Toxic**	**Non-toxic**	**Non-toxic**	**Toxicity was due to metals**
3	**Non-toxic**	**Toxic**	**Non-toxic**	**The elutriate sample was not toxic, toxicity was due to zeolite**
4	**Non-toxic**	**Non-toxic**	**Toxic**	**The elutriate sample was not toxic, toxicity was due to EDTA**
5	**Toxic**	**Toxic**	**Non-toxic**	**Toxicity was due to metals**
6	**Toxic**	**Non-toxic**	**Toxic**	**Toxicity was due to ammonia**
7	**Non-toxic**	**Toxic**	**Toxic**	**The elutriate sample was not toxic, toxicity was due to zeolite, EDTA**
8	**Toxic**	**Toxic**	**Toxic**	**Toxicity was due to contamination other than ammonia or metals**

2.5.1.2 Marine – Cyprinodon variegatus

Sediment elutriates were tested in a 4-day acute SPP test using the marine fish *C. variegatus*. Test animals were supplied by Aquatic Biosystems, Fort Collins, Colorado, and acclimated for three days. Elutriates were prepared according to procedures described above; however the salinity of Site 10 water was 0 ppt (freshwater). Therefore, the salinity was adjusted to 12 ppt following elutriate preparation. Three elutriate concentrations (10, 50, and 100%), were prepared from the 100% elutriate and artificial seawater. In addition, a control treatment was tested using culture water (10 ppt artificial seawater). Each treatment concentration was run with five replicates containing 200 mL exposure volume in 300 mL glass beakers. An environmental chamber was used to maintain temperature. At test initiation, test organisms were randomly distributed to test chambers. Initial stocking densities were 10 organisms per replicate. The chambers were covered to minimize evaporation. The test was run under static conditions at a temperature of 20 ± 1°C with a 16-hour light: 8-hour dark photoperiod. Fish were supplied a feeding ration of *Artemia* nauplii 48-hours following initiation of exposure (USEPA/USACE, 1998). Water quality parameters (i.e., temperature, pH, DO, conductivity, ammonia) were measured from each replicate chamber at experiment initiation and termination. Environmental chamber temperature was monitored and recorded daily. The endpoint assessed was survivorship, defined as lack of motility, determined by use of a blunt probe as necessary. Test acceptability criterion was greater than 90% mean control survival. The *C. variegatus* SPP test was performed in three batches. A summary of test conditions is provided in Table 12.

A reference toxicant test was conducted using potassium chloride with concentrations of 0, 0.28, 0.56, 1.13, 2.25, and 4.50 g KCl/L to establish sensitivity of test organisms used in the evaluation of project sediment.

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[2] Toxic = a statistically significant decrease in survival

Table 12. Test Conditions for the 96-hour Suspended Particulate Phase Test Using *Cyprinodon variegatus*

Test Conditions: *Cyprinodon variegatus* SPP Test				
		Batch 1	Batch 2	Batch 3
Sample Identification		0100C1_6WOSDEE, 0200C1_6WOSDEE, 0300C4_6WTSDEE, 030C1_6NBNSSEE, 0300C1_3LTFIEE, 0800C1_4WOSDEE	0600C1&2WTSDEE, 0600C3_6LTFIEE, 060C1_6NBNSSEE, 0700C1_4WTSDEE, 0700C5_9LTFIEE, 070C1_9NBNSSEE, 10000001WTSDEE, 1000C3&4LTFIEE, 100C3&4NLNSSEE	0400C1_8WTSDEE, 0500C1_8WTSDEE, 45C1_16NWNSSEE, 09000001WOSDEE, 0900C2&4WOSDEE
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*C. variegatus*	*C. variegatus*	*C. variegatus*
Supplier		**Aquatic Biosystems, Fort Collins, Colorado**	**Aquatic Biosystems, Fort Collins, Colorado**	**Aquatic Biosystems, Fort Collins, Colorado**
Date acquired		**August 3, 2007**	**August 24, 2007**	**September 14, 2007**
Acclimation/holding time		**3 days**	**3 days**	**3 days**
Age class		**3 days (at time of testing)**	**3 days (at time of testing)**	**3 days (at time of testing)**
Test Procedures		ITM (USEPA/USACE, 1998), USEPA (2002)	ITM (USEPA/USACE, 1998), USEPA (2002)	ITM (USEPA/USACE, 1998), USEPA (2002)
Test location		**US Army ERDC, Building 6008, Chamber 1**	**US Army ERDC, Building 6008, Chamber 1**	**US Army ERDC, Building 6008, Chamber 1**
Test type/duration		**Static – Acute SPP / 96 hours**	**Static – Acute SPP / 96 hours**	**Static – Acute SPP / 96 hours**
Test dates		**August 6 - 10, 2007**	**August 27 - 31, 2007**	**September 17 - 21, 2007**
Control water		**10 ppt Instant Ocean® sea salt mix (Aquarium Systems, Inc., Mentor, Ohio) made from reverse osmosis water**	**10 ppt Instant Ocean® sea salt mix (Aquarium Systems, Inc., Mentor, Ohio) made from reverse osmosis water**	**10 ppt Instant Ocean® sea salt mix (Aquarium Systems, Inc., Mentor, Ohio) made from reverse osmosis water**
Test temperature	**Target: mean 20 ± 1°C (instantaneous: 20 ± 3°C)**	**Actual: Mean: 20.2 ± 0.3°C Range: 19.8 – 21.4°C**	**Actual: Mean: 20.4 ± 0.5°C Range: 19.7 – 21.5°C**	**Actual: Mean: 19.6 ± 0.5°C Range: 18.9 – 20.7°C**
Test salinity	**Target: No recommended value**	**Actual: Mean: 10 ± 1 ppt Range: 8 – 12 ppt**	**Actual: Mean: 13 ± 2 ppt Range: 7 - 16 ppt**	**Actual: Mean: 10 ± 5 ppt Range: 0 – 13 ppt**
Test dissolved oxygen	**Target: > 40% saturation, equivalent to > 4.0 mg/L**	**Actual: Mean: 8.2 ± 0.6 mg/L Range: 7.0 – 9.9 mg/L**	**Actual: Mean: 7.5 ± 0.3 mg/L Range: 6.1 – 8.6 mg/L**	**Actual: Mean: 8.5 ± 0.5 mg/L Range: 6.1 – 9.3 mg/L**
Test pH	**Target: Watch for pH Drift**	**Actual: Mean: 7.95 ± 0.18 Range: 7.00 – 8.68**	**Actual: Mean: 8.01 ± 0.10 Range: 7.47 – 8.24**	**Actual: Mean: 8.09 ± 0.14 Range: 7.80 – 9.12**
Test total ammonia	**No recommended concentration**	**Actual: <1 – 5 mg/L**	**Actual: < 1 – >8 mg/L***	**Actual: < 1 - > 8 mg/L***
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**300 mL**	**300 mL**	**300 mL**
Replicates/SPP concentration/treatment		**5**	**5**	**5**
SPP concentrations		**100%, 50%, 10%, 0% (control)**	**100%, 50%, 10%, 0% (control)**	**100%, 50%, 10%, 0% (control)**
Organisms/replicate		**10**	**10**	**10**
Exposure volume		**200 mL**	**200 mL**	**200 mL**
Feeding		**~1000 freshly hatched *Artemia* nauplii per replicate - day 2**	**~1000 freshly hatched *Artemia* nauplii per replicate - day 2**	**~1000 freshly hatched *Artemia* nauplii per replicate - day 2**
Water renewal		**None**	**None**	**None**
Deviations from Test Protocol		**None**	**Site 10 water was 0 ppt (freshwater). Salinity adjusted to 12 ppt following elutriate preparation.**	**Site water 09000001WOSDEE was freshwater while site water 0900C2&4WOSDEE was estuarine. Low salinity values determined for sediment elutriate 09000001WOSDEE; test organism survival was high.**

* 8 mg/L was kit maximum.

2.5.2 Solid Phase Tests

SP tests were performed to estimate the potential impact of dredged material on benthic/epibenthic organisms. Acute, ten day sediment toxicity tests were conducted utilizing a freshwater amphipod (*Hyalella azteca*) and a marine amphipod (*Leptocheirus plumulosus*); both recommended benchmark benthic amphipods (USEPA/USACE, 1991, 1998). The freshwater SP test, using *H. azteca*, was conducted in accordance with procedures outlined in the ITM (USEPA/USACE, 1998), and USEPA (2000). The marine SP test, using *L. plumulosus*, was conducted in accordance with procedures outlined in the ITM (USEPA/USACE, 1998), ASTM E1367-03 (ASTM, 2006) and USEPA (1994).

2.5.2.1 Freshwater – Hyalella azteca

Sediment was tested in a 10-day SP test using the freshwater amphipod *H. azteca*. Test animals were cultured in house at US Army ERDC, Vicksburg, Mississippi. Each sediment type (project, reference, and control) was run with eight replicates. Sediment was placed in 300 mL tall-form glass beakers to a thickness of 2 cm, to which was added approximately 250 mL of 5 µm filtered dechlorinated tap water. Water was renewed twice daily and a feeding ration of yeast, CEROPHYL® and trout chow (YCT) was supplied daily. The test was run under a 16-hour light: 8-hour dark photoperiod at a temperature of 23 ± 1°C. Gentle aeration was provided to each replicate to maintain DO levels, with care taken to avoid disturbing the sediment. At test initiation, test organisms were randomly distributed to test chambers. Initial stocking densities were 10 organisms per replicate. The chambers were covered to minimize evaporation. Water quality parameters were measured from each replicate chamber (i.e., temperature, pH, DO, conductivity) and one chamber per sediment (i.e., overlying water ammonia, alkalinity, and hardness) at experiment initiation and termination. Environmental chamber temperature was monitored and recorded daily. Daily observations (e.g., burrowing behavior) that may be significant to test results were also recorded. On Day 10, the amphipods were gently sieved from the sediment, and the number of survivors was recorded. The endpoint assessed was survivorship. Test acceptability criterion was greater than 80 percent mean control survival. The *H. azteca* SP test was performed in three batches. A summary of test conditions is provided in Table 13.

A reference toxicant test was conducted using cadmium chloride with concentrations of 0, 1.00, 2.50, 5.00, 10.0, and 20.0 µg Cd^{2+}/L to establish sensitivity of test organisms used in the evaluation of project sediment.

Table 13. Test Conditions for the 10 Day Solid Phase Test Using *Hyalella azteca*

Test Conditions: *Hyalella azteca* SP Test				
		Batch 1	Batch 2	Batch 3
Sample Identification		0300C4_6WTSDFS, 0300C1_3LTFIFS, 030C1_6NBNSSFS, 0600C1&2WTSDFS, 0800C1_4WOSDFS	0400C1_8WTSDFS, 0500C1_8WTSDFS, 060C1_6NBNSSFS, 070C1_9NBNSSFS, 0700C1_4WTSDFS, 10000001WTSDFS, and 45C1_16NWNSSFS	0600C3_6LTFIFS, 0700C5_9LTFIFS, 09000001WOSDFS, 0900C2&4WOSDFS, 1000C3&4LTFIFS and 100C3&4NLNSSFS
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*H. azteca*	*H. azteca*	*H. azteca*
Supplier		**US Army ERDC, Vicksburg, Mississippi**	**US Army ERDC, Vicksburg, Mississippi**	**US Army ERDC, Vicksburg, Mississippi**
Date acquired		**August 27, 2007**	**September 13, 2007**	**September 17, 2007**
Acclimation/holding time		**1 day**	**1 day**	**1 day**
Age class		**7-14 days old (1-2 day range)**	**7-14 days old (1-2 day range)**	**7-14 days old (1-2 day range)**
Test Procedures		ITM (USEPA/USACE, 1998), USEPA (2000)	ITM (USEPA/USACE, 1998), USEPA (2000)	ITM (USEPA/USACE, 1998), USEPA (2000)
Test location		**US Army ERDC, Building 6000, Room 65-B**	**US Army ERDC, Building 6000, Room 65-B**	**US Army ERDC, Building 6000, Room 65-B**
Test type/duration		**Static Renewal – Acute SP / 10 days**	**Static Renewal – Acute SP / 10 days**	**Static Renewal – Acute SP / 10 days**
Test dates		**August 28 – September 7, 2007**	**September 14 – 24, 2007**	**September 18 – 28, 2007**
Control water		**Dechlorinated tap, Vicksburg municipal; 5 µm filtered**	**Dechlorinated tap, Vicksburg municipal; 5 µm filtered**	**Dechlorinated tap, Vicksburg municipal; 5 µm filtered**
Test temperature	**Target: 23 ± 1°C**	**Actual: 22.7 – 24.0°C**	**Actual: 22.8 – 23.9°C**	**Actual: 20.8 – 23.9°C**
Test dissolved oxygen	**Target: equivalent to > 2.5 mg/L**	**Actual: 7.1 – 8.4 mg/L**	**Actual: 5.2 – 8.8 mg/L**	**Actual: 5.1 – 8.7 mg/L**
Test pH	**Target: Watch for pH Drift**	**Actual: 8.0 - 8.5**	**Actual: 8.1 - 8.3**	**Actual: 7.4 - 8.2**
Test overlying total ammonia	**No recommended concentration**	**Actual: <1 – <2 mg/L**	**Actual: <1 – 8 mg/L**	**Actual: <1 – 3 mg/L**
Test interstitial total ammonia	**Target: < 20 mg/L**	**Actual: 5.9 – 19.4 mg/L**	**Actual: 3.4 - 15.4 mg/L**	**Actual: 4.5 - 27.1 mg/L**
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**300 mL glass beakers**	**300 mL glass beakers**	**300 mL glass beakers**
Replicates/treatment		**8**	**8**	**8**
Organisms/replicate		**10**	**10**	**10**
Exposure volume		**2 cm sediment; 250 mL water**	**2 cm sediment; 250 mL water**	**2 cm sediment; 250 mL water**
Feeding		**Once daily (YCT)**	**Once daily (YCT)**	**Once daily (YCT)**
Water renewal		**2 volume additions daily**	**2 volume additions daily**	**2 volume additions daily**
Deviations from Test Protocol		**None**	**None**	**On day 0, the interstitial total ammonia of sample 0900C2&4WOSDFS (27.1 mg/L) exceeded the protocol target of 20 mg/L. This deviation was determined to be insignificant to test outcome because no toxicity resulted from exposure to project material.**

2.5.2.2 Marine – Leptocheirus plumulosus

Sediment was tested in a 10-day acute SP test using the marine amphipod *L. plumulosus*. Test animals were supplied by Aquatic Biosystems, Fort Collins, Colorado. Laboratory control sediment was also supplied by Aquatic Biosystems, and collected at Oldhouse Creek, Ware River, Chesapeake Bay. Prior to testing, the reference, project, and control sediments were sieved to remove organisms. This was accomplished by press-sieving the sediment through a 2.0-mm mesh screen using only the water available in the sediment sample. Each sediment type (project, reference, and control) was run with five replicates. Sediment was placed in 1 L glass jars to a thickness of 2 cm (150 mL), to which was added approximately 750 mL of 20 ± 2 ppt seawater. Additional surrogate replicates (no animals) for each treatment were set up to obtain measurement of pore water ammonia at test initiation and termination. The test was run at a temperature of 25 ± 2°C with a 16-hour light: 8-hour dark photoperiod. Test chambers were renewed once daily due to elevated levels of ammonia in the pore water. Gentle aeration was provided to each replicate to maintain DO levels, with care taken to avoid disturbing the sediment. At test initiation, test organisms were randomly distributed to test chambers. Initial stocking densities were 20 organisms per replicate. Amphipods remaining in the water column and exhibiting abnormal behavior were replaced after 1 hour. The chambers were covered with petri dishes to minimize evaporation. Daily water quality measurements, including DO, temperature, salinity, and pH, were taken on one replicate from each treatment. Initial and final water quality measurements were taken on every replicate from each treatment. Ammonia was measured in both interstitial and overlying water at the start and finish of the test at each site. Interstitial water was extracted via centrifugation. All instruments used were calibrated and logged daily. Daily observations were also recorded. On Day 10, the amphipods were gently sieved from the sediment using a 0.5-mm screen. The amphipods were transferred to a sorting tray, and the number of survivors was recorded. The endpoint assessed was survivorship. Test acceptability criterion was greater than 90 percent mean control survival. The *L. plumulosus* SP test was performed in three batches. A summary of test conditions is provided in Table 14.

A reference toxicant test was conducted using cadmium chloride with concentrations of 0, 0.125, 0.250, 0.500, 1.00, 2.00, and 4.00 mg Cd^{2+}/L to establish sensitivity of test organisms used in the evaluation of project sediment. An additional reference toxicant test was also conducted using ammonium chloride with nominal concentrations of 0, 15.6, 31.3, 62.5, 125, and 250 mg total NH_3/L to evaluate the potential influence of ammonia toxicity.

Table 14. Test Conditions for the 10 Day Solid Phase Test Using *Leptocheirus plumulosus*

Test Conditions: *Leptocheirus plumulosus* SP Test				
		Batch 1	Batch 2	Batch 3
Sample Identification		SB00000RWOSDMS, 0300C1_3LTFIMS, 0300C4_6WTSDMS, 030C1_6NBNSSMS, 0800C1_4WOSDMS, MT00000RWOSDMS	SB00000RWOSDMS, 0600C1&2WTSDMS, 060C1_6NBNSSMS, 0700C5_9LTFIMS, 0700C1_4WTSDMS, 1000C3&4LTFIMS, 10000001WTSDMS, 100C3&4NLNSSMS, 0600C3_6LTFIMS, 070C1_9NBNSSMS	SB00000RWOSDMS, 0400C1_8WTSDMS, 0500C1_8WTSDMS, 45C1_16NWNSSMS, 0900C2&4WOSDMS, 09000001WOSDMS
Approximate volume received		**8 L per sample**	**8 L per sample**	**8 L per sample**
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*L. plumulosus*	*L. plumulosus*	*L. plumulosus*
Supplier		**Aquatic Biosystems, Fort Collins, Colorado**	**Aquatic Biosystems, Fort Collins, Colorado**	**Aquatic Biosystems, Fort Collins, Colorado**
Date acquired		**August 17 and 18, 2007**	**August 31, 2007**	**October 12, 2007**
Acclimation/holding time		**4 - 5 days**	**4 days**	**4 days**
Size class		**2 – 4 mm**	**2 – 4 mm**	**2 – 4 mm**
Test Procedures		ITM (USEPA/USACE, 1998), RIA (USEPA Region VI/USACE Galveston and New Orleans District, 2003), ASTM E1367-03 (ASTM, 2006), USEPA (1994)	ITM (USEPA/USACE, 1998), RIA (USEPA Region VI/USACE Galveston and New Orleans District, 2003), ASTM E1367-03 (ASTM, 2006), USEPA (1994)	ITM (USEPA/USACE, 1998), RIA (USEPA Region VI/USACE Galveston and New Orleans District, 2003), ASTM E1367-03 (ASTM, 2006), USEPA (1994)
Test location		**Weston Carlsbad Laboratory, Room 5**	**Weston Carlsbad Laboratory, Room 5**	**Weston Carlsbad Laboratory, Room 4**
Test type/duration		**Static Renewal – Acute SP / 10 days**	**Static Renewal – Acute SP / 10 days**	**Static Renewal – Acute SP / 10 days**
Test dates		**August 21 – 31, 2007**	**September 4 – 14, 2007**	**October 16 – 26, 2007**
Control water		**Scripps Institute of Oceanography seawater; 3 µm filtered, UV sterilized**	**Scripps Institute of Oceanography seawater; 3 µm filtered, UV sterilized**	**Scripps Institute of Oceanography seawater; 3 µm filtered, UV sterilized**
Test temperature	**Target: 25 ± 2°C**	**Actual: 25.0 – 26.4°C**	**Actual: 25.1 – 26.2°C**	**Actual: 25.2 – 27.0°C**
Test salinity	**Target: 20 ± 2 ppt**	**Actual: 19.9 – 22.3 ppt**	**Actual: 19.7 – 20.6 ppt**	**Actual: 20.0 – 20.9 ppt**
Test dissolved oxygen	**Target: > 60% saturation, equivalent to > 4.4 mg/L**	**Actual: 6.3 – 7.9 mg/L**	**Actual: 6.0 – 7.8 mg/L**	**Actual: 5.5 – 7.5 mg/L**
Test pH	**Target: Watch for pH Drift**	**Actual: 7.7 - 8.4**	**Actual: 7.2 - 8.4**	**Actual: 7.6 - 8.3**
Test overlying total ammonia	**No recommended concentration**	**Actual: <0.500 – 1.17 mg/L**	**Actual: <0.500 – 2.43 mg/L**	**Actual: <0.500 – 1.38 mg/L**
Test overlying un-ionized ammonia	**No recommended concentration**	**Actual: <0.013 – 0.076 mg/L**	**Actual: <0.013 – 0.124 mg/L**	**Actual: <0.021 – 0.071 mg/L**
Test interstitial total ammonia	**Target: < 20 mg/L**	**Actual: <0.500 – 23.2 mg/L**	**Actual: <0.500 – 9.10 mg/L**	**Actual: <0.500 – 25.0 mg/L**
Test interstitial un-ionized ammonia	**Target: < 0.8 mg/L**	**Actual: 0.001 – 0.396 mg/L**	**Actual: <0.003 – 0.212 mg/L**	**Actual: <0.002 – 0.340 mg/L**
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**1 L glass jars**	**1 L glass jars**	**1 L glass jars**
Replicates/treatment		**5**	**5**	**5**
Organisms/replicate		**20**	**20**	**20**
Exposure volume		**2 cm sediment; 750 mL water**	**2 cm sediment; 750 mL water**	**2 cm sediment; 750 mL water**
Feeding		**None**	**None**	**None**
Water renewal		**Once daily**	**Once daily**	**Once daily**
Deviations from Test Protocol		**On Day 0, the interstitial total ammonia concentration in test sediment 0800C1_4WOSDMS (23.2 mg/L) was slightly higher than the recommended limit of 20 mg/L. Since the No Observable Effect Concentration (NOEC) in the associated ammonium chloride reference toxicant test was 30.5 mg/L, ammonia is not believed to have**	**None**	**On Day 0, the interstitial total ammonia concentration in test sediment 09000001WOSDMS (25.0 mg/L) was slightly higher than the recommended limit of 20 mg/L. Since the NOEC in the associated ammonium chloride reference toxicant test was 38.5 mg/L, ammonia was not believed to have contributed to toxicity in this sample.**

	contributed to toxicity in this sample.		

2.5.3 Bioaccumulation Potential Tests

An assessment of BP was conducted using a marine clam (*Macoma nasuta*), freshwater clam (*Corbicula fluminea*), terrestrial invertebrate (*Eisenia fetida*), wetland plant (*Spartina alterniflora*), and terrestrial plant (*Cyperus esculentus*).

Bioaccumulation data were analyzed by statistically comparing chemical concentrations in the tissues of the organisms that were exposed to reference sediments to the tissues of the organisms that were exposed to the project material. Statistical tests, including analysis of variance, *t*-tests, or non-parametric tests, were used to analyze data, depending on the assumptions of the individual tests (i.e., homogeneity of variance) as specified in the ITM (USEPA/USACE, 1998). In situations in which more than one replicate was reported below the RL, estimated data values were based on a symmetrical breakdown of the data range in such a way that the mean of the estimates centered around a value one-half of the RL. This statistical manipulation of the data were required to generate statistically valid means and variances so that the required statistical evaluation of the data could be performed. For example, if all five replicate values for a particular analyte concentration were below the RL of 20, then the data would be estimated as 5, 15, 10, 15, and 5. This would produce a value with a mean of 10 (i.e., one half the RL) and an associated variance (assuming a normal distribution). This method is one of three recommended approaches described in Appendix D of the ITM (USEPA/USACE 1998). Contaminant concentrations found to be significantly elevated above reference were interpreted in light of criteria specified in the ITM (USEPA/USACE, 1998).

2.5.3.1 Benthic

Benthic BP tests were conducted using a marine clam (*M. nasuta*) and a freshwater clam (*C. fluminea*). The *C. fluminea* experiment was conducted in accordance with methods outlined in Hart Crowser, Inc. (2002) and general guidance in the ITM (USEPA/USACE, 1998), as no standard guidance is currently available. The *M. nasuta* experiment was conducted in accordance to guidance described in USEPA (1993) and the ITM (USEPA/USACE, 1998) with a modification; sediment was layered in ten gallon aquaria and *M. nasuta* were placed on sediment surface without the use of beakers.

Freshwater – *Corbicula fluminea*

Sediment was tested in a 28-day BP test using the freshwater clam *C fluminea*. Field collected test organisms were supplied by Matt Hull, Virginia Tech, Blacksburg, Virginia (Batch 1) and Dr. Jennifer Bouldin, Arkansas State University, Jonesboro, Arkansas (Batches 2, 3, and 4). Prior to testing, approximately 30 g of unexposed soft tissue was archived for determination of initial tissue residues, lipid content and weight ratios. *C. fluminea* were exposed to test sediments in 19 L glass aquarium containing 5 L of sediment. Each sediment treatment included five replicate tanks. At test initiation, *C. fluminea* were placed on the sediment surface of each replicate and allowed to burrow. Initial stocking densities were 70 to 120 organisms per test chamber. Burrowing behavior was closely monitored and individuals failing to burrow within 24 hours were promptly replaced. The test was run at a temperature of 20 ± 1°C with a 16-hour light: 8-hour dark photoperiod. Overlying water (dechlorinated tap) was aerated using air stones and renewed three times per week (Monday, Wednesday, and Friday). Water quality parameters (i.e., temperature, pH, DO, conductivity, ammonia) were measured in each replicate exposure chamber on days 0 and 28. Between days 1 to 27, parameters were measured in at least one replicate chamber per test sediment prior to each water exchange. Parameters were also measured in renewal water used at each water exchange. Environmental chamber temperature was monitored and recorded daily. At test termination, *C. fluminea* were removed from sediments, rinsed thoroughly with dechlorinated tap water and weighed. Clamshells were removed by cutting the valve hinge with a clean scalpel and wet tissues were rinsed thoroughly with dechlorinated tap water. The gut of each clam was dissected (Lee et al., 1989) to remove undigested sediment and wet tissues were rinsed thoroughly with reverse osmosis (RO) water, composited into one container for each test sediment replicate and stored at -80°C until submitted to TestAmerica for tissue residue analysis. A small mass of tissue (0.5 g) from each replicate remained at ERDC for lipid content and wet-to-dry ratio determinations. The *C. fluminea* BP test was performed in four batches. A summary of test conditions is provided in Table 15.

Table 15. Test Conditions for the 28 Day Bioaccumulation Potential Test Using *Corbicula fluminea*

Test Conditions: *Corbicula fluminea* BP Test					
		Batch 1	Batch 2	Batch 3	Batch 4
Sample Identification		0300C1_3LTFIFB, 0700C1_4WTSDFB, 0600C1&2WTSDFB, 060C1_6NBNSSFB, 10000001WTSDFB	MR00000RWOFB, 030C1_6NBNSSFB, 0300C4_6WTSDFB, 0600C3_6LTFIFB, 0700C5_9LTFIFB	070C1_9NBNSSFB, 0400C1_8WTSDFB, 09000001WOSDFB, 100C3&4NLNSSFB	0900C2&4WOSDFB, 0800C1_4WOSDFB, 1000C3&4LTFIFB, 0500C1_8WTSDFB, 45C1_16NWNSSFB
Approximate volume received		**10 L per sample**	**10 L per sample**	**10 L per sample**	**10 L per sample**
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*C. fluminea*	*C. fluminea*	*C. fluminea*	*C. fluminea*
Supplier		**Mr. Matt Hull, Virginia Tech, Blacksburg, Virginia**	**Dr. Jennifer Bouldin, Arkansas State University, Jonesboro, Arkansas**	**Dr. Jennifer Bouldin, Arkansas State University, Jonesboro, Arkansas**	**Dr. Jennifer Bouldin, Arkansas State University, Jonesboro, Arkansas**
Date acquired		**August 9, 21 and September 5, 2007**	**October 1, 2007**	**October 29, 2007**	**November 6, 2007**
Acclimation/holding time		**1 – 8 days**	**2 – 3 days**	**2 – 3 days**	**1 – 3 days**
Age class		**Adult**	**Adult**	**Adult**	**Adult**
Test Procedures		ITM (USEPA/USACE 1998)	ITM (USEPA/USACE, 1998)	ITM (USEPA/USACE, 1998)	ITM (USEPA/USACE, 1998)
Test location		**US Army ERDC, Building 6008, Chamber 1**	**US Army ERDC, Building 6008, Chamber 1**	**US Army ERDC, Building 6008, Chamber 1**	**US Army ERDC, Building 6008, Chamber 1**
Test type/duration		**Static Renewal – BP / 28 days**	**Static Renewal – BP / 28 days**	**Static Renewal – BP / 28 days**	**Static Renewal – BP / 28 days**
Test dates		**August 17 – September 14, 2007; August 23 – September 20, 2007; September 6 – October 4, 2007**	**October 3 – 31, 2007; October 4 - November 1, 2007**	**October 31 – November 28, 2007; November 1 - 29, 2007**	**November 7 – December 6, 2007; November 8 - December 6, 2007; November 9 - December 7, 2007**
Control water		**Dechlorinated tap, Vicksburg municipal**	**Dechlorinated tap, Vicksburg municipal**	**Dechlorinated tap, Vicksburg municipal**	**Dechlorinated tap, Vicksburg municipal**
Test temperature	**Target: 20 ± 3°C**	**Actual: 17.2 – 20.7°C**	**Actual: 18.8 – 20.8°C**	**Actual: 18.5 – 20.9°C**	**Actual: 17.5 – 20.6°C**
Test conductivity	**Target: No recommended value**	**Actual: 250 - > 1,900 µS/cm**	**Actual: 240 - >1,900 µS/cm**	**Actual: 320 - >1,900 µS/cm**	**Actual: 210 - > 1900 µS/cm**
Test dissolved oxygen	**Target: > 4.0 mg/L**	**Actual: 2.0 – 10.0 mg/L**	**Actual: 6.5 – 11.8 mg/L**	**Actual: 6.0 – 11.8 mg/L**	**Actual: 2.5 – 11.2 mg/L**
Test pH	**Target: 7 - 9**	**Actual: 6.90 – 9.08**	**Actual: 7.7 – 8.9**	**Actual: 7.7 – 8.6**	**Actual: 7.7 – 8.6 mg/L**
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**19 L glass aquarium**	**19 L glass aquarium**	**19 L glass aquarium**	**19 L glass aquarium**
Replicates/treatment		**5**	**5**	**5**	**5**
Organisms/replicate		**Various (70 – 120)**	**Various (70 – 120)**	**Various (70 – 120)**	**Various (70 – 120)**
Exposure volume		**5 L sediment**	**5 L sediment**	**5 L sediment**	**5 L sediment**
Feeding		**None**	**None**	**None**	**None**
Water renewal		**Static renewal 3X/wk (M, W, F)**	**Static renewal 3X/wk (M, W, F)**	**Static renewal 3X/wk (M, W, F)**	**Static renewal 3X/wk (M, W, F)**
Deviations from Test Protocol		**At test termination, low DO values were measured in replicate A and B of sample 060C1_6NBNSSFB. The pH of sample 0600C1&2WTSDFB replicate A was slightly above (9.08) the target range on one occasion. The pH of sample 10000001WTSDFB replicate A was slightly below (6.90) the target range on one occasion.**	**None**	**None**	**A low DO value (2.5 mg/L) was measured in replicate E of sample 1000C3&4LTSDFB.**

Marine – *Macoma nasuta*

Sediment was tested in a 28-day BP test using the marine clam *M. nasuta.* Test organisms were supplied by J & G Gunstone Clams, Port Townsend, Washington. Prior to testing, background tissue samples were collected from 30 clams (approximately 105 g) and archived for determination of initial tissue residues, lipid content, and weight ratios. *M. nasuta* were exposed to test sediments in 37 L glass aquarium containing 4 L of sediment. Each sediment treatment included five replicate tanks. *M. nasuta* were placed on the sediment surface of each replicate and allowed to burrow. Initial stocking densities were 30 organisms per test chamber. Burrowing behavior was closely monitored and any individuals that did not bury within 24 hours were promptly replaced. The experiment was conducted with a continuous flow-through renewal of sand filtered seawater from North Hood Canal (5 to 10 volumes per day). Test chambers received continuous trickle flow aeration throughout the test duration. The test was run at a temperature of 15 ± 1°C with a 16-hour light: 8-hour dark photoperiod. Test temperatures were maintained using regulated water baths. Water quality parameters (i.e., temperature, pH, DO, salinity) were measured daily in one replicate per test sediment. At test termination, *M. nasuta* were removed from sediments and depurated for 24 hours in clean, flow-through seawater to purge the gut of sediment as recommended in ASTM Method E 1688-00 (ASTM, 2006) and USEPA (1993) guidance. Clamshells were then removed by cutting the valve hinge with a clean scalpel; wet tissues were rinsed thoroughly with RO water, composited into one container for each test sediment replicate and stored at -80°C until submitted to TestAmerica for tissue residue analysis. The *M. nasuta* BP test was performed in three batches. A summary of test conditions is provided in Table 16.

Table 16. Test Conditions for the 28 Day Bioaccumulation Potential Test Using *Macoma nasuta*

Test Conditions: *Macoma nasuta* BP Test				
		Batch 1	Batch 2	Batch 3
Sample Identification		SB00000RWOSDMB, 0300C1_3LTFIMB, 0300C4_6WTSDMB, 030C1_6NBNSSMB, 0800C1_4WOSDMB, MT00000RWOSDMB	SB00000RWOSDMB, 0600C3_6LTFIMB, 060C1_6NBNSSMB, 0700C5_9LTFIMB, 070C1_9NBNSSMB, 1000C3&4LTFIMB, 100C3&4NLNSSMB, 0600C1&2WTSDMB	SB00000RWOSDMB, 0700C1_4WTSDMB, 10000001WTSDMB, 0400C1_8WTSDMB, 0500C1_8WTSDMB, 45C1_16NWNSSMB, 09000001WOSDMB, 0900C2&4WOSDMB
Approximate volume received		**38 L per sample**	**38 L per sample**	**19 or 38 L per sample**
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*M. nasuta*	*M. nasuta*	*M. nasuta*
Supplier		**J & G Gunstone, Discovery Bay, Washington**	**J & G Gunstone, Discovery Bay, Washington**	**J & G Gunstone, Discovery Bay, Washington**
Date acquired		**August 14, 2007**	**August 29, 2007**	**September 19, 2007**
Acclimation/holding time		**1 day**	**1 day**	**1 day**
Age class		**Adult**	**Adult**	**Adult**
Test Procedures		ITM (USEPA/USACE, 1998), ASTM 1688-00 (ASTM, 2006), RIA (USEPA Region VI/USACE Galveston and New Orleans District, 2003), USEPA (1993)	ITM (USEPA/USACE, 1998), ASTM 1688-00 (ASTM, 2006), RIA (USEPA Region VI/USACE Galveston and New Orleans District, 2003), USEPA (1993)	ITM (USEPA/USACE, 1998), ASTM 1688-00 (ASTM, 2006), RIA (USEPA Region VI/USACE Galveston and New Orleans District, 2003), USEPA (1993)
Test location		**NewFields Northwest, LLC. Port Gamble Environmental Laboratories, Main Testing Room**	**NewFields Northwest, LLC. Port Gamble Environmental Laboratories, Main Testing Room**	**NewFields Northwest, LLC. Port Gamble Environmental Laboratories, Main Testing Room**
Test type/duration		**Flow through / 28 days**	**Flow through / 28 days**	**Flow through / 28 days**
Test dates		**August 15 – September 12, 2007**	**August 30 – September 27, 2007**	**September 20 – October 18, 2007**
Control water		**North Hood Canal, sand filtered**	**North Hood Canal, sand filtered**	**North Hood Canal, sand filtered**
Test temperature	**Target: 15 ± 1°C**	**Actual: 13.8 – 16.0°C**	**Actual: 13.8 – 16.5°C**	**Actual: 13.4 – 16.6°C**
Test salinity	**Target: 32 ± 2 ppt**	**Actual: 32 - 33 ppt**	**Actual: 32 - 33 ppt**	**Actual: 32 - 32 ppt**
Test dissolved oxygen	**Target: > 4.5 mg/L**	**Actual: 6.0 – 8.2 mg/L**	**Actual: 5.6 – 8.3 mg/L**	**Actual: 6.3 – 8.1 mg/L**
Test pH	**Target: 7.8 ± 0.5**	**Actual: 7.6 – 8.0**	**Actual: 7.4 – 8.0**	**Actual: 7.4 – 7.9**
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**37 L glass aquarium**	**37 L glass aquarium**	**37 L glass aquarium**
Replicates/treatment		**5**	**5**	**5**
Organisms/replicate		**30**	**30**	**30**
Exposure volume		**4 L sediment**	**4 L sediment**	**4 L sediment**
Feeding		**None**	**None**	**None**
Water renewal		**Flow-through 76 to 84 mL per minute**	**Flow-through 76 to 84 mL per minute**	**Flow-through 76 to 84 mL per minute**
Deviations from Test Protocol		**Temperature was recorded at 0.2°C below target on test initiation in several chambers. All subsequent temperature readings were within range. This deviation had no effect on survival of test animals.**	**Temperature was outside of target range for about 24 hours. See text for complete explanation. This deviation had no effect on survival of test animals.**	**Temperature was outside of target range for about 24 hours. See text for complete explanation. This deviation had no effect on survival of test animals.**

2.5.3.2 Terrestrial – *Eisenia fetida*

To assess BP in a terrestrial invertebrate, earthworm (*E. fetida*) exposures were conducted. The *E. fetida* experiment was conducted in accordance with methods outlined in ASTM method E 1676-97 (ASTM, 1997) and Appendix G of the UTM (USACE, 2003).

The samples received for earthworm bioaccumulation and plant bioaccumulation were processed together, including air drying and sieving when necessary. Initial soil pH, percent water, and salinity were determined and recorded at this time. After samples were processed, the sample was split once again for plant bioaccumulation and earthworm bioaccumulation procedures. After processing, soil was re-characterized for pH, salinity, and water holding capacity. Samples outside of a pH range of 4 to 10 were not tested, as it was outside the earthworm's nominal range. Soils with salinities outside of the earthworm's tolerance (8 to 12 ppt) were desalinated prior to toxicity testing. Specifically, ERDC conducted extensive washing of the sediments with salinities outside the earthworm's tolerance. Sediments were washed at a 4:1 ratio of reverse osmosis-treated water to sediment (i.e., 5-gal of sediment to 20-gal of water). Sediments were mixed with a garden rake and an industrial-sized hand-held mixer to ensure complete mixing and washing. Sediments were then allowed to settle for 2 days. Some sediments took longer than the allotted 2 days and were either given up to an additional 2 weeks or were flocculated with a small amount of salt. Prior to removing the first wash, salinity levels in each pool were recorded. Large amounts of surface water were then removed with a sump pump. The remaining 2 centimeters of surface water was removed using tygon tubing attached to a pump. This process was repeated 2-3 times per sediment. The sediment samples were then allowed to air dry for up to 3 weeks prior to use in experiments. Sediments were manually broken up with hammers to reduce sediment clump sizes and to increase surface area for drying. Once completely dry, sediments were run through a hammer mill to grind the sediment chunks into fine sedimentsreduce aggregate size to <2 mm. Sediments were stored in 5-gal buckets at room temperature until used for experiments.

Test organisms were cultured on site at ERDC, Vicksburg, Mississippi. The exposure chamber consisted of a 15 cm diameter by 30 cm tall plexiglass chambers with muslin covers on top and bottom, held in place with polyvinyl chloride (PVC) rings. Test chambers contained 4 kg (oven dry weight [ODW]) of soil (slightly less than protocol of 4.5 kg due to limited volume), and were placed in a 20 cm plastic dish containing water. After the soil equilibrates with the water, the worms could migrate to their desired hydration level. Each sediment treatment included five replicate chambers. Worms were depurated overnight on wet filter paper and the total wet weight was recorded before they were added to the chambers. Stocking density was approximately 30 g (39-80 individuals) per test chamber. Only sexually mature, fully clitellate earthworms were utilized. On Day 0, a background tissue sample of unexposed, depurated worms was collected and archived for chemical analyses. A control with Grenada-Loring field soil was also run along side the samples. The test was run at a temperature of 20°C with a 24-hour light photoperiod. Worms were fed weekly (1.5 g) for the first two weeks to prevent excessive mortality due to nutrient-poor sediments. After 28 days, the earthworms were recovered from the chambers, depurated overnight on wet filter paper, re-weighed, and frozen until submitted to TestAmerica for tissue residue analysis. The *E. fetida* BP test was performed in two batches. A summary of test conditions is provided in Table 17.

Table 17. Test Conditions for the 28 Day Bioaccumulation Potential Test Using *Eisenia fetida*

Test Conditions: *Eisenia fetida* BP Test			
		Batch 1	Batch 2
Sample Identification		0100C1_6WOSDEB, 0200C1_6WOSDEB, 030C1_6NBNSSEB, 0300C1_3LTFIEB, 0300C4_6WTSDEB, 0800C1_4WOSDEB	0400C1_8WTSDEB, 45C1_16NWNSSEB, 0500C1_8WTSDEB, 0600C1&2WTSDEB, 0600C3_6LTFIEB, 060C1_6NBNSSEB, 0700C1_4WTSDEB, 0700C5_9LTFIEB, 070C1_9NBNSSEB, 09000001WOSDEB, 0900C2&4WOSDEB, 10000001WTSDEB, 1000C3&4LTFIEB, 100C3&4NLNSSEB, BL00000RLOSDEB
Approximate volume received		**56 L per sample**	**56 L per sample**
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*E. fetida*	*E. fetida*
Supplier		**Cultured on-site**	**Cultured on-site**
Date acquired		**N/A**	**N/A**
Acclimation/holding time		**Not specified**	**Not specified**
Age class		**Mature, fully clitellate**	**Mature, fully clitellate**
Test Procedures		UTM (Appendix G; USACE, 2003), ASTM E 1676-97 (ASTM, 1997)	UTM (Appendix G; USACE, 2003), ASTM E 1676-97 (ASTM, 1997)
Test location		**US Army ERDC EP-R Growth Chamber Building 6009**	**US Army ERDC EP-R Growth Chamber Building 6009**
Test type/duration		**Freshwater Upland / 28 days**	**Freshwater Upland / 28 days**
Test dates		**September 25 - October 23, 2007**	**October 31 – November 28, 2007**
Control media		**Grenada-Loring field soil**	**Grenada-Loring field soil**
Laboratory water and salinity		**Reverse Osmosis @ 0 ppt**	**Reverse Osmosis @ 0 ppt**
Test temperature	**Recommended: Same as field condition if within 10 - 29°C**	**20°C**	**20°C**
Test salinity (sediment)	**Recommended: 0 – 10 ppt**	**Actual: 0 - 4 ppt after washing**	**Actual: 0 - 4 ppt after washing**
Test pH	**Recommended: Same as field condition if within 4 - 10**	**Actual: 7.37 - 8.57 (original sediment)**	**Actual: 7.2 to 8.47 (original sediment)**
Test photoperiod		**24 hr @ 1080 Lux**	**24 hr @ 1080 Lux**
Test chamber		**Plexiglas Cylinder, 15 cm diameter, 30 cm depth, cotton muslin cloth**	**Plexiglas Cylinder, 15 cm diameter, 30 cm depth, cotton muslin cloth**
Replicates/treatment		**5**	**5**
Organisms/replicate		**Approximately 30 grams (39-80 individuals)**	**Approximately 30 grams (39-80 individuals)**
Exposure volume		**4.0 kg (ODW) sediment**	**4.0 kg (ODW) sediment**
Fertilization		**1.5g worm food, once a week for two weeks**	**1.5g worm food, once a week for two weeks**
Water renewal		**Maintained at cylinder bottom to supply needed moisture.**	**Maintained at cylinder bottom to supply needed moisture.**
Deviations from Test Protocol		**Exposure volume 0.5 kg sediment less than protocol. Worms fed weekly (1.5 g) for the first two weeks to prevent excessive mortality due to nutrient-poor sediments.**	**Exposure volume 0.5 kg sediment less than protocol. Worms fed weekly (1.5 g) for the first two weeks to prevent excessive mortality due to nutrient-poor sediments.**

2.5.3.3 Wetland – Spartina alterniflora

To assess BP in plants, exposures using the wetland species *S. alterniflora* were conducted. The *S. alterniflora* experiment was conducted in accordance with methods outlined in Appendix I of the UTM (USACE, 2003).

The samples received for earthworm bioaccumulation and plant bioaccumulation were processed together, including air drying and sieving when necessary. Initial soil pH, percent water, and salinity were determined and recorded at this time. After samples were processed, the sample was split once again for plant bioaccumulation and earthworm bioaccumulation procedures. After processing, soil was re-characterized for pH, salinity, and water holding capacity, as well as organic matter, and electrical conductivity. The test sediment and reference material were prepared to simulate wetland conditions before being planted with seedlings.

Seedlings of *S. alterniflora* were supplied by Environmental Concern, Inc., St. Michaels, Maryland, and propagated in lab cultures before transplanting. Five replicates of each sediment condition were prepared by placing 4.5 kg (ODW) of sediment into each 7.6 L Bain-Marie container. Each Bain-Marie container was placed in a 19.0 L outer container. The inner container had holes drilled in the bottom to facilitate adequate watering. Sediment moisture content was maintained between 0.03 and 0.06 MPa by adding RO water as necessary. A soil moisture sensor (Watermark sensor, Irrometer Company, Riverside, CA) was placed in each container and used for daily monitoring. Water was added to the outer container when readings indicated pressure levels greater then 0.06 MPa. Water was siphoned out when the moisture sensors read less than 0.04 MPa. Seedlings were transplanted into the wetland sediment. All containers were randomly placed on tables in a greenhouse with a 16 hour light: 8 hour dark photoperiod. Light fixtures were placed 130 cm from the top of the 19.0 L outer container and were arranged in an alternating pattern of high-pressure sodium lamps and high-pressure multi-vapor halide lamps. The greenhouse temperature was maintained at 32 ± 2°C maximum during the day and 21 ± 2°C minimum at night to simulate a summer environment. Relative humidity was maintained as close to 100 percent as possible, but never less then 50 percent. Harvesting took place after 90 days. Stainless steel scissors were used to cut the plant tissue 5 cm above the sediment surface. The tissue was washed in distilled water, blotted dry, and a fresh weight determined. Some replicates were combined to provide adequate tissue for analysis of all contaminants of concern. The plant tissues were then placed in appropriate containers and preserved until submitted to TestAmerica for tissue residue analysis. The *S. alterniflora* BP test was performed in three batches. A summary of test conditions is provided in Table 18.

Table 18. Test Conditions for the 90 Day Bioaccumulation Potential Test Using *Spartina alterniflora*

Test Conditions: *Spartina alterniflora* BP Test				
		Batch 1	Batch 2	Batch 3
Sample Identification		0100C1_6WOSDWP, 0200C1_6WOSDWP, 0300C1_3LTFIWP, 0300C4_6WTSDWP, 030C1_6NBNSSWP, 0800C1_4WOSDWP, MT00000RWOSDWP, SB00000RWOSDWP	0600C1&2WTSDWP, 0600C3_6LTFIWP, 060C1_6NBNSSWP, 0700C1_4WTSDWP, 0700C5_9LTFIWP, 070C1_9NBNSSWP, 10000001WTSDWP, 1000C3&4LTFIWP, 100C3&4NLNSSWP	0400C1_8WTSDWP, 45C1_16NWNSSWP, 0500C1_8WTSDWP, 09000001WOSDWP, 0900C2&4W0SDWP
Approximate volume received		**56 L per sample**	**56 L per sample**	**56 L per sample**
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*S. alterniflora*	*S. alterniflora*	*S. alterniflora*
Supplier		**Environmental Concern, St. Michaels, Maryland**	**Environmental Concern, St. Michaels, Maryland**	**Environmental Concern, St. Michaels, Maryland**
Date acquired		**August 2007**	**August 2007**	**September 2007**
Acclimation/holding time		**Not specified**	**Not specified**	**Not specified**
Age class		**Rooted plugs**	**Rooted plugs**	**Rooted plugs**
Test Procedures		UTM (Appendix H; USACE, 2003)	UTM (Appendix H; USACE, 2003)	UTM (Appendix H; USACE, 2003)
Test location		**US Army ERDC EP-R Greenhouse 6010**	**US Army ERDC EP-R Greenhouse 6010**	**US Army ERDC EP-R Greenhouse 6010**
Test type/duration		**Saltwater Wetland / 90 days**	**Saltwater Wetland / 90 days**	**Saltwater Wetland / 90 days**
Test dates		**August 27 - November 25, 2007**	**August 31 - November 29, 2007**	**September 17 - December 17, 2007**
Tissue shipped to Test America		**November 27, 2007**	**November 30, 2007**	**December 17, 2007**
Greenhouse control media		**Miracle Gro® Potting Mix**	**Miracle Gro® Potting Mix**	**Miracle Gro® Potting Mix**
Laboratory water and salinity		**Reverse Osmosis @ 15 ppt**	**Reverse Osmosis @ 15 ppt**	**Reverse Osmosis @ 15 ppt**
Test temperature		**Maximum Day: 32 ± 2 °C** **Minimum Night: 21± 2°C**	**Maximum Day: 32 ± 2 °C** **Minimum Night: 21± 2°C**	**Maximum Day: 32 ± 2 °C** **Minimum Night: 21± 2°C**
Test salinity (sediment)	**Recommended: Same as field condition**	**Actual: 0 - 4 ppt after washing**	**Actual: 0 - 4 ppt after washing**	**Actual: 0 - 4 ppt after washing**
Test pH	**Recommended: Same as field condition**	**Actual: 7.43 – 8.35 (original sediment)3**	**Actual: 7.81 to 9.28 (original sediment)[1]**	**Actual: 7.81 to 8.42 (original sediment)[1]**
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**7.6 L polyethylene Bain Marie**	**7.6 L polyethylene Bain Marie**	**7.6 L polyethylene Bain Marie**
Replicates/treatment		**5**	**5**	**5**
Organisms/replicate		**5 rooted plugs**	**5 rooted plugs**	**5 rooted plugs**
Exposure volume		**4.5 kg (ODW) sediment**	**4.5 kg (ODW) sediment**	**4.5 kg (ODW) sediment**
Fertilization		**None**	**None**	**None**
Water renewal		**As needed to maintain flooded conditions**	**As needed to maintain flooded conditions**	**As needed to maintain flooded conditions**
Deviations from Test Protocol		**None**	**None**	**None**

3 pH values presented are from Attachment 1 of the Wetland Plant interim report.

2.5.3.4 Terrestrial – Cyperus esculentus

To assess BP in plants, exposures using the terrestrial plant *C. esculentus* were conducted. The *C. esculentus* experiment was conducted in accordance with methods outlined in Appendix H of the UTM (USACE 2003).

The samples received for earthworm bioaccumulation and plant bioaccumulation were processed together, including air drying and sieving when necessary. Initial soil pH, percent water, and salinity were determined and recorded at this time. After samples were processed, the sample was split once again for plant bioaccumulation and earthworm bioaccumulation procedures. After processing, soil was re-characterized for pH, salinity, and water holding capacity, as well as organic matter, and electrical conductivity. The test sediment and reference material were processed by drying and oxidation to simulate terrestrial conditions before being planted with seedlings.

Tubers of *C. esculentus* were supplied by Wildlife Nurseries, Oshkosh, Wisconsin, and germinated at 23°C before transplanting when the sprouts were 3 cm long. Five replicates of each sediment condition were prepared by placing 4.5 kg (ODW) of sediment into each 7.6 L Bain-Marie container. Each Bain-Marie container was placed in a 19.0 L outer container. The inner container had holes drilled in the bottom to facilitate adequate watering. Sediment moisture content was maintained between 0.03 and 0.06 MPa by adding RO water as necessary. A soil moisture sensor (Watermark sensor, Irrometer Company, Riverside, CA) was placed in each container and used for daily monitoring. Water was added to the outer container when readings indicated pressure levels greater then 0.06 MPa. Water was siphoned out when the moisture sensors read less than 0.04 MPa. Seedlings were transplanted into the pre-moistened terrestrial sediment. All containers were randomly placed on tables in a greenhouse with 16 hour light: 8 hour dark photoperiod. Light fixtures were placed 130 cm from the top of the 19.0 L outer container and were arranged in an alternating pattern of high-pressure sodium lamps and high-pressure multi-vapor halide lamps. The greenhouse temperature was maintained at 32 ± 2°C maximum during the day and 21 ± 2°C minimum at night to simulate a summer environment. Relative humidity was maintained as close to 100 percent as possible, but never less then 50 percent. Harvesting took place after 45 days. Stainless steel scissors were used to cut the plant tissue 5 cm above the sediment surface. The tissue was washed in distilled water, blotted dry, and a fresh weight determined. Some replicates were combined to provide adequate tissue for analysis of all contaminants of concern. The plant tissues were then placed in appropriate containers and preserved until submitted to TestAmerica for tissue residue analysis. The *C. esculentus* BP test was performed in three batches. A summary of test conditions is provided in Table 19.

Table 19. Test Conditions for the 45 Day Bioaccumulation Potential Test Using *Cyperus esculentus*

Test Conditions: *Cyperus esculentus* BP Test				
		Batch 1	Batch 2	Batch 3
Sample Identification		0100C1_6WOSDUP, 0200C1_6WOSDUP, 0300C1_3LTFIUP, 0300C4_6WTSDUP, 030C1_6NBNSSUP, 0800C1_4WOSDUP	0600C1&2WTSDUP, 0600C3_6LTFIUP, 060C1_6NBNSSUP, 0700C1_4WTSDUP, 0700C5_9LTFIUP, 070C1_9NBNSSUP, 10000001WTSDUP, 1000C3&4LTFIUP, BL00000RWOSDUP	0400C1_8WTSDUP, 45C1_16NWNSSUP, 0500C1_8WTSDUP, 09000001WOSDUP, 0900C2&4WOSDUP, 100C3&4NLNSSUP
Approximate volume received		**56 L per sample**	**56 L per sample**	**56 L per sample**
Sample storage conditions		**4°C, dark, minimal head space**	**4°C, dark, minimal head space**	**4°C, dark, minimal head space**
Test Species		*C. esculentus*	*C. esculentus*	*C. esculentus*
Supplier		**Wildlife Nurseries, Oshkosh, Wisconsin**	**Wildlife Nurseries, Oshkosh, Wisconsin**	**Wildlife Nurseries, Oshkosh, Wisconsin**
Date acquired		**September 2007**	**September 2007**	**September 2007**
Acclimation/holding time		**Not specified**	**Not specified**	**Not specified**
Age class		**Rooted seedlings**	**Rooted seedlings**	**Rooted seedlings**
Test Procedures		UTM (Appendix H; USACE, 2003)	UTM (Appendix H; USACE, 2003)	UTM (Appendix H; USACE, 2003)
Test location		**US Army ERDC EP-R Greenhouse 6010**	**US Army ERDC EP-R Greenhouse 6010**	**US Army ERDC EP-R Greenhouse 6010**
Test type/duration		**Freshwater Upland / 45 days**	**Freshwater Upland / 45 days**	**Freshwater Upland / 45 days**
Test dates		**September 12 – October 26, 2007**	**October 10 – November 24, 2007**	**October 19 – December 3, 2007**
Tissue shipped to Test America		**October 30, 2007**	**November 24, 2007**	**December 3, 2007**
Greenhouse control media		**Miracle Gro® Potting Mix**	**Miracle Gro® Potting Mix**	**Miracle Gro® Potting Mix**
Laboratory water and salinity		**Reverse Osmosis @ 0 ppt**	**Reverse Osmosis @ 0 ppt**	**Reverse Osmosis @ 0 ppt**
Test temperature		**Maximum Day: 32 ± 2 °C Minimum Night: 21± 2°C**	**Maximum Day: 32 ± 2 °C Minimum Night: 21± 2°C**	**Maximum Day: 32 ± 2 °C Minimum Night: 21± 2°C**
Test salinity (sediment)	**Recommended: 0 - 10 ppt**	**Actual: 0 - 4 ppt after washing**	**Actual: 0-3 ppt after washing**	**Actual: 0-6 ppt after washing**
Test pH	**Recommended: Same as field condition**	**Actual: 7.2 – 8.57 (original sediment)**	**Actual: 7.43 to 8.29 (original sediment)**	**Actual: 7.25 to 8.47 (original sediment)**
Test photoperiod		**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**	**16 hours light: 8 hours dark**
Test chamber		**7.6 L polyethylene Bain Marie**	**7.6 L polyethylene Bain Marie**	**7.6 L polyethylene Bain Marie**
Replicates/treatment		**5**	**5**	**5**
Organisms/replicate		**5 rooted seedlings**	**5 rooted seedlings**	**5 rooted seedlings**
Exposure volume		**4.5 kg (ODW) sediment**	**4.5 kg (ODW) sediment**	**4.5 kg (ODW) sediment**
Fertilization		**None**	**None**	**None**
Water renewal		**As needed to maintain between 0.03 and 0.06 MPa sediment moisture.**	**As needed to maintain between 0.03 and 0.06 MPa sediment moisture.**	**As needed to maintain between 0.03 and 0.06 MPa sediment moisture.**
Deviations from Test Protocol		**None**	**None**	**None**

3.0 RESULTS

3.1 Field Sample Collection and Handling

Weston mobilized all sampling equipment and vessels to the IHNC project site beginning July 5, 2007 and commenced sampling on July 9, 2007. The weather was generally hot and humid with periods of heavy rainfall and occasional lightning. Sampling was conducted six days per week except in early September, when work was suspended over the Labor Day weekend. Sampling was temporarily halted a few times, when severe lightening posed a safety concern. Sediment, soil, and water samples were collected in waterside and upland locations throughout the IHNC, from immediately south of the Lock to a waterside area immediately north of the Florida Avenue Bridge. Waterside sampling was performed for the duration of the program, while upland sampling was conducted over a three week period from July 23 to August 10, 2007. Weston completed the sampling on September 10, 2007 after collecting a total of 339 successful core samples and a total sediment and soil volume of 7,609 L of material for analysis.

Sediment, soil, and water samples were collected from 15 of the 16 proposed DMMUs and at all reference locations as specified in the original SOW. DMMU 11 was eliminated from the program when, after taking numerous bathymetry readings throughout the area, Weston determined that the water depth was already at or below the project depth of -40 Mean-Low Gulf (MLG). Station D9-05-3, located immediately south of the IHNC Lock, and Station D10-05-2 located northeast of the Lock, were also eliminated from the program. Like DMMU 11, Station D9-05-3 was already at project depth while a rip rap bottom at Station D10-05-2 and the surrounding area made sampling there infeasible. At Station D9-05-1, sampling to the project depth of -30.5 ft MLG could not be achieved due to the presence of woody debris throughout the target area. Specifically, in 14 out of 16 attempts to collect sediment to project depth, refusal due to debris was encountered. At Station D7-05-4, native material was not encountered and therefore, there was no individual native sample to be analyzed from this particular station. Due to the presence of a large, shallow ponded area covering the upland stations located on the east bank of the IHNC, the upland stations within DMMU 6 (D6-05-3, D6-05-4, D6-05-5, D6-05-6) and DMMU 7 (D7-05-5, D7-05-6, D7-05-7, D7-05-8, and D7-05-9) were relocated to the closest accessible points east of the original station coordinates.

Once collected, all samples were logged by a Weston geologist (as described in Section 2.3.4) and the sediment description entered into an electronic core log established for this project on a field computer. At the beginning and periodically throughout the remainder of the project, a CEMVN geologist was present at the project site verifying sediment descriptions as well as the delineation between non-native and native materials in sediment and soil cores. A representative sediment core collected from the IHNC is shown in Figure 7.

Each night, all sampling information entered into the field computer during that day was downloaded to both a flash drive and the hard drive of a second computer to create redundancy. The field computer was also programmed with internal QA measures so that if any erroneous information was entered into a core log (e.g. negative final core length) the entry was flagged and the core log could not be saved or downloaded until the error was corrected.

Figure 7. Representative Sediment Core from IHNC

3.2 Sediment Core Locations and Sampling Depths

Core samples were collected to the target sampling depth at all stations sampled except at Station D9-05-1 where debris (most likely wood pier pilings) submerged below the mudline prevented penetration to the project depth. At all other stations sampled, if refusal or poor recovery occurred, additional cores were attempted until samples to the project depth were collected and a high percentage recovery of was achieved. All core samples not meeting these criteria were discarded. Of a total of 353 attempted cores, 339 met the required criteria on the first attempt, resulting in a 96% success rate. The 14 unsuccessful cores were discarded and an additional core sample was collected.

The field coordinates, number of cores per station, depth of penetration relative to the mudline (i.e., the sediment or soil surface), depth of recovery relative to the mudline, core length retained, and volume required for analysis for each station location are summarized in Table 20. In cases where a distinction between top and native material was designated, cores were split to create two samples for analysis. Field core logs and core photos for the sampling effort are provided in Appendices F and G, respectively.

Table 20. Field Coordinates, Number of Cores per Station, Depth of Penetration Relative to the Mudline (i.e., the sediment or soil surface), Depth of Recovery, Core Length Retained, and Volume Required for Analysis for Each Station Location

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
DMMU 1 Water	D1-05-1	1	29° 58.938'	-90° 1.287'	7/9/2007	-0.2	-40.0	-30.3	-9.7	7.0	6.0	0.0	
	D1-05-1	2	29° 58.938'	-90° 1.287'	7/9/2007	-0.2	-40.0	-30.3	-9.7	12.0	12.0	9.5	
	D1-05-1	3	29° 58.938'	-90° 1.287'	7/10/2007	0.9	-40.0	-32.7	-7.3	12.0	9.2	9.1	
	D1-05-1	4	29° 58.938'	-90° 1.287'	7/10/2007	0.8	-40.0	-32.5	-7.5	11.0	9.0	9.0	
	D1-05-1	5	29° 58.938'	-90° 1.287'	7/10/2007	0.8	-40.0	-32.5	-7.5	12.0	9.2	9.2	
	D1-05-1	6	29° 58.938'	-90° 1.287'	7/17/2007	0.5	-40.0	-31.7	-8.3	9.5	0.0	0.0	
	D1-05-1	7	29° 58.938'	-90° 1.287'	7/17/2007	0.5	-40.0	-31.7	-8.3	10.5	8.5	8.5	
	D1-05-2	1	29° 58.957'	-90° 1.261'	7/10/2007	0.6	-40.0	-34.5	-5.5	9.0	6.0	6.0	
	D1-05-2	2	29° 58.956'	-90° 1.261'	7/10/2007	0.5	-40.0	-34.3	-5.7	10.0	7.8	6.7	
	D1-05-2	3	29° 58.956'	-90° 1.261'	7/10/2007	0.4	-40.0	-34.1	-5.9	10.0	9.5	9.5	
	D1-05-2	4	29° 58.957'	-90° 1.261'	7/10/2007	0.6	-40.0	-34.5	-5.5	8.0	6.5	6.5	
	D1-05-2	5	29° 58.957'	-90° 1.261'	7/17/2007	0.6	-40.0	-34.5	-5.5	9.0	7.0	6.7	
	D1-05-3	1	29° 59.014'	-90° 1.261'	7/10/2007	-0.1	-40.0	-33.3	-6.7	8.0	6.5	6.5	
	D1-05-3	2	29° 59.014'	-90° 1.261'	7/10/2007	-0.1	-40.0	-33.3	-6.7	10.0	9.5	9.5	
	D1-05-3	3	29° 59.014'	-90° 1.261'	7/10/2007	-0.1	-40.0	-33.3	-6.7	8.5	7.0	6.5	
	D1-05-3	4	29° 59.014'	-90° 1.261'	7/10/2007	-0.1	-40.0	-33.3	-6.7	8.5	7.0	6.5	
	D1-05-3	5	29° 59.014'	-90° 1.261'	7/17/2007	0.7	-40.0	-34.9	-5.1	9.5	7.0	6.5	
	D1-05-4	1	29° 59.022'	-90° 1.279'	7/10/2007	-0.1	-40.0	-33.3	-6.7	8.5	6.5	6.5	
	D1-05-4	2	29° 59.022'	-90° 1.279'	7/10/2007	-0.1	-40.0	-33.3	-6.7	8.5	6.5	6.5	
	D1-05-4	3	29° 59.022'	-90° 1.279'	7/10/2007	-0.3	-40.0	-33.1	-6.9	8.5	6.5	6.5	
	D1-05-4	4	29° 59.022'	-90° 1.279'	7/10/2007	-0.1	-40.0	-33.3	-6.7	8.5	6.5	6.5	
	D1-05-4	5	29° 59.022'	-90° 1.279'	7/17/2007	0.8	-40.0	-35.1	-4.9	7.0	6.5	6.5	
	D1-05-5	1	29° 59.06'	-90° 1.228'	7/11/2007	1.1	-40.0	-30.4	-9.6	12.0	8.0	6.5	Material at location very soft
	D1-05-5	2	29° 59.06'	-90° 1.228'	7/11/2007	1.1	-40.0	-30.4	-9.6	12.0	9.5	9.0	
	D1-05-5	3	29° 59.06'	-90° 1.228'	7/11/2007	1.1	-40.0	-30.4	-9.6	12.5	9.5	9.5	
	D1-05-5	4	29° 59.06'	-90° 1.228'	7/11/2007	1.0	-40.0	-30.3	-9.7	13.0	10.0	9.0	
	D1-05-5	5	29° 59.06'	-90° 1.228'	7/17/2007	0.8	-40.0	-29.8	-10.2	12.5	12.0	11.8	
	D1-05-6	1	29° 59.134'	-90° 1.213'	7/11/2007	0.8	-40.0	-30.8	-9.2	11.5	9.0	9.0	
	D1-05-6	2	29° 59.134'	-90° 1.213'	7/11/2007	0.7	-40.0	-30.7	-9.3	12.5	10.0	10.0	
	D1-05-6	3	29° 59.134'	-90° 1.213'	7/11/2007	0.6	-40.0	-30.6	-9.4	13.0	10.9	9.5	
	D1-05-6	4	29° 59.134'	-90° 1.213'	7/11/2007	0.6	-40.0	-30.6	-9.4	12.0	10.0	9.0	
	D1-05-6	5	29° 59.134'	-90° 1.213'	7/17/2007	0.9	-40.0	-31.0	-9.0	11.0	11.0	10.8	
DMMU 2 Water	D2-05-1	1	29° 58.641'	-90° 1.4'	7/16/2007	1.2	-40.0	-32.4	-7.6	11.5	11.5	10.0	
	D2-05-1	2	29° 58.641'	-90° 1.4'	7/16/2007	1.2	-40.0	-32.4	-7.6	11.0	9.5	9.0	
	D2-05-1	3	29° 58.641'	-90° 1.4'	7/16/2007	1.2	-40.0	-32.4	-7.6	11.0	0.0	0.0	
	D2-05-1	4	29° 58.641'	-90° 1.4'	7/16/2007	1.2	-40.0	-32.4	-7.6	11.0	10.0	10.0	
	D2-05-2	1	29° 58.636'	-90° 1.388'	7/16/2007	1.0	-40.0	-33.0	-7.0	10.0	9.0	9.0	
	D2-05-2	2	29° 58.636'	-90° 1.388'	7/16/2007	1.1	-40.0	-33.2	-6.8	11.0	11.0	9.0	
	D2-05-2	3	29° 58.636'	-90° 1.388'	7/16/2007	1.1	-40.0	-33.2	-6.8	10.0	10.0	9.0	
	D2-05-3	1	29° 58.634'	-90° 1.373'	7/14/2007	0.7	-40.0	-33.0	-7.0	9.0	8.0	8.0	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D2-05-3	2	29° 58.634'	-90° 1.373'	7/14/2007	0.6	-40.0	-32.8	-7.2	9.0	8.7	8.4	
	D2-05-3	3	29° 58.634'	-90° 1.373'	7/14/2007	0.4	-40.0	-32.4	-7.6	9.0	7.5	7.5	
	D2-05-4	1	29° 58.76'	-90° 1.357'	7/14/2007	1.2	-40.0	-30.2	-9.8	12.5	12.2	12.2	
	D2-05-4	2	29° 58.76'	-90° 1.357'	7/14/2007	1.1	-40.0	-30.0	-10.0	13.0	12.0	12.0	
	D2-05-4	3	29° 58.76'	-90° 1.357'	7/14/2007	0.9	-40.0	-29.6	-10.4	13.0	5.0	5.0	Hit wood or other natural debris that prevented recovery of 13 ft of material
	D2-05-4	4	29° 58.76'	-90° 1.357'	7/14/2007	0.8	-40.0	-29.4	-10.6	13.0	13.0	12.2	
	D2-05-5	1	29° 58.763'	-90° 1.346'	7/14/2007	1.3	-40.0	-33.8	-6.2	10.0	8.8	8.8	
	D2-05-5	2	29° 58.763'	-90° 1.346'	7/14/2007	1.3	-40.0	-33.8	-6.2	10.0	9.5	8.8	
	D2-05-5	3	29° 58.763'	-90° 1.346'	7/14/2007	1.3	-40.0	-33.8	-6.2	11.0	11.0	8.8	
	D2-05-6	1	29° 58.758'	-90° 1.332'	7/13/2007	0.3	-40.0	-35.3	-4.7	7.0	5.5	5.5	
	D2-05-6	2	29° 58.758'	-90° 1.332'	7/13/2007	0.2	-40.0	-35.1	-4.9	8.0	7.0	5.3	
	D2-05-6	3	29° 58.758'	-90° 1.332'	7/13/2007	0.1	-40.0	-34.9	-5.1	8.0	2.0	0.0	Sample lost upon recovery
	D2-05-6	4	29° 58.758'	-90° 1.332'	7/13/2007	0.1	-40.0	-34.9	-5.1	7.5	5.5	5.3	
DMMU 3 Land	D3-05-1	1	29° 58.392'	-90° 1.533'	7/24/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-1	2	29° 58.392'	-90° 1.533'	7/25/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-1	3	29° 58.392'	-90° 1.533'	7/25/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-1	4	29° 58.392'	-90° 1.533'	7/25/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-2	1	29° 58.455'	-90° 1.511'	7/23/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-2	2	29° 58.455'	-90° 1.511'	7/23/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-2	3	29° 58.455'	-90° 1.511'	7/24/2007	0.0	-18.0	5.0	-23.0	24.0	24.0	24.0	
	D3-05-2	4	29° 58.455'	-90° 1.511'	7/24/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-2	5	29° 58.455'	-90° 1.511'	7/24/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-2	6	29° 58.455'	-90° 1.511'	7/24/2007	0.0	-18.0	5.0	-23.0	12.0	12.0	12.0	
	D3-05-3	1	29° 58.527'	-90° 1.49'	7/25/2007	0.0	-18.0	0.0	-18.0	23.0	23.0	23.0	
	D3-05-3	2	29° 58.527'	-90° 1.49'	7/26/2007	0.0	-18.0	0.0	-18.0	23.0	23.0	23.0	
	D3-05-3	3	29° 58.527'	-90° 1.49'	7/26/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-3	4	29° 58.527'	-90° 1.49'	7/26/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	Sample interrupted due to rain
	D3-05-3	5	29° 58.527'	-90° 1.49'	7/26/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
	D3-05-3	6	29° 58.527'	-90° 1.49'	7/26/2007	0.0	-18.0	5.0	-23.0	23.0	23.0	23.0	
DMMU 3 Water	D3-05-4	1	29° 58.38'	-90° 1.478'	7/20/2007	0.4	-45.0	-30.9	-14.1	16.0	14.0	14.0	
	D3-05-4	2	29° 58.38'	-90° 1.478'	7/20/2007	0.4	-45.0	-30.9	-14.1	19.0	18.5	14.9	
	D3-05-4	3	29° 58.38'	-90° 1.478'	7/21/2007	0.5	-45.0	-31.1	-13.9	16.0	13.0	13.0	
	D3-05-4	4	29° 58.38'	-90° 1.478'	7/21/2007	0.5	-45.0	-31.1	-13.9	17.0	16.5	14.9	
	D3-05-4	5	29° 58.38'	-90° 1.478'	7/21/2007	0.4	-45.0	-30.9	-14.1	17.0	17.0	14.9	
	D3-05-4	6	29° 58.38'	-90° 1.478'	7/21/2007	0.3	-45.0	-30.7	-14.3	16.0	14.0	14.0	
	D3-05-4	7	29° 58.38'	-90° 1.478'	7/21/2007	0.3	-45.0	-30.7	-14.3	16.0	14.0	14.0	
	D3-05-4	8	29° 58.38'	-90° 1.478'	7/21/2007	0.3	-45.0	-30.7	-14.3	16.0	16.0	14.9	
	D3-05-5	1	29° 58.443'	-90° 1.463'	7/19/2007	0.6	-45.0	-28.6	-16.4	19.0	18.5	17.6	
	D3-05-5	2	29° 58.443'	-90° 1.463'	7/19/2007	0.6	-45.0	-28.6	-16.4	19.5	19.0	17.6	
	D3-05-5	3	29° 58.443'	-90° 1.463'	7/19/2007	0.6	-45.0	-28.6	-16.4	19.0	18.0	17.6	
	D3-05-5	4	29° 58.443'	-90° 1.463'	7/20/2007	0.5	-45.0	-28.4	-16.6	19.0	0.0	0.0	No recovery

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D3-05-5	5	29° 58.443'	-90° 1.463'	7/20/2007	0.5	-45.0	-28.4	-16.6	19.0	17.5	17.5	
	D3-05-5	6	29° 58.443'	-90° 1.463'	7/20/2007	0.5	-45.0	-28.4	-16.6	12.0	11.5	11.5	Refusal at 11.5 ft due to hard debris, only top collected
	D3-05-5	7	29° 58.443'	-90° 1.463'	7/20/2007	0.4	-45.0	-28.2	-16.8	18.0	10.0	10.0	
	D3-05-5	8	29° 58.443'	-90° 1.463'	7/20/2007	0.4	-45.0	-28.2	-16.8	18.0	17.5	17.0	Sediment temperature = 21°C
	D3-05-5	9	29° 58.443'	-90° 1.463'	7/20/2007	0.4	-45.0	-28.2	-16.8	17.5	14.0	14.0	
	D3-05-6	1	29° 58.515'	-90° 1.442'	7/18/2007	0.7	-45.0	-28.7	-16.3	18.5	13.5	13.5	
	D3-05-6	2	29° 58.515'	-90° 1.442'	7/18/2007	0.8	-45.0	-28.9	-16.1	19.0	14.0	14.0	
	D3-05-6	3	29° 58.515'	-90° 1.442'	7/18/2007	0.8	-45.0	-28.9	-16.1	18.0	13.5	13.5	
	D3-05-6	4	29° 58.515'	-90° 1.442'	7/18/2007	0.8	-45.0	-28.9	-16.1	19.5	0.0	0.0	Sample lost upon recovery
	D3-05-6	5	29° 58.515'	-90° 1.442'	7/18/2007	0.8	-45.0	-28.9	-16.1	18.5	14.0	14.0	
	D3-05-6	6	29° 58.515'	-90° 1.442'	7/18/2007	0.7	-45.0	-28.7	-16.3	18.5	14.5	14.5	
	D3-05-6	7	29° 58.515'	-90° 1.442'	7/18/2007	0.6	-45.0	-28.5	-16.5	18.5	14.0	14.0	
	D3-05-6	8	29° 58.515'	-90° 1.442'	7/19/2007	0.6	-45.0	-28.5	-16.5	19.0	17.0	17.0	
DMMU 4 Water	D4-05-1	1	29° 58.333'	-90° 1.463'	8/27/2007	0.6	-64.0	-32.2	-31.8	16.0	13.0	13.0	Penetrated to just below top material for top volume
	D4-05-1	2	29° 58.333'	-90° 1.463'	8/27/2007	0.5	-64.0	-32.0	-32.0	13.0	10.0	10.0	Refusal at 13 feet
	D4-05-1	3	29° 58.333'	-90° 1.463'	8/28/2007	1.1	-64.0	-33.1	-30.9	10.0	0.0	0.0	Lost sampling tube
	D4-05-1	4	29° 58.333'	-90° 1.463'	8/28/2007	1.1	-64.0	-33.2	-30.8	18.0	16.0	16.0	
	D4-05-1	5	29° 58.333'	-90° 1.463'	8/28/2007	1.1	-64.0	-33.1	-30.9	10.0	10.0	10.0	Refusal at 10 feet due to cypress or other debris in area.
	D4-05-1	6	29° 58.333'	-90° 1.463'	8/29/2007	0.9	-64.0	-30.9	-33.1	33.0	0.0	0.0	Sample lost upon recovery.
	D4-05-1	7	29° 58.333'	-90° 1.463'	8/29/2007	0.9	-64.0	-31.9	-32.1	33.0	9.5	9.5	
	D4-05-1	8	29° 58.333'	-90° 1.463'	8/29/2007	0.7	-64.0	-31.6	-32.4	34.0	28.0	28.0	
	D4-05-1	9	29° 58.333'	-90° 1.463'	8/30/2007	0.6	-64.0	-31.4	-32.6	33.0	16.0	16.0	Discarded top material.
	D4-05-2	1	29° 58.366'	-90° 1.458'	8/11/2007	1.3	-45.0	-29.8	-15.2	12.0	9.5	9.5	Refusal at 12 ft
	D4-05-2	2	29° 58.366'	-90° 1.458'	8/11/2007	1.3	-45.0	-29.8	-15.2	17.0	12.0	12.0	Refusal at 17 ft
	D4-05-2	3	29° 58.366'	-90° 1.458'	8/11/2007	1.3	-45.0	-29.8	-15.2	17.0	12.1	12.1	Refusal at 17 ft
	D4-05-2	4	29° 58.366'	-90° 1.458'	8/11/2007	1.3	-45.0	-29.8	-15.2	17.0	13.5	13.5	Refusal at 17 ft
	D4-05-2	5	29° 58.366'	-90° 1.458'	8/11/2007	1.3	-45.0	-29.8	-15.2	17.0	7.9	0.0	Refusal at 17 ft
	D4-05-2	6	29° 58.366'	-90° 1.458'	8/13/2007	1.1	-45.0	-30.1	-14.9	20.0	18.5	17.1	Collected native material only, collected sufficient top material here on 8/11.
	D4-05-2	7	29° 58.366'	-90° 1.458'	8/13/2007	1.1	-45.0	-30.1	-14.9	18.0	15.2	15.2	
	D4-05-2	8	29° 58.366'	-90° 1.458'	8/13/2007	1.1	-45.0	-30.1	-14.9	18.0	14.5	14.5	
	D4-05-3	1	29° 58.412'	-90° 1.445'	8/14/2007	0.9	-45.0	-33.2	-11.8	15.0	14.0	13.6	
	D4-05-3	2	29° 58.412'	-90° 1.445'	8/14/2007	0.8	-45.0	-33.0	-12.0	15.0	14.7	13.6	
	D4-05-3	3	29° 58.412'	-90° 1.445'	8/14/2007	0.7	-45.0	-32.8	-12.2	14.0	11.3	11.3	
	D4-05-3	4	29° 58.412'	-90° 1.445'	8/14/2007	0.6	-45.0	-32.6	-12.4	12.5	0.0	0.0	Sample lost upon recovery.
	D4-05-3	5	29° 58.412'	-90° 1.445'	8/14/2007	0.6	-45.0	-32.6	-12.4	10.0	8.0	6.4	Sampled to 10 feet only for top layer volume
	D4-05-4	1	29° 58.32'	-90° 1.441'	8/17/2007	0.5	-34.0	-20.0	-14.0	17.5	17.5	15.0	
	D4-05-4	2	29° 58.32'	-90° 1.441'	8/17/2007	0.5	-34.0	-20.0	-14.0	15.5	12.3	12.3	
	D4-05-4	3	29° 58.32'	-90° 1.441'	8/17/2007	0.5	-34.0	-20.0	-14.0	17.5	17.2	15.0	
	D4-05-4	4	29° 58.32'	-90° 1.441'	8/18/2007	0.4	-34.0	-19.8	-14.2	5.0	3.9	3.9	Refusal at 5 ft
	D4-05-4	5	29° 58.32'	-90° 1.441'	8/18/2007	0.4	-34.0	-19.8	-14.2	6.0	5.0	5.0	
	D4-05-4	6	29° 58.32'	-90° 1.441'	8/18/2007	0.4	-34.0	-19.8	-14.2	9.0	7.5	7.5	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D4-05-5	1	29° 58.349'	-90° 1.434'	8/11/2007	0.9	-34.0	-18.7	-15.3	3.0	2.9	2.9	
	D4-05-5	2	29° 58.349'	-90° 1.434'	8/11/2007	0.7	-34.0	-18.5	-15.5	7.0	6.0	6.0	
	D4-05-5	3	29° 58.349'	-90° 1.434'	8/13/2007	1.1	-34.0	-20.1	-13.9	18.0	17.0	16.1	
	D4-05-5	4	29° 58.349'	-90° 1.434'	8/13/2007	0.9	-34.0	-19.7	-14.3	18.5	18.5	16.1	
	D4-05-5	5	29° 58.349'	-90° 1.434'	8/13/2007	0.8	-34.0	-19.5	-14.5	10.0	9.0	9.0	
	D4-05-5	6	29° 58.349'	-90° 1.434'	8/13/2007	0.7	-34.0	-19.3	-14.7	17.5	15.4	15.4	
	D4-05-5	7	29° 58.349'	-90° 1.434'	8/13/2007	0.6	-34.0	-19.1	-14.9	8.0	7.5	7.5	
	D4-05-6	1	29° 58.37'	-90° 1.422'	8/16/2007	0.6	-34.0	-12.2	-21.8	23.5	22.5	22.5	
	D4-05-6	2	29° 58.37'	-90° 1.422'	8/16/2007	0.6	-34.0	-12.2	-21.8	9.0	7.1	7.1	
	D4-05-6	3	29° 58.37'	-90° 1.422'	8/17/2007	0.5	-34.0	-12.0	-22.0	23.5	21.6	21.6	
	D4-05-6	4	29° 58.37'	-90° 1.422'	8/17/2007	0.4	-34.0	-11.8	-22.2	8.5	5.5	5.5	
	D4-05-6	5	29° 58.37'	-90° 1.422'	8/17/2007	0.4	-34.0	-11.8	-22.2	23.5	16.5	16.5	
	D4-05-7	1	29° 58.395'	-90° 1.419'	8/14/2007	0.9	-34.0	-18.2	-15.8	19.0	18.0	17.6	
	D4-05-7	2	29° 58.395'	-90° 1.419'	8/14/2007	1.0	-34.0	-18.4	-15.6	19.0	15.0	15.0	
	D4-05-7	3	29° 58.395'	-90° 1.419'	8/14/2007	1.0	-34.0	-18.4	-15.6	19.0	18.0	17.6	
	D4-05-7	4	29° 58.395'	-90° 1.419'	8/14/2007	1.0	-34.0	-18.4	-15.6	7.0	7.0	7.0	
	D4-05-8	1	29° 58.416'	-90° 1.411'	8/18/2007	0.3	-34.0	-18.3	-15.7	17.0	11.5	11.5	
	D4-05-8	2	29° 58.416'	-90° 1.411'	8/18/2007	0.3	-34.0	-18.3	-15.7	18.5	18.5	16.3	
	D4-05-8	3	29° 58.416'	-90° 1.411'	8/18/2007	0.3	-34.0	-18.3	-15.7	16.5	10.0	10.0	
	D4-05-8	4	29° 58.416'	-90° 1.411'	8/18/2007	0.3	-34.0	-18.3	-15.7	17.0	16.3	16.3	
	D4-05-8	5	29° 58.416'	-90° 1.411'	8/18/2007	0.4	-34.0	-18.4	-15.6	8.5	8.0	8.0	
	D4-05-8	6	29° 58.416'	-90° 1.411'	8/18/2007	0.4	-34.0	-18.4	-15.6	9.0	8.6	8.6	
DMMU 5 Water	D5-05-1	1	29° 58.456'	-90° 1.434'	8/20/2007	0.6	-45.0	-32.6	-12.4	14.0	13.0	13.0	
	D5-05-1	2	29° 58.456'	-90° 1.434'	8/20/2007	0.3	-45.0	-32.0	-13.0	10.0	8.8	8.8	
	D5-05-1	3	29° 58.456'	-90° 1.434'	8/20/2007	0.3	-45.0	-32.0	-13.0	15.0	13.9	13.6	
	D5-05-1	4	29° 58.456'	-90° 1.434'	8/24/2007	0.1	-45.0	-32.2	-12.8	14.0	13.4	13.0	
	D5-05-2	1	29° 58.486'	-90° 1.426'	8/20/2007	0.2	-45.0	-32.7	-12.3	16.0	15.9	12.7	
	D5-05-2	2	29° 58.486'	-90° 1.426'	8/20/2007	0.2	-45.0	-32.7	-12.3	14.0	12.4	12.4	
	D5-05-2	3	29° 58.486'	-90° 1.426'	8/20/2007	0.2	-45.0	-32.7	-12.3	14.0	10.6	10.6	
	D5-05-2	4	29° 58.486'	-90° 1.426'	8/25/2007	1.3	-45.0	-34.9	-10.1	13.0	8.8	8.8	
	D5-05-2	5	29° 58.486'	-90° 1.426'	8/27/2007	1.3	-45.0	-34.9	-10.1	13.0	11.2	11.2	
	D5-05-3	1	29° 58.541'	-90° 1.402'	8/28/2007	1.0	-64.0	-33.4	-30.6	15.0	12.5	12.5	
	D5-05-3	2	29° 58.541'	-90° 1.402'	8/28/2007	0.9	-64.0	-35.9	-28.1	27.0	25.5	25.5	
	D5-05-3	3	29° 58.541'	-90° 1.402'	8/28/2007	0.6	-64.0	-35.7	-28.3	8.0	7.9	7.9	Refusal at 8 feet due to pier piling
	D5-05-3	4	29° 58.541'	-90° 1.402'	8/29/2007	0.8	-64.0	-34.8	-29.2	27.0	22.0	22.0	Refusal at 27 feet due to debris
	D5-05-3	5	29° 58.541'	-90° 1.402'	8/29/2007	0.9	-64.0	-35.0	-29.0	23.0	15.5	15.5	Refusal at 22 ft due to debris in area
	D5-05-4	1	29° 58.439'	-90° 1.403'	8/24/2007	0.8	-34.0	-17.8	-16.2	10.5	9.5	9.5	
	D5-05-4	2	29° 58.439'	-90° 1.403'	8/24/2007	0.7	-34.0	-17.6	-16.4	19.5	18.2	17.8	
	D5-05-4	3	29° 58.439'	-90° 1.403'	8/24/2007	0.4	-34.0	-17.0	-17.0	18.0	14.5	14.5	
	D5-05-4	4	29° 58.439'	-90° 1.403'	8/24/2007	0.3	-34.0	-16.8	-17.2	18.0	9.9	9.9	
	D5-05-4	5	29° 58.439'	-90° 1.403'	8/24/2007	0.2	-34.0	-16.6	-17.4	18.5	10.9	10.9	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D5-05-5	1	29° 58.46'	-90° 1.395'	8/23/2007	1.0	-34.0	-17.0	-17.0	20.0	20.0	19.0	
	D5-05-5	2	29° 58.46'	-90° 1.395'	8/23/2007	0.8	-34.0	-16.6	-17.4	19.5	17.5	17.5	
	D5-05-5	3	29° 58.46'	-90° 1.395'	8/23/2007	0.5	-34.0	-16.0	-18.0	19.5	18.4	18.4	
	D5-05-5	4	29° 58.46'	-90° 1.395'	8/27/2007	1.2	-34.0	-16.7	-17.3	20.0	16.5	16.5	
	D5-05-6	1	29° 58.515'	-90° 1.386'	8/22/2007	0.1	-34.0	-24.1	-9.9	12.0	12.0	10.1	
	D5-05-6	2	29° 58.515'	-90° 1.386'	8/22/2007	0.1	-34.0	-24.1	-9.9	11.0	7.5	7.5	
	D5-05-6	3	29° 58.515'	-90° 1.386'	8/22/2007	0.0	-34.0	-23.9	-10.1	10.5	3.2	3.2	
	D5-05-6	4	29° 58.515'	-90° 1.386'	8/23/2007	0.4	-34.0	-24.7	-9.3	11.0	6.0	6.0	
	D5-05-7	1	29° 58.515'	-90° 1.382'	8/21/2007	0.6	-34.0	-21.2	-12.8	15.0	14.0	14.0	
	D5-05-7	2	29° 58.515'	-90° 1.382'	8/21/2007	0.5	-34.0	-21.0	-13.0	14.5	10.0	10.0	
	D5-05-7	3	29° 58.515'	-90° 1.382'	8/21/2007	0.4	-34.0	-20.8	-13.2	14.0	11.0	11.0	
	D5-05-7	4	29° 58.515'	-90° 1.382'	8/21/2007	0.2	-34.0	-19.5	-14.5	7.0	7.0	3.3	
	D5-05-7	5	29° 58.515'	-90° 1.382'	8/21/2007	0.2	-34.0	-19.5	-14.5	8.0	7.5	3.5	
	D5-05-7	6	29° 58.515'	-90° 1.382'	8/21/2007	0.1	-34.0	-19.3	-14.7	4.0	2.4	2.4	
	D5-05-7	7	29° 58.515'	-90° 1.382'	8/21/2007	0.1	-34.0	-19.3	-14.7	5.0	4.5	4.5	
	D5-05-8	1	29° 58.538'	-90° 1.374'	8/22/2007	0.9	-34.0	-15.9	-18.1	20.0	12.0	12.0	
	D5-05-8	2	29° 58.538'	-90° 1.374'	8/22/2007	0.7	-34.0	-15.5	-18.5	20.0	10.5	10.5	
	D5-05-8	3	29° 58.538'	-90° 1.374'	8/22/2007	0.6	-34.0	-15.3	-18.7	20.0	20.0	19.9	
	D5-05-8	4	29° 58.538'	-90° 1.374'	8/22/2007	0.4	-34.0	-14.9	-19.1	5.0	2.0	2.0	
	D5-05-8	5	29° 58.538'	-90° 1.374'	8/22/2007	0.3	-34.0	-14.7	-19.3	5.0	2.0	2.0	
	D5-05-8	6	29° 58.538'	-90° 1.374'	8/22/2007	0.3	-34.0	-14.7	-19.3	4.0	2.5	2.5	
	D5-05-8	7	29° 58.538'	-90° 1.374'	8/22/2007	0.3	-34.0	-14.7	-19.3	5.0	4.0	4.0	
DMMU 6 Water	D6-05-1	1	29° 58.229'	-90° 1.456'	7/30/2007	1.1	-34.0	-18.2	-15.8	18.0	14.4	14.4	
	D6-05-1	2	29° 58.229'	-90° 1.456'	7/30/2007	1.1	-34.0	-18.2	-15.8	18.0	14.4	14.4	
	D6-05-1	3	29° 58.229'	-90° 1.456'	7/30/2007	0.9	-34.0	-17.8	-16.2	18.0	11.5	11.5	
	D6-05-1	4	29° 58.229'	-90° 1.456'	7/30/2007	0.7	-34.0	-17.4	-16.6	18.0	14.7	14.7	
	D6-05-1	5	29° 58.229'	-90° 1.456'	7/30/2007	0.5	-34.0	-17.0	-17.0	5.0	4.0	4.0	
	D6-05-1	6	29° 58.229'	-90° 1.456'	7/31/2007	1.1	-34.0	-18.2	-15.8	18.0	10.0	10.0	
	D6-05-1	7	29° 58.229'	-90° 1.456'	7/31/2007	1.2	-34.0	-18.4	-15.6	7.0	6.0	6.0	Refusal at 7 ft. Moved next station due to debris.
	D6-05-1	8	29° 58.229'	-90° 1.456'	7/31/2007	1.2	-34.0	-18.4	-15.6	19.0	16.5	16.5	
	D6-05-1	9	29° 58.229'	-90° 1.456'	7/31/2007	1.0	-34.0	-18.0	-16.0	18.0	10.0	10.0	
	D6-05-1	10	29° 58.229'	-90° 1.456'	7/31/2007	1.0	-34.0	-18.0	-16.0	18.0	15.0	15.0	
	D6-05-1	11	29° 58.229'	-90° 1.456'	8/1/2007	1.0	-34.0	-18.0	-16.0	12.0	11.5	11.5	Refusal at 12 ft
	D6-05-1	12	29° 58.229'	-90° 1.456'	8/1/2007	0.9	-34.0	-18.4	-15.6	10.0	8.5	8.5	Refusal at 10 ft likely due to tree
	D6-05-1	13	29° 58.229'	-90° 1.456'	8/1/2007	0.8	-34.0	-18.2	-15.8	7.0	5.0	5.0	Refusal at 7 ft due to cypress wood
	D6-05-1	14	29° 58.229'	-90° 1.456'	8/1/2007	0.7	-34.0	-17.4	-16.6	5.0	4.2	4.2	Refusal at 5 ft due to cypress
	D6-05-1	15	29° 58.229'	-90° 1.456'	8/2/2007	0.7	-34.0	-19.2	-14.8	14.0	9.0	9.0	Refusal at 14 ft due to cypress
	D6-05-1	16	29° 58.229'	-90° 1.456'	8/2/2007	0.7	-34.0	-19.2	-14.8	17.0	12.5	12.5	
	D6-05-2	1	29° 58.275'	-90° 1.441'	7/26/2007	0.8	-34.0	-22.3	-11.7	3.0	3.0	3.0	Refusal at 3 ft. Moved station due to levee fill material and rocks.
	D6-05-2	2	29° 58.275'	-90° 1.441'	7/26/2007	0.4	-34.0	-21.4	-12.6	14.0	12.0	12.0	
	D6-05-2	3	29° 58.275'	-90° 1.441'	7/26/2007	0.2	-34.0	-21.0	-13.0	16.0	16.0	13.4	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D6-05-2	4	29° 58.275'	-90° 1.441'	7/27/2007	1.4	-34.0	-22.1	-11.9	14.7	13.0	13.0	
	D6-05-2	5	29° 58.275'	-90° 1.441'	7/27/2007	1.4	-34.0	-22.1	-11.9	16.0	16.0	14.7	
	D6-05-2	6	29° 58.275'	-90° 1.441'	7/27/2007	1.0	-34.0	-21.3	-12.7	16.0	14.0	14.0	
	D6-05-2	7	29° 58.275'	-90° 1.441'	7/27/2007	0.5	-34.0	-20.3	-13.7	16.0	15.0	15.0	
	D6-05-2	8	29° 58.275'	-90° 1.441'	7/27/2007	0.2	-34.0	-19.7	-14.3	8.0	8.0	8.0	
	D6-05-2	9	29° 58.275'	-90° 1.441'	7/28/2007	1.3	-34.0	-22.8	-11.2	3.0	2.0	2.0	Refusal at 3 ft due to rocks
	D6-05-2	10	29° 58.275'	-90° 1.441'	7/28/2007	1.3	-34.0	-22.8	-11.2	7.5	6.5	6.5	
	D6-05-2	11	29° 58.275'	-90° 1.441'	7/28/2007	1.0	-34.0	-22.2	-11.8	8.0	7.0	7.0	
	D6-05-2	12	29° 58.275'	-90° 1.441'	7/28/2007	1.0	-34.0	-22.2	-11.8	8.0	7.2	7.2	
	D6-05-2	13	29° 58.275'	-90° 1.441'	7/28/2007	0.9	-34.0	-22.0	-12.0	7.5	5.5	5.5	
	D6-05-2	14	29° 58.275'	-90° 1.441'	7/28/2007	0.7	-34.0	-21.6	-12.4	8.5	8.0	8.0	
	D6-05-2	15	29° 58.275'	-90° 1.441'	7/28/2007	0.6	-34.0	-21.4	-12.6	7.5	4.0	4.0	
	D6-05-2	16	29° 58.275'	-90° 1.441'	7/28/2007	0.5	-34.0	-21.2	-12.8	7.5	5.0	5.0	
	D6-05-2	17	29° 58.275'	-90° 1.441'	7/28/2007	0.4	-34.0	-21.0	-13.0	7.0	6.0	6.0	
	D6-05-2	18	29° 58.275'	-90° 1.441'	7/28/2007	0.3	-34.0	-20.8	-13.2	8.0	7.0	7.0	
	D6-05-2	19	29° 58.275'	-90° 1.441'	7/28/2007	0.2	-34.0	-20.6	-13.4	7.5	5.0	5.0	
	D6-05-2	20	29° 58.275'	-90° 1.441'	7/28/2007	0.1	-34.0	-20.4	-13.6	7.0	5.0	5.0	
	D6-05-2	21	29° 58.275'	-90° 1.441'	7/28/2007	0.1	-34.0	-20.4	-13.6	7.0	6.0	6.0	
DMMU 6 Land	D6-05-3	1	29° 58.222'	-90° 1.41'	8/2/2007	0.0	-25.0	3.0	-28.0	28.0	28.0	27.0	
	D6-05-3	2	29° 58.222'	-90° 1.41'	8/2/2007	0.0	-25.0	3.0	-28.0	28.0	28.0	27.0	
	D6-05-3	3	29° 58.222'	-90° 1.41'	8/2/2007	0.0	-25.0	3.0	-28.0	16.0	16.0	13.0	
	D6-05-3	4	29° 58.222'	-90° 1.41'	8/2/2007	0.0	-25.0	3.0	-28.0	16.0	16.0	13.0	
	D6-05-4	1	29° 58.287'	-90° 1.387'	8/1/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	30.0	
	D6-05-4	2	29° 58.287'	-90° 1.387'	8/1/2007	0.0	-25.0	5.0	-30.0	30.0	29.5	29.5	
	D6-05-4	3	29° 58.287'	-90° 1.387'	8/1/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	30.0	
	D6-05-4	4	29° 58.287'	-90° 1.387'	8/1/2007	0.0	-25.0	5.0	-30.0	30.0	14.0	14.0	
	D6-05-5	1	29° 58.368'	-90° 1.36'	7/31/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	30.0	
	D6-05-5	2	29° 58.368'	-90° 1.36'	7/31/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	30.0	
	D6-05-5	3	29° 58.368'	-90° 1.36'	7/31/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	30.0	
	D6-05-5	4	29° 58.368'	-90° 1.36'	7/31/2007	0.0	-25.0	5.0	-30.0	16.0	16.0	16.0	
	D6-05-6	1	29° 58.457'	-90° 1.345'	7/30/2007	0.0	-25.0	2.0	-27.0	28.0	28.0	28.0	
	D6-05-6	2	29° 58.457'	-90° 1.345'	7/30/2007	0.0	-25.0	2.0	-27.0	28.0	28.0	28.0	
	D6-05-6	3	29° 58.457'	-90° 1.345'	7/30/2007	0.0	-25.0	2.0	-27.0	12.0	12.0	12.0	
	D6-05-6	4	29° 58.457'	-90° 1.345'	7/30/2007	0.0	-25.0	2.0	-27.0	12.0	12.0	12.0	
	D6-05-6	5	29° 58.457'	-90° 1.345'	8/2/2007	0.0	-25.0	2.0	-27.0	27.0	27.0	27.0	
DMMU 7 Water	D7-05-1	1	29° 58.613'	-90° 1.343'	8/4/2007	0.3	-34.0	-12.6	-21.4	22.0	16.7	16.7	
	D7-05-1	2	29° 58.613'	-90° 1.343'	8/6/2007	0.5	-34.0	-14.2	-19.8	19.0	16.0	16.0	
	D7-05-1	3	29° 58.613'	-90° 1.343'	8/6/2007	0.1	-34.0	-13.2	-20.8	21.0	14.5	14.5	
	D7-05-1	4	29° 58.611'	-90° 1.343'	8/8/2007	0.6	-34.0	-13.0	-21.0	0.2	0.2	0.2	BOXCORE
	D7-05-1	5	29° 58.611'	-90° 1.343'	8/8/2007	0.6	-34.0	-13.0	-21.0	0.1	0.1	0.1	BOXCORE
	D7-05-1	6	29° 58.611'	-90° 1.343'	8/8/2007	0.6	-34.0	-13.0	-21.0	0.1	0.1	0.1	BOXCORE

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D7-05-1	7	29° 58.611'	-90° 1.343'	8/8/2007	0.6	-34.0	-13.0	-21.0	0.2	0.2	0.2	BOXCORE
	D7-05-1	8	29° 58.611'	-90° 1.343'	8/8/2007	0.6	-34.0	-13.0	-21.0	0.3	0.0	0.0	BOXCORE
	D7-05-1	0	29° 58.611'	-90° 1.343'	8/8/2007	0.4	-34.0	-12.8	-21.2	0.0	0.0	0.0	
	D7-05-2	1	29° 58.645'	-90° 1.33'	8/3/2007	0.5	-34.0	-23.0	-11.0	13.5	13.4	12.0	
	D7-05-2	2	29° 58.645'	-90° 1.33'	8/3/2007	0.6	-34.0	-23.2	-10.8	13.0	11.4	11.4	
	D7-05-2	3	29° 58.645'	-90° 1.33'	8/3/2007	0.5	-34.0	-23.0	-11.0	14.0	12.4	12.0	
	D7-05-2	4	29° 58.645'	-90° 1.33'	8/3/2007	0.5	-34.0	-23.0	-11.0	13.0	10.0	10.0	
	D7-05-2	5	29° 58.645'	-90° 1.331'	8/3/2007	0.5	-34.0	-23.0	-11.0	12.0	8.5	8.5	
	D7-05-2	6	29° 58.645'	-90° 1.33'	8/4/2007	0.4	-34.0	-23.8	-10.2	13.0	11.8	11.0	
	D7-05-2	7	29° 58.645'	-90° 1.333'	8/4/2007	0.4	-34.0	-23.8	-10.2	4.0	4.0	4.0	Refusal at 4 ft, no recovery.
	D7-05-2	8	29° 58.645'	-90° 1.33'	8/4/2007	0.3	-34.0	-23.3	-10.7	13.0	12.0	11.3	
	D7-05-2	9	29° 58.645'	-90° 1.33'	8/4/2007	0.2	-34.0	-23.1	-10.9	14.0	11.5	11.3	
	D7-05-2	10	29° 58.645'	-90° 1.33'	8/4/2007	0.2	-34.0	-23.1	-10.9	14.0	13.0	11.3	
	D7-05-2	11	29° 58.645'	-90° 1.333'	8/4/2007	0.2	-34.0	-23.1	-10.9	13.0	12.3	11.3	
	D7-05-2	12	29° 58.645'	-90° 1.33'	8/8/2007	0.9	-34.0	-21.0	-13.0	1.5	1.5	1.5	BOXCORE
	D7-05-2	13	29° 58.645'	-90° 1.33'	8/8/2007	0.9	-34.0	-21.1	-12.9	1.0	0.9	0.9	BOXCORE
	D7-05-2	14	29° 58.645'	-90° 1.33'	8/8/2007	0.9	-34.0	-23.1	-10.9	1.0	0.0	0.0	BOXCORE
	D7-05-2	15	29° 58.645'	-90° 1.33'	8/8/2007	0.8	-34.0	-21.0	-13.0	2.0	2.0	2.0	BOXCORE
	D7-05-2	16	29° 58.645'	-90° 1.33'	8/8/2007	0.8	-34.0	-21.0	-13.0	2.0	1.5	1.5	BOXCORE
	D7-05-2	17	29° 58.645'	-90° 1.33'	8/8/2007	0.8	-34.0	-21.0	-13.0	1.0	1.0	1.0	BOXCORE
	D7-05-3	1	29° 58.703'	-90° 1.313'	8/6/2007	0.0	-34.0	-24.0	-10.0	5.0	4.0	4.0	Refusal at 5 ft
	D7-05-3	2	29° 58.703'	-90° 1.313'	8/6/2007	0.0	-34.0	-23.0	-11.0	12.0	11.9	11.0	
	D7-05-3	3	29° 58.703'	-90° 1.313'	8/6/2007	0.0	-34.0	-24.0	-10.0	11.0	0.0	0.0	Inverted catcher. No recovery. Possible sandblasting material
	D7-05-3	4	29° 58.703'	-90° 1.313'	8/7/2007	0.8	-34.0	-26.9	-7.1	11.0	7.2	7.2	Inverted cutter head
	D7-05-3	5	29° 58.703'	-90° 1.313'	8/7/2007	0.8	-34.0	-26.3	-7.7	11.5	11.3	9.3	
	D7-05-3	6	29° 58.703'	-90° 1.313'	8/7/2007	0.6	-34.0	-26.8	-7.2	11.0	8.8	8.4	
	D7-05-3	7	29° 58.703'	-90° 1.313'	8/7/2007	0.5	-34.0	-26.3	-7.7	11.0	7.9	7.9	
	D7-05-3	8	29° 58.703'	-90° 1.313'	8/7/2007	0.4	-34.0	-26.4	-7.6	11.5	11.0	8.4	
	D7-05-3	9	29° 58.703'	-90° 1.313'	8/7/2007	0.3	-34.0	-25.6	-8.4	11.0	10.5	9.0	
	D7-05-3	10	29° 58.703'	-90° 1.313'	8/7/2007	0.1	-34.0	-25.5	-8.5	9.0	8.7	8.7	
	D7-05-3	11	29° 58.703'	-90° 1.313'	8/7/2007	0.0	-34.0	-25.4	-8.6	9.0	8.0	8.0	
	D7-05-3	12	29° 58.703'	-90° 1.313'	8/7/2007	-0.1	-34.0	-24.9	-9.1	0.5	0.5	0.5	BOXCORE
	D7-05-3	13	29° 58.703'	-90° 1.313'	8/7/2007	0.0	-34.0	-24.0	-10.0	1.5	1.5	1.5	BOXCORE
	D7-05-3	14	29° 58.703'	-90° 1.313'	8/7/2007	0.0	-34.0	-25.0	-9.0	1.5	1.5	1.5	BOXCORE
	D7-05-3	15	29° 58.703'	-90° 1.313'	8/7/2007	0.0	-34.0	-24.0	-10.0	1.0	1.0	1.0	
	D7-05-3	16	29° 58.7'	-90° 1.312'	8/8/2007	0.9	-34.0	-21.1	-12.9	1.0	1.0	1.0	BOXCORE
	D7-05-3	17	29° 58.7'	-90° 1.312'	8/8/2007	0.9	-34.0	-21.1	-12.9	1.5	1.5	1.5	BOXCORE
	D7-05-4	1	29° 58.755'	-90° 1.294'	8/2/2007	0.7	-34.0	-25.7	-8.3	12.0	8.9	8.9	
	D7-05-4	2	29° 58.755'	-90° 1.294'	8/2/2007	0.7	-34.0	-25.7	-8.3	12.0	9.0	9.0	
	D7-05-4	3	29° 58.755'	-90° 1.294'	8/2/2007	0.7	-34.0	-25.7	-8.3	11.0	0.0	0.0	Lost sample upon recovery.
	D7-05-4	4	29° 58.755'	-90° 1.294'	8/2/2007	0.6	-34.0	-26.1	-7.9	11.5	11.5	11.5	
	D7-05-4	5	29° 58.755'	-90° 1.294'	8/2/2007	0.6	-34.0	-25.5	-8.5	10.0	8.9	8.9	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D7-05-4	6	29° 58.755'	-90° 1.294'	8/3/2007	0.4	-34.0	-25.9	-8.1	12.0	12.0	9.0	
	D7-05-4	7	29° 58.755'	-90° 1.294'	8/3/2007	0.4	-34.0	-25.1	-8.9	10.0	7.8	7.8	Metal or other debris at 34' MLG
	D7-05-4	8	29° 58.755'	-90° 1.294'	8/3/2007	0.4	-34.0	-25.9	-8.1	10.0	8.0	8.0	
	D7-05-4	9	29° 58.755'	-90° 1.294'	8/3/2007	0.6	-34.0	-26.3	-7.7	10.0	8.0	8.0	
	D7-05-4	10	29° 58.755'	-90° 1.294'	8/3/2007	0.7	-34.0	-24.7	-9.3	12.0	10.7	10.7	
	D7-05-4	11	29° 58.755'	-90° 1.294'	8/8/2007	1.3	-34.0	-17.2	-16.8	7.5	7.2	7.2	
	D7-05-4	12	29° 58.755'	-90° 1.294'	8/8/2007	1.3	-34.0	-17.2	-16.8	9.0	7.0	7.0	Refusal at 9ft
	D7-05-4	13	29° 58.755'	-90° 1.294'	8/8/2007	1.2	-34.0	-26.7	-7.3	3.0	3.0	3.0	
	D7-05-4	14	29° 58.755'	-90° 1.294'	8/8/2007	1.2	-34.0	-26.7	-7.3	7.5	6.8	6.8	
	D7-05-4	15	29° 58.755'	-90° 1.294'	8/8/2007	1.1	-34.0	-16.9	-17.1	7.5	7.0	7.0	Refusal a 7 ft
	D7-05-4	16	29° 58.755'	-90° 1.294'	8/8/2007	1.1	-34.0	-16.9	-17.1	9.0	9.0	9.0	Refusal a 9 ft
	D7-05-4	17	29° 58.755'	-90° 1.294'	8/16/2007	0.6	-34.0	-25.1	-8.9	10.5	8.5	8.5	
	D7-05-4	18	29° 58.755'	-90° 1.294'	8/16/2007	0.6	-34.0	-25.1	-8.9	10.5	7.0	7.0	
	D7-05-4	19	29° 58.755'	-90° 1.294'	8/16/2007	0.6	-34.0	-25.1	-8.9	10.5	7.0	7.0	
DMMU 7 Land	D7-05-5	1	29° 58.498'	-90° 1.326'	8/2/2007	0.0	-25.0	4.0	-29.0	30.0	30.0	29.0	
	D7-05-5	2	29° 58.498'	-90° 1.326'	8/2/2007	0.0	-25.0	4.0	-29.0	16.0	16.0	14.0	
	D7-05-5	3	29° 58.498'	-90° 1.326'	8/10/2007	0.0	-25.0	4.0	-29.0	14.0	13.5	13.5	
	D7-05-6	1	29° 58.591'	-90° 1.283'	8/3/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	29.0	
	D7-05-6	2	29° 58.591'	-90° 1.283'	8/3/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	29.0	
	D7-05-6	3	29° 58.591'	-90° 1.283'	8/10/2007	0.0	-25.0	5.0	-30.0	14.0	13.5	13.5	
	D7-05-7	1	29° 58.634'	-90° 1.27'	8/3/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	30.0	
	D7-05-7	2	29° 58.634'	-90° 1.27'	8/3/2007	0.0	-25.0	5.0	-30.0	30.0	30.0	30.0	
	D7-05-7	3	29° 58.634'	-90° 1.27'	8/10/2007	0.0	-25.0	5.0	-30.0	13.0	13.0	13.0	
	D7-05-8	1	29° 58.693'	-90° 1.262'	8/6/2007	0.0	-25.0	4.0	-29.0	30.0	30.0	30.0	
	D7-05-8	2	29° 58.693'	-90° 1.262'	8/6/2007	0.0	-25.0	4.0	-29.0	16.0	16.0	13.8	
	D7-05-8	3	29° 58.693'	-90° 1.262'	8/10/2007	0.0	-25.0	4.0	-29.0	14.0	13.5	13.5	
	D7-05-9	1	29° 58.743'	-90° 1.24'	8/6/2007	0.0	-25.0	4.0	-29.0	30.0	30.0	30.0	
	D7-05-9	2	29° 58.743'	-90° 1.24'	8/6/2007	0.0	-25.0	4.0	-29.0	16.0	14.5	13.5	
	D7-05-9	3	29° 58.743'	-90° 1.24'	8/10/2007	0.0	-25.0	4.0	-29.0	14.0	14.0	11.0	
DMMU 8 Water	D8-05-1	1	29° 58.129'	-90° 1.568'	7/12/2007	1.3	-40.0	-23.3	-16.7	20.0	16.0	16.0	
	D8-05-1	2	29° 58.129'	-90° 1.568'	7/12/2007	1.1	-40.0	-23.1	-16.9	20.0	16.5	16.5	
	D8-05-1	3	29° 58.129'	-90° 1.568'	7/12/2007	0.8	-40.0	-22.8	-17.2	11.0	11.0	11.0	Refusal at 11 ft due to hard debris
	D8-05-1	4	29° 58.129'	-90° 1.568'	7/12/2007	0.8	-40.0	-22.8	-17.2	20.0	18.0	18.0	
	D8-05-1	5	29° 58.129'	-90° 1.568'	7/12/2007	0.7	-40.0	-22.7	-17.3	20.0	17.5	17.5	
	D8-05-2	1	29° 58.233'	-90° 1.539'	7/12/2007	0.5	-40.0	-25.0	-15.0	10.0	9.0	9.0	Refusal at 10 ft due to rocks or other debris
	D8-05-2	2	29° 58.233'	-90° 1.539'	7/13/2007	1.4	-40.0	-26.4	-13.6	16.5	11.5	11.5	Site moved slightly due to refusal on attempt 1
	D8-05-2	3	29° 58.233'	-90° 1.539'	7/13/2007	1.3	-40.0	-26.3	-13.7	17.0	12.0	12.0	Natural gas pocket hit during coring
	D8-05-2	4	29° 58.233'	-90° 1.539'	7/13/2007	1.3	-40.0	-26.3	-13.7	17.0	13.0	13.0	
	D8-05-2	5	29° 58.233'	-90° 1.539'	7/13/2007	1.3	-40.0	-26.3	-13.7	17.0	13.5	13.5	Natural gas pocket hit during coring
	D8-05-3	1	29° 58.127'	-90° 1.552'	7/13/2007	0.7	-40.0	-34.2	-5.8	8.0	7.5	7.5	
	D8-05-3	2	29° 58.127'	-90° 1.552'	7/13/2007	0.7	-40.0	-34.2	-5.8	8.0	6.0	6.0	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D8-05-3	3	29° 58.127'	-90° 1.552'	7/13/2007	0.6	-40.0	-33.9	-6.1	8.0	7.0	7.0	
	D8-05-3	4	29° 58.127'	-90° 1.552'	7/13/2007	0.5	-40.0	-33.7	-6.3	8.0	7.0	7.0	
	D8-05-3	5	29° 58.127'	-90° 1.552'	7/13/2007	0.5	-40.0	-33.7	-6.3	7.5	5.5	5.5	
	D8-05-4	1	29° 58.227'	-90° 1.522'	7/11/2007	0.1	-40.0	-31.1	-8.9	9.5	8.5	9.0	
	D8-05-4	2	29° 58.227'	-90° 1.522'	7/11/2007	0.0	-40.0	-31.0	-9.0	11.0	10.0	9.0	
	D8-05-4	3	29° 58.227'	-90° 1.522'	7/11/2007	-0.1	-40.0	-30.9	-9.1	10.0	9.0	9.0	
	D8-05-4	4	29° 58.227'	-90° 1.522'	7/11/2007	-0.1	-40.0	-30.9	-9.1	10.0	9.0	9.0	
DMMU 9 Water	D9-05-1	1	29° 57.815'	-90° 1.674'	9/8/2007	1.3	-40.0	-14.0	-26.0	10.0	6.7	6.7	Refusal at 10 ft due to pier piling other debris
	D9-05-1	2	29° 57.815'	-90° 1.674'	9/8/2007	1.3	-40.0	-10.6	-29.4	20.0	15.0	15.0	Refusal at 20 feet due to potential debris in area.
	D9-05-1	3	29° 57.815'	-90° 1.674'	9/8/2007	1.2	-40.0	-10.4	-29.6	10.0	7.2	7.2	Sampled same location - little recovery. Location moved slightly.
	D9-05-1	4	29° 57.815'	-90° 1.674'	9/8/2007	0.0	-40.0	-9.4	-30.6	21.0	18.4	18.4	Refusal at 21 feet.
	D9-05-1	5	29° 57.815'	-90° 1.674'	9/8/2007	0.0	-40.0	-9.5	-30.5	25.0	13.6	13.6	Lost material upon recovery.
	D9-05-1	6	29° 57.815'	-90° 1.674'	9/8/2007	0.0	-40.0	-9.5	-30.5	21.0	18.5	18.5	Refusal at 21 ft due to debris in area.
	D9-05-1	7	29° 57.815'	-90° 1.674'	9/8/2007	0.0	-40.0	-9.5	-30.5	20.0	15.0	15.0	Refusal at 20 feet due to debris.
	D9-05-1	8	29° 57.815'	-90° 1.674'	9/8/2007	0.0	-40.0	-9.5	-30.5	20.0	9.8	9.8	Refusal at 20 ft - Location moved slightly.
	D9-05-1	9	29° 57.815'	-90° 1.676'	9/8/2007	0.0	-40.0	-9.4	-30.6	20.0	15.0	15.0	Refusal at 20 ft
	D9-05-1	10	29° 57.795'	-90° 1.679'	9/10/2007	0.0	-40.0	-9.5	-30.5	23.0	17.2	17.2	Refusal at 23 ft due to wood debris in area.
	D9-05-1	11	29° 57.795'	-90° 1.679'	9/10/2007	0.0	-40.0	-9.5	-30.5	22.0	16.2	16.2	Refusal at 22 ft due to wood debris in area.
	D9-05-1	12	29° 57.795'	-90° 1.679'	9/10/2007	0.0	-40.0	-9.5	-30.5	24.0	9.5	9.5	Refusal at 24 ft due to wood debris in area. Lost material upon recovery.
	D9-05-1	13	29° 57.815'	-90° 1.674'	9/10/2007	0.0	-40.0	-9.5	-30.5	14.0	8.4	8.4	Refusal at 14 ft due to pier piling or other debris. Location moved slightly.
	D9-05-1	14	29° 57.805'	-90° 1.675'	9/10/2007	0.0	-40.0	-10.0	-30.0	14.0	8.0	8.0	Refusal at 14 ft due to pier piling or other debris.
	D9-05-1	15	29° 57.807'	-90° 1.674'	9/10/2007	0.0	-40.0	-10.0	-30.0	15.0	8.5	8.5	Refusal due to pier piling.
	D9-05-1	16	29° 57.81'	-90° 1.672'	9/10/2007	0.0	-40.0	-9.5	-30.5	14.0	9.9	9.9	Refusal at 15 feet due to pier debris.
	D9-05-2	1	29° 58.036'	-90° 1.607'	8/30/2007	0.8	-40.0	-13.8	-26.2	30.0	29.6	27.8	
	D9-05-2	2	29° 58.036'	-90° 1.607'	9/5/2007	0.0	-40.0	-13.0	-27.0	30.2	30.2	27.0	
	D9-05-2	3	29° 58.036'	-90° 1.607'	9/6/2007	0.8	-40.0	-14.8	-25.2	16.0	11.0	11.0	
	D9-05-2	4	29° 58.036'	-90° 1.607'	9/6/2007	0.2	-40.0	-14.4	-25.6	18.0	17.0	16.0	
	D9-05-2	5	29° 58.036'	-90° 1.607'	9/7/2007	1.3	-40.0	-15.7	-24.3	23.0	21.0	20.5	Refusal at 23ft
	D9-05-2	6	29° 58.036'	-90° 1.607'	9/7/2007	1.2	-40.0	-15.7	-24.3	24.0	20.6	20.6	Refusal at 24ft
	D9-05-2	7	29° 58.036'	-90° 1.607'	9/7/2007	0.7	-40.0	-14.7	-25.3	22.0	10.6	10.6	Refusal at 22 ft
	D9-05-2	8	29° 58.036'	-90° 1.607'	9/7/2007	0.4	-40.0	-14.1	-25.9	21.0	18.3	18.3	Refusal at 21 ft
	D9-05-4	1	29° 58.032'	-90° 1.587'	9/5/2007	0.9	-40.0	-35.4	-4.6	8.5	7.4	6.4	
	D9-05-4	2	29° 58.032'	-90° 1.587'	9/5/2007	0.8	-40.0	-35.2	-4.8	7.5	7.4	6.4	
	D9-05-4	3	29° 58.032'	-90° 1.587'	9/5/2007	0.7	-40.0	-35.0	-5.0	8.5	8.0	6.4	
	D9-05-4	4	29° 58.032'	-90° 1.587'	9/5/2007	0.6	-40.0	-34.8	-5.2	8.5	8.4	6.4	
	D9-05-4	5	29° 58.032'	-90° 1.587'	9/5/2007	0.6	-40.0	-34.8	-5.2	8.0	0.0	0.0	Lost sample upon recovery
	D9-05-4	6	29° 58.032'	-90° 1.587'	9/5/2007	0.5	-40.0	-34.6	-5.4	5.0	4.8	4.8	Refusal at 5 feet due to wood debris.
	D9-05-4	7	29° 58.032'	-90° 1.587'	9/5/2007	0.4	-40.0	-34.4	-5.6	8.0	8.0	6.4	
	D9-05-4	8	29° 58.032'	-90° 1.587'	9/5/2007	0.2	-40.0	-34.0	-6.0	8.0	7.8	6.4	
	D9-05-4	9	29° 58.032'	-90° 1.587'	9/5/2007	0.2	-40.0	-34.0	-6.0	9.0	8.8	6.4	
	D9-05-4	10	29° 58.032'	-90° 1.587'	9/5/2007	0.2	-40.0	-34.0	-6.0	8.0	8.0	6.4	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
DMMU 10 Water	D10-05-1	1	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	8.5	6.0	6.0	
	D10-05-1	2	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	9.5	5.8	5.8	
	D10-05-1	3	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	11.0	8.5	8.0	Entire core is composed of non-native sediment per Rodney Mach (CEMVN), no native material
	D10-05-1	4	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	11.0	6.2	6.2	Entire core is composed of non-native sediment per Rodney Mach (CEMVN), no native material
	D10-05-1	5	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	11.0	7.5	7.5	
	D10-05-1	6	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	10.5	8.0	8.0	
	D10-05-1	7	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	11.0	8.0	8.0	
	D10-05-1	8	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	10.0	7.4	7.4	
	D10-05-1	9	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	10.5	6.7	6.7	
	D10-05-1	10	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	10.0	6.2	6.2	
	D10-05-1	11	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	11.5	7.7	7.7	
	D10-05-1	12	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	11.0	6.9	6.9	
	D10-05-1	13	29° 57.798'	-90° 1.64'	8/9/2007	0.0	-15.0	-7.0	-8.0	11.0	7.8	7.8	
	D10-05-1	14	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.0	6.6	6.6	
	D10-05-1	15	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.5	8.0	8.0	
	D10-05-1	16	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.0	7.6	7.6	
	D10-05-1	17	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.0	-8.0	11.5	7.9	7.9	
	D10-05-1	18	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.5	7.8	7.8	
	D10-05-1	19	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.5	7.7	7.7	
	D10-05-1	20	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.5	8.2	8.2	
	D10-05-1	21	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.0	-8.0	11.5	6.9	6.9	
	D10-05-1	22	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.5	7.3	7.3	
	D10-05-1	23	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.0	6.7	6.7	
	D10-05-1	24	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-7.5	-7.5	11.0	6.2	6.2	
	D10-05-1	25	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-10.8	-4.2	11.0	7.3	5.0	
	D10-05-1	26	29° 57.798'	-90° 1.64'	8/10/2007	0.0	-15.0	-10.8	-4.2	5.0	3.6	3.6	
	D10-05-1	27	29° 57.798'	-90° 1.64'	8/15/2007	0.6	-15.0	-8.6	-6.4	8.0	5.5	5.5	
	D10-05-1	28	29° 57.798'	-90° 1.64'	8/15/2007	0.6	-15.0	-8.6	-6.4	8.0	4.9	4.9	
	D10-05-1	29	29° 57.798'	-90° 1.64'	8/15/2007	0.7	-15.0	-8.2	-6.8	8.0	7.8	7.5	
	D10-05-1	30	29° 57.798'	-90° 1.64'	8/15/2007	0.7	-15.0	-8.2	-6.8	9.0	5.0	5.0	
	D10-05-1	31	29° 57.798'	-90° 1.64'	8/15/2007	0.6	-15.0	-8.6	-6.4	8.0	5.5	5.0	
	D10-05-1	32	29° 57.798'	-90° 1.64'	8/15/2007	0.7	-15.0	-8.2	-6.8	8.0	7.3	7.3	
	D10-05-1	33	29° 57.798'	-90° 1.64'	8/15/2007	0.7	-15.0	-8.2	-6.8	8.0	7.7	7.7	
	D10-05-1	34	29° 57.798'	-90° 1.64'	8/15/2007	0.8	-15.0	-8.4	-6.6	9.0	8.8	8.2	
	D10-05-1	35	29° 57.798'	-90° 1.64'	8/15/2007	0.0	-15.0	-7.5	-7.5	9.0	8.9	7.5	
DMMU 10 Land	D10-05-3	1	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	24.0	23.0	23.0	
	D10-05-3	2	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	24.0	23.5	23.5	
	D10-05-3	3	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	24.0	23.0	23.0	
	D10-05-3	4	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	24.0	20.7	20.7	
	D10-05-3	5	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	24.0	20.2	20.2	
	D10-05-3	6	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	12.0	8.2	8.2	

Dredged Material Management Unit	Station ID	Attempt	Latitude	Longitude	Date	Tide (ft)	Project Depth (ft)	Actual Water Depth (ft MLG)	Target Core Length (ft)	Penetration (ft)	Final Core Length (ft)	Core Length Submitted for Analysis (ft)	Comments
	D10-05-3	7	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	12.0	9.0	9.0	
	D10-05-3	8	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	12.0	10.4	10.4	
	D10-05-3	9	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	12.0	7.9	7.9	
	D10-05-3	10	29° 57.867'	-90° 1.612'	8/7/2007	-9.0	-15.0	9.0	-24.0	12.0	8.0	8.0	
	D10-05-4	1	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	23.0	21.9	21.9	
	D10-05-4	2	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	23.0	19.0	19.0	
	D10-05-4	3	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	23.0	20.0	20.0	
	D10-05-4	4	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	23.0	20.2	20.2	
	D10-05-4	5	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	23.0	21.0	21.0	
	D10-05-4	6	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	23.0	20.0	20.0	
	D10-05-4	7	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	12.0	10.5	10.5	
	D10-05-4	8	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	12.0	9.5	9.5	
	D10-05-4	9	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	12.0	10.0	10.0	
	D10-05-4	10	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	12.0	11.0	11.0	
	D10-05-4	11	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	12.0	9.5	9.5	
	D10-05-4	12	29° 57.945'	-90° 1.583'	8/8/2007	0.0	-15.0	8.0	-23.0	12.0	10.5	10.5	
Reference	Miss River - A	1	29° 55.285'	-90° 8.333'	7/23/2007	0.0	NA	-89.0	NA	NA	NA	1.0	
	Miss River - A	2	29° 55.285'	-90° 8.333'	7/23/2007	0.0	NA	-89.0	NA	NA	NA	0.0	No recovery
	Miss River - B	1	29° 55.284'	-90° 8.144'	7/23/2007	0.0	NA	-38.0	NA	NA	NA	1.0	
	Miss River - B	2	29° 55.284'	-90° 8.144'	7/23/2007	0.0	NA	-38.0	NA	NA	NA	1.0	
	Miss River - A	1	29° 55.285'	-90° 8.333'	7/25/2007	0.0	NA	-89.0	NA	NA	NA	1.0	
	Mitigation Site	1	29° 59.050'	-90° 00.123'	7/25/2007	0.0	NA	-4.0	NA	NA	NA	1.0	
	Marine/SB	1	29° 59.232'	-89° 55.973'	7/24/2007	0.0	NA	-3.0	NA	NA	NA	1.0	
	Marine/SB	2	29° 59.232'	-89° 55.973'	7/25/2007	0.0	NA	-3.0	NA	NA	NA	1.0	
	Bayou La Loutre	1	29° 49.456'	-89° 35.349'	7/24/2007	0.0	NA	10.0	NA	NA	NA	1.0	
	Bayou La Loutre	2	29° 49.456'	-89° 35.349'	7/25/2007	0.0	NA	10.0	NA	NA	NA	1.0	

3.3 Water Sampling Locations and Volumes

Site water samples were collected from each DMMU within the IHNC canal, with the exception of DMMU 11, which was eliminated from the project for reasons discussed previously. In DMMU 9, site water characterizing the freshwater influence of the Mississippi River was collected from Station D9-05-1 instead of D9-05-3 as originally specified in the SOW (D9-05-3 was eliminated from the project). Since station D10-05-2 was not sampled for sediments due to rip-rap in the area, site water was similarly not collected there, and was instead collected from D10-05-1. In the Mississippi River Reference area, one of the site water samples was collected from the target locations. However, due to extreme depths, high current velocities, and heavy ship traffic, the second station location was moved to an area that was more conducive to sampling, and the third sampling location was eliminated. The field coordinates and water volume collected at each DMMU and reference site are shown in Table 21.

Table 21. Field Coordinates and Water Volumes Collected From Each Site for Subsequent Analysis

DMMU-Site#	Linking Sample IDs	Latitude (NAD83)	Longitude (NAD83)	Date	Time	Source	Attempt	Water Depth (ft MLG)	Target Sample Depth (ft MLG)	Volume Collected (L)	Comments
D1-05-3	01000000WOWAWC	29° 59.017'	-90° 01.261'	7/12/2007	10:30	W	1	-34	-40	240	D1 site water. 12 cubitainers
D1-05-3	01000000WOWAWC	29° 59.017'	-90° 01.261'	7/30/2007	9:30	W	2	-34	-40	60	D1 site water. 3 cubitainers
D2-05-2	02000000WOWAWC	29° 58.636'	-90° 01.387'	7/16/2007	11:00	W	1	-32	-40	80	D2 site water. 4 cubitainers
D2-05-2	02000000WOWAWC	29° 58.636'	-90° 01.387'	7/30/2007	9:10	W	2	-32	-40	60	D2 site water. 3 cubitainers.
D3-05-5	03000000WOWAWC	29° 58.443'	-90° 01.463'	7/21/2007	10:30	W	1	-25	-45	300	D3 site water. 15 cubitainers.
D3-05-5	03000000WOWAWC	29° 58.443'	-90° 01.463'	7/30/2007	10:30	W	2	-25	-45	220	D3 site water. 11 cubitainers.
D4-05-2	04000000WOWAWC	29° 58.366'	-90° 01.458'	7/23/2007	15:30	W	1	-29	-45	560	D4 site water. 28 cubitainers
D5-05-2	05000000WOWAWC	29° 58.485'	-90° 01.427'	8/27/2007	11:30	W	1	-30	-45	560	D5 site water. 28 cubitainers
D6-05-1	06000000WOWAWC	29° 58.229'	-90° 01.456'	7/31/2007	14:50	W	1	-15	-34	180	D6 site water. 9 cubitainers.
D6-05-1	06000000WOWAWC	29° 58.229'	-90° 01.456'	8/1/2007	14:30	W	2	-15	-34	360	D6 site water. 18 cubitainers
D6-05-1	06000000WOWAWC	29° 58.229'	-90° 01.456'	8/4/2007	15:00	W	3	-15	-34	320	D6 site water. 16 cubitainers
D6-05-1	06000000WOWAWC	29° 58.229'	-90° 01.456'	8/6/2007	16:45	W	4	-15	-34	320	D6 site water. 16 cubitainers.
D7-05-1	07000000WOWAWC	29° 58.611'	-90° 01.341'	8/8/2007	12:15	W	1	-5	-34	320	D7 site water. 16 cubitainers
D7-05-1	07000000WOWAWC	29° 58.611'	-90° 01.341'	8/14/2007	13:30	W	2	-5	-34	680	D7 site water. 34 cubitainers
D8-05-3	08000000WOWAWC	29° 58.127'	-90° 01.552'	7/14/2007	16:30	W	1	-34	-40	80	D8 site water. 4 cubitainers.
D8-05-3	08000000WOWAWC	29° 58.127'	-90° 01.552'	7/30/2007	10:00	W	2	-34	-40	80	D8 site water. 4 cubitainers.
D9-05-1	09000001WOWAWC	29° 57.816'	-90° 01.681'	9/8/2007	11:30	W	1	-9	-40	160	D9 site water. 8 cubitainers
D9-05-2	09000002WOWAWC	29° 58.036'	-90° 01.607'	9/8/2007	10:30	W	2	-9	-40	160	D9 site water. 8 cubitainers
D10-05-1	10000001WOWAWC	29° 57.789'	-90° 01.639'	8/10/2007	13:30	W	1	-7	-15	340	D10 site water. 17 cubitainers
DMT-05-0	MT000000WOWAWC	29° 59.050'	-90° 00.123'	7/25/2007	14:00	W	1	0	0	300	MT site water. 15 cubitainers
DBB-05-0	BB000000WOWAWC	29° 59.216'	-89° 59.874'	7/23/2007	11:00	W	1	0	0	300	Bayou Bien. site water. 15 cubitainers
DMR-05-0	MR000000WOWAWC	29° 57.382'	-90° 01.728'	7/24/2007	14:30	W	1	0	0	300	Miss River site water 15 cubitainers

3.4 Physical Analyses

General physical characteristics of material from IHNC are presented in Tables A-1 to A-3 of Appendix A as measurements of Atterberg limits, grainsize, specific gravity, and black carbon. Laboratory analytical reports are provided in Appendix H.

3.5 Asbestos Results

Asbestos fibers were only observed in six of the 125 sediment samples. These included samples from DMMU 4 Site 5, DMMU 5 Composite 1 – 8, DMMU 5 Site 4, DMMU 5 Site 6, DMMU 7 Site 2, and DMMU 7 Composite 1 – 4. Only two types of asbestos fibers were observed. Amosite fibers were observed in samples from DMMU 5 Composite 1 – 8, DMMU 7 Site 2, and DMMU 7 Composite 1 – 4. Chrysotile fibers were observed in samples from DMMU 4 Site 5, DMMU 5 Composite 1 – 8, DMMU 5 Site 4, DMMU 5 Site 6, DMMU 7 Site 2, and DMMU 7 Composite 1 – 4. None of the observations of asbestos fibers in sediment samples were above the detection limit (1%).

Raw asbestos data is provided in Tables A-4 to A-5 of Appendix A.

3.6 Column Settling Tests & SETTLE Model Results

Column settling test results were used in the SETTLE model to predict effluent suspended sediment concentrations for given sediment and for alternative CDF configurations. A summary of the results is provided below. Detailed results are presented in Appendix I.

Salinity for samples taken from the lake side of the Lock ranged from 3 to 15.5 ppt (Table 2). Salinity for samples taken from the river side of the Lock ranged from 0.81 to 4.24 ppt. Because significant salinity variation was observed for samples taken from adjacent locations, it was concluded that the variation reflected temporal salinity variations as well as the influence of the Lock operation. The median salinity value, 9 ppt, was used for all estuarine samples for all but the first four column runs, and a conservative value of 0.81 or 0.98 ppt was used for all the freshwater samples, based on comparison to adjacent samples and the measured value at the site.

Table 22. Measured and assumed salinity for column settling testing

DMMU/Sample ID		Measured	Used
		(ppt)	
3	03-00C1-6N-B-N-SS-CS	5.9	9.0
3	03-00C4-6-W-T-SD-CS	14.4	9.0
3	03-00C1-3-L-T-Fl-CS	3.1	9.0
4	04-00C1-8-W-T-SD-CS	15.5	9.0
5	05-00C1-8W-T-SD-CS	14.9	9.0
4/5	4/5-C1-16N-W-N-SD-CS	10.8	9.0
6	06-00C1-6N-B-N-SS-CS	13.2	13.2
6	06-00C3-6-L-T-Fl-CS	13.2	13.2
6	06-00C1-2-W-T-SD-CS	13.2	13.2
7	07-0C1-9N-B-N-SS-CS	7.7	9.0
7	07-00C5-9-L-T-Fl-CS	3.0	9.0
7	07-00C1-4-W-T-SD-CS	12.4	12.4
8	08-00C1-4-W-O-SD-CS	12.6	9.0
9	09-00C2&4-W-O-SD-CS	13.7	9.0
9	09-000001-W-O-SD-CS	0.98	0.98
10	10-0C3-4N-L-N-SD-CS	4.24	0.98
10	10-00C3-4-L-T-Fl-CS	1.85	0.81
10	10-000001-W-T-SD-CS	0.81	0.81

The sample composites provided for the column testing were predominantly fine grained (<75 μm), with a mean percent fines of 80.2%, a maximum of 98.7% and minimum of 24.5% (Table 23). Water content ranged from 28.4 to 131.1%, with a mean of 70.1%. Organic matter ranged from 1.8 to 6.4%, with a mean value of 4.6%. Specific gravity ranged from 2.58 to 2.65, with a mean of 2.60.

Zone settling velocity (ZSV) observed for the column tests ranged from 0.05 to 0.26 ft/hr, with a mean value of 0.1 ft/hr. Plots of ZSV are included in Appendix A for each column. Mean ZSV for freshwater samples was 0.145 ft/hr, while mean ZSV for estuarine samples was 0.121 ft/hr. Mean ZSV observed for native samples was 0.084 ft/hr. These values were consistent with observed column behavior. Column tests were run in groups of four, so differences in material character and settling velocity could readily be observed (Figure 8). Figure 8 also illustrates the slower settling properties and lighter color of the native sediments is evident. This was consistently observed for all native sediment samples.

Table 23. Sample Properties

DMMU/Sample ID		SG	Water Content (%)	Percent Fines (%)	Organic Matter (%)
3	03-00C1-3-L-T-Fl-CS	2.65	28.4	24.5	1.8
3	03-00C4-6-W-T-SD-CS	2.59	131.1	97.3	6.0
3	03-00C1-6N-B-N-SS-CS	2.61	65.8	86.5	4.2
4	04-00C1-8-W-T-SD-CS	2.60	75.5	90.7	5.0
4/5	4/5-C1-16N-W-N-SD-CS	2.63	46.1	59.6	3.1
5	05-00C1-8W-T-SD-CS	2.59	100.5	91.0	5.6
6	06-00C1-2-W-T-SD-CS	2.61	58.3	69.0	4.3
6	06-00C3-6-L-T-Fl-CS	2.61	52.1	79.0	4.6
6	06-00C1-6N-B-N-SS-CS	2.58	75.7	75.0	6.4
7	07-00C1-4-W-T-SD-CS	2.61	93.9	84.0	4.7
7	07-00C5-9-L-T-Fl-CS	2.61	52.2	86.0	4.4
7	07-0C1-9N-B-N-SS-CS	2.58	80.5	85.0	6.2
8	08-00C1-4-W-O-SD-CS	2.58	110.5	98.7	6.4
9	09-000001-W-O-SD-CS	2.60	67.6	95.8	4.8
9	09-00C2&4-W-O-SD-CS	2.61	68.1	92.2	4.6
10	10-000001-W-T-SD-CS	2.62	67.7	93.0	3.7
10	10-00C3-4-L-T-Fl-CS	2.65	36.3	52.0	2.0
10	10-0C3-4N-L-N-SD-CS	2.61	51.6	83.7	4.6

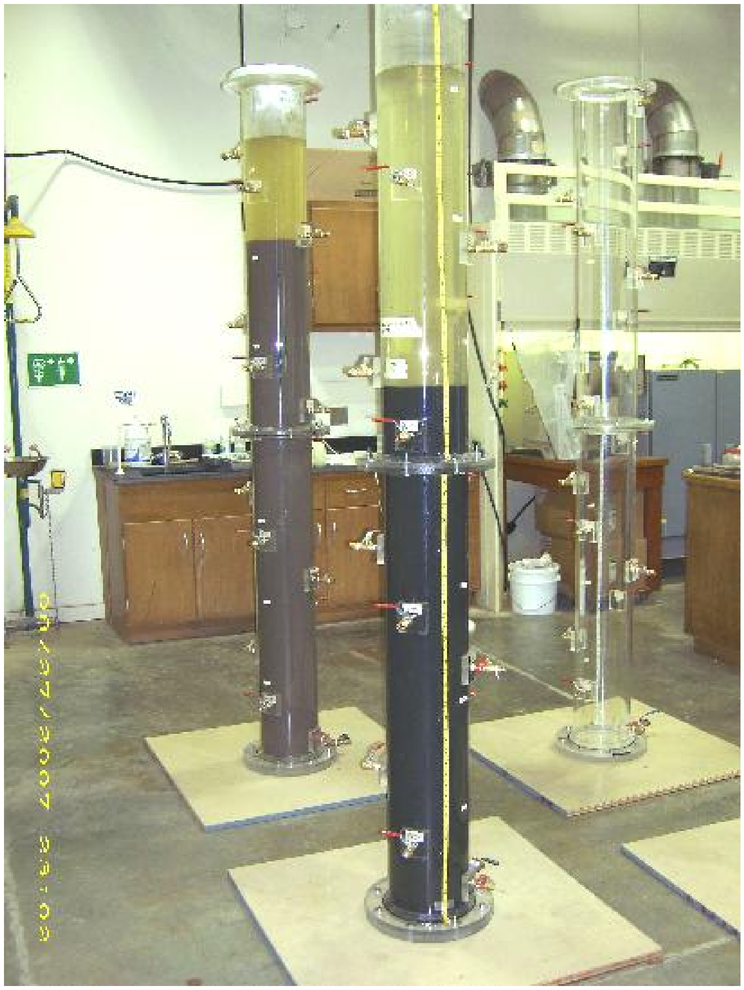

Figure 8. Column Settling Test

3.7 SLRP

SLRP chemistry results are presented in Tables A-6 through A-8 of Appendix A and are discussed by DMMU below, by the type of soil (i.e., non-native sediment, non-native fill, or native subsurface soil) from which elutriates were made, and by the type of SLRP conducted (i.e., Wet or Dry). The list of contaminants of concern evaluated in SLRP samples were determined by ERDC based on the Tier II results which list the contaminants that exceeded the WQC screen. This information from ERDC is provided in Appendix E.

Exceedances of the lowest and highest WQC criteria in the analytical summary tables of Appendix A are shown by yellow and orange highlights, respectively. The most conservative approach was used to evaluate the data. Specifically, even if the data were non-detects (indicated with a U qualifier) but exceeded a WQC, the non-detect result was highlighted yellow or orange in accordance with the WQC exceeded. However, it should be noted that there is a high degree of uncertainty with this approach because it is possible that if the data were evaluated to a lower detection limit that the data would be lower than the WQCs.

3.7.1 DMMU 1

3.7.1.1 SLRP Samples Derived from Non-native Sediment

Non-native SLRP samples analyzed from DMMU 1 includes one (1) composite sample. The composite sample, which includes DMMU 1 Sites 1 through 6, was derived from sediment.

DMMU 1 Sites 1 – 6 Composite Sample

Wet, unoxidized SLRP

At a concentration of 50,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 1, including one (1) inorganic and one (1) PCB. Cyanide was the inorganic constituent exceeding WQC. Total PCBs were detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 1, including one (1) inorganic and one (1) PCB. Cyanide was the inorganic constituent exceeding WQC. Total PCBs were detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 1, including one (1) inorganic and one (1) PCB. Cyanide was the inorganic constituent exceeding WQC. Total PCBs were detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

Dry, oxidized SLRP

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 1, including one (1) inorganic and one (1) metal. Cyanide was the inorganic constituent exceeding WQC. Copper was the metal detected above WQC. Cyanide and copper exceeded the acute WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 1, including one (1) inorganic, one (1) metal, and one (1) PCB. Cyanide was the inorganic constituent exceeding WQC. Copper was the only metal exceeding WQC. Total PCBs were detected above WQC. Cyanide and copper exceeded acute WQC.

At a concentration of 50 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 1, including one (1) metal and one (1) inorganic. Copper was the metal exceeding WQC. Cyanide was the inorganic constituent exceeding WQC. Cyanide was the only contaminant to exceed acute WQC.

3.7.1.2 SLRP Samples Derived from Native Subsurface Soil

There were no native SLRP samples from this DMMU.

3.7.2 DMMU 2

3.7.2.1 SLRP Samples Derived from Non-native Sediment

Non-native SLRP samples analyzed from DMMU 2 includes one (1) composite sample. The composite sample, which includes DMMU 2 Sites 1 through 6, was derived from sediment.

DMMU 2 Sites 1 – 6 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 2. Cyanide was the inorganic exceeding WQC. Copper and mercury were metals exceeding WQC. The only pesticide detected above WQC was gamma chlordane. Cyanide and copper exceeded acute WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 2. Copper was the only contaminant to exceed either acute or chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 2. This included one (1) inorganic, two (2) metals, and one (1) pesticide. Cyanide was the inorganic exceeding WQC. Copper and mercury were the metals exceeding WQC. The only pesticide detected above WQC was heptachlor. Cyanide, copper, and heptachlor exceeded acute WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 2, including one (1) inorganic, two (2) metals and one (1) pesticide. Cyanide was the only inorganic constituent exceeding WQC. Copper and nickel were the metals detected above WQC. The pesticide detected above WQC was heptachlor epoxide. Cyanide, copper, and nickel exceeded acute WQC.

At a concentration of 500 mg/L total suspended solids, a total of five (5) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 2, including one (1) inorganic, one (1) metal, and three (3) pesticides. Cyanide was the only inorganic constituent exceeding WQC. Copper was the metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, dieldrin, and gamma chlordane. Cyanide and copper exceeded acute WQC.

At a concentration of 50 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates within one sample from DMMU 2, including one (1) inorganic, one (1) metal, and one (1) pesticide. Cyanide was the only inorganic constituent exceeding WQC. Copper was the metal detected above WQC. The only pesticide detected above WQC was alpha-chlordane. Cyanide and copper exceeded acute WQC.

SLRP Samples Derived from Native Subsurface Soil
There were no native SLRP samples from this DMMU.

3.7.3 DMMU 3

3.7.3.1 SLRP Samples Derived from Non-native Sediment and/or Fill
Non-native SLRP samples analyzed from DMMU 3 includes two (2) composite samples. One composite sample, which includes DMMU 3 Sites 1 through 3, was derived from fill. One composite sample, which includes DMMU 3 Sites 4 through 6, was derived from sediment.

DMMU 3 Sites 1 – 3 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of seven (7) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 3 in DMMU 3. These contaminants included one (1) inorganic, one (1) metal, one (1) PCB, and four (4) pesticides. Cyanide was the inorganic exceeding acute WQC. Copper was the only metal to exceed either acute or chronic WQC. Total Aroclors exceeded chronic WQC. Pesticides that exceeded chronic WQC included dieldrin, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide.

At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 3 in DMMU 3. This contaminant was the inorganic cyanide, which was above the acute WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 3 in DMMU 3. This contaminant was the inorganic cyanide, which was above the acute WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 3 in DMMU 3. This included one (1) inorganic, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Total Aroclors exceeded chronic WQC. 4,4'-DDT was the only pesticide to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 3 in DMMU 3. This included one (1) inorganic and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. 4,4'-DDT was the only pesticide to exceed chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 3 in DMMU 3. This included one (1) inorganic and two (2) metals. Cyanide was the only inorganic to exceed acute WQC. Copper and nickel were the only metals to exceed chronic WQC.

DMMU 3 Sites 4 – 6 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 4 through 6 in DMMU 3. This included one (1) inorganic and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Heptachlor was the only pesticide to exceed chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 4 through 6 in DMMU 3. This included one (1) inorganic, one (1) metal, and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metals to exceed chronic WQC. Gamma-chlordane was the only pesticide to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 4 through 6 in DMMU 3. This contaminant was the inorganic cyanide, which was above the acute WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of five (5) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 4 through 6 in DMMU 3. This included one (1) inorganic, two (2) metals, and two (2) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC while lead exceeded chronic WQC. The pesticides gamma-chlordane and heptachlor exceeded acute WQC.

At a concentration of 500 mg/L total suspended solids, a total of six (6) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 4 through 6 in DMMU 3. This included one (1) inorganic, three (3) metals, and two (2) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute or chronic WQC while lead and mercury only exceeded chronic WQC. Gamma-chlordane was the only pesticide to exceed acute or chronic WQC while heptachlor exceeded acute WQC.

At a concentration of 50 mg/L total suspended solids, a total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 4 through 6 in DMMU 3. This included one (1) inorganic, three (3) metals, one (1) PCB, and three (3) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute or chronic WQC while lead and nickel exceeded chronic WQC. Total Aroclors exceeded chronic WQC. The pesticide 4,4'-DDT exceeded chronic WQC and the pesticides endrin and heptachlor exceeded acute or chronic WQC.

3.7.3.2 SLRP Samples Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 3 included one (1) composite sample derived with material from Sites 1 through 6.

DMMU 3 Sites 1 – 6 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 3. This included one (1) metal and one (1) pesticide. Copper was the only metal to exceed either acute or chronic WQC. Gamma-chlordane was the only pesticide to exceed chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 3. This included one (1) inorganic and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Gamma-chlordane was the only pesticide to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 3. This contaminant was the pesticide gamma-chlordane which was above the chronic WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 3. This included two (2) metals and two (2) pesticides. Copper was the only metal to exceed acute WQC while mercury exceeded chronic WQC. The pesticides dieldrin and gamma-chlordane exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 3. This included one (1) metal and one (1) pesticide. Copper was the only metal to exceed acute or chronic WQC. Gamma-chlordane was the only pesticide to exceed chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 3. This included one (1) metal and two (2) pesticides. Copper was the only metal to exceed chronic WQC. The pesticides gamma-chlordane and heptachlor exceeded chronic WQC.

3.7.4 DMMU 4

3.7.4.1 SLRP Samples Derived from Non-native Sediment and/or Fill

Non-native SLRP samples analyzed from DMMU 4 includes one (1) composite sample. The composite sample, which includes DMMU 4 Sites 1 through 8, was derived from sediment.

DMMU 4 Sites 1 – 8 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 4. This included one (1) metal and two (2) pesticides. Copper was the only metal to exceed acute or chronic WQC. The pesticides dieldrin and gamma-chlordane exceeded chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 4. This included one (1) metal and two (2) pesticides. Copper was the only metal to exceed acute WQC. The pesticides gamma-chlordane and heptachlor exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 4. This contaminant was the metal copper, which was above the chronic WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above

the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 4. This included one (1) metal and one (1) pesticide. Copper was the only metal to exceed acute WQC. Gamma-chlordane was the only pesticide to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 4. This included one (1) metal and one (1) pesticide. Copper was the only metal to exceed either acute or chronic WQC. Gamma-chlordane was the only pesticide to exceed chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 4. This included one (1) metal and one (1) pesticide. Copper was the only metal to exceed either acute or chronic WQC. Gamma-chlordane was the only pesticide to exceed chronic WQC.

3.7.4.2 SLRP Samples Derived from Native Subsurface Soil
Native subsurface soil samples obtained for DMMU 4 were relegated to DMMU 4/5; therefore, the native SLRP sample results for DMMU 4 can be found in the SLRP samples summary for DMMU 4/5.

3.7.5 DMMU 5

3.7.5.1 SLRP Samples Derived from Non-native Sediment
Non-native SLRP samples analyzed from DMMU 5 includes one (1) composite sample. The composite sample, which includes DMMU 5 Sites 1 through 8 was derived from sediment.

DMMU 5 Sites 1 – 8 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of nine (9) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 5. This included one (1) inorganic, two (2) metals, one (1) PCB, and five (5) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper and mercury were the only metals to exceed chronic WQC. Total Aroclors exceeded chronic WQC. The pesticides alpha-chlordane, dieldrin, gamma-chlordane, heptachlor, and heptachlor epoxide exceeded chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 5. This included one (1) inorganic, two (2) metals, and one (1) PCB. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC while mercury exceeded only chronic WQC. Total Aroclors exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 5. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Mercury was the only metal to exceed chronic WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 5. This contaminant was the inorganic cyanide which was above the acute WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 5. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute.

At a concentration of 50 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 8 in DMMU 5. This included one (1) inorganic, one (1) metal, and one (1) PCB. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC. Total Aroclors exceeded chronic WQC.

3.7.5.2 SLRP Samples Derived from Native Subsurface Soil
Native subsurface soil samples obtained for DMMU 5 were relegated to DMMU 4/5; therefore, the native SLRP sample results for DMMU 5 can be found in the SLRP Samples summary for DMMU 4/5.

3.7.6 DMMU 4/5

3.7.6.1 SLRP Samples Derived from Non-native Sediment or Fill
There were no non-native samples for DMMU 4/5; there are separate non-native samples for DMMUs 4 and 5 as described in sections 3.8.3.4 and 3.8.3.5, respectively.

3.7.6.2 SLRP Samples Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 4/5 includes include one (1) composite sample. This composite sample includes DMMU 4/5 Sites 1 through 16.

DMMU 4/5 Sites 1 - 16 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 16 in DMMU 4/5. This included one (1) metal and one (1) pesticide. Copper was the only metal to exceed acute WQC. 4,4'-DDT was the only pesticide to exceed chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 16 in DMMU 4/5. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 16 in DMMU 4/5. This contaminant was the metal copper which was above the chronic WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 16 in DMMU 4/5. This contaminant was the metal copper which was above either the acute or chronic WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 16 in DMMU 4/5. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of six (6) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 16 in DMMU 4/5. This included one (1) inorganic, one (1) metal, and four (4) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed chronic WQC. The pesticides 4,4'-DDT, alpha-chlordane, dieldrin, and gamma-chlordane exceeded chronic WQC.

3.7.7 DMMU 6

3.7.7.1 SLRP Samples Derived from Non-native Sediment

Non-native SLRP samples analyzed from DMMU 6 includes two (2) composite samples. One composite sample is from DMMU 6 Sites 1 and 2 and was derived from sediment. The other composite sample is from DMMU 6 Sites 3 through 6 and was derived from fill.

DMMU 6 Sites 1 and 2 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 and 2 in DMMU 6. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute.

At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 and 2 in DMMU 6. This included one (1) inorganic, one (1) metal, and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed chronic WQC. 4,4'-DDT was the only pesticide to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 and 2 in DMMU 6. This contaminant was the inorganic cyanide, which was above the acute WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 and 2 in DMMU 6. This contaminant was copper, which was above either the acute or chronic WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 and 2 in DMMU 6. This included one (1) inorganic and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Heptachlor was the only pesticide to exceed chronic WQC.

At a concentration of 50 mg/L total suspended solids, no contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 and 2 in DMMU 6.

DMMU 6 Sites 3 – 6 Composite Sample

Wet, unoxidized SLRP

At a concentration of 50,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 through 6 in DMMU 6. This contaminant was copper, which was above the chronic WQC. No other contaminants were above WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 through 6 in DMMU 6. This contaminant was copper, which was above the chronic WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 through 6 in DMMU 6. This contaminant was the inorganic cyanide, which was above the acute WQC. No other contaminants were above WQC.

Dry, oxidized SLRP

At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 through 6 in DMMU 6. This contaminant was copper, which was above the acute WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 through 6 in DMMU 6. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 through 6 in DMMU 6. This contaminant was copper, which was above the acute WQC. No other contaminants were above WQC.

3.7.7.2 SLRP Samples Derived from Native Subsurface Soil

Native subsurface soil samples analyzed from DMMU 6 includes one (1) composite sample. This composite sample is from DMMU 6 Sites 1 through 6.

DMMU 6 Sites 1 – 6 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 6. This included two (2) metals and one (1) pesticide. Copper was the only metal to exceed either acute or chronic WQC while mercury exceeded only chronic WQC. 4,4'-DDT was the only pesticide to exceed chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 6. This contaminant was copper, which was above the acute WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 6. This contaminant was copper, which was above the acute WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 6. This included one (1) inorganic, one (1) metal, and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC. Alpha-chlordane was the only pesticide to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 6. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC.

At a concentration of 50 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 6 in DMMU 6. This contaminant was the inorganic cyanide, which was above the acute WQC. No other contaminants were above WQC.

3.7.8 DMMU 7

3.7.8.1 SLRP Samples Derived from Non-native Sediment

Non-native SLRP samples analyzed from DMMU 7 includes two (2) composite samples. One composite sample is from DMMU 7 Sites 1 through 4 and was derived from sediment. The other composite sample is from DMMU 7 Sites 5 through 9 and was derived from fill.

DMMU 7 Sites 1 – 4 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of six (6) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 7. This included one (1) inorganic, two (2) metals, one (1) PCB, and two (2) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC while lead exceeded chronic WQC. Total Aroclors exceeded chronic WQC. The pesticides heptachlor and heptachlor epoxide exceeded chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 7. This included one (1) metal, one (1) PCB, and one (1) pesticide. Copper was the only metals to exceed chronic WQC. Total Aroclors exceeded chronic WQC. Heptachlor epoxide was the only pesticide to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 7. This included one (1) inorganic and one (1) PCB. Cyanide was the only inorganic to exceed acute WQC. Total Aroclors exceeded chronic WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 7. This included one (1) inorganic, one (1) metal, and one (1) PCB. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC. Total Aroclors exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 7. This included one (1) metal and one (1) PCB. Copper was the only metal to exceed acute WQC. Total Aroclors exceeded chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 7. This included one (1) metal and one (1) PCB. Copper was the only metal to exceed acute WQC. Total Aroclors exceeded chronic WQC.

DMMU 7 Sites 5 - 9 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 5 through 9 in DMMU 7. This contaminant was the pesticide 4,4'-DDT, which was above chronic WQC. No other contaminants were above WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 5 through 9 in DMMU 7. This included two (2) metals and one (1) PCB. Copper and nickel were the only metals to exceed chronic WQC. Total Aroclors exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 5 through 9 in DMMU 7. This contaminant was total Aroclors, which was above chronic WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 5 through 9 in DMMU 7. This included one (1) metal, one (1) PCB, and two (2) pesticides. Copper was the only metal to exceed acute WQC. Total Aroclors exceeded chronic WQC. The pesticides 4,4'-DDT and dieldrin exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, no contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 5 through 9 in DMMU 7.

At a concentration of 50 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 5 through 9 in DMMU 7. This included one (1) metal and one (1) PCB. Copper was the only metals to exceed chronic WQC. Total Aroclors exceeded chronic WQC.

3.7.8.2 SLRP Samples Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 7 includes one (1) composite sample comprised of DMMU 7 Sites 1 through 9.

DMMU 7 Sites 1 - 9 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 9 in DMMU 7. This included two (2) metals. Copper was the only metal to exceed acute WQC while mercury was the only metal to exceed chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 9 in DMMU 7. This included two (2) metals. Copper was the only metal to exceed acute WQC while mercury was the only metal to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 9 in DMMU 7. This contaminant was mercury, which was above chronic WQC. No other contaminants were above WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 9 in DMMU 7. This contaminant was copper, which was above either acute or chronic WQC. No other contaminants were above WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 9 in DMMU 7. This contaminant was the inorganic cyanide, which was above acute WQC. No other contaminants were above WQC.

At a concentration of 50 mg/L total suspended solids, no contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 9 in DMMU 7.

3.7.9 DMMU 8

3.7.9.1 SLRP Samples Derived from Non-native Sediment
Non-native SLRP samples analyzed from DMMU 8 include (1) composite sample. The composite sample, which includes DMMU 8 Sites 1 through 4, was derived from sediment.

<u>DMMU 8 Sites 1 – 4 Composite Sample</u>

<u>Wet, unoxidized SLRP</u>
At a concentration of 50,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 8. This included one (1) inorganic, one (1) metal and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Mercury was the only metal to exceed chronic WQC. The pesticide heptachlor exceeded chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 8. This included one (1) inorganic and two (2) metals. Cyanide was the only inorganic to exceed acute WQC. Copper and mercury were the only metals to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 8. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Mercury was the only metal to exceed chronic WQC.

<u>Dry, oxidized SLRP</u>
At a concentration of 5,000 mg/L total suspended solids, a total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 8. This included two (2) metals and one (1) pesticide. Copper was the only metal to exceed acute WQC while mercury was the only metal to exceed chronic WQC. The pesticide gamma-chlordane exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 8. This included one (1) inorganic, one (1) metal and two (2) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC. The pesticides gamma-chlordane and heptachlor exceeded chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of five (5) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 1 through 4 in DMMU 8. This included one (1) inorganic, three (3) metals and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper, mercury and nickel were the only metals to exceed chronic WQC. The pesticide gamma-chlordane exceeded chronic WQC.

3.7.9.2 SLRP Samples Derived from Native Subsurface Soil
There were no native SLRP samples from this DMMU.

3.7.10 DMMU 9

3.7.10.1SLRP Samples Derived from Non-native Sediment or Fill
Non-native SLRP samples analyzed from DMMU 9 includes one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 9 Sites 2 and 4, was derived from sediment. The individual sample, DMMU 9 Site 1, was derived from sediment.

DMMU 9 Site 1 Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 9. This included one (1) inorganic, one (1) metal and two (2) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper exceeded the chronic WQC. The pesticides gamma-chlordane and heptachlor exceeded chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 9. This included one (1) inorganic, one (1) metal and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper exceeded the acute WQC. The pesticide gamma-chlordane exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 9. This included one (1) inorganic, one (1) metal and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper exceeded chronic WQC. The pesticides gamma-chlordane exceeded chronic WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of seven (7) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 9. This included one (1) inorganic, one (1) metal and five (5) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metals to exceed either acute or chronic WQC. The pesticides 4,4'-DDT, dieldrin, endrin, and gamma-chlordane exceeded chronic WQC while heptachlor was the only pesticide to exceed acute WQC.

At a concentration of 500 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 9. This included one (1) inorganic, two (2) metals and two (2) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper exceeded either chronic or acute WQC while mercury exceeded only chronic WQC. The pesticides dieldrin and gamma-chlordane exceeded chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 9. This included one (1) inorganic, one (1) metal and two (2) pesticides. Cyanide was the only inorganic to exceed acute WQC. Copper exceeded the chronic WQC. The pesticides gamma-chlordane and heptachlor exceeded chronic WQC.

DMMU 9 Sites 2 and 4 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 2 and 4 in DMMU 9. This included one (1) metal, copper which exceeded acute WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 2 and 4 in DMMU 9. This included one (1) metal and one (1) pesticide. Copper was the only metal to exceed chronic WQC. The pesticide 4,4'-DDT exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 2 and 4 in DMMU 9. This included one (1) metal, copper which exceeded chronic WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 2 and 4 in DMMU 9. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 2 and 4 in DMMU 9. This included one (1) inorganic, cyanide which exceeded acute WQC.

At a concentration of 50 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 2 and 4 in DMMU 9. This included one (1) inorganic, cyanide which exceeded acute WQC.

3.7.10.2SLRP Samples Derived from Native Subsurface Soil
There were no native SLRP samples from this DMMU.

3.7.11 DMMU 10

3.7.11.1SLRP Samples Derived from Non-native Sediment and/or Fill
Non-native SLRP samples analyzed from DMMU 10 includes one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 10 Sites 3 and 4, was derived from fill. The individual sample, DMMU 10 Site 1, was derived from sediment.

DMMU 10 Site 1 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 10. This included one (1) inorganic, cyanide, which exceeded acute WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 10. This included one (1) metal, copper, which exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 10. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Mercury was the only metal to exceed chronic WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 10. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 10. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the sample collected from Site 1 in DMMU 10. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC.

DMMU 10 Site 3 and 4 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, one (1) metal and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC. The pesticide heptachlor exceeded chronic WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed chronic WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, cyanide, which exceeded acute WQC.

3.7.11.2SLRP Samples Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 10 includes one (1) composite sample comprised of DMMU 10 Sites 3 and 4.

DMMU 10 Sites 3 and 4 Composite Sample

Wet, unoxidized SLRP
At a concentration of 50,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC.

At a concentration of 5,000 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, cyanide, which exceeded acute WQC.

Dry, oxidized SLRP
At a concentration of 5,000 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, one (1) metal and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC. The pesticide 4,4'-DDT exceeded chronic WQC.

At a concentration of 500 mg/L total suspended solids, a total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, one (1) metal and one (1) pesticide. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed acute WQC. The pesticide dieldrin, exceeded chronic WQC.

At a concentration of 50 mg/L total suspended solids, a total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the three (3) replicates from the one composite sample generated from Sites 3 and 4 in DMMU 10. This included one (1) inorganic, and one (1) metal. Cyanide was the only inorganic to exceed acute WQC. Copper was the only metal to exceed either acute or chronic WQC.

3.8 Chemical Analyses

3.8.1 Non-native Sediment, Non-native Fill, Native Subsurface Soil

Results of chemical analyses of sediment from ten DMMUs within the IHNC are presented in Tables A-9 to A-12 of Appendix A. In these tables, the data were compared to the SQGs described in the method section above (section 2.4.3.1), because there are no sediment quality standards promulgated by the USEPA or by the State of Louisiana. These benchmarks or guidelines include the following: threshold effects levels [TEL], probable effects levels [PEL], effects-range low [ER-L] and effects-range median [ER-M] benchmarks for those parameters tested. Exceedances of the lowest SQG are highlighted in yellow while exceedances of the highest SQG are highlighted in orange in the tables. The most conservative approach was used to evaluate the data. Specifically, even if the data were non-detects (indicated with a U qualifier) but exceeded a SQG, the non-detect result was highlighted yellow or orange in accordance with the SQG exceeded. However, it should be noted that there is a high degree of uncertainty with this approach because it is possible that if the data were evaluated to a lower detection limit that the data would be lower than the SQGs. Qualifiers in the tables are presented in a key on the first page of Appendix A and are applied to the data following data validation. Raw analytical data reports are presented in Appendix H.

Results of chemical analyses of sediment from ten DMMUs within the IHNC revealed the presence of 17 metals, 29 SVOCs, 18 pesticides, 2 petroleum hydrocarbons, 5 PCBs, 14 VOCs, 3 organotins, 7 herbicides, ammonia, and cyanide.

The concentrations of most metals detected in sediments from the IHNC were within the same order of magnitude as metals detected in the Mississippi River, Bayou LaLoutre and Saint Bernard reference areas. The concentrations of all metals found within native subsurface soil from the IHNC were within the same order of magnitude as those in sediment from the reference site. Metals found to be within the same order of magnitude non-native sediment in the IHNC to those in sediment from the reference areas included aluminum, arsenic, beryllium, cadmium, calcium, chromium, mercury, nickel, silver, selenium, thallium, and tin. Antimony concentrations in non-native sediment from DMMUs 4 and 7 (0.4 – 0.64 mg/kg) were one order of magnitude above the reference material concentrations (0.03 – 0.09 mg/kg). Barium concentrations were consistently higher in the non-native sediment of the IHNC (124 - 2000 mg/kg) but within one to two orders of magnitude of concentrations observed in reference sediments (80.2 – 132 mg/kg). With the exception of non-native material from sites within DMMUs 4 and 5 (21.6 – 308 mg/kg), copper concentrations in the IHNC were similar to and within the same order of magnitude as those in the reference sites (10.9 – 19.4 mg/kg). Lead concentrations were typically higher in the non-native sediment of the IHNC (13 - 589 mg/kg) but within one to two orders of magnitude of the reference material concentrations (9.9 – 14.1 mg/kg). Zinc concentrations in non-native sediment from DMMUs 5 and 7 (414 – 577 mg/kg) were one order of magnitude above the reference material concentrations (37.3 – 53.7 mg/kg); however, higher concentrations were also noted in non-native sediment from DMMU 4 (194 – 284 mg/kg). Hexavalent chromium was not detected in any IHNC DMMUs or in any reference areas.

The concentrations of all metals in the native subsurface soil from the IHNC were within the same order of magnitude as those in sediment from the reference site. The concentrations of most metals detected in non-native sediments from the IHNC were within the same order of magnitude to that of metals detected in the Mitigation Site sediment, with the exception of barium and copper. Barium concentrations were consistently higher in the non-native sediment of the IHNC (124 - 2000 mg/kg) but within one to two orders of magnitude of concentrations observed in the Mitigation Site sediment (191 mg/kg). Copper concentrations in non-native sediment from DMMU 4 Site 5 (308 mg/kg) were elevated above the Mitigation Site concentration (84.2 mg/kg); copper in sediment, fill, and subsurface soil from other DMMUs was within the same order of magnitude as that of the Mitigation Site.

No organotins were detected in native subsurface soil from the IHNC. Organotins were detected in non-native sediment from all DMMUs except 2, 6, and 9, but not in sediment from the reference sites or the Mitigation Site. The only notably elevated concentrations were at DMMU 7 Site 3 (67 mg/kg) and DMMU 4 Site 4 (80 mg/kg) for DBT and TBT, respectively. These concentrations were more than one order of magnitude greater than the reporting limits of the non-detects in sediment samples from the reference sites.

SVOCs were detected in all DMMUs of the IHNC (1.1 – 13,000 μg/kg) and the Mitigation Site (27 – 410 μg/kg), but were found below the detection limit or at extremely low levels (1.9 – 15 μg/kg) in reference site sediments. SVOCs were most prevalent and found at the highest concentrations in the non-native sediment and fill (1.4 – 13,000 μg/kg) as compared to native subsurface soil (1.1 - 1500 μg/kg). Within the SVOCs, the contaminants measured at the highest concentrations and were found to be elevated within four or more DMMUs (i.e., acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene). Total detectable PAHs in non-native sediment (42.4 – 62,920 μg/kg), non-native fill (16.4 – 1624 μg/kg), and native subsurface soil (below detection limit – 3545 μg/kg) were elevated above those in the references (0 – 50.2 μg/kg) by one to four orders of magnitude; however, only the total detectable PAHs in non-native sediment from DMMUs 1,2,3,4,5,7, and 9 and native subsurface soil from DMMU 10 were elevated by one order of magnitude above those in the Mitigation Site (2625 μg/kg). In addition, within non-native sediment from two DMMUs, bis(2-ethylhexyl)phthalate was elevated by up to one order of magnitude (210 – 3400 μg/kg) relative to reference sediment concentrations (below detection limit to 15 μg/kg) and the Mitigation Site sediment concentration (170 μg/kg).

Pesticides were detected in all DMMUs of the IHNC (1.6 - 260 μg/kg) but were found below the detection limit or at extremely low levels (0.13 - 11 μg/kg) in reference site sediments. Only two pesticides were detected in the Mitigation Site sediment samples including endrin (29 μg/kg) and 4,4'-DDE (31 μg/kg), while the only pesticides detected in the reference sites were 4,4'-DDD (0.16 μg/kg), 4,4'-DDE (0.17 - 0.79 μg/kg), delta-BHC (3.4 – 11 μg/kg), endosulfan I (0.13 μg/kg) and endrin (0.89 – 4.9 μg/kg). Pesticides found in at least four DMMUs included aldrin, alpha-chlordane, beta-BHC, 4,4'-DDD, 4,4'-DDE, delta-BHC, dieldrin, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, gamma-chlordane, heptachlor, heptachlor epoxide, lindane, and methoxychlor. The highest concentrations of pesticides were found in non-native sediment from DMMU's 1, 4, 5, and 7. DDD (4,4') was elevated in DMMUs 5 and 7 (37 – 42 μg/kg), alpha chlordane and beta-BHC were elevated in DMMU 7, gamma-chlordane was elevated in DMMU 4 (260 μg/kg), and methoxychlor was elevated in DMMU 1 (41 μg/kg). The pesticide concentrations within non-native sediment from DMMUs 3, 6,7,9, and 10 and native subsurface soil from DMMUs 4/5, 6, and 10 were within the same order of magnitude to those in the reference sites and the Mitigation Site. The pesticide concentrations detected in non-native sediment from DMMUs 1,2,3,4,5,6,7, and 8, and native subsurface soil from DMMUs 3 and 7, were up to two orders of magnitude greater than those in reference sites and the Mitigation Site.

Volatile organic compounds (VOCs) were detected throughout the IHNC (8.8 – 27,000 μg/kg) but were found below the detection limit or at extremely low levels (2.9 - 15 μg/kg) in reference site sediments. Methylene chloride was the only VOC detected in the Mitigation Site sediment sample (15 μg/kg) and reference site sediment samples (2.9 – 7.2 μg/kg). VOCs found in at least four DMMUs included acetone and methylene chloride. The highest concentration of a VOC was for chlorobenzene in non-native sediment from DMMU 2 (27,000 μg/kg). All other VOCs detected in DMMUs were in the same order of magnitude as reporting limits of the non-detects in sediment from the reference sites and Mitigation Site. There were at least four VOCs detected in non-native sediment from DMMUs 2 and 4 and in native sediment from DMMU 4/5. Only one or two VOCs were detected in all other sediment types from all other DMMUs.

Herbicides were detected throµghout the IHNC (2.1 – 2600 µg/kg) but were found below the detection limit or at extremely low levels (0.91 µg/kg) in reference site sediments. No herbicides were detected in the Mitigation Site sediment sample. Only two herbicides demonstrated concentrations that were more than two orders of magnitude above reference site reporting limits for non-detects; the herbicide 2,4-DB was elevated (2000 µg/kg) in non-native sediment from DMMU 7 and MCPP was elevated in native subsurface soil from DMMU 4/5. All other herbicides detected in DMMUs were in the same order of magnitude as reporting limits of the non-detects in sediment from the reference sites and Mitigation Site. No herbicides were detected in non-native sediment from DMMUs 2,3,5,6, and 10, and native subsurface soil from DMMU 3, 6 and 10. The only herbicide found in three or more DMMUs was dichloroprop.

Total petroleum hydrocarbons (i.e., TPH-D and TPH-G from diesel and gas, respectively) were detected throughout the IHNC, the reference site sediments and the Mitigation Site sediment. The range of concentrations of TPH-D (2.3 – 2100 mg/kg) and TPH-G (41 – 59,000 µg/kg) in the IHNC were elevated above TPH-D and TPH-G in the reference site sediment (12 – 110 mg/kg and 60 – 170 µg/kg, respectively) and the Mitigation Site sediment (1300 mg/kg and 560 µg/kg, respectively).

Aroclor PCBs were detected throughout the IHNC, with total detectable PCBs ranging from 1.0 to 2800 µg/kg and were 370 µg/kg in sediment from the Mitigation Site; however, PCBs but were found below the detection limit or at extremely low levels (5.1 µg/kg) in reference site sediments. Only two PCBs demonstrated concentrations that were more than two orders of magnitude above reference site reporting limits for non-detects; Aroclor-1232 was elevated (2300 µg/kg) in non-native sediment from DMMU 7 and total detectable PCBs were elevated in non-native sediment from DMMUs 5 and 7. All other PCBs detected in DMMUs were within the same order of magnitude as reporting limits of the non-detects in sediment from the reference sites and Mitigation Site. No PCBs were detected in non-native fill from DMMUs 3 and 10, and native subsurface soil from DMMU 6 and 10. The only PCBs found in three or more DMMUs were aroclor aroclor-1254 and total detectable PCBs.

Ammonia was detected in all DMMUs of the IHNC having concentrations in project samples (1.5 – 382 mg/kg) similar to those in the reference sites (2.3 – 125 mg/kg) and the Mitigation Site (148 mg/kg). Cyanide concentrations were notably elevated in non-native sediment samples from DMMUs 2,3,4,7, and 9 (2.9 – 22.5 mg/kg) relative to concentrations in the reference areas (0.16 – 1 mg/kg) and the Mitigation Site (2.8 mg/kg).

3.8.2 Water

It should be noted that the water chemistry results presented in Tables A-13 and A-14 of Appendix A are discussed in relation to the lowest WQC (either the USEPA Critical Continuous Concentration [CCC] or the LA chronic value) and the highest WQC (either the USEPA CMC or the LDEQ acute value). Exceedances of the lowest WQC are highlighted in yellow while exceedances of the highest WQC are highlighted in orange in the tables. The most conservative approach was used to evaluate the data. Specifically, even if the data were non-detects (indicated with a U qualifier) but exceeded a WQC, the non-detect result was highlighted yellow or orange in accordance with the WQC exceeded. However, it should be noted that there is a high degree of uncertainty with this approach because it is possible that if the data were evaluated to a lower detection limit that the data would be lower than the WQCs. Qualifiers in the tables are presented in a key on the first page of Appendix A and are those qualifiers applied to the data following data validation. Raw analytical data reports are presented in Appendix H.

3.8.2.1 DMMU 1

One (1) composite ambient water sample was analyzed from DMMU 1. This sample was collected from

DMMU 1, Site 3.

A total of five (5) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 1, including one (1) metal, total PCBs, and three (3) pesticides. The metal detected above WQC was copper. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT, dieldrin, and heptachlor epoxide. <u>None of these exceedances were for acute WQC.</u>

3.8.2.2 DMMU 2

One (1) composite ambient water sample was analyzed from DMMU 2. This sample was collected from DMMU 2, Site 2.

A total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 2, including two (2) metals, and one (1) pesticide. The metals detected above WQC included copper and nickel. The pesticide detected above WQC was 4,4'-DDT. The only exceedance of the acute WQC was nickel.

3.8.2.3 DMMU 3

One (1) composite ambient water sample was analyzed from DMMU 3. This sample was collected from DMMU 3, Site 5.

A total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 3, including two (2) metals, and total PCBs. The metals detected above WQC included copper and nickel. Total PCBs were detected above WQC. The only exceedance of the acute WQC was nickel.

3.8.2.4 DMMU 4

One (1) composite ambient water sample was analyzed from DMMU 4. This sample was collected from DMMU 4, Site 2.

The only contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 4 was heptachlor. <u>This exceedance was not for acute WQC.</u> <u>No other contaminants were detected above WQC.</u>

3.8.2.5 DMMU 5

One (1) composite ambient water sample was analyzed from DMMU 5. This sample was collected from DMMU 5, Site 2.

The only contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 5 was heptachlor. <u>This exceedance was not for acute WQC.</u> <u>No other contaminants were detected above WQC.</u>

3.8.2.6 DMMU 6

One (1) composite ambient water sample was analyzed from DMMU 6. This sample was collected from DMMU 6, Site 1.

Two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 6, including one (1) metal and one (1) pesticide. Copper was the metal detected above WQC and gamma-chlordane was the pesticide detected above WQC. <u>Neither of these exceedances were for acute WQC.</u>

3.8.2.7 DMMU 7

One (1) composite ambient water sample was analyzed from DMMU 7. This sample was collected from DMMU 7, Site 1.

The only contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 7 was copper. This exceedance was not for acute WQC. No other contaminants were detected above WQC.

3.8.2.8 DMMU 8

One (1) composite ambient water sample was analyzed from DMMU 8. This sample was collected from DMMU 8, Site 3.

Two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 8, including one (1) metal and one (1) pesticide. Copper was the metal detected above WQC and 4,4'-DDT was the pesticide detected above WQC. Neither of these exceedances were for acute WQC.

3.8.2.9 DMMU 9 (Freshwater – Station 1 and Saltwater – Station2)

Two (2) composite ambient water samples were analyzed from DMMU 9. Samples included those collected from DMMU 9, Sites 1 and 2.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 9, including one (1) metals, and three (3) pesticides. The metal detected above WQC was mercury. The pesticides detected above WQC included 4,4'-DDT, dieldrin, and heptachlor. None of these exceedances were for acute WQC.

For individual sample DMMU 9 Site 1, a total of four (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 9, including one (1) metal, and one (1) pesticide. The metal detected above WQC was mercury. The pesticides detected above WQC was heptachlor. Neither of these exceedances were for acute WQC.

For individual sample DMMU 9 Site 2, a total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 9, including one (1) metals, and three (3) pesticides. The metal detected above WQC was mercury. The pesticides detected above WQC included 4,4'-DDT, dieldrin, and heptachlor. None of these exceedances were for acute WQC.

3.8.2.10 DMMU 10

One (1) composite ambient water sample was analyzed from DMMU 10. This sample was collected from DMMU 10, Site 1.

No contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in DMMU 10.

3.8.2.11 Bayou Bienvenue Reference

One (1) composite ambient water sample was analyzed from the Bayou Bienvenue Reference Site.

A total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in the Bayou Bienvenue Reference water, including two (2) pesticides. The pesticides detected above WQC included heptachlor and gamma-chlordane. The only exceedance of the acute WQC was heptachlor.

3.8.2.12 Mississippi River Reference

One (1) composite ambient water sample was analyzed from the Mississippi River Reference Site.

The only contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC in the Mississippi Reference Site Water was 4,4'-DDT. <u>This exceedance was not for acute WQC.</u> <u>No other contaminants were detected above WQC.</u>

3.8.2.13 Mitigation Site Reference

One (1) composite ambient water sample was analyzed from the Mitigation Site.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC in the Bayou Bienvenue Reference water, including one (1) inorganic, one (1) metal, and two (2) pesticides. Cyanide was the inorganic detected above WQC and copper was the metal detected above WQC. The pesticides detected above WQC included heptachlor and gamma-chlordane. Cyanide, copper, and heptachlor exceeded acute WQC.

3.8.3 Standard Elutriate

Standard elutriate chemistry results are presented in Tables A-15 and A-16 of Appendix A and are discussed by DMMU below and in terms of the type of soil (i.e., non-native sediment, non-native fill, or native subsurface soil) from which elutriates were made. It should be noted that the elutriate results are discussed in relation to the lowest WQC and the highest WQC. Exceedances of the lowest and highest criteria in the analytical summary tables of Appendix A are shown by yellow and orange highlights, respectively. The most conservative approach was used to evaluate the data. Specifically, even if the data were non-detects (indicated with a U qualifier) but exceeded a WQC, the non-detect result was highlighted yellow or orange in accordance with the WQC exceeded. However, it should be noted that there is a high degree of uncertainty with this approach because it is possible that if the data were evaluated to a lower detection limit that the data would be lower than the WQCs. Raw analytical data reports are presented in Appendix H.

3.8.3.1 DMMU 1

Standard Elutriates Derived from Non-native Sediment
Non-native standard elutriate samples analyzed from DMMU 1 include one (1) composite sample. The composite sample, which includes DMMU 1 Sites 1 through 6, was derived from sediment.

A total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 1, including one (1) metal and one (1) pesticide. Selenium was the only metal constituent detected exceeding WQC. Gamma-chlordane was the only pesticide constituent detected exceeding WQC.

Analysis of the composite non-native sample for DMMU 1 revealed a total of two (2) contaminants which exceeded WQC, including one (1) metal and one (1) pesticide. Selenium was the only metal detected above WQC. Gamma-Chlordane was the only pesticide detected above WQC. <u>None of these exceedances were for acute WQC.</u>

Standard Elutriates Derived from Native Subsurface Soil
There were no native standard elutriate samples from this DMMU.

3.8.3.2 DMMU 2

Standard Elutriates Derived from Non-native Sediment

Non-native standard elutriate samples analyzed from DMMU 2 include one (1) composite sample. The composite sample, which includes DMMU 2 Sites 1 through 6, was derived from sediment.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 2, including one (1) metal, one (1) PCB, and two (2) pesticides. Selenium was the only metal constituent exceeding WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor.

Analysis of the composite non-native sample for DMMU 2 revealed a total of one (1) metal, one (1) PCB, and two (2) pesticides. Selenium was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor. <u>None of these exceedances were for acute WQC.</u>

Standard Elutriates Derived from Native Subsurface Soil
There were no native standard elutriate samples from this DMMU.

3.8.3.3 DMMU 3

Standard Elutriates Derived from Non-native Sediment and/or Fill
Non-native standard elutriate samples analyzed from DMMU 3 include two (2) composite samples. One composite sample, which includes DMMU 3 Sites 1 through 3, was derived from fill. One composite sample, which includes DMMU 3 Sites 4 through 6, was derived from sediment.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 3, including four (4) metals, one (1) PCB, and three (3) pesticides. Metals detected above WQC include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT, gamma-chlordane, and heptachlor.

One (1) metal and one (1) PCB were detected above WQC throughout all of the sampling stations within DMMU 3. Selenium was the only metal detected above WQC. Total PCBs were detected above WQC.

Analysis of the composite non-native sample for DMMU 3 revealed a total of eight (8) contaminants which exceeded WQC, including four (4) metals, one (1) PCB, and three (3) pesticides. Metals detected above WQC in the composite sample include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT, gamma-chlordane, and heptachlor. <u>None of these exceedances were for acute WQC.</u>

For the composite non-native sample for DMMU 3 Sites 1 through 3 revealed a total of five (5) contaminants which exceeded WQC, including two (2) metals, one (1) PCB, and two (2) pesticides. Metals detected above WQC in the composite sample include mercury and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor.

For the composite non-native sample for DMMU 3 Sites 4 through 6 revealed a total of five (5) contaminants which exceeded WQC, including three (3) metals, one (1) PCB, and one (1) pesticides. Metals detected above WQC in the composite sample include cadmium, lead and selenium. Total PCBs were detected above WQC. 4,4'-DDT was the only pesticide detected above WQC.

Standard Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 3 include two (2) composite samples. One includes DMMU3 Sites 1 through 3 and the other includes DMMU 3 Sites 4 through 6.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 3, including two (2) metals, and two (2) pesticides. Metals detected above the WQC include lead and selenium. Pesticides detected above WQC include 4,4'-DDD and 4,4'-DDT.

One (1) metal was detected above WQC throughout all of the sampling stations within DMMU 3. Selenium was the only metal detected above WQC.

Analysis of the composite native samples for DMMU 3 revealed a total of four (4) contaminants which exceeded WQC, including two (2) metals, and two (2) pesticides. Metals detected above WQC in the composite sample include lead and selenium. Pesticides detected above WQC included 4,4'-DDD and 4,4'-DDT.

For the composite native sample for DMMU 3 Sites 1 through 3, a total of four (4) contaminants which exceeded WQC, including two (2) metals, and two (2) pesticides. Metals detected above WQC in the composite sample include lead and selenium. Pesticides detected above WQC included 4,4'-DDD and 4,4'-DDT

For the composite native sample for DMMU 3 Sites 4 through 6, one (1) contaminant exceeded WQC. The metal selenium was the only contaminant detected above WQC.

3.8.3.4 DMMU 4

Standard Elutriates Derived from Non-native Sediment and/or Fill

Non-native standard elutriate samples analyzed from DMMU 4 include five (5) individual samples and one (1) composite sample. Individual samples, which include DMMU 4 Sites 4 through 8, were derived from sediment. The composite sample, which includes DMMU 4 Sites 1 through 3, was derived from sediment.

A total of twelve (12) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 4, including one (1) inorganic, four (4) metals, one (1) PCB, and six (6) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide.

Two (2) metals and one (1) pesticide were detected above WQC throughout all of the sampling stations within DMMU 4. Metals detected above WQC include lead and selenium. 4,4'-DDT was the only pesticide detected above WQC.

Analysis of the composite non-native sample for DMMU 4 revealed a total of four (4) contaminants which exceeded WQC, including two (2) metals, one (1) PCB, and one (1) pesticide. Metals detected above WQC in the composite sample include lead and selenium. Total PCBs were detected above WQC. 4,4'-DDT was the only pesticide detected above WQC. <u>None of these exceedances were for acute WQC.</u>

Analysis of the individual non-native samples for DMMU 4 revealed a total of twelve (12) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic, four (4) metals, one (1) PCB, and six (6) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide. <u>None of these exceedances were for acute WQC.</u>

For individual sample DMMU 4 Site 4, a total of seven (7) contaminants were detected above WQC, including two (2) metals, one (1) PCB, and four (4) pesticides. Metals detected above WQC include lead and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, gamma-chlordane, and heptachlor epoxide.

For individual sample DMMU 4 Site 5, a total of seven (7) contaminants were detected above WQC, including one (1) inorganic, two (2) metals, one (1) PCB, and five (5) pesticides. Cyanide was the only inorganic detected above WQC. Metals detected above WQC include lead and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide.

For individual sample DMMU 4 Site 6, a total of nine (9) contaminants were detected above WQC, including four (4) metals, one (1) PCB, and four (4) pesticides. Cyanide was the only inorganic detected above WQC. Metals detected above WQC include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT, endrin, gamma-chlordane, and heptachlor epoxide.

For individual sample DMMU 4 Site 7, a total of four (4) contaminants were detected above WQC, including two (2) metals and two (2) pesticides. Metals detected above WQC include lead and selenium. Pesticides detected above WQC include 4,4'-DDT and heptachlor.

For individual sample DMMU 4 Site 8, a total of three (3) contaminants were detected above WQC, including two (2) metals and one (1) pesticide. Metals detected above WQC include lead and selenium. 4,4'-DDT was the only pesticide detected above WQC.

Standard Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples obtained for DMMU 4 were relegated to DMMU 4/5; therefore, the native standard elutriate results for DMMU 4 can be found in the standard elutriates summary for DMMU 4/5.

3.8.3.5 DMMU 5

Standard Elutriates Derived from Non-native Sediment
Non-native standard elutriate samples analyzed from DMMU 5 include five (5) individual samples and one (1) composite sample. Individual samples, which include DMMU 5 Sites 4 through 8, were derived from sediment. The composite sample, which includes DMMU 5 Sites 1 through 3 was derived from sediment.

A total of ten (10) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 5, including three (3) metals, one (1) PCB, and six (6) pesticides. Metals detected above WQC include lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, alpha-chlordane, gamma-chlordane, heptachlor, and heptachlor epoxide.

Two (2) metals were detected above WQC throughout all of the sampling stations within DMMU 5. Metals detected above WQC include lead and selenium.

Analysis of the composite non-native sample for DMMU 5 revealed a total of four (4) contaminants which exceeded WQC, including two (2) metals, one (1) PCB, and one pesticide. Metals detected above WQC in the composite sample include lead and selenium. Total PCBs were detected above WQC. 4,4'-DDT was the only pesticide detected above WQC. <u>None of these exceedances were for acute WQC.</u>

Analysis of the individual non-native samples for DMMU 5 revealed a total of ten (10) contaminants which exceeded WQC for at least one sampling station within the DMMU, including three (3) metals, one

(1) PCB, and six (6) pesticides. Metals detected above WQC include lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, alpha-chlordane, gamma-chlordane, heptachlor, and heptachlor epoxide. Two (2) contaminants exceeded acute WQC. Total PCBs exceeded acute WQC. 4,4'-DDD was the only pesticide to exceed acute WQC.

For individual sample DMMU 5 Site 4, a total of eight (8) contaminants were detected above WQC, including two (2) metals, one (1) PCB, and five (5) pesticides. Metals detected above WQC include lead and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, alpha-chlordane, gamma-chlordane, heptachlor, and heptachlor epoxide. Total PCBs and 4,4'-DDD exceeded the acute WQC.

For individual sample DMMU 5 Site 5, a total of five (5) contaminants were detected above WQC, including three (3) metals, one (1) PCB, and one (1) pesticide. Metals detected above WQC include lead, mercury, and selenium. 4,4'-DDD was the only pesticide detected above WQC.

For individual sample DMMU 5 Site 6, a total of six (6) contaminants were detected above WQC, including two (2) metals, one (1) PCB, and three (3) pesticides. Metals detected above WQC include lead and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, gamma-chlordane, and heptachlor epoxide. 4,4'-DDD was the only contaminant to exceed acute WQC.

For individual sample DMMU 5 Site 7, a total of four (4) contaminants were detected above WQC, including two (2) metals, one (1) PCB, and one (1) pesticide. Metals detected above WQC include lead and selenium. Total PCBs were detected above WQC. Heptachlor was the only pesticide detected above WQC.

For individual sample DMMU 5 Site 8, a total of two (2) contaminants were detected above WQC, including two (2) metals. Metals detected above WQC include lead and selenium.

Standard Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples obtained for DMMU 5 were relegated to DMMU 4/5; therefore, the native standard elutriate results for DMMU 5 can be found in the standard elutriates summary for DMMU 4/5.

3.8.3.6 DMMU 4/5

Standard Elutriates Derived from Non-native Sediment or Fill
There were no non-native samples for DMMU 4/5; there are separate non-native samples for DMMUs 4 and 5 as described in sections 3.8.3.4 and 3.8.3.5, respectively.

Standard Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 4/5 includes include two (2) composite samples and nine (9) individual samples. Individual samples include DMMU 4/5 Sites 4 through 8 and 12 through 16. One composite sample includes DMMU 4/5 Sites 1 and 11 and the other composite sample includes DMMU 4/5 Sites 2 through 10.

A total of seven (7) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 4/5, including four (4) metals, one (1) PCB, and two (2) pesticides. Metals detected above WQC include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT and heptachlor.

One (1) metal was detected above WQC throughout all of the sampling stations within DMMU 4/5. Selenium was the only metal detected above WQC.

Analysis of the composite native samples for DMMU 4/5 revealed a total of three (3) contaminants which exceeded WQC, including two (2) metals and one (1) pesticide. Metals detected above WQC in the composite sample include lead and selenium. Heptachlor was the only pesticide detected above WQC. <u>None of these exceedances were for acute WQC</u>

For the composite native sample for DMMU 4/5 Sites 1 and 11 revealed a total of two (2) contaminants which exceeded WQC, including two (2) metals. Metals detected above WQC in the composite sample include lead and selenium.

For the composite native sample for DMMU 4/5 Sites 2 through 10 revealed a total of two (2) contaminants which exceeded WQC, including one (1) metal and one (1) pesticide. Selenium was the only metal detected above WQC. Heptachlor was the only pesticide detected above WQC.

Analysis of the individual native subsurface samples for DMMU 4/5 revealed a total of seven (7) contaminants which exceeded WQC for at least one sampling station within the DMMU, including four (4) metals, one (1) PCB, and two (2) pesticides. Metals detected above WQC include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT and heptachlor. <u>None of these exceedances were for acute WQC.</u>

For individual sample DMMU 4/5 Site 4, a total of five (5) contaminants were detected above WQC, including three (3) metals, one (1) PCB, and one (1) pesticide. Metals detected above WQC include lead, mercury, and selenium. Total PCBs were detected above WQC. Heptachlor was the only pesticide detected above WQC.

For individual sample DMMU 4/5 Site 5, a total of four (4) contaminants were detected above WQC, including two (2) metals, one (1) PCB, and one (1) pesticide. Metals detected above WQC include lead and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 4/5 Site 6, a total of three (3) contaminants were detected above WQC, including two (2) metals and one (1) PCB. Metals detected above WQC include lead and selenium. Total PCBs were detected above WQC.

For individual sample DMMU 4/5 Site 7, a total of three (3) contaminants were detected above WQC, including two (2) metals and one (1) pesticide. Metals detected above WQC include lead and selenium. Heptachlor was the only pesticide detected above WQC.

For individual sample DMMU 4/5 Site 8, a total of four (4) contaminants were detected above WQC, including three (3) metals and one (1) pesticide. Metals detected above WQC include cadmium, lead, and selenium. Heptachlor was the only pesticide detected above WQC.

For individual sample DMMU 4/5 Site 12, a total of two (2) contaminants were detected above WQC, including two (2) metals. Metals detected above WQC include lead and selenium.

For individual sample DMMU 4/5 Site 13, a total of two (2) contaminants were detected above WQC, including two (2) metals. Metals detected above WQC include lead and selenium

For individual sample DMMU 4/5 Site 15, a total of two (2) contaminants were detected above WQC, including two (2) metals. Metals detected above WQC include lead and selenium

For individual sample DMMU 4/5 Site 16, a total of two (2) contaminants were detected above WQC, including two (2) metals. Metals detected above WQC include lead and selenium.

3.8.3.7 DMMU 6

Standard Elutriates Derived from Non-native Sediment
Non-native standard elutriate samples analyzed from DMMU 6 include six (6) individual samples. Individual samples, which include DMMU 6 Sites 1 through 6, were derived from sediment.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 3, including four (4) metals and four (4) pesticides. Metals detected above WQC include copper, lead, mercury, and selenium. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, gamma-chlordane, and heptachlor.

Two (2) metals and one (1) pesticide were detected above WQC throughout all of the sampling stations within DMMU 6. Metals detected above WQC include lead and selenium. 4,4'-DDT was the only pesticide detected above WQC.

Analysis of the individual non-native sample for DMMU 6 revealed a total of eight (8) contaminants which exceeded WQC, including four (4) metals and four (4) pesticides. Metals detected above WQC in the composite sample include copper, lead, mercury, and selenium. Pesticides detected above WQC include endosulfan, gamma-chlordane, and heptachlor. <u>None of these exceedances were for acute WQC.</u>

For individual sample DMMU 6 Site 1, a total of four (4) contaminants were detected above WQC, including two (2) metals and two (2) pesticides. Metals detected above WQC include lead and selenium. Pesticides detected above WQC include 4,4'-DDT and total endosulfan.

For individual sample DMMU 6 Site 2, a total of four (4) contaminants were detected above WQC, including two (2) metals and two (2) pesticides. Metals detected above WQC include lead and selenium. Pesticides detected above WQC include 4,4'-DDT and gamma-chlordane.

For individual sample DMMU 6 Site 3, a total of three (3) contaminants were detected above WQC, including two (2) metals and one (1) pesticide. Metals detected above WQC include lead and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 4, a total of three (3) contaminants were detected above WQC, including two (2) metals and one (1) pesticide. Metals detected above WQC include lead and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 5, a total of five (5) contaminants were detected above WQC, including three (3) metals and two (2) pesticides. Metals detected above WQC include copper, lead, and selenium. Pesticides detected above WQC include 4,4'-DDT and heptachlor.

For individual sample DMMU 6 Site 6, a total of six (6) contaminants were detected above WQC, including four (4) metals and two (2) pesticides. Metals detected above WQC include copper, lead, mercury, and selenium. Pesticides detected above WQC include 4,4'-DDT and heptachlor.

Standard Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 6 include six (6) individual samples. Individual samples include DMMU 6 Sites 1 through 6.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 6, including five (5) metals and three (3) pesticides. Metals detected above WQC include cadmium, copper, lead, mercury, and selenium. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, and heptachlor.

Two (2) metals were detected above WQC throughout all of the sampling stations within DMMU 6. Metals detected above WQC include lead and selenium.

Analysis of the individual native subsurface samples for DMMU 6 revealed a total of eight (8) contaminants which exceeded WQC for at least one sampling station within the DMMU, including five (5) metals three (3) pesticides. Metals detected above WQC include cadmium, copper, lead, mercury, and selenium. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT and heptachlor. <u>None of these exceedances were for acute WQC.</u>

For individual sample DMMU 6 Site 1, a total of three (3) contaminants were detected above WQC, including two (2) metals and one (1) pesticide. Metals detected above WQC include lead and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 2, a total of three (3) contaminants were detected above WQC, including two (2) metals and one (1) pesticide. Metals detected above WQC include lead and selenium. Heptachlor was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 3, a total of five (5) contaminants were detected above WQC, including four (4) metals and one (1) pesticide. Metals detected above WQC include cadmium, lead, mercury, and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 4, a total of four (4) contaminants were detected above WQC, including three (3) metals and one (1) pesticide. Metals detected above WQC include cadmium, lead, and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 5, a total of five (5) contaminants were detected above WQC, including four (4) metals and one (1) pesticide. Metals detected above WQC include copper, lead, mercury, and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 6, a total of six (6) contaminants were detected above WQC, including four (4) metals and two (2) pesticides. Metals detected above WQC include copper, lead, mercury, and selenium. Pesticides detected above WQC include 4,4'-DDD and 4,4'-DDT.

3.8.3.8 DMMU 7

Standard Elutriates Derived from Non-native Sediment
Non-native standard elutriate samples analyzed from DMMU 7 include eight (8) individual samples. Individual samples, which include DMMU 7 Sites 2 through 9, were derived from sediment.

A total of twelve (12) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 7, including one (1) inorganic, four (4) metals, one (1) PCB, and six (6) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, dieldrin, total endosulfan, gamma-chlordane, and heptachlor-epoxide.

Two (2) metals were detected above WQC throughout all of the sampling stations within DMMU 7. Metals detected above WQC include lead and selenium.

Analysis of the individual non-native samples for DMMU 7 revealed a total of twelve (12) contaminants which exceeded WQC, including one (1) inorganic, four (4) metals one (1) PCB, and six (6) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC in the composite sample include cadmium, lead, mercury, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, 4,4'-DDT, dielden, total endosulfan, gamma-chlordane, and heptachlor-epoxide. 4,4'-DDD was the only pesticide to exceed acute WQC.

For individual sample DMMU 7 Site 2, a total of nine (9) contaminants were detected above WQC, including three (3) metals, one (1) PCB, and five (5) pesticides. Metals detected above WQC include cadmium, lead, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD, dieldrin, total endosulfan, gamma-chlordane, and heptachlor-epoxide.

For individual sample DMMU 7 Site 3, a total of six (6) contaminants were detected above WQC, including three (3) metals, one (1) PCB, and two (2) pesticides. Metals detected above WQC include cadmium, lead, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDD and gamma-chlordane.

For individual sample DMMU 7 Site 4, a total of eight (8) contaminants were detected above WQC, including one (1) inorganic, three (3) metals, one (1) PCB, and three (3) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include cadmium, lead, and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT, gamma-chlordane, and heptachlor-epoxide.

For individual sample DMMU 7 Site 5, a total of four (4) contaminants were detected above WQC, including three (3) metals and one (1) pesticide. Metals detected above WQC include cadmium, lead, and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 7 Site 6, a total of five (5) contaminants were detected above WQC, including four (4) metals and one (1) pesticide. Metals detected above WQC include cadmium, lead, mercury, and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 7 Site 7, a total of five (5) contaminants were detected above WQC, including four (4) metals and one (1) pesticide. Metals detected above WQC include cadmium, lead, mercury, and selenium. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 7 Site 8, a total of four (4) contaminants were detected above WQC, including two (2) metals and two (2) pesticides. Metals detected above WQC include lead and selenium. Pesticides detected above WQC include 4,4'-DDT and gamma-chlordane.

For individual sample DMMU 7 Site 9, a total of four (4) contaminants were detected above WQC, including three (3) metals and one (1) pesticide. Metals detected above WQC include cadmium, lead, and selenium. 4,4'-DDT was the only pesticide detected above WQC.

Standard Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 7 includes one (1) composite sample comprised of DMMU 7 Sites 1 through 9.

A total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 7, including one (1) metal. Selenium was the only metal constituent detected exceeding WQC.

Analysis of the composite native sample for DMMU 7 revealed a total of one (1) contaminant which exceeded WQC, including one (1) metal. Selenium was the only metal detected above WQC. None of these exceedances were for acute WQC.

3.8.3.9 DMMU 8

Standard Elutriates Derived from Non-native Sediment
Non-native standard elutriate samples analyzed from DMMU 8 include (1) composite sample. The composite sample, which includes DMMU 8 Sites 1 through 4 was derived from sediment.

A total of five (5) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 8, including two (2) metals, one (1) PCB, and two (2) pesticides. Metals detected above WQC include cadmium and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor-epoxide.

Analysis of the individual non-native sample for DMMU 8 revealed a total of five (5) contaminants which exceeded WQC two (2) metals, one (1) PCB, and two (2) pesticides. Metals detected above WQC in the composite sample include cadmium and selenium. Total PCBs were detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor-epoxide. None of these exceedances were for acute WQC.

Standard Elutriates Derived from Native Subsurface Soil
There were no native standard elutriate samples from this DMMU.

3.8.3.10 DMMU 9

Standard Elutriates Derived from Non-native Sediment or Fill
Non-native standard elutriate samples analyzed from DMMU 9 include one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 9 Sites 2 and 4 was derived from sediment. The individual sample, DMMU 9 Site 1, was derived from sediment.

A total of five (5) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 9, including one (1) inorganic, three (3) metals, and one (1) PCB. Cyanide was the only inorganic constituent deteted exceeding WQC. Metals detected above WQC include copper, lead, and selenium. Total PCBs were detected above WQC.

One (1) metal was detected above WQC throughout all of the sampling stations within DMMU 9. Lead was the only metal detected above WQC.

Analysis of the composite non-native sample for DMMU 9 revealed a total of three (3) contaminants which exceeded WQC, including two (2) metals and one (1) PCB. Metals detected above WQC in the composite sample include lead and selenium. Total PCBs were detected above WQC. None of these exceedances were for acute WQC.

Analysis of the individual non-native sample for DMMU 9 revealed a total of three (3) contaminants which exceeded WQC, including one (1) inorganic and two (2) metals. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include copper and lead. None of these exceedances were for acute WQC

Standard Elutriates Derived from Native Subsurface Soil
There were no native standard elutriate samples from this DMMU.

3.8.3.11 DMMU 10

Standard Elutriates Derived from Non-native Sediment and/or Fill
Non-native standard elutriate samples analyzed from DMMU 10 includes one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 10 Sites 3 and 4 was derived from fill. The individual sample, DMMU 10 Site 1, was derived from sediment.

A total of ten (10) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 10, including six (6) metals, one (1) PCB, and three (3) pesticides. Metals detected above WQC include cadmium, copper, lead, mercury, selenium, and silver. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4’-DDD, 4,4’-DDT, and gamma-chlordane.

Two (2) pesticides were detected above WQC throughout all of the sampling stations within DMMU 10. Pesticides detected above WQC include 4,4’-DDD and 4,4’-DDT.

Analysis of the composite non-native sample for DMMU 10 revealed a total of six (6) contaminants which exceeded WQC, including four (4) metals and two (2) pesticides. Metals detected above WQC in the composite sample include cadmium, mercury, selenium, and silver. Pesticides detected above WQC include 4,4’-DDD and 4,4’-DDT. Silver was the only contaminant to exceed acute WQC.

Analysis of the individual non-native sample for DMMU 10 revealed a total of six (6) contaminants which exceeded WQC for at least one sampling station within the DMMU, including two (2) metals, one (1) PCB, and three (3) pesticides. Metals detected above WQC include copper and lead. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4’-DDD, 4,4’-DDT, and gamma-chlordane.

Standard Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 10 includes one (1) composite sample comprised of DMMU 10 Sites 3 and 4.

A total of fourteen (14) contaminants which exceeded WQC, including one (1) inorganic, ten (10) metals and three (3) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC in the composite sample include arsenic, cadmium, trivalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Pesticides detected above WQC included 4,4’-DDD, 4,4’-DDT, and heptachlor.

Analysis of the composite non-native sample for DMMU 10 revealed a total of fourteen (14) contaminants which exceeded WQC, including one (1) inorganic, ten (10) metals and three (3) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC in the composite sample include arsenic, cadmium, trivalent chromium, copper, lead, mercury, nickel, selenium, silver, and zinc. Pesticides detected above WQC included 4,4’-DDD, 4,4’-DDT, and heptachlor. Cadmium, trivalent chromium, copper, lead, silver, and zinc exceeded acute WQC.

3.8.4 Mixing Zone Model

ERDC is using the standard elutriate chemistry results that do not meeting the most stringent WQC to determine the size of the mixing zone in the Mississippi River required to meet the criteria. ERDC will provide the mixing zone model results in a separatae report.

3.8.5 Modified Elutriate – Dissolved Fraction

Modified Elutriate – Dissolved Fraction chemistry results are presented in Tables A-17 and A-18 of Appendix A and are discussed by DMMU below and in terms of the type of soil (i.e., non-native sediment, non-native fill, or native subsurface soil) from which elutriates were made. It should be noted that the elutriate results are discussed in relation to the lowest criteria (typically the USEPA WQC SW CCC) and the highest criteria (typically USEPA WQC SW Critical Maximum Concentration [CMC]). Exceedances of the lowest and highest criteria in the analytical summary tables of Appendix A are shown by yellow and orange highlights, respectively. The most conservative approach was used to evaluate the data. Specifically, even if the data were non-detects (indicated with a U qualifier) but exceeded a WQC, the non-detect result was highlighted yellow or orange in accordance with the WQC exceeded. However, it should be noted that there is a high degree of uncertainty with this approach because it is possible that if the data were evaluated to a lower detection limit that the data would be lower than the WQCs. Raw analytical data reports are presented in Appendix H.

3.8.5.1 DMMU 1

Modified Elutriates Derived from Non-native Sediment
Non-native modified elutriate samples analyzed from DMMU 1 include one (1) composite sample. The composite sample, which includes DMMU 1 Sites 1 through 6, was derived from sediment.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for one sample from DMMU 1, including one (1) metal, one (1) PCB, and two (2) pesticides. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC included total endosulfan and gamma-chlordane.

Analysis of the composite non-native sample for DMMU 1 revealed a total of four (4) contaminants which exceeded WQC, including one (1) metal, one (1) PCB, and two (2) pesticides. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC included total endosulfan and gamma-chlordane. <u>None of these exceedances were for acute WQC.</u>

Modified Elutriates Derived from Native Subsurface Soil
There were no native modified elutriate samples from this DMMU.

3.8.5.2 DMMU 2

Modified Elutriates Derived from Non-native Sediment
Non-native modified elutriate samples analyzed from DMMU 2 include one (1) composite sample. The composite sample, which includes DMMU 2 Sites 1 through 6, was derived from sediment.

A total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 1, including one (1) metal, one (1) PCB, and one (1) pesticide. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Gamma-chlordane was the only pesticide detected above WQC.

Analysis of the composite non-native sample for DMMU 1 revealed a total of three (3) contaminants which exceeded WQC, including one (1) metal, one (1) PCB, and one (1) pesticide. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Gamma-chlordane was the only pesticide detected above WQC. <u>None of these exceedances were for acute WQC.</u>

Modified Elutriates Derived from Native Subsurface Soil
There were no native modified elutriate samples from this DMMU.

3.8.5.3 DMMU 3

Modified Elutriates Derived from Non-native Sediment and/or Fill
Non-native modified elutriate samples analyzed from DMMU 3 include two (2) composite samples. One composite sample, which includes DMMU3 Sites 1 through 3, was derived from fill. One composite sample, which includes DMMU 3 Sites 4 through 6, was derived from sediment.

A total of six (6) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 3, including one (1) metal and five (5) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, alpha-chordane, dieldrin, endrin, and gamma-chlordane.

Analysis of the composite non-native sample for DMMU 3 revealed a total of six (6) contaminants which exceeded WQC, including one (1) metal and five (5) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, aplpha-chordane, dieldrin, endrin, and gamma-chlordane. <u>None of these exceedances were for acute WQC.</u>

For the composite non-native sample for DMMU 3 Sites 1 through 3 revealed a total of six (6) contaminants which exceeded WQC, including one (1) metal and five (5) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, aplpha-chordane, dieldrin, endrin, and gamma-chlordane.

For the composite non-native sample for DMMU 3 Sites 4 through 6 no contaminants exceeded WQC.

Modified Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 3 include two (2) composite samples. One composite sample includes DMMU3 Sites 1 through 3 and the other composite sample includes DMMU 3 Sites 4 through 6.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 3, including one (1) metal and three (3) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, dieldrin, and total endosulfan.

Analysis of the composite native sample for DMMU 3 revealed a total of four (4) contaminants which exceeded WQC, including one (1) metal and threee (3) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, dieldrin, and total endosulfan. <u>None of these exceedances were for acute WQC.</u>

For the composite native sample for DMMU 3 Sites 1 through 3 revealed a total of (4) contaminants which exceeded WQC, including one (1) metal and three (3) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, dieldrin, and total endosulfan.

For the composite native sample for DMMU 3 Sites 4 through 6 no contaminants exceeded WQC.

3.8.5.4 DMMU 4

Modified Elutriates Derived from Non-native Subsurface Soil
Non-native modified elutriate samples analyzed from DMMU 4 include five (5) individual samples and one (1) composite sample. Individual samples, which include DMMU 4 Sites 4 through 8, were derived from sediment. The composite sample, which includes DMMU 4 Sites 1 through 3, was derived from sediment.

A total of seven (7) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 4, including one (1) inorganic, two (2) metals, one (1) PCB, and three (3) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include copper and mercury. Total PCBs were detected above WQC. Pesticides detected above WQC include dieldrin, gamma-chlordane, and heptachlor epoxide

One (1) inorganic was detected above WQC throughout all of the sampling stations within DMMU 4. The inorganic detected above WQC was cyanide.

Analysis of the composite non-native sample for DMMU 4 revealed a total of six (6) contaminants which exceeded WQC, including one (1) inorganic, one (1) metal, one (1) PCB, and three (3) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Mercury was the metal above WQC in the composite sample. Total PCBs were detected above WQC. Pesticides detected above WQC include dieldrin, gamma-chlordane, and heptachlor epoxide. Cyanide was the only contaminant to exceed acute WQC.

Analysis of the individual non-native samples for DMMU 4 revealed a total of five (5) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic, one (1) metal, one (1) PCB, and two (2) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the metal above WQC .Total PCBs were detected above WQC. Pesticides detected above WQC include gamma-chlordane and dieldrin. Cyanide and copper exceeded the acute WQC.

For individual sample DMMU 4 Site 4, a total of five (5) contaminants were detected above WQC, including one (1) inorganic, one (1) metal, one (1) PCB, and two (2) pesticides. Cyanide was the only inorganic detected above WQC. The metal detected above WQC was copper. Total PCBs were detected above WQC. The pesticides detected above WQC were dieldrin and gamma-chlordane. Cyanide was the only contaminant to exceed acute WQC.

For individual sample DMMU 4 Site 5, a total of four (4) contaminants were detected above WQC, including one (1) inorganic, one (1) metal, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic detected above WQC. The metal detected above WQC was copper. Total PCBs were detected above WQC. The pesticide detected above WQC was dieldrin. Cyanide and copper exceeded acute WQC.

For individual sample DMMU 4 Site 6, a total of four (4) contaminants were detected above WQC, including one (1) inorganic, one (1) metal, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic detected above WQC. The metal detected above WQC was copper. Total PCBs were detected above WQC. The pesticide detected above WQC was dieldrin. Cyanide was the only contaminant to exceed acute WQC.

For individual sample DMMU 4 Site 7, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4 Site 8, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

Modified Elutriates Derived from Native Subsurface Soil

Native subsurface soil samples obtained for DMMU 4 were relegated to DMMU 4/5; therefore, the native modified elutriate results for DMMU 4 can be found in the modified elutriates summary for DMMU 4/5.

3.8.5.5 DMMU 5

Modified Elutriates Derived from Non-native Subsurface Soil
Non-native modified elutriate samples analyzed from DMMU 5 include five (5) individual samples and one (1) composite sample. Individual samples, which include DMMU 5 Sites 4 through 8, were derived from sediment. The composite sample, which includes DMMU 5 Sites 1 through 3 was derived from sediment.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 5, including one (1) inorganic, two (2) metals, one (1) PCB, and four (4) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include copper and mercury. Total PCBs were detected above WQC. Pesticides detected above WQC include dieldrin, total endosulfan, gamma-chlordane, and heptachlor epoxide.

Analysis of the composite non-native sample for DMMU 5 revealed a total of two (2) contaminants which exceeded WQC, including one (1) metal and one (1) PCB. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. <u>None of these exceedances were for acute WQC.</u>

Analysis of the individual non-native samples for DMMU 5 revealed a total of seven (7) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic, one (1) metal, one (1) PCB, and four (4) pesticides. Cyanide was the only inorganic constituent detected above WQC. Mercury was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include dieldrin, total endosulfan, gamma-chlordane, and heptachlor epoxide. Cyanide was the only contaminant to exceed acute WQC.

For individual sample DMMU 5 Site 4, a total of five (5) contaminants were detected above WQC, including one (1) metal, one (1) PCB, and three (3) pesticides. Mercury was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan, gamma-chlordane, and heptachlor epoxide.

For individual sample DMMU 5 Site 5, no contaminants exceeded WQC.

For individual sample DMMU 5 Site 6, a total of six (6) contaminants were detected above WQC, including one (1) inorganic, one (1) metal, and four (4) pesticides. Cyanide was the only inorganic detected above WQC. Mercury was the only metal detected above WQC. Pesticides detected above WQC include dieldrin, total endosulfan, gamma-chlordane, and heptachlor epoxide.

For individual sample DMMU 5 Site 7, one (1) contaminant exceeded WQC. Total PCBs was the only contaminant detected above WQC.

For individual sample DMMU 5 Site 8, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

Modified Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples obtained for DMMU 5 were relegated to DMMU 4/5; therefore, the native modified elutriate results for DMMU 5 can be found in the modified elutriates summary for DMMU 4/5.

3.8.5.6 DMMU 4/5

Modified Elutriates Derived from Non-native Subsurface Soil
There were no non-native samples for DMMU 4/5; there are separate non-native samples for DMMUs 4

and 5 as described in sections 3.8.5.4 and 3.8.5.5, respectively.

Modified Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 4/5 includes include two (2) composite samples and nine (9) individual samples. Individual samples include DMMU 4/5 Sites 4 through 8 and 12 through 16. One composite sample includes DMMU 4/5 Sites 1 and 11 and the other composite sample includes DMMU 4/5 Sites 2 through 10.

A total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 4/5, including one (1) inorganic and one (1) metal.

Analysis of the composite native sample for DMMU 4/5 revealed one (1) contaminant which exceeded WQC. The inorganic cyanide was the only contaminant exceeding WQC.

For the composite native sample for DMMU 4/5 Sites 1 and 11, no contaminants exceeded WQC.

For the composite native sample for DMMU Sites 2 through 10, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

Analysis of the individual native samples for DMMU 4/5 revealed a total of two (2) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic and one (1) metal. Cyanide was the only inorganic constituent detected above WQC. Mercury was the only metal detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

For individual sample DMMU 4/5 Site 4, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 5, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 6, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 7, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 8, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 12, one (1) contaminant exceeded WQC. The metal mercury was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 13, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 15, one (1) contaminant exceeded WQC. The inorganic cyanide was the only contaminant detected above WQC.

For individual sample DMMU 4/5 Site 16, no contaminants exceeded WQC.

3.8.5.7 DMMU 6

Modified Elutriates Derived from Non-native Subsurface Soil
Non-native modified elutriate samples analyzed from DMMU 6 include six (6) individual samples. Individual samples, which include DMMU 6 Sites 1 through 6, were derived from sediment.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 6, including one (1) inorganic, one (1) metal, one (1) PCB, and five (5) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include 4,4'-DDT, dieldrin, total endosulfan, gamma-chlordane, and heptachlor.

Analysis of the individual non-native samples for DMMU 6 revealed a total of eight (8) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic, one (1) metal, one (1) PCB, and five (5) pesticides. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include dieldrin, total endosulfan, gamma-chlordane, and heptachlor. Cyanide was the only contaminant to exceed acute WQC.

For individual sample DMMU 6 Site 1, no contaminants exceeded WQC.

For individual sample DMMU 6 Site 2, a total of four (4) contaminants were detected above WQC, including one (1) metal, one (1) PCB, and two (2) pesticides. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor.

For individual sample DMMU 6 Site 3, no contaminants exceeded WQC.

For individual sample DMMU 6 Site 4, two (2) contaminants exceeded WQC, including one (1) metal and one (1) pesticide. Copper was the only metal detected above WQC. Total endosulfan was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 5, a total of five (5) contaminants were detected above WQC, including one (1) inorganic and four (4) pesticides. Cyanide was the only inorganic detected above WQC. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, gamma-chlordane and heptachlor.

For individual sample DMMU 6 Site 6, a total of six (6) contaminants were detected above WQC, including one (1) inorganic, one (1) metal, and four (4) pesticides. Cyanide was the only inorganic detected above WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT, dieldrin, gamma-chlordane, and heptachlor.

Modified Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 6 include six (6) individual samples. Individual samples include DMMU 6 Sites 1 through 6.

A total of five (5) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for a least one sample from DMMU 6, including one (1) inorganic, one (1) metal, and three (3) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, and heptachlor.

Analysis of the individual non-native samples for DMMU 6 revealed a total of five (5) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic, one (1) metal, and three (3) pesticides. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, and heptachlor.
Cyanide was the only contaminant to exceed acute WQC.

For individual sample DMMU 6 Site 1, no contaminants exceeded WQC.

For individual sample DMMU 6 Site 2, one (1) contaminant was detected above WQC. The pesticide heptachlor was the only contaminant detected above WQC.

For individual sample DMMU 6 Site 3, two (2) contaminants exceeded WQC, including one (1) metal and one (1) pesticide. Copper was the only metal detected above WQC. 4,4'-DDT was the only pesticide detected above WQC.

For individual sample DMMU 6 Site 4, three (3) contaminants exceeded WQC, including one (1) metal and two (2) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT and total endosulfan.

For individual sample DMMU 6 Site 5, a total of four (4) contaminants were detected above WQC, including one (1) inorganic, one (1) metal, and two (2) pesticides. Cyanide was the only inorganic detected above WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include total endosulfan and heptachlor.

For individual sample DMMU 6 Site 6, a total of four (4) contaminants were detected above WQC, including one (1) metal and three (3) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, and heptachlor.

3.8.5.8 DMMU 7

Modified Elutriates Derived from Non-native Subsurface Soil
Non-native modified elutriate samples analyzed from DMMU 7 include eight (8) individual samples. Individual samples, which include DMMU 7 Sites 2 through 9, were derived from sediment.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 7, including one (1) inorganic, two (2) metals, one (1) PCB, and four (4) pesticides. Cyanide was the only inorganic constituent detected above WQC. Metals detected above WQC include copper and mercury. Total PCBs were detected above WQC. Pesticides detected above WQC include dieldrin, total endosulfan, gamma-chlordane, and heptachlor-epoxide.

One (1) PCB was detected above WQC throughout all of the sampling stations within DMMU 7. Total PCBs were detected above WQC.

Analysis of the individual non-native samples for DMMU 7 revealed a total of eight (8) contaminants which exceeded WQC, including one (1) inorganic, two (2) metals one (1) PCB, and four (4) pesticides. Cyanide was the only inorganic constituent detected above WQC. Metals detected above WQC in the composite sample include copper and mercury. Total PCBs were detected above WQC. Pesticides detected above WQC include dielden, total endosulfan, gamma-chlordane, and heptachlor-epoxide. Cyanide was the only contaminant to exceed acute WQC.

For individual sample DMMU 7 Site 2, a total of six (6) contaminants were detected above WQC, including one (1) metal, one (1) PCB, and four (4) pesticides. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include dielden, total endosulfan, gamma-chlordane, and heptachlor-epoxide.

For individual sample DMMU 7 Site 3, a total of five (5) contaminants were detected above WQC, including one (1) metal, one (1) PCB, and three (3) pesticides. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include dielden, total endosulfan, and gamma-chlordane.

For individual sample DMMU 7 Site 4, a total of three (3) contaminants were detected above WQC, including one (1) inorganic, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic detected above WQC. Total PCBs were detected above WQC. Dieldren was the only pesticide detected above WQC.

For individual sample DMMU 7 Site 5, a total of two (2) contaminants were detected above WQC, including one (1) metal metal one (1) PCB. Copper was the only metal detected above WQC. Total PCBs were detected above WQC.

For individual sample DMMU 7 Site 6, a total of two (2) contaminants were detected above WQC, including one (1) metal and one (1) PCB. Mercury was the only metal detected above WQC. Total PCBs were detected above WQC.

For individual sample DMMU 7 Site 7, a total of two (2) contaminants were detected above WQC, including one (1) metal and one (1) PCB. Copper was the only metal detected above WQC. Total PCBs were detected above WQC.

For individual sample DMMU 7 Site 8, a total of two (2) contaminants were detected above WQC, including one (1) metal and one (1) PCB. Copper was the only metal detected above WQC. Total PCBs were detected above WQC.

For individual sample DMMU 7 Site 9, one (1) contaminant was detected above WQC. Total PCBs were detected above WQC.

Modified Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 7 includes one (1) composite sample comprised of DMMU 7 Sites 1 through 9.

A total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 7, including one (1) inorganic, one (1) metal, and one (1) pesticide. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC. 4,4'-DDT was the only pesticide detected above WQC.

Analysis of the composite native sample for DMMU 7 revealed a total of three (3) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic, one (1) metal, and one (1) pesticides. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC. 4,4'-DDT was the only pesticide detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

3.8.5.9 DMMU 8

Modified Elutriates Derived from Non-native Subsurface Soil
Non-native modified elutriate samples analyzed from DMMU 8 include (1) composite sample. The

composite sample, which includes DMMU 8 Sites 1 through 4 was derived from sediment.

A total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 8, including one (1) PCB and two (2) pesticide. Total PCBs were above exceeding WQC. Pesticides detected above WQC were dieldrin and gamma-chlordane.

Analysis of the composite native samples for DMMU 8 revealed a total of three (3) contaminants which exceeded WQC for the one sampling station within the DMMU, including one (1) PCB and two (2) pesticides. Total PCBs were detected above WQC. Pesticides detected above WQC were dieldrin and gamma-chlordane. <u>None of these exceedances were for acute WQC.</u>

Modified Elutriates Derived from Native Subsurface Soil
There were no native modified elutriate samples from this DMMU.

3.8.5.10 DMMU 9

Modified Elutriates Derived from Non-native Subsurface Soil
Non-native modified elutriate samples analyzed from DMMU 9 include one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 9 Sites 2 and 4 was derived from sediment. The individual sample, DMMU 9 Site 1, was derived from sediment.

A total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 9, including one (1) inorganic and one (1) metal. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC.

One (1) inorganic was detected above WQC throughout all of the sampling stations within DMMU 9. Cyanide was the only inorganic detected above WQC.

Analysis of the composite non-native sample for DMMU 9 revealed a total of one (1) contaminant which exceeded WQC, including one (1) inorganic. Cyanide was the only inorganic constituent detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

For the individual non-native sample for DMMU 9 Site 1 revealed a total of two (2) contaminants which exceeded WQC, including one (1) inorganic and one (1) metal. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC.

Modified Elutriates Derived from Native Subsurface Soil
There were no native modified elutriate samples from this DMMU.

3.8.5.11 DMMU 10

Modified Elutriates Derived from Non-native Sediment and/or Fill
Non-native modified elutriate samples analyzed from DMMU 10 includes one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 10 Sites 3 and 4 was derived from fill. The individual sample, DMMU 10 Site 1, was derived from sediment.

A total of six (6) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 10, including one (1) inorganic, three (3) metals, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include copper, lead, and nickel. Total PCBs were detected above WQC. Dieldrin was the only pesticide detected above WQC.

One (1) inorganic and one (1) metal were detected above WQC throughout all of the sampling stations within DMMU 10. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC.

Analysis of the composite non-native sample for DMMU 10 revealed a total of four (4) contaminants which exceeded WQC, including one (1) inorganic and three (3) metals. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC included copper, lead, and nickel. Cyanide and copper exceeded the acute WQC.

Analysis of the individual non-native sample for DMMU 10 revealed a total of four (4) contaminants which exceeded WQC, including one (1) inorganic, one (1) metal, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Dieldrin was the only pesticide detected above WQC. Cyanide and copper exceeded the acute WQC.

Modified Elutriates Derived from Native Subsurface Soil
Native subsurface soil samples analyzed from DMMU 10 includes one (1) composite sample comprised of DMMU 10 Sites 3 and 4.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 10, including one (1) inorganic and seven (7) metals. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include arsenic, trivalent chromium, copper, lead, mercury, nickel, and zinc.

Analysis of the composite native samples for DMMU 10 revealed a total of eight (8) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic and seven (7) metals. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC included arsenic, trivalent chromium, copper, lead, mercury, nickel, and zinc. Cyanide, copper, nickel, and zinc exceeded the acute WQC.

3.8.6 Modified Elutriate – Total Fraction

Modified Elutriate – Total Fraction chemistry results are presented in Tables A-19 and A-20 of Appendix A. Raw analytical data reports are presented in Appendix H.

3.8.7 Modified Elutriate – Fraction of Contaminants in the Total Suspended Solids

These results will be provided in the final report. Results are pending the final QA/QC on the database prior to completion of these tables and associated calculations.

3.8.8 Dredged Elutriate – Dissolved Fraction

Dredged Elutriate – Dissolved Fraction chemistry results are presented in Tables A-21 to A-23 of Appendix A and are discussed by DMMU below and in terms of the type of soil (i.e., non-native sediment, non-native fill, or native subsurface soil) from which elutriates were made. It should be noted that the elutriate results are discussed in relation to the lowest WQC and the highest WQC. Exceedances of the lowest and highest criteria in the analytical summary tables of Appendix A are shown by yellow and orange highlights, respectively. The most conservative approach was used to evaluate the data. Specifically, even if the data were non-detects (indicated with a U qualifier) but exceeded a WQC, the non-detect result was highlighted yellow or orange in accordance with the WQC exceeded. However, it should be noted that there is a high degree of uncertainty with this approach because it is possible that if the data were evaluated to a lower detection limit that the data would be lower than the WQCs. Raw analytical data reports are presented in Appendix H.

3.8.8.1 DMMU 1

Dredged Elutriates Derived from Non-native Sediment
Non-native dredged elutriate samples analyzed from DMMU 1 include one (1) composite sample. The composite sample, which includes DMMU 1 Sites 1 through 6, was derived from sediment.

A total of zero (0) contaminants were detected above the reporting limit exceeded LDEQ or USEPA WQC for DMMU 1.

Analysis of the composite non-native sample for DMMU 1 revealed a total of zero (0) contaminants which exceeded acute or chronic WQC.

Dredged Elutriates Derived from Native Sediment
There were no native dredged elutriate samples from this DMMU.

3.8.8.2 DMMU 2

Dredged Elutriates Derived from Non-native Sediment
Non-native dredged elutriate samples analyzed from DMMU 2 include one (1) composite sample. The composite sample, which includes DMMU 2 Sites 1 through 6, was derived from sediment.

A total of zero (0) contaminants were detected above the reporting limit exceeded LDEQ or USEPA WQC for DMMU 2.

Analysis of the composite non-native sample for DMMU 2 revealed a total of zero (0) contaminants which exceeded acute or chronic WQC.

Dredged Elutriates Derived from Native Sediment
There were no native dredged elutriate samples from this DMMU.

3.8.8.3 DMMU 3

Dredged Elutriates Derived from Non-native Sediment and/or Fill
Non-native dredged elutriate samples analyzed from DMMU 3 include two (2) composite samples. One composite sample, which includes DMMU 3 Sites 1 through 3, was derived from fill. One composite sample, which includes DMMU 3 Sites 4 through 6, was derived from sediment.

A total of nine (9) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 3, including one (1) metal and eight (8) pesticides. Copper was the only metal detected above. Pesticides detected above WQC include 4,4'-DDT, alpha-chlordane, dieldrin, total endosulfan, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide.

Analysis of the composite non-native samples for DMMU 3 revealed a total of nine (9) contaminants which exceeded WQC, including one (1) metal and eight (8) pesticides. Copper was the only metal detected above. Pesticides detected above WQC include 4,4'-DDT, alpha-chlordane, dieldrin, total endosulfan, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide. None of these exceedances were for acute WQC.

For the composite non-native sample for DMMU 3 Sites 1 through 3 revealed a total of nine (9) contaminants which exceeded WQC, including one (1) metal and eight (8) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC included 4,4'-DDT, alpha-chordane, dieldrin, total endosulfan, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide.

For the composite non-native sample for DMMU 3 Sites 4 through 6 no contaminants exceeded WQC.

Dredged Elutriates Derived from Native Sediment
Native subsurface soil samples analyzed from DMMU 3 include two (2) composite samples. One includes DMMU 3 Sites 1 through 3 and the other includes DMMU 3 Sites 4 through 6.

A total of eight (8) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 3, including one (1) inorganic, two (2) metals, and five (5) pesticides. Cyanide was the only inorganic constituent detected above WQC. Metals detected above WQC include copper and mercury. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, endrin, gamma-chlordane, and heptachlor.

One (1) metal was detected above WQC throughout all of the sampling stations within DMMU 3. Copper was the only metal detected above WQC.

Analysis of the composite native samples for DMMU 3 revealed a total of eight (8) contaminants which exceeded WQC, including one (1) inorganic, two (2) metal, and five (5) pesticides. Cyanide was the only inorganic constituent detected above WQC. Metals detected above WQC include copper and mercury. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, endrin, gamma-chlordane, and heptachlor. Cyanide was the only contaminant to exceed acute WQC.

For the composite native sample for DMMU 3 Sites 1 through 3 revealed a total of eight (8) contaminants which exceeded WQC, including one (1) inorganic, two (2) metals, and five (5) pesticides. Cyanide was the only inorganic constituent detected above WQC. Metals detected above WQC include copper and mercury. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, endrin, gamma-chlordane, and heptachlor.

For the composite native sample for DMMU 3 Sites 4 through 6 revealed a total of one (1) contaminant which exceeded WQC, including one (1) metal. Copper was the only metal detected above WQC.

3.8.8.4 DMMU 4

Dredged Elutriates Derived from Non-native Sediment
Non-native dredged elutriate samples analyzed from DMMU 4 include five (5) individual samples and one (1) composite sample. Individual samples, which include DMMU 4 Sites 4 through 8, were derived from sediment. The composite sample, which includes DMMU 4 Sites 1 through 3, was derived from sediment.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 4, including one (1) inorganic and three (3) pesticides. Cyanide was the only inorganic constituent detected above WQC. Pesticides detected above WQC include total endosulfan, gamma-chlordane, and heptachlor.

Analysis of the composite non-native samples for DMMU 4 revealed a total of one (1) contaminant which exceeded WQC, including one (1) pesticide. Gamma-chlordane was the only pesticide detected above WQC. <u>None of these exceedances were for acute WQC.</u>

Analysis of the individual non-native samples for DMMU 4 revealed a total of four (4) contaminants which exceeded WQC, including one (1) inorganic and three (3) pesticides. Cyanide was the only inorganic constituent detected above WQC. Pesticides detected above WQC include total endosulfan, gamma-chlordane, and heptachlor. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 4 Site 4, a total of two (2) contaminants exceeded WQC, including two (2) pesticides. Pesticides detected above WQC include total endosulfan and heptachlor.

For the individual sample DMMU 4 Site 5, a total of one (1) contaminant exceeded WQC, including one (1) pesticide. Heptachlor was the only pesticide detected above WQC.

For the individual sample DMMU 4 Site 6, a total of one (1) contaminant exceeded WQC, including one (1) pesticide. Heptachlor was the only pesticide detected above WQC

For the individual sample DMMU 4 Site 7, no contaminants exceeded WQC.

For the individual sample DMMU 4 Site 8, a total of four (4) contaminants exceeded WQC, including one (1) inorganic and three (3) pesticides. Cyanide was the only inorganic constituent detected above WQC. Pesticides detected above WQC include total endosulfan, gamma-chlordane, and heptachlor.

Dredged Elutriates Derived from Native Sediment
Native subsurface soil samples obtained for DMMU 4 were relegated to DMMU 4/5; therefore, the native dredged elutriate results for DMMU 4 can be found in the dredged elutriates summary for DMMU 4/5.

3.8.8.5 DMMU 5

Dredged Elutriates Derived from Non-native Sediment
Non-native dredged elutriate samples analyzed from DMMU 5 include five (5) individual samples and one (1) composite sample. Individual samples, which include DMMU 5 Sites 4 through 8, were derived from sediment. The composite sample, which includes DMMU 5 Sites 1 through 3 was derived from sediment.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 5, including one (1) inorganic, one (1) PCB, and two (2) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan and heptachlor.

Analysis of the composite non-native samples for DMMU 5 revealed a total of one (1) contaminant which exceeded WQC, including one (1) pesticide. Heptachlor was the only pesticide detected above WQC. None of these exceedances were for acute WQC.

Analysis of the individual non-native samples for DMMU 5 revealed a total of four (4) contaminants which exceeded WQC, including one (1) inorganic, one (1) PCB, and two (2) pesticides. Cyanide was the only inorganic constituent detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan and heptachlor. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 5 Site 4, revealed a total of three (3) contaminants which exceeded WQC, including one (1) PCB and two (2) pesticides. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan and heptachlor.

For the individual sample DMMU 5 Site 5, revealed a total of three (3) contaminants which exceeded WQC, including one (1) PCB and two (2) pesticides. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan and heptachlor

For the individual sample DMMU 5 Site 6, revealed a total of three (3) contaminants which exceeded WQC, including one (1) inorganic, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic detected above WQC. Total PCBs were detected above WQC. Heptachlor was the only pesticides detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 5 Site 7, revealed a total of two (2) contaminants which exceeded WQC, including one (1) inorganic and one (1) pesticide. Cyanide was the only inorganic detected above WQC. Total endosulfan was the only pesticides detected above WQC. Cyanide was the only contaminant to exceed acute WQC

For the individual sample DMMU 5 Site 8, revealed a total of three (3) contaminants which exceeded WQC, including one (1) inorganic, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic detected above WQC. Total PCBs were detected above WQC. Heptachlor was the only pesticide detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

Dredged Elutriates Derived from Native Sediment
Native subsurface soil samples obtained for DMMU 5 were relegated to DMMU 4/5; therefore, the native dredged elutriate results for DMMU 5 can be found in the dredged elutriates summary for DMMU 4/5.

3.8.8.6 DMMU 4/5

Dredged Elutriates Derived from Non-native Sediment
There were no non-native samples for DMMU 4/5; there are separate non-native samples for DMMUs 4 and 5 as described in sections 3.8.8.4 and 3.8.8.5, respectively.

Dredged Elutriates Derived from Native Sediment
Native subsurface soil samples analyzed from DMMU 4/5 includes include two (2) composite samples and nine (9) individual samples. Individual samples include DMMU 4/5 Sites 4 through 8 and 12 through 16. One composite sample includes DMMU 4/5 Sites 1 and 11 and the other composite sample includes DMMU 4/5 Sites 2 through 10.

A total of six (6) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 4/5, including one (1) inorganic, one (1) metal, one (1) PCB, and three (3) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan, gamma-chlordane, and heptachlor.

One (1) pesticide was detected above WQC throughout all of the sampling stations within DMMU 4/5. Heptachlor was the only pesticide detected above WQC.

Analysis of the composite native samples for DMMU 4/5 revealed a total of two (2) contaminants which exceeded WQC, including one (1) inorganic and one (1) pesticide. Cyanide was the only inorganic constituent detected above WQC. Heptachlor was the only pesticide detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

For the composite native sample for DMMU 4/5 Sites 1 and 11, revealed a total of two (2) contaminants exceeded WQC, including one (1) inorganic and one (1) pesticide. The inorganic cyanide was the only contaminant detected above WQC. Heptachlor was the only pesticide detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

For the composite native sample for DMMU 4/5 Sites 2 through 10, revealed a total of two (2) contaminants exceeded WQC, including one (1) inorganic and one (1) pesticide. The inorganic cyanide was the only contaminant detected above WQC. Heptachlor was the only pesticide detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

Analysis of the individual native samples for DMMU 4/5 revealed a total of six (6) contaminants which exceeded WQC, including one (1) inorganic, one (1) metal, one (1) PCB, and three (3) pesticides. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan, gamma-chlordane, and heptachlor. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 4/5 Site 4, a total of one (1) contaminant exceeded WQC, including one (1) pesticide. Heptachlor was the only pesticide detected above WQC.

For the individual sample DMMU 4/5 Site 5, a total of two (2) contaminants exceeded WQC, including two (2) pesticides. Pesticides detected above WQC include total endosulfan and heptachlor.

For the individual sample DMMU 4/5 Site 6, a total of two (2) contaminants exceeded WQC, including two (2) pesticides. Pesticides detected above WQC include total endosulfan and heptachlor.

For the individual sample DMMU 4/5 Site 7, a total of two (2) contaminants exceeded WQC, including two (2) pesticides. Pesticides detected above WQC include total endosulfan and heptachlor.

For the individual sample DMMU 4/5 Site 8, a total of four (4) contaminants exceeded WQC, including one (1) inorganic, one (1) metal, and two (2) pesticides. Cyanide was the only inorganic detected above WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 4/5 Site 12, a total of four (4) contaminants exceeded WQC, including one (1) inorganic, one (1) PCB, and two (2) pesticides. Cyanide was the only inorganic detected above WQC. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan and heptachlor. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 4/5 Site 13, a total of four (4) contaminants exceeded WQC, including one (1) PCB, and three (3) pesticides. Total PCBs were detected above WQC. Pesticides detected above WQC include total endosulfan, gamma-chlordane, and heptachlor.

For the individual sample DMMU 4/5 Site 15, a total of three (3) contaminants exceeded WQC, including one (1) inorganic, one (1) PCB, and one (1) pesticide. Cyanide was the only inorganic detected above WQC. Total PCBs were detected above WQC. Heptachlor was the only pesticide detected above. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 4/5 Site 16, a total of two (2) contaminants exceeded WQC, including two (2) pesticides. Pesticides detected above WQC include gamma-chlordane and heptachlor.

3.8.8.7 DMMU 6

Dredged Elutriates Derived from Non-native Sediment

Non-native dredged elutriate samples analyzed from DMMU 6 include six (6) individual samples. Individual samples, which include DMMU 6 Sites 1 through 6, were derived from sediment.

A total of six (6) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 6, including one (1) inorganic, one (1) metal, and four (4) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, gamma-chlordane, and heptachlor.

Analysis of the individual non-native samples for DMMU 6 revealed a total of six (6) contaminants which exceeded WQC, including one (1) inorganic, one (1) metal, and four (4) pesticides. Cyanide was the only inorganic constituent detected above WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, gamma-chlordane, and heptachlor. Cyanide and copper were the only contaminants to exceed acute WQC.

For the individual sample DMMU 6 Site 1, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 6 Site 2, revealed a total of four (4) contaminants which exceeded WQC, including one (1) inorganic, one (1) metal, and two (2) pesticides. Cyanide was the only inorganic detected above WQC. Copper was the only metal detected above WQC. Pesticides detected above WQC include gamma-chlordane and heptachlor. Cyanide and copper were the only contaminants to exceed acute WQC.

For the individual sample DMMU 6 Site 3, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC

For the individual sample DMMU 6 Site 4, revealed a total of three (3) contaminants which exceeded WQC, including three (3) pesticides. Pesticides detected above WQC include 4,4'-DDT, gamma-chlordane, and heptachlor.

For the individual sample DMMU 6 Site 5, revealed a total of two (2) contaminants which exceeded WQC, including one (1) inorganic and one (1) pesticide. Cyanide was the only inorganic detected above WQC. Heptachlor was the only pesticide detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 6 Site 6, revealed a total of four (4) contaminants which exceeded WQC, including one (1) metal and three (3) pesticides. Copper was the only metal detected above WQC. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, and heptachlor.

Dredged Elutriates Derived from Native Sediment
Native subsurface soil samples analyzed from DMMU 6 include six (6) individual samples. Individual samples include DMMU 6 Sites 1 through 6.

A total of nine (9) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 6, including one (1) inorganic, two (2) metals, and six (6) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include copper and nickel. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide.

Analysis of the individual native samples for DMMU 6 revealed a total of nine (9) contaminants which exceeded WQC, including one (1) inorganic, two (2) metals, and six (6) pesticides. Cyanide was the only inorganic constituent detected exceeding WQC. Metals detected above WQC include copper and nickel. Pesticides detected above WQC include 4,4'-DDT, total endosulfan, endrin, gamma-chlordane, heptachlor, and heptachlor epoxide. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 6 Site 1, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 6 Site 2, a total of four (4) contaminants exceeded WQC, including four (4) pesticides. Pesticides detected above WQC include total endosulfan, gamma-chlordane heptachlor, and heptachlor epoxide.

For the individual sample DMMU 6 Site 3, a total of two (2) contaminants exceeded WQC including one (1) inorganic and one (1) metal. Cyanide was the only inorganic detected above WQC. Copper was the only metal detected above WQC.

For the individual sample DMMU 6 Site 4, a total of one (1) contaminant exceeded WQC, including one (1) pesticide. Heptachlor epoxide was the only pesticide detected above WQC.

For the individual sample DMMU 6 Site 5, a total of three (3) contaminants exceeded WQC, including three (3) pesticides. Pesticides detected above WQC include endrin, gamma-chlordane, and heptachlor.

For the individual sample DMMU 6 Site 6, revealed a total of four (4) contaminants which exceeded WQC, including two (2) metals and two (2) pesticides. Metals detected above WQC include copper and nickel. Pesticides detected above WQC include 4,4'-DDT and heptachlor.

3.8.8.8 DMMU 7

Dredged Elutriates Derived from Non-native Sediment

Non-native dredged elutriate samples analyzed from DMMU 7 include eight (8) individual samples. Individual samples, which include DMMU 7 Sites 2 through 9, were derived from sediment.

A total of three (3) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 7, including one (1) inorganic, one (1) metal, and one (1) pesticide. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the only metal detected above WQC. Heptachlor was the only pesticide detected above WQC.

Analysis of the individual non-native samples for DMMU 7 revealed a total of three (3) contaminants which exceeded WQC, including one (1) inorganic, one (1) metal and (1) pesticide. Cyanide was the only inorganic constituent detected exceeding WQC. Copper was the only metal detected above WQC. Heptachlor was the only pesticide detected above WQC. Cyanide and heptachlor were the only contaminants to exceed acute WQC.

For the individual sample DMMU 7 Site 2, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 7 Site 3, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 7 Site 4, one (1) contaminant exceeded WQC. The pesticide, heptachlor exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 7 Site 5, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 7 Site 6, a total of two (2) contaminants exceeded WQC, including one (1) inorganic and one (1) metal. Cyanide was the only inorganic detected above WQC. Copper was the only metal detected above WQC. Cyanide was the only contaminant to exceed acute WQC.

For the individual sample DMMU 7 Site 7, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 7 Site 8, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

For the individual sample DMMU 7 Site 9, one (1) contaminant exceeded WQC. The inorganic, cyanide exceeded acute WQC; however, no other contaminants exceeded WQC.

Dredged Elutriates Derived from Native Sediment
Native subsurface soil samples analyzed from DMMU 7 includes one (1) composite sample comprised of DMMU 7 Sites 1 through 9.

A total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 7, including one (1) metal and one (1) pesticide. Copper was the only metal detected above WQC. Total endosulfan was the only pesticide detected above WQC.

Analysis of the composite native samples for DMMU 7 revealed a total of two (2) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) metal and one (1) pesticide. Copper was the only metal detected above WQC. Total endosulfan was the only pesticide detected above WQC.

3.8.8.9 DMMU 8

Dredged Elutriates Derived from Non-native Sediment
Non-native dredged elutriate samples analyzed from DMMU 8 includes one (1) composite sample. The composite sample, which includes DMMU 8 Sites 1 through 4, was derived from sediment.

A total of one (1) contaminant detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 8, including one (1) metal. Copper was the only metal detected above WQC.

Analysis of the composite non-native samples for DMMU 8 revealed a total of one (1) contaminant which exceeded WQC for the one sampling station within the DMMU, including one (1) metal. Copper was the only metal detected above WQC. None of these exceedances were for acute WQC.

Dredged Elutriates Derived from Native Sediment
There were no native dredged elutriate samples from this DMMU.

3.8.8.10 DMMU 9

Dredged Elutriates Derived from Non-native Sediment
Non-native dredged elutriate samples analyzed from DMMU 9 include one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 9 Sites 2 and 4 was derived from sediment. The individual sample, DMMU 9 Site 1, was derived from sediment.

A total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 9, including one (1) inorganic and (1) metal. Cyanide was the only inorganic constituent detected exceeding WQC. Mercury was the only metal detected above WQC.

One (1) inorganic was detected above WQC throughout all of the sampling stations within DMMU 9.

Cyanide was the only inorganic constituent detected above WQC

Analysis of the composite non-native samples for DMMU 9 revealed a total of two (2) contaminants which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic and one (1) metal. Cyanide was the only inorganic constituent detected exceeding WQC. Mercury was the only metal detected above WQC. Cyanide exceeded the acute WQC.

Analysis of the individual non-native samples for DMMU 9 revealed a total of one (1) contaminant which exceeded WQC for at least one sampling station within the DMMU, including one (1) inorganic. Cyanide was the only inorganic constituent detected exceeding WQC. Cyanide exceeded the acute marine WQC; however it did not exceed the acute freshwater WQC.

Dredged Elutriates Derived from Native
There were no native dredged elutriate samples from this DMMU.

3.8.8.11 DMMU 10

Dredged Elutriates Derived from Non-native Sediment
Non-native dredged elutriate samples analyzed from DMMU 10 includes one (1) composite sample and one (1) individual sample. The composite sample, which includes DMMU 10 Sites 3 and 4, was derived from fill. The individual sample, DMMU 10 Site 1, was derived from sediment.

A total of four (4) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for at least one sample from DMMU 10, including two (2) metals and two (2) pesticides. Copper was the only metal detected above marine WQC. Lead was the only metal detected above freshwater WQC. Pesticides detected above WQC include 4,4'-DDT and heptachlor.

One (1) pesticide was detected above WQC throughout all of the sampling stations within DMMU 10. 4,4'-DDT was the only pesticide detected above WQC.

Analysis of the composite non-native samples for DMMU 10 revealed a total of three (3) contaminants which exceeded WQC for at least one sampling station within the DMMU, including two (2) metals and one (1) pesticide. Copper was the only metal detected above marine WQC. Lead was the only metal detected above freshwater WQC. 4,4'-DDT was the only pesticide detected above WQC.

Analysis of the individual non-native samples for DMMU 10 revealed a total of two (2) contaminants which exceeded WQC for at least one sampling station within the DMMU, including two (2) peticides. Pesticides detected above WQC 4,4'-DDT and heptachlor. None of these exceedances were for acute WQC.

Dredged Elutriates Derived from Native Sediment
Native subsurface soil samples analyzed from DMMU 10 includes one (1) composite sample comprised of DMMU 10 Sites 3 and 4.

A total of two (2) contaminants detected above the reporting limit exceeded LDEQ or USEPA WQC for the one sample from DMMU 10, including two (2) metals. Copper was the only metal detected above marine WQC. Lead was the only metal detected above freshwater WQC.

Analysis of the composite non-native samples for DMMU 10 revealed a total of two (2) contaminants which exceeded WQC for the one sampling station within the DMMU, including two (2) metals. Copper was the only metal detected above marine WQC. Lead was the only metal detected above freshwater WQC. None of these exceedances were for acute WQC.

3.8.9 Dredged Elutriate – Total Fraction

Dredged Elutriate – Total Fraction chemistry results are presented in Tables A-24 and A-25 of Appendix A. Raw analytical data reports are presented in Appendix H.

3.8.10 DREDGE Model

DREDGE Model evaluation is currently underway and results will be provided separately from this report by ERDC.

3.8.11 Tissue

Bioaccumulation tissue chemistry results from the bioaccumulation tests with the following species are presented in Tables A-26 to A-30 of Appendix A: *M. nasuta, C. fluminea, S. alterniflora, E. fetida, and C. esculentus*. Raw analytical data reports are presented in Appendix H.

3.8.12 Statistical Analyses of Tissue Chemistry

Statistical analyses of tissue chemistry indicated that several contaminant concentrations were found to be significantly elevated above the reference. These results are presented in the following sections. *C. fluminea*, a freshwater bivalve, is discussed in Section 3.8.12.1. *M. nasuta*, a marine bivalve, is discussed in Section 3.8.12.2. *E. fetida*, an earthworm, is discussed in Section 3.8.12.3. *S. alterniflora*, a wetland plant, is discussed in Section 3.8.12.4. *C. esculentus*, an upland plant, is discussed in Section 3.8.12.5. All DMMUs were tested with each species with the exception of DMMUs 1 and 2, which were not tested with *C. fluminea* and *M. nasuta*. Only analytes within each test species that were statistically elevated above the relevant reference material are presented below. The raw data for the tissue analyses are provided in Appendix A (Analytical Tables). Bioaccumulation statistical analyses are presented in Appendix J. Due to lengthy nomenclature for IHNC sediments, some tissue samples were submitted to the chemistry lab with incorrect sample IDs. The sample IDs were corrected by Weston and a nomenclature key is provided in Appendix K.

3.8.12.1 Corbicula fluminea

Bioaccumulation evaluation was not performed for DMMUs 1 and 2. *C. fluminea* tissue chemistry was compared to the Mississippi River reference.

In DMMU 3, statistically elevated tissue residues relative to the reference were detected in all samples. Four metals, several SVOCs, four pesticides, and total Aroclors were significantly elevated (Table 24). Only the mean concentrations of dibenzofuran and fluoranthene exceeded the reference by more than 25 fold, at 71.5 and 26.8 fold higher than the reference concentration, respectively. The only analytes detected on day 0 were aluminum, barium, chromium, lead, and total Aroclors. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 4, statistically elevated tissue residues relative to the reference were detected in sample 0400C1_8WTSDFB. Three metals, one pesticide, one organotin, and one Aroclor were significantly elevated (Table 24). Only the mean concentration of tributyltin (TBT) exceeded the reference by more than 25 fold, at 40.0 fold higher than the reference concentration. The only analytes detected on day 0 were chromium, lead, and selenium. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 5, statistically elevated tissue residues relative to the reference were detected in sample 0500C1_8WTSDFB. Five metals, two pesticides, one Aroclor, and total Aroclors were significantly elevated (Table 24). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were aluminum, barium, chromium, lead, selenium and total Aroclors. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 6, statistically elevated tissue residues relative to the reference were detected in all samples. Four metals, one SVOC, one pesticide, and total Aroclors were significantly elevated (Table 24). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were aluminum, barium, lead, nickel, and total Aroclors. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 7, statistically elevated tissue residues relative to the reference were detected in all samples. Five metals, several SVOCs, four pesticides, two Aroclors, and total Aroclors were significantly elevated (Table 24). Only the mean concentrations of fluoranthene and pyrene exceeded the reference by more than 25 fold, at 86.8 and 95.2 fold higher than the reference concentration, respectively. The only analytes detected on day 0 were aluminum, barium, chromium, lead, tin, dieldrin, endrin, and total Aroclors. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 8, statistically elevated tissue residues relative to the reference were detected in the composite sample 0800C1_4WOSDFB, the only sample tested for biological effects. Four metals, one SVOC, and two pesticides were significantly elevated (Table 24). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were aluminum, chromium, lead, and tin. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 9, statistically elevated tissue residues relative to the reference were detected in both samples. Four metals, three SVOCs, one pesticide, and one Aroclor were significantly elevated (Table 24). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were chromium, lead, selenium, and tin. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 10, statistically elevated tissue residues relative to the reference were detected in all samples. Several metals were significantly elevated (Table 24). No analytes exceeded the reference by more than 25 fold. The analytes detected on day 0 were aluminum, barium, chromium, lead, nickel, selenium, and tin. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 4/5, statistically elevated tissue residues relative to the reference were detected in sample 45C1_16NWNSSFB. Five metals were significantly elevated (Table 24). No analytes exceeded the reference by more than 25 fold. The analytes detected on day 0 were aluminum, chromium, nickel, selenium, and tin. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

Table 24. Summary of Statistically Elevated Tissue Residues Relative to Reference from Bioaccumulation Tests of Project Sediments Using *Corbicula fluminea*

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration[2]	MS Reference Mean Tissue Concentration[1]	MS Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
3	0300C1_3LTFIFB	Barium	mg/kg	1	0.48	0.91	0.34	3.58	0.97	<0.001	3.93
3	0300C1_3LTFIFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.51	0.03	<0.001	1.56
3	0300C1_3LTFIFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.17	0.03	<0.001	2.02
3	0300C1_3LTFIFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	6.38	0.40	<0.001	8.87
3	0300C1_3LTFIFB	4,4'-DDE	ug/kg	1.2	<1.2	0.98	0.48	7.43	2.34	<0.001	7.57
3	0300C1_3LTFIFB	4,4'-DDT	ug/kg	1.2	<1.2	0.72	0.43	3.00	0.33	0.006	4.17
3	0300C1_3LTFIFB	alpha-Chlordane	ug/kg	1.2	<1.2	0.72	0.43	6.90	5.20	0.012	9.59
3	0300C1_3LTFIFB	Aroclors (Total)	ug/kg	12	10.18	31.23	18.48	114	32.25	<0.001	3.66
3	0300C1_3LTFIFB	Acenaphthene	ug/kg	40	<800	23.99	14.35	235[3]	286	0.011	9.79
3	0300C1_3LTFIFB	Anthracene	ug/kg	40	<800	23.99	14.35	197[4]	195	<0.001	8.23
3	0300C1_3LTFIFB	Dibenzofuran	ug/kg	200	<4000	15.81	5.54	1130[5]	1474	0.048	71.48
3	0300C1_3LTFIFB	Fluoranthene	ug/kg	40	<800	23.99	14.35	259[6]	186	<0.001	10.79
3	0300C1_3LTFIFB	Phenanthrene	ug/kg	40	<800	47.02	19.49	298[7]	226	<0.001	6.35
3	0300C1_3LTFIFB	Phenol	ug/kg	40	<800	32.93	15.92	247[8]	274	0.003	7.50
3	0300C1_3LTFIFB	Pyrene	ug/kg	40	<800	23.99	14.35	271[9]	251	<0.001	11.29
3	0300C4_6WTSDFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	4.84	1.05	<0.001	6.73
3	0300C4_6WTSDFB	Acenaphthene	ug/kg	40	<800	23.99	14.35	106	48.57	0.011	4.43
3	0300C4_6WTSDFB	Anthracene	ug/kg	40	<800	23.99	14.35	73.26	32.36	<0.001	3.05
3	0300C4_6WTSDFB	Fluoranthene	ug/kg	40	<800	23.99	14.35	642	300	<0.001	26.78
3	0300C4_6WTSDFB	Phenanthrene	ug/kg	40	<800	47.02	19.49	283	124	<0.001	6.02
3	0300C4_6WTSDFB	Pyrene	ug/kg	40	<800	23.99	14.35	390	119	<0.001	16.27
3	030C1_6NBNSSFB	Aluminum	mg/kg	3	0.75	22.86	16.27	58.70	26.86	0.006	2.57
4	0400C1_8WTSDFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.47	0.04	<0.001	1.44
4	0400C1_8WTSDFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.12	0.03	<0.001	1.42
4	0400C1_8WTSDFB	Selenium	mg/kg	0.5	0.62	0.64	0.04	0.74	0.08	<0.001	1.16
4	0400C1_8WTSDFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	5.45	1.14	<0.001	7.58
4	0400C1_8WTSDFB	Tributyltin	ug/Kg	1	<1	0.50	0.24	20.00	6.96	0.001	40.00
4	0400C1_8WTSDFB	Aroclor 1248	ug/kg	12	<12	7.20	4.30	23.25	2.54	<0.001	3.23
5	0500C1_8WTSDFB	Aluminum	mg/kg	3	0.75	22.86	16.27	63.80	23.60	<0.001	2.79
5	0500C1_8WTSDFB	Barium	mg/kg	1	0.48	0.91	0.34	1.52	0.63	<0.001	1.67
5	0500C1_8WTSDFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.63	0.05	<0.001	1.94
5	0500C1_8WTSDFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.20	0.06	<0.001	2.43
5	0500C1_8WTSDFB	Selenium	mg/kg	0.5	0.62	0.64	0.04	0.88	0.08	<0.001	1.38
5	0500C1_8WTSDFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	11.93	3.39	<0.001	16.57
5	0500C1_8WTSDFB	4,4'-DDE	ug/kg	1.2	<1.2	0.98	0.48	4.27	2.43	0.037	4.35
5	0500C1_8WTSDFB	Aroclor 1248	ug/kg	12	<12	7.20	4.30	115	29.56	<0.001	16.03
5	0500C1_8WTSDFB	Aroclors (Total)	ug/kg	12	10.18	31.23	18.48	122	33.79	<0.001	3.90
6	0600C1&2WTSDFB	Aluminum	mg/kg	3	0.75	22.86	16.27	107	89.29	0.006	4.66
6	0600C1&2WTSDFB	Barium	mg/kg	1	0.48	0.91	0.34	4.10	0.87	<0.001	4.50
6	0600C1&2WTSDFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.23	0.12	<0.001	2.79
6	0600C1&2WTSDFB	Nickel	mg/kg	0.1	0.14	0.14	0.05	0.31	0.13	0.001	2.19
6	0600C1&2WTSDFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	3.38	1.87	<0.001	4.70
6	0600C1&2WTSDFB	Aroclors (Total)	ug/kg	12	10.18	31.23	18.48	98.27	32.05	<0.001	3.15
6	0600C1&2WTSDFB	4-Methylphenol	ug/kg	200	<4000	120	71.73	624	641	0.002	5.20

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration[2]	MS Reference Mean Tissue Concentration[1]	MS Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
6	0600C3_6LTFIFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.15	0.08	<0.001	1.81
6	060C1_6NBNSSFB	Aluminum	mg/kg	3	0.75	22.86	16.27	51.00	13.25	0.006	2.23
6	060C1_6NBNSSFB	Barium	mg/kg	1	0.48	0.91	0.34	2.42	0.46	<0.001	2.65
7	0700C1_4WTSDFB	Barium	mg/kg	1	0.48	0.91	0.34	3.88	0.26	<0.001	4.25
7	0700C1_4WTSDFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.60	0.13	<0.001	7.10
7	0700C1_4WTSDFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	11.30	2.96	<0.001	15.70
7	0700C1_4WTSDFB	4,4'-DDE	ug/kg	1.2	<1.2	0.98	0.48	8.88	1.67	<0.001	9.05
7	0700C1_4WTSDFB	Dieldrin	ug/kg	1.2	2.86	1.92	1.20	8.94	1.57	<0.001	4.66
7	0700C1_4WTSDFB	Endrin	ug/kg	1.2	1.92	1.79	1.30	6.90	1.75	0.007	3.86
7	0700C1_4WTSDFB	Aroclor 1016	ug/kg	12	<12	23.50	5.74	72.94	6.73	0.015	3.10
7	0700C1_4WTSDFB	Aroclor 1254	ug/kg	12	<12	13.66	15.24	138	13.46	0.005	10.10
7	0700C1_4WTSDFB	Aroclors (Total)	ug/kg	12	10.18	31.23	18.48	212	16.25	<0.001	6.80
7	0700C1_4WTSDFB	4-Methylphenol	ug/kg	200	<4000	120	71.73	770	436.31	0.002	6.42
7	0700C1_4WTSDFB	Acenaphthene	ug/kg	40	<800	23.99	14.35	138	13.26	0.011	5.77
7	0700C1_4WTSDFB	Anthracene	ug/kg	40	<800	23.99	14.35	164	18.82	<0.001	6.86
7	0700C1_4WTSDFB	Benzo(a)anthracene	ug/kg	40	<800	23.99	14.35	232	66.13	0.004	9.66
7	0700C1_4WTSDFB	Benzo(a)pyrene	ug/kg	40	<800	23.99	14.35	89.46	19.80	<0.001	3.73
7	0700C1_4WTSDFB	Benzo(b)fluoranthene	ug/kg	40	<800	23.99	14.35	205	52.46	0.009	8.56
7	0700C1_4WTSDFB	Benzo(k)fluoranthene	ug/kg	40	<800	23.99	14.35	62.49	10.57	0.001	2.61
7	0700C1_4WTSDFB	bis(2-Ethylhexyl) phthalate	ug/kg	200	<4000	120	71.73	487	244	0.165	4.06
7	0700C1_4WTSDFB	Chrysene	ug/kg	40	<800	23.99	14.35	256	61.67	0.016	10.66
7	0700C1_4WTSDFB	Fluoranthene	ug/kg	40	<800	23.99	14.35	2082	333	<0.001	86.81
7	0700C1_4WTSDFB	Phenanthrene	ug/kg	40	<800	47.02	19.49	471	53.68	<0.001	10.01
7	0700C1_4WTSDFB	Pyrene	ug/kg	40	<800	23.99	14.35	2283	778	<0.001	95.17
7	0700C5_9LTFIFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.21	0.14	<0.001	2.45
7	070C1_9NBNSSFB	Aluminum	mg/kg	3	0.75	22.86	16.27	54.74	22.02	<0.001	2.39
7	070C1_9NBNSSFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.42	0.04	<0.001	1.31
7	070C1_9NBNSSFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.13	0.03	<0.001	1.52
7	070C1_9NBNSSFB	Tin	mg/kg	0.5	1.80	0.25	0.13	1.68	0.38	0.001	6.72
8	0800C1_4WOSDFB	Aluminum	mg/kg	3	0.75	22.86	16.27	56.00	27.58	<0.001	2.45
8	0800C1_4WOSDFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.40	0.07	<0.001	1.25
8	0800C1_4WOSDFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.16	0.02	<0.001	1.95
8	0800C1_4WOSDFB	Tin	mg/kg	0.5	1.80	0.25	0.13	1.34	0.74	0.001	5.37
8	0800C1_4WOSDFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	9.34	2.43	<0.001	12.98
8	0800C1_4WOSDFB	4,4'-DDE	ug/kg	1.2	<1.2	0.98	0.48	4.66	2.23	0.037	4.75
8	0800C1_4WOSDFB	Phenanthrene	ug/kg	800	<800	157	237	435	278	0.103	2.77
9	09000001WOSDFB	Tin	mg/kg	0.5	1.80	0.25	0.13	1.84	0.44	0.001	7.36
9	09000001WOSDFB	Phenanthrene	ug/kg	800	<800	157	237	435	120	0.103	2.77
9	0900C2&4WOSDFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.44	0.03	<0.001	1.35
9	0900C2&4WOSDFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.14	0.03	<0.001	1.64
9	0900C2&4WOSDFB	Selenium	mg/kg	0.5	0.62	0.64	0.04	0.77	0.05	<0.001	1.21
9	0900C2&4WOSDFB	4,4'-DDD	ug/kg	1.2	<1.2	0.72	0.43	4.72	3.00	<0.001	6.56
9	0900C2&4WOSDFB	Aroclor 1248	ug/kg	12	<12	7.20	4.30	65.91	28.96	<0.001	9.16
9	0900C2&4WOSDFB	Diethyl phthalate	ug/kg	4000	<4000	373	723	1902	1519	0.084	5.10
9	0900C2&4WOSDFB	Pyrene	ug/kg	800	<800	480	287	1032	526	0.015	2.15

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration[2]	MS Reference Mean Tissue Concentration[1]	MS Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
10	10000001WTSDFB	Aluminum	mg/kg	3	0.75	22.86	16.27	51.40	8.30	0.006	2.25
10	10000001WTSDFB	Barium	mg/kg	1	0.48	0.91	0.34	3.05	0.55	<0.001	3.34
10	10000001WTSDFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.15	0.01	<0.001	1.76
10	1000C3&4LTFIFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.59	0.02	<0.001	1.82
10	1000C3&4LTFIFB	Lead	mg/kg	0.1	0.05	0.08	0.03	0.11	0.02	<0.001	1.35
10	1000C3&4LTFIFB	Nickel	mg/kg	0.1	0.14	0.14	0.05	0.20	0.02	<0.001	1.41
10	1000C3&4LTFIFB	Selenium	mg/kg	0.5	0.62	0.64	0.04	0.86	0.08	<0.001	1.34
10	100C3&4NLNSSFB	Aluminum	mg/kg	3	0.75	22.86	16.27	51.96	14.62	<0.001	2.27
10	100C3&4NLNSSFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.45	0.09	<0.001	1.38
10	100C3&4NLNSSFB	Nickel	mg/kg	0.1	0.14	0.14	0.05	0.24	0.06	<0.001	1.70
10	100C3&4NLNSSFB	Tin	mg/kg	0.5	1.80	0.25	0.13	1.70	0.34	0.001	6.80
45	45C1_16NWNSSFB	Aluminum	mg/kg	3	0.75	22.86	16.27	49.10	10.24	<0.001	2.15
45	45C1_16NWNSSFB	Chromium	mg/kg	0.2	0.71	0.32	0.08	0.60	0.03	<0.001	1.85
45	45C1_16NWNSSFB	Nickel	mg/kg	0.1	0.14	0.14	0.05	0.20	0.02	<0.001	1.40
45	45C1_16NWNSSFB	Selenium	mg/kg	0.5	0.62	0.64	0.04	0.81	0.04	<0.001	1.27
45	45C1_16NWNSSFB	Tin	mg/kg	0.5	1.80	0.25	0.13	1.44	0.15	0.001	5.76

[1] Tissue organic chemical concentrations were normalized to lipid concentrations prior to statistical analyses
[2] Day 0 tissues were analyzed at higher MDL.
[3] Project area mean was biased by 2 replicates with elevated detection limits (800 ug/kg) while three of the replicates had J values less than 40 ug/kg.
[4] Project area mean was biased by 2 replicates with elevated detection limits (800 ug/kg) while one of the replicates had nondetect values less than 40 ug/kg and two replicates had detected values of 70 and 68 ug/kg.
[5] Project area mean was biased by 2 replicates with elevated detection limits (4000 ug/kg) while three of the replicates had J values less than 40 ug/kg.
[6] Project area mean was biased by 2 replicates with elevated detection limits (800 ug/kg) while one of the replicates had nondetect values less than 40 ug/kg and two replicates had detected values of 150 and 270 ug/kg.
[7] Project area mean was biased by 2 replicates with elevated detection limits (800 ug/kg)] while three replicates had detected values of 123, 130, and 150 ug/kg.
[8] Project area mean was biased by 2 replicates with elevated detection limits (800 ug/kg) while three replicates had detected values of 42, 37J, and 36J ug/kg.
[9] Project area mean was biased by 2 replicates with elevated detection limits (800 ug/kg) while three replicates had detected values of 82, 70, and 76 ug/kg.

3.8.12.2 *Macoma nasuta*

DMMUs 1 and 2 were not tested in 2007. These tests were conducted in 2005 by ERDC. *M. nasuta* tissue chemistry was compared to the SB reference.

In DMMU 3, no analytes were statistically elevated above the reference in sample 030C1_6NBNSSMB. Statistically elevated tissue residues relative to the reference were detected in samples 0300C1_3LTFIMB and 0300C4_6WTSDMB. Three metals, four SVOCs, two Aroclors, and total Aroclors were significantly elevated (Table 25). Only the mean concentrations of Aroclors exceeded the reference by more than 25 fold, ranging from 33.3 to 87.3 fold higher than the reference concentration. The only analytes detected on day 0 were aluminum, barium, lead, and phenanthrene. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 4, statistically elevated tissue residues relative to the reference were detected in sample 0400C1_8WTSDMB. Four metals, several SVOCs, one pesticide, and two organotins were significantly elevated (Table 25). Only the mean concentration of TBT exceeded the reference by more than 25 fold, at 60.2 fold higher than the reference concentration. The only analytes detected on day 0 were aluminum, barium, calcium, and lead. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 5, statistically elevated tissue residues relative to the reference were detected in sample 0500C1_8WTSDMB. Several metals, four SVOCs, two Aroclors, total Aroclors, and two pesticides were significantly elevated (Table 25). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were aluminum, barium, calcium, copper, lead, and nickel. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 6, no analytes were statistically elevated above the reference in sample 060C1_6NBNSSMB. Statistically elevated tissue residues relative to the reference were detected in samples 0600C1&2WTSDMB and 0600C3_6LTFIMB. Two metals, one SVOC, and one pesticide were significantly elevated (Table 25). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were barium, lead, and 1,4-dichlorobenzene. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 7, statistically elevated tissue residues relative to the reference were detected in all samples. Three metals, several SVOCs, four pesticides, two Aroclors, and total Aroclors were significantly elevated (Table 25). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were barium, lead, tin, benzoic acid, and 1,4-dichlorobenzene. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 8, statistically elevated tissue residues relative to the reference were detected in sample 0800C1_4WOSDMB. Three metals, three SVOCs, two Aroclors, and total Aroclors were significantly elevated (Table 25). Only the mean concentrations of Aroclors exceeded the reference by more than 25 fold, ranging from 28.8 to 99.1 fold higher than the reference concentration. The only analytes detected on day 0 were aluminum, barium, lead, and phenanthrene. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 9, statistically elevated tissue residues relative to the reference were detected in samples. Two metals, three SVOCs, and three pesticides were significantly elevated (Table 25). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were barium, calcium, and dieldrin. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 10, no analytes were statistically elevated above the reference in sample 100C3&4NLNSSMB. Statistically elevated tissue residues relative to the reference were detected in samples 10000001WTSDMB and 1000C3&4LTFIMB. Five metals, several SVOCs, and two pesticides were significantly elevated (Table 25). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were barium, calcium, lead, tin, 1,4-dichlorobenzene, and benzoic acid. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In the Mitigation Site, statistically elevated tissue residues relative to the reference were detected. Two metals, two Aroclors, and total Aroclors were significantly elevated (Table 25). Only the mean concentrations of Aroclors exceeded the reference by more than 25 fold, ranging from 27.2 to 82.5 fold higher than the reference concentration. The only analytes detected on day 0 were barium and lead. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

Table 25. Summary of Statistically Elevated Tissue Residues Relative to Reference from Bioaccumulation Tests of Project Sediments Using *Macoma nasuta*

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	SB Reference Mean Tissue Concentration[1]	SB Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
3	0300C1_3LTFIMB	Aluminum	mg/kg	3	4	19.96	7.39	59.18	25.47	0.007	2.96
3	0300C1_3LTFIMB	Barium	mg/kg	1	0.33	0.45	0.06	1.16	0.39	<0.001	2.61
3	0300C1_3LTFIMB	Lead	mg/kg	0.1	0.18	0.21	0.02	0.44	0.12	<0.001	2.08
3	0300C4_6WTSDMB	Aluminum	mg/kg	3	4	19.96	7.39	54.84	21.29	0.007	2.75
3	0300C4_6WTSDMB	Barium	mg/kg	1	0.33	0.45	0.06	5.90	3.08	<0.001	13.23
3	0300C4_6WTSDMB	Lead	mg/kg	0.1	0.18	0.21	0.02	0.98	0.77	<0.001	4.62
3	0300C4_6WTSDMB	Aroclor 1248	ug/kg	0.83	<0.83	0.85	0.49	46.23	6.91	0.001	54.11
3	0300C4_6WTSDMB	Aroclor 1254	ug/kg	0.83	<0.83	0.85	0.49	28.46	6.96	0.008	33.31
3	0300C4_6WTSDMB	Aroclors (Total)	ug/kg	0.83	<0.83	0.85	0.49	74.63	13.19	0.004	87.34
3	0300C4_6WTSDMB	Benzo(a)anthracene	ug/kg		<40	41.18	23.72	93.20	28.80	0.086	2.26
3	0300C4_6WTSDMB	Fluoranthene	ug/kg	40	<40	41.18	23.72	511.65	123.51	<0.001	12.43
3	0300C4_6WTSDMB	Phenanthrene	ug/kg	40	14	37.58	16.09	173.50	54.36	<0.001	4.62
3	0300C4_6WTSDMB	Pyrene	ug/kg	40	<40	41.18	23.72	408.52	132.04	<0.001	9.92
4	0400C1_8WTSDMB	Aluminum	mg/kg	3	11.3	15.88	4.03	30.56	12.42	<0.001	1.92
4	0400C1_8WTSDMB	Barium	mg/kg	1	0.34	0.42	0.08	8.74	3.77	<0.001	20.61
4	0400C1_8WTSDMB	Calcium	mg/kg	10	731	352.00	49.29	576.80	307.78	0.002	1.64
4	0400C1_8WTSDMB	Lead	mg/kg	0.1	0.19	0.23	0.04	0.48	0.13	<0.001	2.07
4	0400C1_8WTSDMB	4,4'-DDD	ug/kg	1.2	<1.2	1.03	0.65	3.24	0.99	<0.001	3.13
4	0400C1_8WTSDMB	Dibutyltin	ug/kg	1	NA	0.43	0.19	3.02	1.61	0.004	6.98
4	0400C1_8WTSDMB	Tributyltin	ug/kg	1	NA	0.43	0.19	26.00	4.00	<0.001	60.19
4	0400C1_8WTSDMB	Aroclor 1254	ug/kg	12	<12	10.35	6.48	37.52	9.06	<0.001	3.63
4	0400C1_8WTSDMB	Aroclors (Total)	ug/kg	12	<12	10.35	6.48	71.00	35.45	<0.001	6.86
4	0400C1_8WTSDMB	Benzo(a)anthracene	ug/kg	40	<40	34.49	21.59	92.34	25.98	0.002	2.68
4	0400C1_8WTSDMB	Chrysene	ug/kg	40	<40	34.49	21.59	79.86	23.41	<0.001	2.32
4	0400C1_8WTSDMB	Fluoranthene	ug/kg	40	<40	34.49	21.59	370.18	97.30	<0.001	10.73
4	0400C1_8WTSDMB	Phenanthrene	ug/kg	40	<40	25.52	7.31	110.49	22.08	<0.001	4.33
4	0400C1_8WTSDMB	Pyrene	ug/kg	40	<40	34.49	21.59	259.08	48.25	<0.001	7.51
5	0500C1_8WTSDMB	Aluminum	mg/kg	3	11.3	15.88	4.03	46.94	12.82	<0.001	2.96
5	0500C1_8WTSDMB	Barium	mg/kg	1	0.34	0.42	0.08	3.46	1.33	<0.001	8.16
5	0500C1_8WTSDMB	Calcium	mg/kg	10	731	352.00	49.29	802.80	664.32	0.002	2.28
5	0500C1_8WTSDMB	Copper	mg/kg	0.2	1.9	1.72	0.22	2.30	0.28	0.003	1.34
5	0500C1_8WTSDMB	Lead	mg/kg	0.1	0.19	0.23	0.04	0.63	0.33	<0.001	2.75
5	0500C1_8WTSDMB	Nickel	mg/kg	0.1	0.43	0.45	0.06	0.57	0.11	0.007	1.26
5	0500C1_8WTSDMB	4,4'-DDD	ug/kg	1.2	<1.2	1.03	0.65	5.33	1.60	<0.001	5.15
5	0500C1_8WTSDMB	4,4'-DDE	ug/kg	1.2	<1.2	2.65	1.67	5.47	2.32	0.065	2.06
5	0500C1_8WTSDMB	Aroclor 1248	ug/kg	12	<12	10.35	6.48	103.47	33.91	<0.001	10.00
5	0500C1_8WTSDMB	Aroclor 1254	ug/kg	12	<12	10.35	6.48	59.55	13.63	<0.001	5.76
5	0500C1_8WTSDMB	Aroclors (Total)	ug/kg	12	<12	10.35	6.48	163.01	46.91	<0.001	15.76
5	0500C1_8WTSDMB	Benzo(a)anthracene	ug/kg	40	<40	34.49	21.59	73.79	15.69	0.002	2.14
5	0500C1_8WTSDMB	Fluoranthene	ug/kg	40	<40	34.49	21.59	320.44	55.73	<0.001	9.29
5	0500C1_8WTSDMB	Phenanthrene	ug/kg	40	<40	25.52	7.31	91.02	16.72	<0.001	3.57
5	0500C1_8WTSDMB	Pyrene	ug/kg	40	<40	34.49	21.59	217.88	43.05	<0.001	6.32
6	0600C1&2WTSDMB	Barium	mg/kg	1	0.29	0.48	0.15	1.18	0.48	<0.001	2.44
6	0600C1&2WTSDMB	Lead	mg/kg	0.1	0.13	0.26	0.03	0.42	0.07	<0.001	1.60
6	0600C3_6LTFIMB	Lead	mg/kg	0.1	0.13	0.26	0.03	0.35	0.06	<0.001	1.35

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	SB Reference Mean Tissue Concentration[1]	SB Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
6	0600C3_6LTFIMB	Heptachlor epoxide	ug/kg	1.2	<1.2	1.02	0.43	2.20	0.97	0.005	2.16
6	0600C3_6LTFIMB	1,4-Dichlorobenzene	ug/kg	40	50	49.92	9.82	77.02	11.95	<0.001	1.54
7	0700C1_4WTSDMB	Barium	mg/kg	1	0.34	0.42	0.08	2.84	1.16	<0.001	6.70
7	0700C1_4WTSDMB	Lead	mg/kg	0.1	0.19	0.23	0.04	0.88	0.66	<0.001	3.83
7	0700C1_4WTSDMB	Tin	mg/kg	0.5	0.11	0.19	0.13	0.83	0.39	<0.001	4.30
7	0700C1_4WTSDMB	4,4'-DDD	ug/kg	1.2	<1.2	1.03	0.65	4.57	1.17	<0.001	4.41
7	0700C1_4WTSDMB	4,4'-DDT	ug/kg	1.2	<1.2	1.03	0.65	2.85	1.89	0.209	2.76
7	0700C1_4WTSDMB	Aroclor 1248	ug/kg	12	<12	10.35	6.48	89.12	12.72	<0.001	8.61
7	0700C1_4WTSDMB	Aroclor 1254	ug/kg	12	<12	10.35	6.48	75.13	10.95	<0.001	7.26
7	0700C1_4WTSDMB	Aroclors (Total)	ug/kg	12	<12	10.35	6.48	165.27	23.91	<0.001	15.97
7	0700C1_4WTSDMB	Benzo(a)anthracene	ug/kg	40	<40	34.49	21.59	100.49	26.73	0.002	2.91
7	0700C1_4WTSDMB	Chrysene	ug/kg	40	<41	34.49	21.59	102.59	33.65	<0.001	2.97
7	0700C1_4WTSDMB	Fluoranthene	ug/kg	40	<40	34.49	21.59	505.30	157.93	<0.001	14.65
7	0700C1_4WTSDMB	Phenanthrene	ug/kg	40	<40	25.52	7.31	129.50	41.81	<0.001	5.07
7	0700C1_4WTSDMB	Pyrene	ug/kg	40	<40	34.49	21.59	453.82	141.73	<0.001	13.16
7	0700C5_9LTFIMB	4,4'-DDT	ug/kg	1.2	<1.2	0.74	0.53	4.85	6.62	0.048	6.58
7	0700C5_9LTFIMB	delta-BHC	ug/kg	1.2	<1.2	4.84	1.15	10.23	4.60	0.003	2.11
7	0700C5_9LTFIMB	Dieldrin	ug/kg	1.2	<1.2	0.86	0.53	2.48	0.82	0.009	2.90
7	0700C5_9LTFIMB	1,4-Dichlorobenzene	ug/kg	40	50	49.92	9.82	127.49	51.68	<0.001	2.55
7	0700C5_9LTFIMB	4-Methylphenol	ug/kg	200	<200	45.31	13.02	207.00	120.75	0.031	4.57
7	0700C5_9LTFIMB	Benzoic acid	ug/kg	1000	770	855.10	311.37	1691.69	882.41	<0.001	1.98
7	0700C5_9LTFIMB	Dibenzofuran	ug/kg	200	<200	191.98	94.40	506.67	205.50	<0.001	2.64
7	0700C5_9LTFIMB	Fluorene	ug/kg	40	<40	28.51	17.65	318.66	380.93	0.004	11.18
7	070C1_9NBNSSMB	Lead	mg/kg	0.1	0.13	0.26	0.03	0.35	0.05	<0.001	1.35
7	070C1_9NBNSSMB	4,4'-DDT	ug/kg	1.2	<1.2	0.74	0.53	3.99	3.50	0.048	5.40
7	070C1_9NBNSSMB	delta-BHC	ug/kg	1.2	<1.2	4.84	1.15	15.57	11.22	0.003	3.22
7	070C1_9NBNSSMB	Dieldrin	ug/kg	1.2	<1.2	0.86	0.53	3.61	3.76	0.009	4.22
7	070C1_9NBNSSMB	Heptachlor epoxide	ug/kg	1.2	<1.2	1.02	0.43	5.70	6.86	0.005	5.60
7	070C1_9NBNSSMB	1,4-Dichlorobenzene	ug/kg	40	50	49.92	9.82	142.70	59.93	<0.001	2.86
7	070C1_9NBNSSMB	4-Methylphenol	ug/kg	200	<200	45.31	13.02	164.54	79.78	0.031	3.63
7	070C1_9NBNSSMB	Dibenzofuran	ug/kg	200	<200	191.98	94.40	578.54	178.13	<0.001	3.01
7	070C1_9NBNSSMB	Fluorene	ug/kg	40	<40	28.51	17.65	571.53	231.66	0.004	20.05
7	070C1_9NBNSSMB	Phenanthrene	ug/kg	40	<40	247.37	59.49	603.28	244.53	0.003	2.44
8	0800C1_4WOSDMB	Aluminum	mg/kg	3	4	19.96	7.39	54.74	14.91	0.007	2.74
8	0800C1_4WOSDMB	Barium	mg/kg	1	0.33	0.45	0.06	3.82	2.43	<0.001	8.57
8	0800C1_4WOSDMB	Lead	mg/kg	0.1	0.18	0.21	0.02	0.45	0.09	<0.001	2.13
8	0800C1_4WOSDMB	Aroclor 1248	ug/kg	0.83	<0.83	0.85	0.49	60.96	30.20	0.001	71.34
8	0800C1_4WOSDMB	Aroclor 1254	ug/kg	0.83	<0.83	0.85	0.49	24.56	12.72	0.008	28.75
8	0800C1_4WOSDMB	Aroclors (Total)	ug/kg	0.83	<0.83	0.85	0.49	84.69	41.51	0.004	99.12
8	0800C1_4WOSDMB	Fluoranthene	ug/kg	40	<40	41.18	23.72	378.87	220.52	<0.001	9.20
8	0800C1_4WOSDMB	Phenanthrene	ug/kg	40	14	37.58	16.09	141.64	81.16	<0.001	3.77
8	0800C1_4WOSDMB	Pyrene	ug/kg	40	<40	41.18	23.72	260.67	158.05	<0.001	6.33
9	09000001WOSDMB	Calcium	mg/kg	10	731	352.00	49.29	499.00	58.70	0.002	1.42
9	09000001WOSDMB	Fluoranthene	ug/kg	40	<40	34.49	21.59	328.50	162.12	<0.001	9.53
9	09000001WOSDMB	Phenanthrene	ug/kg	40	<40	25.52	7.31	196.98	101.17	<0.001	7.72
9	09000001WOSDMB	Pyrene	ug/kg	40	<40	34.49	21.59	185.43	85.08	<0.001	5.38
9	0900C2&4WOSDMB	Barium	mg/kg	1	0.34	0.42	0.08	1.82	0.53	<0.001	4.29

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	SB Reference Mean Tissue Concentration[1]	SB Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
9	0900C2&4WOSDMB	Endosulfan II	ug/kg	1.2	<1.2	8.73	1.58	25.57	10.60	<0.001	2.93
9	0900C2&4WOSDMB	Heptachlor epoxide	ug/kg	1.2	<1.2	1.03	0.65	8.00	5.98	0.118	7.73
9	0900C2&4WOSDMB	Dieldrin	ug/kg	1.2	0.18	1.03	0.65	4.30	3.29	0.146	4.15
9	0900C2&4WOSDMB	Fluoranthene	ug/kg	40	<40	34.49	21.59	363.15	128.97	<0.001	10.53
9	0900C2&4WOSDMB	Phenanthrene	ug/kg	40	<40	25.52	7.31	84.46	27.24	<0.001	3.31
9	0900C2&4WOSDMB	Pyrene	ug/kg	40	<40	34.49	21.59	385.87	130.17	<0.001	11.19
10	10000001WTSDMB	Barium	mg/kg	1	0.34	0.42	0.08	0.97	0.70	<0.001	2.28
10	10000001WTSDMB	Calcium	mg/kg	10	731	352.00	49.29	803.60	386.61	0.002	2.28
10	10000001WTSDMB	Chromium	mg/kg	0.2	<0.2	0.34	0.06	1.05	1.37	<0.001	3.11
10	10000001WTSDMB	Tin	mg/kg	0.5	0.11	0.19	0.13	2.22	3.01	<0.001	11.46
10	1000C3&4LTFIMB	Lead	mg/kg	0.1	0.13	0.26	0.03	0.34	0.04	<0.001	1.32
10	1000C3&4LTFIMB	delta-BHC	ug/kg	1.2	<1.2	4.84	1.15	9.12	1.69	0.003	1.89
10	1000C3&4LTFIMB	Heptachlor epoxide	ug/kg	1.2	<1.2	1.02	0.43	3.71	3.04	0.005	3.64
10	1000C3&4LTFIMB	1,4-Dichlorobenzene	ug/kg	40	50	49.92	9.82	127.19	32.43	<0.001	2.55
10	1000C3&4LTFIMB	4-Methylphenol	ug/kg	200	<200	45.31	13.02	209.18	165.06	0.031	4.62
10	1000C3&4LTFIMB	Benzoic acid	ug/kg	1000	770	855.10	311.37	1781.38	351.41	<0.001	2.08
10	1000C3&4LTFIMB	Dibenzofuran	ug/kg	200	<200	191.98	94.40	628.85	231.84	<0.001	3.28
10	1000C3&4LTFIMB	Diethyl phthalate	ug/kg	200	<200	52.53	24.74	109.52	26.87	0.023	2.08
10	1000C3&4LTFIMB	Fluorene	ug/kg	40	<40	28.51	17.65	468.75	248.35	0.004	16.44
10	1000C3&4LTFIMB	Phenanthrene	ug/kg	40	<40	247.37	59.49	591.30	102.30	0.003	2.39
MT	MT00000RWOSDMB	Barium	mg/kg	1	0.33	0.45	0.06	1.29	1.20	<0.001	2.89
MT	MT00000RWOSDMB	Lead	mg/kg	0.1	0.18	0.21	0.02	1.13	0.20	<0.001	5.34
MT	MT00000RWOSDMB	Aroclor 1248	ug/kg	0.83	<0.83	0.85	0.49	47.41	13.00	0.001	55.48
MT	MT00000RWOSDMB	Aroclor 1254	ug/kg	0.83	<0.83	0.85	0.49	23.25	13.17	0.008	27.21
MT	MT00000RWOSDMB	Aroclors (Total)	ug/kg	0.83	<0.83	0.85	0.49	70.47	25.95	0.004	82.47

[1] Tissue organic chemical concentrations were normalized to lipid concentrations prior to statistical analyses

3.8.12.3 Eisenia fetida

Several samples did not have enough tissue mass for percent lipids analysis, therefore statistical analyses was performed on data with and without normalization. *E. fetida* tissue chemistry was compared to the Bayou La Loutre reference.

In DMMU 1, statistically elevated tissue residues relative to the reference were detected in sample 0100C1_6WOSDEB. With normalization, two SVOCs, two pesticides, two Aroclors, and total Aroclors were significantly elevated (Table 26). Without normalization, three metals, five SVOCs, two pesticides, two Aroclors, and total Aroclors were significantly elevated (Table 26). In both instances, the mean concentrations of total Aroclors and pyrene exceeded the reference by more than 25 fold, ranging up to 33.9 and 41.3 fold higher than the reference concentrations, respectively. Without normalization, Aroclor 1232 also exceeded the reference by more than 25 fold, at 30.5 fold higher than the reference concentration. The only analytes detected on day 0 were arsenic, selenium, Aroclor 1232 and total Aroclors. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 2, statistically elevated tissue residues relative to the reference were detected in sample 0200C1_6WOSDEB. With normalization, two SVOCs and one pesticides were significantly elevated (Table 26), however no analytes exceeded the reference by more than 25 fold and all analytes were undetected on day 0. Without normalization, three metals, several SVOCs, two pesticides, two Aroclors, and total Aroclors were significantly elevated (Table 26). The mean concentrations of Aroclor 1242 and pyrene exceeded the reference by more than 25 fold, at 35.6 and 45.3 fold higher than the reference concentrations, respectively. The only analytes detected on day 0 were arsenic, selenium, Aroclor 1242 and total Aroclors. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 3, statistically elevated tissue residues relative to the reference were detected in all samples. With normalization, three SVOCs, four pesticides, one Aroclor, and total Aroclors were significantly elevated (Table 26). Without normalization four metals, several SVOCs, three pesticides, two Aroclors, and total Aroclors were significantly elevated (Table 26). In both instances, the mean concentrations of 4,4'-DDD, fluoranthene, and pyrene exceeded the reference by more than 25 fold, ranging up to 30.7, 40.1, and 65.0 fold higher than the reference concentrations, respectively. Without normalization, Aroclor 1242 also exceeded the reference by more than 25 fold, ranging 31.3 to 38.3 fold higher than the reference concentrations. The only analytes detected on day 0 were arsenic, cadmium, selenium, Aroclor 1232, Aroclor 1242, total Aroclors, and gamma-chlordane. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 4, statistically elevated tissue residues relative to the reference were detected in sample 0400C1_8WTSDEB. With normalization, three SVOCs were significantly elevated (Table 26). Without normalization, several SVOCs, three pesticides, and one Aroclor were significantly elevated (Table 26). In both instances, only the mean concentrations of fluoranthene and pyrene exceeded the reference by more than 25 fold, ranging up to 55.9 and 46.1 fold higher than the reference concentrations, respectively. All analytes were undetected on day 0.

In DMMU 5, statistically elevated tissue residues relative to the reference were detected in sample 0500C1_8WTSDEB. With normalization, no analytes were statistically elevated above the reference. Without normalization, one metal, several SVOCs, and several pesticides were significantly elevated (Table 26). The mean concentrations of aldrin, fluoranthene and pyrene exceeded the reference by more than 25 fold, at 48.3, 39.0, and 35.1 fold higher than the reference concentrations, respectively. The only analytes detected on day 0 were arsenic, delta-BHC, and gamma-chlordane. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 6, statistically elevated tissue residues relative to the reference were detected in all samples. With normalization, no analytes were statistically elevated above the reference in samples 0600C1&2WTSDEB and 0600C3_6LTFIEB. One pesticide was significantly elevated in sample 060C1_6NBNSSEB (Table 26). This analyte did not exceed the reference by more than 25 fold. Without normalization, one metal, two SVOCs, four pesticides, one Aroclor, and total Aroclors were significantly elevated (Table 26). Only the mean concentrations of alpha-BHC exceeded the reference by more than 25 fold, ranging from 62.5 to 65.0 fold higher than the reference concentrations. The only analytes detected on day 0 were arsenic, total Aroclors, and delta-BHC. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 7, statistically elevated tissue residues relative to the reference were detected in all samples. With normalization, no analytes were statistically elevated above the reference. Without normalization, four metals, several SVOCs, several pesticides, one Aroclor, and total Aroclors were significantly elevated (Table 26). The mean concentrations of several analytes exceeded the reference by more than 25 fold. The mean concentrations of 4,4'-DDD, aldrin, Aroclor 1254, total Aroclors, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, dieldrin, fluoranthene, and pyrene exceeded the reference by 35.7, 26.7, 41.7, 37.7, 44.8, 28.0, 55.0, 33.3, 208, and 295 fold, respectively. The only analytes detected on day 0 were arsenic, cadmium, selenium, total Aroclors, and gamma-chlordane. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 8, statistically elevated tissue residues relative to the reference were detected in sample 0800C1_4WOSDEB. With normalization, one SVOC, two pesticides, and total Aroclors were significantly elevated (Table 26). Without normalization, two metals, several SVOCs, two pesticides, one Aroclor, and total Aroclors were significantly elevated (Table 26). In both instances, the mean concentrations of 4,4'-DDD and pyrene exceeded the reference by more than 25 fold, ranging up to 26.3 and 53.8 fold higher than the reference concentrations, respectively. Without normalization, Aroclor 1242 and fluoranthene also exceeded the reference by more than 25 fold, at 40.8 and 25.4 fold higher than the reference concentrations, respectively. The only analytes detected on day 0 were arsenic, selenium, Aroclor 1242, and total Aroclors. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 9, statistically elevated tissue residues relative to the reference were detected in both samples. With normalization, no analytes were statistically elevated above the reference in sample 09000001WOSDEB. Two SVOCs and three pesticides were significantly elevated in sample 0900C2&4WOSDEB (Table 26). Without normalization, two metals, five SVOCs, and two pesticides were significantly elevated (Table 26). In both instances, the mean concentration of fluoranthene exceeded the reference by more than 25 fold, ranging up to 49.8 fold higher than the reference concentration. Without normalization, pyrene also exceeded the reference by more than 25 fold, with values up to 29.3 fold higher than the reference concentrations. The only analytes detected on day 0 were arsenic, selenium, and delta-BHC. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 10, complete mortality was observed in sample 1000C3&4LTFIEB, therefore tissue chemistry was not analyzed for this sample. With normalization, no analytes were statistically elevated above the reference in sample 100C3&4NLNSSEB. One Aroclor was significantly elevated in sample 10000001WTSDEB (Table 26). This analyte did not exceed the reference by more than 25 fold. Without normalization, statistically elevated tissue residues relative to the reference were detected in samples 10000001WTSDEB and 100C3&4NLNSSEB. Five metals, four SVOCs, and one pesticide were significantly elevated (Table 26). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were arsenic, cadmium, calcium, Aroclor 1232, and benzoic acid. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 4/5, statistically elevated tissue residues relative to the reference were detected in sample 45C1_16NWNSSEB. With normalization, four pesticides were significantly elevated (Table 26). Without normalization, one metal, two SVOCs, and one pesticide were significantly elevated (Table 26). With normalization, the mean concentration of alpha-BHC exceeded the reference by more than 25 fold, at 28.8 fold higher than the reference concentration. Without normalization, no analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were arsenic, beta-BHC, and gamma-BHC. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

Table 26. Summary of Statistically Elevated Tissue Residues Relative to Reference from Bioaccumulation Tests of Project Sediments Using *Eisenia fetida*

Lipid Normalized	DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	BL Reference Mean Tissue Concentration[1]	BL Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
Y	1	0100C1_6WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	1.30	0.61	15.14	2.84	<0.001	11.62
Y	1	0100C1_6WOSDEB	Endosulfan sulfate	µg/kg	1.2	<1.2	0.91	0.41	3.05	0.74	0.019	3.34
Y	1	0100C1_6WOSDEB	Aroclor 1232	µg/kg	12, 62	72.80	26.78	20.91	656.6	na	<0.001	24.51
Y	1	0100C1_6WOSDEB	Aroclor 1260	µg/kg	12, 62	<62	11.25	4.18	74.7	na	<0.001	6.65
Y	1	0100C1_6WOSDEB	Aroclors (Total)	µg/kg	12, 62	204.00	26.78	20.91	727.3	na	0.006	27.15
Y	1	0100C1_6WOSDEB	Phenol	µg/kg	200, 800	<400	180.38	191.01	1678	1484	0.021	9.30
Y	1	0100C1_6WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	33.46	10.92	1362	498	0.002	40.71
N	1	0100C1_6WOSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.69	0.18	<0.001	2.12
N	1	0100C1_6WOSDEB	Chromium	mg/kg	0.2	<0.2	0.13	0.08	0.35	0.10	<0.001	2.71
N	1	0100C1_6WOSDEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.69	0.12	<0.001	2.03
N	1	0100C1_6WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	9.68	3.69	<0.001	14.39
N	1	0100C1_6WOSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	3.00	1.04	<0.001	5.00
N	1	0100C1_6WOSDEB	Aroclor 1232	µg/kg	12, 62	72.80	15.93	8.19	485.0	233.35	0.007	30.46
N	1	0100C1_6WOSDEB	Aroclor 1260	µg/kg	12, 62	<62	6.00	3.10	55.0	26.87	0.003	9.17
N	1	0100C1_6WOSDEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	540.0	254.6	<0.001	33.91
N	1	0100C1_6WOSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	102.0	49.94	<0.001	5.10
N	1	0100C1_6WOSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	121	65.92	<0.001	6.07
N	1	0100C1_6WOSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	318	122	<0.001	15.90
N	1	0100C1_6WOSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	1790	1789	<0.001	23.49
N	1	0100C1_6WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	826	279	<0.001	41.30
Y	2	0200C1_6WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	1.30	0.61	8.75	3.39	<0.001	6.72
Y	2	0200C1_6WOSDEB	Phenol	µg/kg	200, 800	<400	180.38	191.01	887	324	0.021	4.92
Y	2	0200C1_6WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	33.46	10.92	813	149	0.002	24.31
N	2	0200C1_6WOSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.78	0.23	<0.001	2.40
N	2	0200C1_6WOSDEB	Chromium	mg/kg	0.2	<0.2	0.13	0.08	0.75	0.92	<0.001	5.85
N	2	0200C1_6WOSDEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.73	0.12	<0.001	2.14
N	2	0200C1_6WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	9.05	2.46	<0.001	13.46
N	2	0200C1_6WOSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	1.80	0.45	<0.001	3.00
N	2	0200C1_6WOSDEB	Aroclor 1242	µg/kg	12, 62	162.20	6.00	3.10	213.3	35.12	<0.001	35.56
N	2	0200C1_6WOSDEB	Aroclor 1260	µg/kg	12, 62	<62	6.00	3.10	29.7	10.59	0.003	4.94
N	2	0200C1_6WOSDEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	223.3	23.09	<0.001	14.02
N	2	0200C1_6WOSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	122.4	33.60	<0.001	6.12
N	2	0200C1_6WOSDEB	Benzo(b)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	43.80	17.01	<0.001	2.19
N	2	0200C1_6WOSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	129	33.12	<0.001	6.44
N	2	0200C1_6WOSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	412	28	<0.001	20.60
N	2	0200C1_6WOSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	810	484	<0.001	10.63
N	2	0200C1_6WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	906	87	<0.001	45.30
Y	3	0300C1_3LTFIEB	4,4'-DDD	µg/kg	1.2	<1.2	1.30	0.61	3.96	0.95	<0.001	3.04
Y	3	0300C1_3LTFIEB	4,4'-DDE	µg/kg	1.2	<1.2	1.12	0.42	10.03	2.68	0.017	8.92
Y	3	0300C1_3LTFIEB	Aroclors (Total)	µg/kg	12, 62	204.00	26.78	20.91	168.7	61.44	0.006	6.30
N	3	0300C1_3LTFIEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.98	0.11	<0.001	3.02
N	3	0300C1_3LTFIEB	Cadmium	mg/kg	0.1	0.13	0.11	0.09	0.28	0.05	<0.001	2.52
N	3	0300C1_3LTFIEB	Chromium	mg/kg	0.2	<0.2	0.13	0.08	0.36	0.05	<0.001	2.80
N	3	0300C1_3LTFIEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.67	0.04	<0.001	1.98

Lipid Normalized	DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	BL Reference Mean Tissue Concentration[1]	BL Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
N	3	0300C1_3LTFIEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	4.64	0.73	<0.001	6.90
N	3	0300C1_3LTFIEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	11.68	1.95	<0.001	19.47
N	3	0300C1_3LTFIEB	Aroclor 1242	µg/kg	12, 62	162.20	6.00	3.10	187.5	60.76	<0.001	31.25
N	3	0300C1_3LTFIEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	187.5	60.76	<0.001	11.77
Y	3	0300C4_6WTSDEB	4,4'-DDD	µg/kg	1.2	<1.2	1.30	0.61	35.00	na	<0.001	26.88
Y	3	0300C4_6WTSDEB	alpha-BHC	µg/kg	1.2	<1.2	1.12	0.42	6.5	na	<0.001	5.78
Y	3	0300C4_6WTSDEB	gamma-Chlordane	µg/kg	1.2	2.14	0.91	0.41	8.50	na	0.031	9.30
Y	3	0300C4_6WTSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	33.46	10.92	1313	618	0.007	39.25
Y	3	0300C4_6WTSDEB	Phenol	µg/kg	200, 800	<400	180.38	191.01	1086	762	0.021	6.02
Y	3	0300C4_6WTSDEB	Pyrene	µg/kg	40, 200, 800	<400	33.46	10.92	1941	614	0.002	58.01
N	3	0300C4_6WTSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.60	0.05	<0.001	1.84
N	3	0300C4_6WTSDEB	Chromium	mg/kg	0.2	<0.2	0.13	0.08	0.55	0.48	<0.001	4.26
N	3	0300C4_6WTSDEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.65	0.05	<0.001	1.92
N	3	0300C4_6WTSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	20.67	6.66	<0.001	30.73
N	3	0300C4_6WTSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	4.20	1.15	<0.001	7.00
N	3	0300C4_6WTSDEB	4,4'-DDT	µg/kg	1.2	<1.2	2.58	2.70	5.93	1.40	<0.001	2.30
N	3	0300C4_6WTSDEB	Aroclor 1232	µg/kg	12, 62	72.80	15.93	8.19	380.0	28.28	0.007	23.86
N	3	0300C4_6WTSDEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	380.0	28.28	<0.001	23.86
N	3	0300C4_6WTSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	121.0	45.53	<0.001	6.05
N	3	0300C4_6WTSDEB	Benzo(b)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	58.80	29.00	<0.001	2.94
N	3	0300C4_6WTSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	137	67.15	<0.001	6.87
N	3	0300C4_6WTSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	802	364	<0.001	40.10
N	3	0300C4_6WTSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	522	476	<0.001	6.85
N	3	0300C4_6WTSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	1300	367	<0.001	65.00
Y	3	030C1_6NBNSSEB	4,4'-DDD	µg/kg	1.2	<1.2	1.30	0.61	2.94	0.40	<0.001	2.26
Y	3	030C1_6NBNSSEB	Aroclor 1242	µg/kg	12, 62	162.20	11.25	4.18	249.8	140.4	0.057	22.22
Y	3	030C1_6NBNSSEB	Aroclors (Total)	µg/kg	12, 62	204.00	26.78	20.91	249.8	140.4	0.006	9.33
N	3	030C1_6NBNSSEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	1.15	0.27	<0.001	3.54
N	3	030C1_6NBNSSEB	Cadmium	mg/kg	0.1	0.13	0.11	0.09	0.17	0.04	<0.001	1.52
N	3	030C1_6NBNSSEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.68	0.03	<0.001	2.00
N	3	030C1_6NBNSSEB	Aroclor 1242	µg/kg	12, 62	162.20	6.00	3.10	229.8	83.19	<0.001	38.30
N	3	030C1_6NBNSSEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	229.8	83.19	<0.001	14.43
N	3	030C1_6NBNSSEB	4-Methylphenol	µg/kg	200, 990	<2000	108	66	398	160	<0.001	3.70
N	3	030C1_6NBNSSEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	264	112	<0.001	3.46
Y	4	0400C1_8WTSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	33.46	10.92	1046	755	0.007	31.27
Y	4	0400C1_8WTSDEB	Phenanthrene	µg/kg	40, 200, 800	<400	33.46	10.92	204	174	0.074	6.11
Y	4	0400C1_8WTSDEB	Pyrene	µg/kg	40, 200, 800	<400	33.46	10.92	836	577	0.002	25.00
N	4	0400C1_8WTSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	3.83	2.59	<0.001	5.69
N	4	0400C1_8WTSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	3.50	2.51	<0.001	5.83
N	4	0400C1_8WTSDEB	Aldrin	µg/kg	1.2	<1.2	0.60	0.31	6.1	3.48	0.034	10.17
N	4	0400C1_8WTSDEB	Aroclor 1254	µg/kg	12, 62	<62	6.00	3.10	28.0	na	<0.001	4.67
N	4	0400C1_8WTSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	192.5	113.5	<0.001	9.63
N	4	0400C1_8WTSDEB	Benzo(b)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	46.25	20.84	<0.001	2.31
N	4	0400C1_8WTSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	233	91.79	<0.001	11.63
N	4	0400C1_8WTSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	1118	323	<0.001	55.88

Lipid Normalized	DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	BL Reference Mean Tissue Concentration[1]	BL Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
N	4	0400C1_8WTSDEB	Phenanthrene	µg/kg	40, 200, 800	<400	20.00	10.54	218	88.16	<0.001	10.91
N	4	0400C1_8WTSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	728	319	<0.001	9.55
N	4	0400C1_8WTSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	923	270	<0.001	46.13
N	5	0500C1_8WTSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.73	0.12	<0.001	2.23
N	5	0500C1_8WTSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	12.00	na	<0.001	17.84
N	5	0500C1_8WTSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	6.20	na	<0.001	10.33
N	5	0500C1_8WTSDEB	Aldrin	µg/kg	1.2	<1.2	0.60	0.31	29.0	na	0.034	48.33
N	5	0500C1_8WTSDEB	delta-BHC	µg/kg	1.2	2.34	3.28	2.65	25.00	na	0.006	7.63
N	5	0500C1_8WTSDEB	Endosulfan II	µg/kg	1.2	<1.2	0.60	0.31	6.60	na	0.042	11.00
N	5	0500C1_8WTSDEB	Endrin	µg/kg	1.2	<1.2	0.60	0.31	4.40	na	<0.001	7.33
N	5	0500C1_8WTSDEB	gamma-Chlordane	µg/kg	1.2	2.14	1.88	2.56	6.80	na	0.005	3.63
N	5	0500C1_8WTSDEB	4-Methylphenol	µg/kg	200, 990	<2000	108	66	774	435	<0.001	7.19
N	5	0500C1_8WTSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	86.00	16.54	<0.001	4.30
N	5	0500C1_8WTSDEB	Benzo(b)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	62.20	13.95	<0.001	3.11
N	5	0500C1_8WTSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	126	27.35	<0.001	6.29
N	5	0500C1_8WTSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	780	152	<0.001	39.00
N	5	0500C1_8WTSDEB	Phenanthrene	µg/kg	40, 200, 800	<400	20.00	10.54	84.80	51.04	<0.001	4.24
N	5	0500C1_8WTSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	796	417	<0.001	10.45
N	5	0500C1_8WTSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	702	220	<0.001	35.10
N	6	0600C1&2WTSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.86	0.11	<0.001	2.63
N	6	0600C1&2WTSDEB	4-Methylphenol	µg/kg	200, 990	<2000	108	66	863	426	<0.001	8.02
N	6	0600C1&2WTSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	860	321	<0.001	11.29
N	6	0600C3_6LTFIEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.83	0.31	<0.001	2.56
N	6	0600C3_6LTFIEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	3.70	1.25	<0.001	5.50
N	6	0600C3_6LTFIEB	alpha-BHC	µg/kg	1.2	<1.2	0.60	0.31	39.0	21.7	0.008	65.00
N	6	0600C3_6LTFIEB	delta-BHC	µg/kg	1.2	2.34	3.28	2.65	9.27	4.56	0.006	2.83
N	6	0600C3_6LTFIEB	Endrin	µg/kg	1.2	<1.2	0.60	0.31	2.87	2.08	<0.001	4.78
N	6	0600C3_6LTFIEB	Aroclor 1260	µg/kg	12, 62	<62	6.00	3.10	32.5	21.92	0.003	5.42
N	6	0600C3_6LTFIEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	88.5	30.41	<0.001	5.56
Y	6	060C1_6NBNSSEB	alpha-BHC	µg/kg	1.2	<1.2	1.12	0.42	24.4	na	<0.001	21.74
N	6	060C1_6NBNSSEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.77	0.37	<0.001	2.35
N	6	060C1_6NBNSSEB	alpha-BHC	µg/kg	1.2	<1.2	0.60	0.31	37.5	21.9	0.008	62.50
N	6	060C1_6NBNSSEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	382	306	<0.001	5.01
N	7	0700C1_4WTSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.52	0.10	<0.001	1.60
N	7	0700C1_4WTSDEB	Lead	mg/kg	0.1	<0.1	0.18	0.06	4.02	6.22	<0.001	22.41
N	7	0700C1_4WTSDEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.49	0.04	<0.001	1.45
N	7	0700C1_4WTSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	24.00	na	<0.001	35.69
N	7	0700C1_4WTSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	9.70	na	<0.001	16.17
N	7	0700C1_4WTSDEB	4,4'-DDT	µg/kg	1.2	<1.2	2.58	2.70	19.00	na	<0.001	7.38
N	7	0700C1_4WTSDEB	Aldrin	µg/kg	1.2	<1.2	0.60	0.31	16.0	na	0.034	26.67
N	7	0700C1_4WTSDEB	Dieldrin	µg/kg	1.2	<1.2	0.60	0.31	20.00	na	0.071	33.33
N	7	0700C1_4WTSDEB	Endosulfan I	µg/kg	1.2	<1.2	0.60	0.31	5.20	na	<0.001	8.67
N	7	0700C1_4WTSDEB	Endrin	µg/kg	1.2	<1.2	0.60	0.31	14.00	na	<0.001	23.33
N	7	0700C1_4WTSDEB	gamma-Chlordane	µg/kg	1.2	2.14	1.88	2.56	11.00	na	0.005	5.87
N	7	0700C1_4WTSDEB	Aroclor 1254	µg/kg	12, 62	<62	6.00	3.10	250.0	na	<0.001	41.67

Lipid Normalized	DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	BL Reference Mean Tissue Concentration[1]	BL Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
N	7	0700C1_4WTSDEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	600.0	na	<0.001	37.68
N	7	0700C1_4WTSDEB	Anthracene	µg/kg	40	<400	19.40	9.04	170.0	28.28	0.065	8.76
N	7	0700C1_4WTSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	895.0	77.78	<0.001	44.75
N	7	0700C1_4WTSDEB	Benzo(a)pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	245.0	7.07	<0.001	12.25
N	7	0700C1_4WTSDEB	Benzo(b)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	560.0	84.85	<0.001	28.00
N	7	0700C1_4WTSDEB	Benzo(k)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	235.0	7.07	<0.001	11.75
N	7	0700C1_4WTSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	1100	141	<0.001	55.00
N	7	0700C1_4WTSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	4150	495	<0.001	207.50
N	7	0700C1_4WTSDEB	Indeno(1,2,3-cd)pyrene	µg/kg	40, 200	<400	20.00	10.54	45.00	7.07	0.030	2.25
N	7	0700C1_4WTSDEB	Phenanthrene	µg/kg	40, 200, 800	<400	20.00	10.54	400	156	<0.001	20.00
N	7	0700C1_4WTSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	1800	283	<0.001	23.62
N	7	0700C1_4WTSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	5900	283	<0.001	295.00
N	7	0700C5_9LTFIEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.83	0.23	<0.001	2.53
N	7	0700C5_9LTFIEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.48	0.05	<0.001	1.40
N	7	070C1_9NBNSSEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	1.22	0.30	<0.001	3.74
N	7	070C1_9NBNSSEB	Cadmium	mg/kg	0.1	0.13	0.11	0.09	0.19	0.01	<0.001	1.74
N	7	070C1_9NBNSSEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.54	0.03	<0.001	1.58
Y	8	0800C1_4WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	1.30	0.61	33.72	na	<0.001	25.89
Y	8	0800C1_4WOSDEB	Endosulfan II	µg/kg	1.2	<1.2	1.12	0.42	6.98	na	0.004	6.20
Y	8	0800C1_4WOSDEB	Aroclors (Total)	µg/kg	12, 62	204.00	26.78	20.91	255.8	na	0.006	9.55
Y	8	0800C1_4WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	33.46	10.92	1744	na	0.002	52.13
N	8	0800C1_4WOSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.68	0.09	<0.001	2.08
N	8	0800C1_4WOSDEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.64	0.04	<0.001	1.89
N	8	0800C1_4WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	17.60	9.17	<0.001	26.17
N	8	0800C1_4WOSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	3.20	1.85	<0.001	5.33
N	8	0800C1_4WOSDEB	Aroclor 1242	µg/kg	12, 62	162.20	6.00	3.10	245.0	35.36	<0.001	40.83
N	8	0800C1_4WOSDEB	Aroclors (Total)	µg/kg	12, 62	204.00	15.93	8.19	245.0	35.36	<0.001	15.38
N	8	0800C1_4WOSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	93.60	25.68	<0.001	4.68
N	8	0800C1_4WOSDEB	Benzo(b)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	46.00	9.43	<0.001	2.30
N	8	0800C1_4WOSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	129	36.05	<0.001	6.43
N	8	0800C1_4WOSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	508	196	<0.001	25.40
N	8	0800C1_4WOSDEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	442	328	<0.001	5.80
N	8	0800C1_4WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	1076	331	<0.001	53.80
N	9	09000001WOSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	1.68	0.36	<0.001	5.15
N	9	09000001WOSDEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.55	0.12	<0.001	1.61
N	9	09000001WOSDEB	Endosulfan I	µg/kg	1.2	<1.2	0.60	0.31	4.70	na	<0.001	7.83
N	9	09000001WOSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	133.0	66.47	<0.001	6.65
N	9	09000001WOSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	150	56.57	<0.001	7.50
N	9	09000001WOSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	995	290	<0.001	49.75
N	9	09000001WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	585	106	<0.001	29.25
Y	9	0900C2&4WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	1.30	0.61	10.05	1.51	<0.001	7.72
Y	9	0900C2&4WOSDEB	delta-BHC	µg/kg	1.2	2.34	3.14	2.28	8.92	4.62	0.081	2.85
Y	9	0900C2&4WOSDEB	Endosulfan sulfate	µg/kg	1.2	<1.2	0.91	0.41	7.94	3.97	0.019	8.69
Y	9	0900C2&4WOSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	33.46	10.92	1227	350	0.007	36.67
Y	9	0900C2&4WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	33.46	10.92	794	214	0.002	23.74

Lipid Normalized	DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	BL Reference Mean Tissue Concentration[1]	BL Reference Std Deviation	Project Area Mean Tissue Concentration[1]	Project Area Std Deviation	P value	Ratio to Reference
N	9	0900C2&4WOSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	1.34	0.29	<0.001	4.11
N	9	0900C2&4WOSDEB	Selenium	mg/kg	0.5	0.57	0.34	0.08	0.65	0.05	<0.001	1.91
N	9	0900C2&4WOSDEB	4,4'-DDD	µg/kg	1.2	<1.2	0.67	0.28	7.06	0.70	<0.001	10.50
N	9	0900C2&4WOSDEB	Benzo(a)anthracene	µg/kg	40, 200, 800	<400	20.00	10.54	81.80	35.44	<0.001	4.09
N	9	0900C2&4WOSDEB	Benzo(b)fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	53.80	19.51	<0.001	2.69
N	9	0900C2&4WOSDEB	Chrysene	µg/kg	40, 200, 800	<400	20.00	10.54	106	48.79	<0.001	5.30
N	9	0900C2&4WOSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	704	396	<0.001	35.20
N	9	0900C2&4WOSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	504	304	<0.001	25.20
Y	10	10000001WTSDEB	Aroclor 1232	µg/kg	12, 62	72.80	26.78	20.91	209.7	na	<0.001	7.83
N	10	10000001WTSDEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	1.10	0.12	<0.001	3.37
N	10	10000001WTSDEB	Cadmium	mg/kg	0.1	0.13	0.11	0.09	0.23	0.06	<0.001	2.14
N	10	10000001WTSDEB	Calcium	mg/kg	10	409	396	38	911	922	<0.001	2.30
N	10	10000001WTSDEB	Chromium	mg/kg	0.2	<0.2	0.13	0.08	0.52	0.21	<0.001	4.03
N	10	10000001WTSDEB	Lead	mg/kg	0.1	<0.1	0.18	0.06	0.47	0.13	<0.001	2.59
N	10	10000001WTSDEB	4,4'-DDE	µg/kg	1.2	<1.2	0.60	0.31	4.73	1.26	<0.001	7.88
N	10	10000001WTSDEB	Fluoranthene	µg/kg	40, 200, 800	<400	20.00	10.54	94.00	5.70	<0.001	4.70
N	10	10000001WTSDEB	Pyrene	µg/kg	40, 200, 800	<400	20.00	10.54	84.80	26.11	<0.001	4.24
N	10	100C3&4NLNSSEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.86	0.34	<0.001	2.65
N	10	100C3&4NLNSSEB	Benzoic acid	µg/kg	5100, 20000	804	31400	12012	66500	17540	<0.001	2.12
N	10	100C3&4NLNSSEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	983	184	<0.001	12.89
Y	45	45C1_16NWNSSEB	alpha-BHC	µg/kg	1.2	<1.2	1.12	0.42	32.4	na	<0.001	28.81
Y	45	45C1_16NWNSSEB	beta-BHC	µg/kg	1.2	1.20	1.12	0.42	6.20	na	0.009	5.51
Y	45	45C1_16NWNSSEB	Endosulfan II	µg/kg	1.2	<1.2	1.12	0.42	11.13	na	0.004	9.89
Y	45	45C1_16NWNSSEB	gamma-BHC (Lindane)	µg/kg	1.2	2.34	3.57	3.61	16.90	na	0.011	4.73
N	45	45C1_16NWNSSEB	Arsenic	mg/kg	0.1	0.28	0.33	0.11	0.83	0.25	<0.001	2.53
N	45	45C1_16NWNSSEB	Endosulfan II	µg/kg	1.2	<1.2	0.60	0.31	6.10	2.55	0.042	10.17
N	45	45C1_16NWNSSEB	4-Methylphenol	µg/kg	200, 990	<2000	108	66	950	526	<0.001	8.83
N	45	45C1_16NWNSSEB	Phenol	µg/kg	200, 800	<400	76.20	58.91	782	232	<0.001	10.26

na = Not available, only one replicate in comparison.

3.8.12.4 *Spartina alterniflora*

S. alterniflora tissue chemistry was compared to both the SB reference and MT reference, given the potential for use of IHNC dredged material in wetland creation/enhancement projects at various locations in the AOC. The use of the MT site alone was subject to concern given its proximity to the municipal wastewater treatment facility.

In DMMU 1, statistically elevated tissue residues relative to the references were detected in sample 0100C1_6WOSDWP. One metal, two pesticides, and one SVOC were significantly elevated compared to the SB reference (Table 27). Only the mean concentrations of alpha-chlordane and endosulfan II exceeded the SB reference by more than 25 fold, at 43.0 and 25.7 fold higher than the reference concentrations, respectively. Three pesticides and one SVOC were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane and endosulfan II exceeded the MT reference by more than 25 fold, at 43.0 and 25.7 fold higher than the reference concentrations, respectively. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 1.5 fold) relative to day 0 plants.

In DMMU 2, statistically elevated tissue residues relative to the references were detected in sample 0200C1_6WOSDWP. One metal, three pesticides, and one SVOC were significantly elevated compared to the SB reference (Table 27). Only the mean concentrations of alpha-chlordane and endosulfan II exceeded the SB reference by more than 25 fold, at 31.3 and 27.0 fold higher than the reference concentrations, respectively. One metal, five pesticides and one SVOC were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane and endosulfan II exceeded the MT reference by more than 25 fold, at 31.3 and 27.0 fold higher than the reference concentrations, respectively. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 2 fold) relative to day 0 plants.

In DMMU 3, no analytes were statistically elevated above the references in sample 030C1_6NBNSSWP. Statistically elevated tissue residues relative to the references were detected in samples 0300C1_3LTFIWP and 0300C4_6WTSDWP. One metal, three pesticides, and one SVOC were significantly elevated compared to the SB reference (Table 27). Only the mean concentrations of alpha-chlordane exceeded the SB reference by more than 25 fold, ranging 37.3 to 42.7 fold higher than the reference concentrations. Two metals, five pesticides and one SVOC were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane exceeded the MT reference by more than 25 fold, ranging 37.3 to 42.7 fold higher than the reference concentrations, respectively. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 1.5 fold) relative to day 0 plants.

In DMMU 4, statistically elevated tissue residues relative to the references were detected in sample 0400C1_8WTSDWP. Three pesticides were significantly elevated compared to the SB reference (Table 27). Only the mean concentration of alpha-chlordane exceeded the SB reference by more than 25 fold, at 54.3 fold higher than the reference concentration. Three pesticides were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane exceeded the MT reference by more than 25 fold, at 54.3 fold higher than the reference concentration. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 1.5 fold) relative to day 0 plants.

In DMMU 5, statistically elevated tissue residues relative to the references were detected in sample 0500C1_8WTSDWP. One metal and two pesticides were significantly elevated compared to the SB reference (Table 27). Only the mean concentration of alpha-chlordane exceeded the SB reference by more than 25 fold, at 50.7 fold higher than the reference concentration. Two pesticides and one SVOC were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane exceeded the MT reference by more than 25 fold, at 50.7 fold higher than the reference concentration. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 1.5 fold) relative to day 0 plants.

In DMMU 6, statistically elevated tissue residues relative to the references were detected in all samples. Three metals and three pesticides were significantly elevated compared to the SB reference (Table 27). Only the mean concentration of alpha-chlordane exceeded the SB reference by more than 25 fold, at 33.9 fold higher than the reference concentration. Three metals and four pesticides were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane exceeded the MT reference by more than 25 fold, ranging 27.9 to 33.9 fold higher than the reference concentration. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 2.5 fold) relative to day 0 plants.

In DMMU 7, statistically elevated tissue residues relative to the references were detected in all samples. Two metals and one pesticide were significantly elevated compared to the SB reference (Table 27). Only the mean concentration of alpha-chlordane exceeded the SB reference by more than 25 fold, at 40.3 fold higher than the reference concentration. Three metals and one pesticide were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane exceeded the MT reference by more than 25 fold, at 40.3 fold higher than the reference concentration. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 3 fold) relative to day 0 plants.

In DMMU 8, no analytes were statistically elevated above the MT reference. Statistically elevated tissue residues relative to the SB reference were detected in sample 0800C1_4WOSDWP. One metal was significantly elevated compared to the SB reference (Table 27). No analytes exceeded the reference by more than 25 fold. This analyte was detected on day 0. The day 0 concentration was similar to the reference and/or DMMU tissue concentration.

In DMMU 9, statistically elevated tissue residues relative to the references were detected in both samples. One metal and four pesticides were significantly elevated compared to the SB reference (Table 27). Only the mean concentrations of alpha-chlordane exceeded the SB reference by more than 25 fold, ranging 42.3 to 57.7 fold higher than reference concentrations. Four pesticides were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane exceeded the MT reference by more than 25 fold, ranging 42.3 to 57.7 fold higher than reference concentrations. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 1.5 fold) relative to day 0 plants.

In DMMU 10, statistically elevated tissue residues relative to the references were detected in all samples. Three metals and one pesticide were significantly elevated compared to the SB reference (Table 27). Only the mean concentrations of alpha-chlordane exceeded the SB reference by more than 25 fold, ranging 31.0 to 35.2 fold higher than reference concentrations. Three metals and two pesticides were significantly elevated compared to the MT reference. Only the mean concentrations of alpha-chlordane exceeded the MT reference by more than 25 fold, ranging 25.5 to 35.2 fold higher than reference concentrations. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 2 fold) relative to day 0 plants.

In DMMU 4/5, statistically elevated tissue residues relative to the references were detected in sample 45C1_16NWNSSWP. One metal and two pesticides were significantly elevated compared to the SB reference (Table 27). Only the mean concentration of alpha-chlordane exceeded the SB reference by more than 25 fold, at 29.1 fold higher than the reference concentration. One metal, two pesticides, and one SVOC were significantly elevated compared to the MT reference. Only the mean concentration of alpha-chlordane exceeded the MT reference by more than 25 fold, at 29.1 fold higher than the reference concentration. All analytes were detected on day 0. The day 0 concentrations were similar to the reference and/or DMMU tissue concentrations with the exception of alpha-chlordane. It should be noted that alpha-chlordane concentrations were significantly lower in reference plants (≈ 70 fold) relative to day 0 plants and also slightly reduced in DMMU plants (≈ 2.5 fold) relative to day 0 plants.

Table 27. Summary of Statistically Elevated Tissue Residues Relative to Reference from Bioaccumulation Tests of Project Sediments Using *Spartina alterniflora*

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	SB Reference Mean Tissue Concentration	SB Reference Std Deviation	MT Reference Mean Tissue Concentration	MT Reference Std Deviation	Project Area Mean Tissue Concentration	Project Area Std Deviation	SB Comparison P value	MT Comparison P value	Ratio to SB Reference	Ratio to MT Reference
1	0100C1_6WOSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.020	0.004	<0.001	<0.001	**4.820**	0.899
1	0100C1_6WOSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	25.80	12.19	0.004	<0.001	**43.00**	**43.00**
1	0100C1_6WOSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	15.40	1.14	<0.001	<0.001	**25.67**	**25.67**
1	0100C1_6WOSDWP	Methoxychlor	ug/kg	2.5	1.40	1.25	0.59	1.25	0.66	3.46	1.08	<0.001	<0.001	2.77	**2.77**
1	0100C1_6WOSDWP	Benzoic acid	ug/kg	2000	1252	767	196	614	111	1760	55	<0.001	<0.001	**2**	**3**
2	0200C1_6WOSDWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	0.32	0.04	<0.001	<0.001	1.57	**1.93**
2	0200C1_6WOSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.027	0.026	<0.001	<0.001	**6.580**	1.228
2	0200C1_6WOSDWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	6.22	2.01	<0.001	<0.001	2.04	**2.45**
2	0200C1_6WOSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	18.80	5.31	0.004	<0.001	**31.33**	**31.33**
2	0200C1_6WOSDWP	Dieldrin	ug/kg	1.2	1.32	0.60	0.28	0.60	0.32	4.94	0.53	0.004	0.001	8.23	**8.23**
2	0200C1_6WOSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	16.20	3.35	<0.001	<0.001	**27.00**	**27.00**
2	0200C1_6WOSDWP	Methoxychlor	ug/kg	2.5	1.40	1.25	0.59	1.25	0.66	4.76	1.55	<0.001	<0.001	**3.81**	**3.81**
2	0200C1_6WOSDWP	Benzoic acid	ug/kg	2000	1252	767	196	614	111	1680	130	<0.001	<0.001	**2**	**3**
3	0300C1_3LTFIWP	Calcium	mg/kg	10	761	1730	195	1232	162	3128	1363	<0.001	<0.001	2	**3**
3	0300C1_3LTFIWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	0.28	0.05	<0.001	<0.001	1.36	**1.66**
3	0300C1_3LTFIWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.011	0.001	<0.001	<0.001	**2.641**	0.493
3	0300C1_3LTFIWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	22.40	13.13	0.004	<0.001	**37.33**	**37.33**
3	0300C1_3LTFIWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	11.76	3.44	<0.001	<0.001	**19.60**	**19.60**
3	0300C1_3LTFIWP	Methoxychlor	ug/kg	2.5	1.40	1.25	0.59	1.25	0.66	4.06	1.85	<0.001	<0.001	3.25	**3.25**
3	0300C1_3LTFIWP	Benzoic acid	ug/kg	2000	1252	767	196	614	111	2140	270	<0.001	<0.001	**3**	**3**
3	0300C4_6WTSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.014	0.008	<0.001	<0.001	**3.428**	0.639
3	0300C4_6WTSDWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	5.46	1.18	<0.001	<0.001	1.79	**2.15**
3	0300C4_6WTSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	25.60	15.58	0.004	<0.001	**42.67**	**42.67**
3	0300C4_6WTSDWP	Dieldrin	ug/kg	1.2	1.32	0.60	0.28	0.60	0.32	4.26	2.45	0.004	0.001	7.10	**7.10**
3	0300C4_6WTSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	9.06	1.68	<0.001	<0.001	**15.10**	**15.10**
3	0300C4_6WTSDWP	Methoxychlor	ug/kg	2.5	1.40	1.25	0.59	1.25	0.66	3.23	1.48	<0.001	<0.001	2.58	**2.58**
3	0300C4_6WTSDWP	Benzoic acid	ug/kg	2000	1252	767	196	614	111	1780	432	<0.001	<0.001	**2**	**3**
4	0400C1_8WTSDWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	15.92	10.13	<0.001	<0.001	**5.22**	**6.27**
4	0400C1_8WTSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	32.60	16.77	0.004	<0.001	**54.33**	**54.33**
4	0400C1_8WTSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	8.40	2.15	<0.001	<0.001	**14.00**	**14.00**
5	0500C1_8WTSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.011	0.003	<0.001	<0.001	**2.705**	0.505
5	0500C1_8WTSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	30.40	15.76	0.004	<0.001	**50.67**	**50.67**
5	0500C1_8WTSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	9.32	4.20	<0.001	<0.001	**15.53**	**15.53**
5	0500C1_8WTSDWP	Benzoic acid	ug/kg	2000	1252	767	196	614	111	1424	520	<0.001	<0.001	2	**2**
6	0600C1&2WTSDWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	0.76	0.22	<0.001	<0.001	**3.73**	**4.57**
6	0600C1&2WTSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.011	0.004	<0.001	<0.001	**2.705**	0.505
6	0600C1&2WTSDWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	6.54	2.32	<0.001	<0.001	2.14	**2.57**
6	0600C1&2WTSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	16.76	8.71	0.004	<0.001	27.93	**27.93**
6	0600C1&2WTSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	6.58	1.14	<0.001	<0.001	**10.97**	**10.97**
6	0600C3_6LTFIWP	Arsenic	mg/kg	0.1	0.06	0.15	0.05	0.09	0.03	0.33	0.05	<0.001	<0.001	**2.19**	**3.57**
6	0600C3_6LTFIWP	Calcium	mg/kg	10	761	1730	195	1232	162	2744	596	<0.001	<0.001	2	**2**
6	0600C3_6LTFIWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	1.20	0.30	<0.001	<0.001	**5.89**	**7.22**
6	0600C3_6LTFIWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.012	0.003	<0.001	<0.001	**3.049**	0.569

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	SB Reference Mean Tissue Concentration	SB Reference Std Deviation	MT Reference Mean Tissue Concentration	MT Reference Std Deviation	Project Area Mean Tissue Concentration	Project Area Std Deviation	SB Comparison P value	MT Comparison P value	Ratio to SB Reference	Ratio to MT Reference
6	0600C3_6LTFIWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	7.20	4.46	<0.001	<0.001	2.36	**2.83**
6	0600C3_6LTFIWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	20.36	12.70	0.004	<0.001	**33.93**	**33.93**
6	0600C3_6LTFIWP	Dieldrin	ug/kg	1.2	1.32	0.60	0.28	0.60	0.32	6.04	5.34	0.004	0.001	**10.07**	**10.07**
6	0600C3_6LTFIWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	6.70	2.38	<0.001	<0.001	**11.17**	**11.17**
6	060C1_6NBNSSWP	Arsenic	mg/kg	0.1	0.06	0.15	0.05	0.09	0.03	0.28	0.06	<0.001	<0.001	1.85	**3.03**
6	060C1_6NBNSSWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	1.05	0.30	<0.001	<0.001	**5.14**	**6.30**
6	060C1_6NBNSSWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.015	0.005	<0.001	<0.001	**3.605**	0.672
7	0700C1_4WTSDWP	Arsenic	mg/kg	0.1	0.06	0.15	0.05	0.09	0.03	0.28	0.02	<0.001	<0.001	1.87	**3.05**
7	0700C1_4WTSDWP	Chromium	mg/kg	0.2	0.09	0.51	0.26	0.21	0.04	0.35	0.06	<0.001	<0.001	0.69	**1.69**
7	0700C1_4WTSDWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	1.04	0.06	<0.001	<0.001	**5.10**	**6.25**
7	0700C5_9LTFIWP	Arsenic	mg/kg	0.1	0.06	0.15	0.05	0.09	0.03	0.24	0.07	<0.001	<0.001	1.61	**2.64**
7	0700C5_9LTFIWP	Chromium	mg/kg	0.2	0.09	0.51	0.26	0.21	0.04	0.34	0.03	<0.001	<0.001	0.68	**1.67**
7	0700C5_9LTFIWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	0.87	0.24	<0.001	<0.001	**4.27**	**5.23**
7	0700C5_9LTFIWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.011	0.001	<0.001	<0.001	**2.656**	0.495
7	0700C5_9LTFIWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	14.86	6.34	0.004	<0.001	24.77	**24.77**
7	070C1_9NBNSSWP	Arsenic	mg/kg	0.1	0.06	0.15	0.05	0.09	0.03	0.26	0.09	<0.001	<0.001	1.73	**2.83**
7	070C1_9NBNSSWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	0.99	0.35	<0.001	<0.001	**4.85**	**5.94**
7	070C1_9NBNSSWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.012	0.003	<0.001	<0.001	**3.000**	0.560
7	070C1_9NBNSSWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	24.20	12.34	0.004	<0.001	**40.33**	**40.33**
8	0800C1_4WOSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.012	0.003	<0.001	<0.001	**2.828**	0.528
9	09000001WOSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.015	0.004	<0.001	<0.001	**3.787**	0.706
9	09000001WOSDWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	7.56	0.74	<0.001	<0.001	**2.48**	**2.98**
9	09000001WOSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	34.60	10.50	0.004	<0.001	**57.67**	**57.67**
9	09000001WOSDWP	Dieldrin	ug/kg	1.2	1.32	0.60	0.28	0.60	0.32	7.48	2.97	0.004	0.001	**12.47**	**12.47**
9	09000001WOSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	8.46	0.88	<0.001	<0.001	**14.10**	**14.10**
9	0900C2&4WOSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.015	0.003	<0.001	<0.001	**3.787**	0.706
9	0900C2&4WOSDWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	8.04	2.40	<0.001	<0.001	**2.64**	**3.17**
9	0900C2&4WOSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	25.40	16.98	0.004	<0.001	**42.33**	**42.33**
9	0900C2&4WOSDWP	Dieldrin	ug/kg	1.2	1.32	0.60	0.28	0.60	0.32	6.36	3.46	0.004	0.001	**10.60**	**10.60**
9	0900C2&4WOSDWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	8.98	3.54	<0.001	<0.001	**14.97**	**14.97**
10	10000001WTSDWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	0.91	0.13	<0.001	<0.001	**4.46**	**5.46**
10	10000001WTSDWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.015	0.003	<0.001	<0.001	**3.689**	0.688
10	10000001WTSDWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	21.12	13.76	0.004	<0.001	**35.20**	**35.20**
10	1000C3&4LTFIWP	Arsenic	mg/kg	0.1	0.06	0.15	0.05	0.09	0.03	0.30	0.04	<0.001	<0.001	**2.03**	**3.31**
10	1000C3&4LTFIWP	Chromium	mg/kg	0.2	0.09	0.51	0.26	0.21	0.04	0.38	0.04	<0.001	<0.001	0.76	**1.86**
10	1000C3&4LTFIWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	1.02	0.05	<0.001	<0.001	**5.01**	**6.13**
10	1000C3&4LTFIWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	18.62	11.19	0.004	<0.001	**31.03**	**31.03**
10	100C3&4NLNSSWP	Chromium	mg/kg	0.2	0.09	0.51	0.26	0.21	0.04	0.39	0.10	<0.001	<0.001	0.77	**1.90**
10	100C3&4NLNSSWP	Selenium	mg/kg	0.5	0.16	0.20	0.03	0.17	0.04	0.57	0.11	<0.001	<0.001	2.78	**3.41**
10	100C3&4NLNSSWP	alpha-BHC	ug/kg	1.2	12.22	3.05	1.34	2.54	0.59	5.66	1.46	<0.001	<0.001	1.86	**2.23**
10	100C3&4NLNSSWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	15.28	6.52	0.004	<0.001	25.47	**25.47**
4/5	45C1_16NWNSSWP	Nickel	mg/kg	0.1	0.08	0.11	0.02	0.08	0.02	0.19	0.04	<0.001	<0.001	1.65	**2.22**
4/5	45C1_16NWNSSWP	Silver	mg/kg	0.1	0.013	0.004	0.001	0.022	0.006	0.015	0.003	<0.001	<0.001	**3.590**	0.670
4/5	45C1_16NWNSSWP	alpha-Chlordane	ug/kg	1.2	42.20	0.60	0.28	0.60	0.32	17.44	6.32	0.004	<0.001	**29.07**	**29.07**
4/5	45C1_16NWNSSWP	Endosulfan II	ug/kg	1.2	7.38	0.60	0.28	0.60	0.32	9.12	1.90	<0.001	<0.001	**15.20**	**15.20**

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	SB Reference Mean Tissue Concentration	SB Reference Std Deviation	MT Reference Mean Tissue Concentration	MT Reference Std Deviation	Project Area Mean Tissue Concentration	Project Area Std Deviation	SB Comparison P value	MT Comparison P value	Ratio to SB Reference	Ratio to MT Reference
4/5	45C1_16NWNSSWP	Benzoic acid	ug/kg	2000	1252	767	196	614	111	1474	691	<0.001	<0.001	2	**2**

Bold = Project area tissue concentration is significantly elevated above the reference.

3.8.12.5 *Cyperus esculentus*

C. esculentus tissue chemistry was compared to the Bayou La Loutre reference.

In DMMU 1, statistically elevated tissue residues relative to the reference were detected in sample 0100C1_6WOSDUP. Four metals were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The analytes detected on day 0 were calcium, chromium, copper, and zinc. The day 0 concentrations were less than the reference and DMMU tissue concentrations.

In DMMU 2, statistically elevated tissue residues relative to the reference were detected in sample 0200C1_6WOSDUP. Two metals and two pesticides were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were copper, zinc, and gamma-chlordane. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 3, statistically elevated tissue residues relative to the reference were detected in all samples. Three metals and two pesticides were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were calcium, copper, zinc, and gamma-chlordane. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 4, statistically elevated tissue residues relative to the reference were detected in sample 0400C1_8WTSDUP. Three metals were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The analytes detected on day 0 were cadmium, copper, and zinc. The day 0 concentrations were less than the reference and DMMU tissue concentrations.

In DMMU 5, statistically elevated tissue residues relative to the reference were detected in sample 0500C1_8WTSDUP. Two metals and two pesticides were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were cadmium, zinc, and alpha-BHC. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 6, statistically elevated tissue residues relative to the reference were detected in all samples. Four metals, one SVOC, and one pesticide were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were arsenic, calcium, chromium, selenium, and benzoic acid. The day 0 concentrations of these analytes were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 7, statistically elevated tissue residues relative to the reference were detected in all samples. Four metals and one SVOC were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The analytes detected on day 0 were arsenic, calcium, chromium, selenium, and benzoic acid. The day 0 concentrations were less than or similar to the reference and/or DMMU tissue concentrations.

In DMMU 8, statistically elevated tissue residues relative to the reference were detected in sample 0800C1_4WOSDUP. One metal and three pesticides were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were copper, delta-BHC, and gamma-chlordane. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 9, statistically elevated tissue residues relative to the reference were detected both samples. Five metals and three pesticides were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were calcium, cadmium, copper, selenium, zinc, alpha-BHC, and delta-BHC. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 10, no analytes were statistically elevated above the reference in sample 10000001WTSDUP. Statistically elevated tissue residues relative to the reference were detected in samples 1000C3&4LTFIUP and 100C3&4NLNSSUP. Several metals and two pesticides were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analytes detected on day 0 were aluminum, arsenic, barium, cadmium, calcium, chromium, copper, lead, selenium, zinc, and alph-BHC. The day 0 concentrations of these analytes were less than the reference and DMMU tissue concentrations.

In DMMU 4/5, statistically elevated tissue residues relative to the reference were detected in sample 45C1_16NWNSSUP. One metal and one pesticide were significantly elevated (Table 28). No analytes exceeded the reference by more than 25 fold. The only analyte detected on day 0 was chromium. The day 0 concentration of chromium was less than the reference and DMMU tissue concentrations.

Table 28. Summary of Statistically Elevated Tissue Residues Relative to Reference from Bioaccumulation Tests of Project Sediments Using *Cyperus esculentus*

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	BL Reference Mean Tissue Concentration	BL Reference Std Deviation	Project Area Mean Tissue Concentration	Project Area Std Deviation	P value	Ratio to Reference
1	0100C1_6WOSDUP	Calcium	mg/kg	10	606	724	59.74	2462	1740	<0.001	3.40
1	0100C1_6WOSDUP	Chromium	mg/kg	0.2	0.22	0.30	0.05	0.46	0.16	<0.001	1.54
1	0100C1_6WOSDUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.24	0.32	<0.001	1.45
1	0100C1_6WOSDUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	34.58	6.52	<0.001	1.77
2	0200C1_6WOSDUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.62	0.40	<0.001	1.70
2	0200C1_6WOSDUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	55.52	21.62	<0.001	2.85
2	0200C1_6WOSDUP	Endosulfan sulfate	ug/kg	1.2	<1.2	0.60	0.32	8.80	na	<0.001	14.67
2	0200C1_6WOSDUP	gamma-Chlordane	ug/kg	1.2	2.52	3.92	0.60	41.00	na	<0.001	10.46
3	0300C1_3LTFIUP	Calcium	mg/kg	10	606	724	59.74	1334	262	<0.001	1.84
3	0300C1_3LTFIUP	gamma-Chlordane	ug/kg	1.2	2.52	3.92	0.60	11.70	5.70	<0.001	2.98
3	0300C4_6WTSDUP	Calcium	mg/kg	10	606	724	59.74	1444	1037	<0.001	2.00
3	0300C4_6WTSDUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.32	0.36	<0.001	1.51
3	0300C4_6WTSDUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	45.76	15.48	<0.001	2.35
3	030C1_6NBNSSUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	34.78	9.07	<0.001	1.78
3	030C1_6NBNSSUP	Aldrin	ug/kg	1.2	<1.2	0.60	0.32	8.34	4.66	0.001	13.90
4	0400C1_8WTSDUP	Cadmium	mg/kg	0.1	0.08	0.28	0.11	1.02	0.56	<0.001	3.58
4	0400C1_8WTSDUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.26	0.73	<0.001	1.47
4	0400C1_8WTSDUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	53.20	17.77	<0.001	2.73
5	0500C1_8WTSDUP	Cadmium	mg/kg	0.1	0.08	0.28	0.11	1.09	0.49	<0.001	3.82
5	0500C1_8WTSDUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	59.20	8.48	<0.001	3.04
5	0500C1_8WTSDUP	alpha-BHC	ug/kg	1.2	1.28	3.24	1.72	8.58	2.93	<0.001	2.65
5	0500C1_8WTSDUP	alpha-Chlordane	ug/kg	1.2	<1.2	0.60	0.32	3.38	1.26	0.027	5.63
6	0600C1&2WTSDUP	Chromium	mg/kg	0.2	0.22	0.30	0.05	0.48	0.05	<0.001	1.59
6	0600C1&2WTSDUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	0.59	0.17	<0.001	2.25
6	0600C1&2WTSDUP	Benzoic acid	ug/kg	2000	1540	1376	720	3600	216	<0.001	2.62
6	0600C3_6LTFIUP	Calcium	mg/kg	10	606	724	59.74	1120	118	<0.001	1.55
6	0600C3_6LTFIUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	0.60	0.14	<0.001	2.27
6	0600C3_6LTFIUP	alpha-Chlordane	ug/kg	1.2	<1.2	0.60	0.32	4.12	1.50	0.027	6.87
6	060C1_6NBNSSUP	Arsenic	mg/kg	0.1	0.04	0.07	0.03	0.14	0.02	<0.001	2.11
6	060C1_6NBNSSUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	0.69	0.14	<0.001	2.63
6	060C1_6NBNSSUP	Benzoic acid	ug/kg	2000	1540	1376	720	3360	513	<0.001	2.44
7	0700C1_4WTSDUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	0.47	0.06	<0.001	1.77
7	0700C5_9LTFIUP	Calcium	mg/kg	10	606	724	59.74	1292	125	<0.001	1.79
7	070C1_9NBNSSUP	Arsenic	mg/kg	0.1	0.04	0.07	0.03	0.15	0.03	<0.001	2.26
7	070C1_9NBNSSUP	Chromium	mg/kg	0.2	0.22	0.30	0.05	0.45	0.03	<0.001	1.51
7	070C1_9NBNSSUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	0.69	0.12	<0.001	2.61
7	070C1_9NBNSSUP	Benzoic acid	ug/kg	2000	1540	1376	720	3220	277	<0.001	2.34
8	0800C1_4WOSDUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.22	0.15	<0.001	1.44
8	0800C1_4WOSDUP	Aldrin	ug/kg	1.2	<1.2	0.60	0.32	5.38	1.57	0.001	8.97
8	0800C1_4WOSDUP	delta-BHC	ug/kg	1.2	3.26	4.26	2.00	6.66	0.96	<0.001	1.56
8	0800C1_4WOSDUP	gamma-Chlordane	ug/kg	1.2	2.52	3.92	0.60	10.16	2.62	<0.001	2.59
9	09000001WOSDUP	Calcium	mg/kg	10	606	724	59.74	1296	291	<0.001	1.79
9	09000001WOSDUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.44	0.48	<0.001	1.58

DMMU	Sample ID	Analyte	Units	Method Detection Limit	Day 0 Tissue Concentration	BL Reference Mean Tissue Concentration	BL Reference Std Deviation	Project Area Mean Tissue Concentration	Project Area Std Deviation	P value	Ratio to Reference
9	09000001WOSDUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	0.51	0.06	<0.001	1.93
9	09000001WOSDUP	alpha-BHC	ug/kg	1.2	1.28	3.24	1.72	6.94	3.78	<0.001	2.14
9	09000001WOSDUP	alpha-Chlordane	ug/kg	1.2	<1.2	0.60	0.32	3.20	0.42	0.027	5.33
9	09000001WOSDUP	delta-BHC	ug/kg	1.2	3.26	4.26	2.00	6.66	1.03	<0.001	1.56
9	0900C2&4WOSDUP	Cadmium	mg/kg	0.1	0.08	0.28	0.11	1.74	1.09	<0.001	6.14
9	0900C2&4WOSDUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.48	0.45	<0.001	1.61
9	0900C2&4WOSDUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	0.53	0.09	<0.001	1.99
9	0900C2&4WOSDUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	62.52	17.39	<0.001	3.21
9	0900C2&4WOSDUP	alpha-BHC	ug/kg	1.2	1.28	3.24	1.72	14.40	3.21	<0.001	4.44
9	0900C2&4WOSDUP	alpha-Chlordane	ug/kg	1.2	<1.2	0.60	0.32	5.64	3.66	0.027	9.40
10	1000C3&4LTFIUP	Aluminum	mg/kg	3	1.15	26.72	22.90	116.82	39.69	<0.001	4.37
10	1000C3&4LTFIUP	Arsenic	mg/kg	0.1	0.04	0.07	0.03	0.38	0.04	<0.001	5.63
10	1000C3&4LTFIUP	Barium	mg/kg	1	0.39	1.42	0.22	7.38	2.07	<0.001	5.20
10	1000C3&4LTFIUP	Calcium	mg/kg	10	606	724	59.74	9238	1916	<0.001	12.76
10	1000C3&4LTFIUP	Chromium	mg/kg	0.2	0.22	0.30	0.05	0.48	0.09	<0.001	1.59
10	1000C3&4LTFIUP	Lead	mg/kg	0.1	0.03	0.08	0.03	1.37	0.69	<0.001	16.71
10	1000C3&4LTFIUP	Selenium	mg/kg	0.5	0.15	0.26	0.06	1.00	0.14	<0.001	3.80
10	1000C3&4LTFIUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	35.16	9.06	<0.001	1.80
10	100C3&4NLNSSUP	Cadmium	mg/kg	0.1	0.08	0.28	0.11	1.62	1.25	<0.001	5.71
10	100C3&4NLNSSUP	Copper	mg/kg	0.2	0.64	1.54	0.30	2.36	0.54	<0.001	1.53
10	100C3&4NLNSSUP	Zinc	mg/kg	0.5	13.14	19.50	4.26	53.60	29.55	<0.001	2.75
10	100C3&4NLNSSUP	alpha-BHC	ug/kg	1.2	1.28	3.24	1.72	24.00	7.18	<0.001	7.41
10	100C3&4NLNSSUP	alpha-Chlordane	ug/kg	1.2	<1.2	0.60	0.32	3.40	1.81	0.027	5.67
4/5	45C1_16NWNSSUP	Chromium	mg/kg	0.2	0.22	0.30	0.05	0.44	0.06	<0.001	1.47
4/5	45C1_16NWNSSUP	alpha-Chlordane	ug/kg	1.2	<1.2	0.60	0.32	3.40	1.12	0.027	5.67

na = Not available, only one replicate.

3.9 Data Validation Summary

A data validation report prepared by MECX, LP is presented in Appendix L. This report indicated that overall the sediment, water, elutriate and tissue chemistry data are usable with the limitations described in detail in their detailed report.

MECX identified some data quality issues early in the data validation process; however, the laboratory was able to adjust the process or re-report the analytical data to correct deficiencies. These issues included the following: inconsistent reporting of GC and HPLC data (herbicides, organophosphorus pesticides, pesticides, and organotins) when inter-column comparisons failed method acceptance criteria, interference in the metals analyses affecting selenium reporting, and incorrect application of conversion factors for the Krone Method organotin tissue analyses. Corrections were made prior to use of the data and consequently the integrity of the data was not affected by these occurrences.

MECX also determined that numerous sediment samples were analyzed at a dilution resulting in elevated reporting limits, relative to those specified in the QAPP The data were further evaluated and MECX determined that the analytical dilutions were supported by the presence of target compounds or matrix interference in the samples. In accordance with the QAPP, some cleanups had been performed and additional cleanups were evaluated by the laboratory. Although some sample results retained the elevated reporting limits, the data are usable and are consistent with other sediment programs.

MECX determined that the project met the completeness goal of 90%. Specifically, MECX found that over 99% of the project chemistry data were determined to be usable data. In addition, MECX found that 89% of the data did not require any qualification. Of the dataset, 10.5% of the data, (13,428 analytes of a total 127,367 analytes), were qualified as estimated, "UJ," for nondetects, or "J," for detected compounds. Estimated data and data without qualification were determined to be usable data, with limitations interpreted by the data user based upon the information in the data validation reports, the DV Qual code populated by the ADR software, and the notes provided in MECX's report (Appendix L). Of the dataset, MECX rejected 0.45% of the data; however, the dataset met the project completeness goal of 90%. MECX noted also that some of these rejections were the result of the ADR software only assessing holding times from the date of sample collection to the date of extraction or analysis (i.e., ADR does not assess from the date an elutriate was prepared in the laboratory). Thus, holding time qualifications are likely artificially elevated because they include data rejected for grossly exceeded holding times when it could be due to ADR not recognizing the real holding time of elutriates.

3.10 Biological Tests

3.10.1 Suspended Particulate Phase Tests

3.10.1.1Freshwater – Pimephales promelas

Batch 1

Water quality parameters were within the appropriate limits (Table 10). Temperature values were within the specified means (20 ± 1°C) and range of instantaneous (20 ± 3°C) measurements (USEPA, 2002). Mean percent control survival of *P. promelas* was 92.0% (Table 29), which met the minimum acceptable control survival criterion (≥ 90%). One replicate was lost in the 10% treatment for 08-00C1_4-W-O-SD-FE due to technician error and analysis preceded using four replicates. Statistical analysis using the simple t-test (SigmaStat, Chicago, IL, USA) determined statistically reduced survival relative to the performance control for the following treatments: 01-00C1_6-W-O-SD-FE-100%, 03-00C1_3-L-T-FI-FE-10%, 03-00C1_3-L-T-FI-FE-50%, 03-00C1_3-L-T-FI-FE-100%, and 08-00C1_4-W-O-SD-FE-10%. LC_{50} values were determined by trimmed Spearman-Karber (Toxstat® software (Gulley 1996, University of Wyoming), however, insufficient mortality occurred in 01-00C1_6-W-O-SD-FE, 02-00C1_6-W-O-

SD-FE, 03-00C4_6-W-T-SD-FE, 03-0C1_6N-B-N-SS-FE and 08-00C1_4-W-O-SD-FE to calculate LC_{50} values for survival (LC_{50} values > 100%). Mortality in 03-00C1_3-L-T-FI-FE was similar in all treatments (approximately 50.0%). This lack of dose dependency did not allow for modeling of an LC_{50} value. The statistically reduced survival observed in 08-00C1_4-W-O-SD-FE-10% was unexpected since survival was not reduced in the higher treatment levels. Water quality parameters were similar between treatments with the exception of conductivity, which increased with test concentration (10%: 365 ± 35 μS/cm, 50%: 537 ± 12 μS/cm, 100%: 822 ± 18 μS/cm). This indicates test waters were allocated to chambers properly. The laboratory bench sheets are provided in Appendix M.

The potassium chloride reference toxicant test was conducted at concentrations of 0.17, 0.34, 0.68, 1.35, and 2.70 g KCl/L. The LC_{50} was determined to be 0.59 g KCl/L, which was inside two standard deviations (± 0.22 g KCl/L) of the ERDC laboratory mean of 0.71 g KCl/L. This indicates that the sensitivity of *P. promelas* used in the assessment of test sediments fell within the normal range.

A toxicity reduction evaluation for total ammonia was initiated for 01-00C1_6-W-O-SD-FE and 02-00C1_6-W-O-SD-FE, which both had total ammonia concentrations of 5 mg/L. Zeolite was used to reduce ammonia toxicity while EDTA was used to reduce metals bioavailability (Hockett *et al.* 1996, Burgess *et al*., 2004). The zeolite treatment resulted in increased survival for both 01-00C1_6-W-O-SD-FE (58.0% vs. 100% survival) and 02-00C1_6-W-O-SD-FE (78.0% vs. 100%). However, complete mortality occurred in the EDTA treatments, possibly due to too high a concentration of EDTA in the treatment. While the ammonia-reducing treatment (i.e., zeolite) resulted in decreased mortality in 01-00C1_6-W-O-SD-FE and 02-00C1_6-W-O-SD-FE, without comparison to the metal-reducing treatment (i.e., EDTA), conclusions regarding ammonia as the sole source of toxicity are uncertain.

Table 29. Results of Suspended Particulate Phase Test Using *Pimephales promelas*

Sample ID	**Fish (*Pimephales promelas*)**			
	Day 0 Overlying Total Ammonia Values (mg/L)	**Day 4 Overlying Total Ammonia Values (mg/L)**	**Mean % Survival (SD)**	**LC_{50} (%)**
Batch 1				
Control	<1	<1	92 (4)	
01-00C1_6-W-O-SD-FE – 10%			98 (4)	>100
01-00C1_6-W-O-SD-FE – 50%			98 (4)	
01-00C1_6-W-O-SD-FE – 100%	5	4	58 (13)*	
01-00C1_6-W-O-SD-FE – *100% Zeolite*	*< 1*	*< 1*	*100 (0)*	
01-00C1_6-W-O-SD-FE – *100% EDTA*	*4*	*2*	*0 (0)**	
02-00C1_6-W-O-SD-FE – 10%			100 (0)	>100
02-00C1_6-W-O-SD-FE – 50%			94 (9)	
02-00C1_6-W-O-SD-FE – 100%	5	4	78 (16)	
02-00C1_6-W-O-SD-FE – *100% Zeolite*	*< 1*	*< 1*	*100 (0)*	
02-00C1_6-W-O-SD-FE – *100% EDTA*	*4*	*1*	*0 (0)**	
03-00C4_6-W-T-SD-FE – 10%			96 (5)	>100
03-00C4_6-W-T-SD-FE – 50%			92 (8)	
03-00C4_6-W-T-SD-FE – 100%	1	2	98 (4)	
03-0C1_6N-B-N-SS-FE – 10%			88 (8)	>100
03-0C1_6N-B-N-SS-FE – 50%			92 (13)	
03-0C1_6N-B-N-SS-FE – 100%	2	2	94 (5)	
03-00C1_3-L-T-FI-FE – 10%			50 (19)*	50.0% survival in 100% treatment
03-00C1_3-L-T-FI-FE – 50%			58 (11)*	
03-00C1_3-L-T-FI-FE – 100%	1	1	50 (20)*	
08-00C1_4-W-O-SD-FE – 10%			53 (17)*	>100
08-00C1_4-W-O-SD-FE – 50%			98 (4)	
08-00C1_4-W-O-SD-FE – 100%	2	2	86 (13)	
Batch 2				
Control	< 1	< 1	96 (5)	
06-00C1&2-W-T-SD-FE – 10%			86 (17)	> 100%
06-00C1&2-W-T-SD-FE – 50%			96 (5)	
06-00C1&2-W-T-SD-FE – 100%	4	2	86 (5)	
06-00C3_6-L-T-FI-FE – 10%			82 (16)	> 100%
06-00C3_6-L-T-FI-FE – 50%			82 (19)	
06-00C3_6-L-T-FI-FE – 100%	1	1	82 (8)*	
06-0C1_6N-B-N-SS-FE – 10%			82 (25)	> 100%
06-0C1_6N-B-N-SS-FE – 50%			86 (5)	
06-0C1_6N-B-N-SS-FE – 100%	6	2	70 (20)*	
06-0C1_6N-B-N-SS-FE – 100% Zeolite	*< 1*	*< 1*	*57 (23)**	
06-0C1_6N-B-N-SS-FE – 100% EDTA	*6*	*4*	*67 (6)**	

Sample ID	**Fish (*Pimephales promelas*)**			
	Day 0 Overlying Total Ammonia Values (mg/L)	**Day 4 Overlying Total Ammonia Values (mg/L)**	**Mean % Survival (SD)**	**LC_{50} (%)**
07-00C1_4-W-T-SD-FE – 10%			90 (10)	42.0
07-00C1_4-W-T-SD-FE – 50%			46.0 (22)*	
07-00C1_4-W-T-SD-FE – 100%	5	2	14.0 (11)*	
07-00C1_4-W-T-SD-FE – *100% Zeolite*	*< 1*	*< 1*	*83.0 (6)**	
07-00C1_4-W-T-SD-FE – *100% EDTA*	*5*	*2*	*17.0 (12)**	
07-00C5_9-L-T-FI-FE – 10%			100 (0)	> 100%
07-00C5_9-L-T-FI-FE – 50%			96.0 (5)	
07-00C5_9-L-T-FI-FE – 100%	2	2	76.0 (13)*	
07-0C1_9N-B-N-SS-FE – 10%			88.0 (13)	72.0
07-0C1_9N-B-N-SS-FE – 50%			82.0 (11)	
07-0C1_9N-B-N-SS-FE – 100%	4	2	18.0 (20)*	
10-000001-W-T-SD-FE – 10%			94.0 (5)	> 100%
10-000001-W-T-SD-FE – 50%			92.0 (8)	
10-000001-W-T-SD-FE – 100%	4	2	88.0 (11)	
10-00C3&4-L-T-FI-FE – 10%			90.0 (17)	> 100%
10-00C3&4-L-T-FI-FE – 50%			92.0 (13)	
10-00C3&4-L-T-FI-FE – 100%	1	1	72.0 (33)	
10-0C3&4N-L-N-SS-FE – 10%			98.0 (4)	26.0
10-0C3&4N-L-N-SS-FE – 50%			14.0 (15)*	
10-0C3&4N-L-N-SS-FE – 100%	2	1	2.00 (4)*	
Batch 3				
Control	<1	<1	98.0 (4)	
04-00C1_8-W-T-SD-FE – 10%			100 (0)	>100
04-00C1_8-W-T-SD-FE – 50%			94.0 (5)	
04-00C1_8-W-T-SD-FE – 100%	3	<1	94.0 (9)	
05-00C1_8-W-T-SD-FE – 10%			100 (0)	>100
05-00C1_8-W-T-SD-FE – 50%			96.0 (5)	
05-00C1_8-W-T-SD-FE – 100%	3	3	92.0 (8)	
45-C1_16N-W-N-SS-FE – 10%			100 (0)	69.0
45-C1_16N-W-N-SS-FE – 50%			94.0 (5)	
45-C1_16N-W-N-SS-FE – 100%	> 8	> 8	2.00 (4)*	
45-C1_16N-W-N-SS-FE – *100% Zeolite*	*< 1*	*< 1*	*80.0 (0)**	
45-C1_16N-W-N-SS-FE – *100% EDTA*	*> 8*	*> 8*	*0.00 (0)**	
09-000001-W-O-SD-FE – 10%			98.0 (4)	>100
09-000001-W-O-SD-FE – 50%			98.0 (4)	
09-000001-W-O-SD-FE – 100%	5	5	82.0 (11)*	
09-000001-W-O-SD-FE – *100% Zeolite*	*< 1*	*< 1*	*97.0 (6)*	
09-000001-W-O-SD-FE – *100% EDTA*	*4*	*4*	*87.0 (6)*	
09-00C2&4-W-O-SD-FE – 10%			92.0 (13)	>100

Sample ID	Fish (*Pimephales promelas*)			
	Day 0 Overlying Total Ammonia Values (mg/L)	Day 4 Overlying Total Ammonia Values (mg/L)	Mean % Survival (SD)	LC_{50} (%)
09-00C2&4-W-O-SD-FE – 50%			92.0 (8)	
09-00C2&4-W-O-SD-FE – 100%	6	4	94.0 (5)	
09-00C2&4-W-O-SD-FE – 100% Zeolite	< 1	< 1	90.0 (0)	
09-00C2&4-W-O-SD-FE – 100% Zeolite	4	4	90.0 (0)	

Potassium Chloride Reference Toxicant		
Concentration (g/L)	**Mean % Survival**	**LC_{50} (g/L)**
Batch 1		
Control	100	0.59
0.17	100	
0.34	100	
0.68	30.0	
1.35	0.00	
2.70	0.00	
Batch 2 and 3		
Control	90	0.78
0.17	100	
0.34	100	
0.68	60.0	
1.35	0.00	
2.70	0.00	

*Significant reduction in survival relative to the performance control.

Batch 2

Water quality parameters were within the appropriate limits (Table 10). Temperature values were within the specified means (20 ± 1°C) and range of instantaneous (20 ± 3°C) measurements (USEPA, 2002). Mean percent control survival of *P. promelas* was 96.0%, which met the minimum acceptable control survival criterion (≥ 90%). Statistically reduced survival relative to the performance control was determined for the following treatments: 06-00C3_6-L-T-FI-FE-100%, 06-0C1_6N-B-N-SS-FE-100%, 07-00C1_4-W-T-SD-FE-50%, 07-00C1_4-W-T-SD-FE-100%, 07-00C5_9-L-T-FI-FE-100%, 07-0C1_9N-B-N-SS-FE-100%, 10-0C3&4N-L-N-SS-FE-50%, and 10-0C3&4N-L-N-SS-FE-100% (Table 29). LC_{50} values were determined by trimmed Spearman-Karber (Toxstat® software (Gulley 1996, University of Wyoming). The LC_{50} values for survival of 42.0, 72.0 and 26.0% were determined for 07-00C1_4-W-T-SD-FE, 07-0C1_9N-B-N-SS-FE, and 10-0C3&4N-L-N-SS-FE, respectively. Insufficient mortality occurred in the remaining sediment elutriates to calculate LC_{50} values for survival (LC_{50} values > 100%). The laboratory bench sheets are provided in Appendix M.

The potassium chloride reference toxicant test was conducted at concentrations of 0.17, 0.34, 0.68, 1.35, and 2.70 g KCl/L. The LC_{50} was determined to be 0.78 g KCl/L, which was inside two standard deviations (± 0.22 g KCl/L) of the ERDC laboratory mean of 0.71 g KCl/L. This indicates that the sensitivity of *P. promelas* used in the assessment of test sediments fell within the normal range.

A toxicity reduction evaluation for total ammonia was initiated for 06-0C1_6N-B-N-SS-FE and 07-00C1_4-W-T-SD-FE, which had total ammonia concentrations of 6 and 5 mg/L, respectively. Zeolite was used to reduce ammonia toxicity while EDTA was used to reduce metals bioavailability (Hockett *et al.* 1996, Burgess *et al*., 2004). The zeolite treatment did not result in increased survival for 06-0C1_6N-B-N-SS-FE (70.0% vs. 57.0%) and the EDTA treatment did not alter survival (70.0% vs. 67.0%). This indicates that ammonia was unlikely to have confounded toxicity in 06-0C1_6N-B-N-SS-FE. The zeolite treatment resulted in increased survival for 07-00C1_4-W-T-SD-FE (14.0% vs. 83.0%) and the EDTA treatment did not alter survival (14.0% vs. 17.0%). This indicates that ammonia may have induced toxicity in 07-00C1_4-W-T-SD-FE.

Batch 3

Water quality parameters were within the appropriate limits (Table 10). Temperature values were within the specified means (20 ± 1°C) and range of instantaneous (20 ± 3°C) measurements (USEPA, 2002). Mean percent control survival of *P. promelas* was 98.0%, which met the minimum acceptable control survival criterion (≥ 90%). Statistically reduced survival relative to the performance control was determined for the following treatments: 45-C1_16N-W-N-SS-FE-100%, and 09-000001-W-O-SD-FE-100% (Table 29). LC_{50} values were determined by trimmed Spearman-Karber (Toxstat® software (Gulley 1996, University of Wyoming). An LC_{50} value for survival of 69.0% was determined for 45-C1_16N-W-N-SS-FE. Insufficient mortality occurred in the remaining sediment elutriates to calculate LC_{50} values for survival (LC_{50} values > 100%). The laboratory bench sheets are provided in Appendix M.

The potassium chloride reference toxicant test was conducted at concentrations of 0.17, 0.34, 0.68, 1.35, and 2.70 g KCl/L. The LC_{50} was determined to be 0.78 g KCl/L, which was inside two standard deviations (± 0.22 g KCl/L) of the ERDC laboratory mean of 0.71 g KCl/L. This indicates that the sensitivity of *P. promelas* used in the assessment of test sediments fell within the normal range.

A toxicity reduction evaluation for total ammonia was initiated for 45-C1_16N-W-N-SS-FE, 09-000001-W-O-SD-FE, and 09-00C2&4-W-O-SD-FE, which had total ammonia concentrations of >8, 5, and 6 mg/L, respectively. Zeolite was used to reduce ammonia toxicity while EDTA was used to reduce metals bioavailability (Hockett *et al.* 1996, Burgess *et al*., 2004). The zeolite treatment resulted in increased survival for 45-C1_16N-W-N-SD-FE (2.00% vs. 80.0%) and the EDTA treatment did not alter survival (2.00 % vs. 0.00%). This indicates that ammonia may have induced toxicity in 45-C1_16N-W-N-SS-FE. The zeolite treatment resulted in increased survival for 09-000001-W-O-SD-FE (82.0% vs. 97.0%) and the EDTA treatment did not alter survival (82.0% vs. 87.0%). This indicates that ammonia may have induced toxicity in 09-000001-W-O-SD-FE. Survival was not reduced significantly in 09-00C2&4-W-O-SS-FE test treatment and survival in the zeolite and EDTA treatments were similar. This indicates that ammonia was unlikely to have induced toxicity in 09-00C2&4-W-O-SD-FE.

3.10.1.2Marine – Cyprinodon variegatus

Batch 1

Water quality parameters were within the appropriate limits (Table 12). Temperature values were within the specified means (20 ± 1 °C) and range of instantaneous (20 ± 3 °C) measurements (USEPA, 2002). Mean percent control survival of *Cyprinodon variegatus* was 100%, which met the minimum acceptable control survival criterion (≥ 90%). Statistical analysis using the simple t-test (SigmaStat, Chicago, IL, USA) determined that no treatments were statistically reduced relative to the performance control (Table 30). LC_{50} values were determined by trimmed Spearman-Karber (Toxstat® software (Gulley 1996, University of Wyoming), however, there was insufficient mortality to calculate LC_{50} values for survival (LC_{50} values > 100%). The laboratory bench sheets are provided in Appendix M.

The potassium chloride reference toxicant test was conducted at concentrations of 0.28, 0.56, 1.13, 2.25, and 4.50 g KCl/L, tested in 30 ppt reconstituted seawater. The 48-hour LC_{50} was determined to be 1.59 g KCl/L, which was inside two standard deviations (± 0.186 g KCl/L) of the Aquatic Biosystems (Fort Collins, Colorado) control charts mean of 1.46 g KCl/L. This indicates that the sensitivity of *C. variegatus* used in the assessment of test sediments fell within the normal range.

Table 30. Results of Suspended Particulate Phase Test Using *Cyprinodon variegatus*

Sample ID	Fish (*Cyprinodon variegatus*)			
	Day 0 Overlying Total Ammonia Values (mg/L)	Day 4 Overlying Total Ammonia Values (mg/L)	Mean % Survival (SD)	LC_{50} (%)
Batch 1				
Control	< 1	< 1	100 (0)	
01-00C1_6-W-O-SD-EE – 10%			100 (0)	>100
01-00C1_6-W-O-SD-EE – 50%			100 (0)	
01-00C1_6-W-O-SD-EE – 100%	< 1	< 1	100 (0)	
02-00C1_6-W-O-SD-EE – 10%			100 (0)	>100
02-00C1_6-W-O-SD-EE – 50%			100 (0)	
02-00C1_6-W-O-SD-EE – 100%	2	2	100 (0)	
03-00C4_6-W-T-SD-EE – 10%			100 (0)	>100
03-00C4_6-W-T-SD-EE – 50%			100 (0)	
03-00C4_6-W-T-SD-EE – 100%	3	3	100 (0)	
03-0C1_6N-B-N-SS-EE – 10%			100 (0)	>100
03-0C1_6N-B-N-SS-EE – 50%			100 (0)	
03-0C1_6N-B-N-SS-EE – 100%	2	2	100 (0)	
03-00C1_3-L-T-FI-EE – 10%			100 (0)	>100
03-00C1_3-L-T-FI-EE – 50%			98.0 (4)	
03-00C1_3-L-T-FI-EE – 100%	< 1	< 1	100 (0)	
08-00C1_4-W-O-SD-EE – 10%			100 (0)	>100
08-00C1_4-W-O-SD-EE – 50%			100 (0)	
08-00C1_4-W-O-SD-EE – 100%	NA	5	100 (0)	
Batch 2				
Control	< 1	< 1	100 (0)	
06-00C1&2-W-T-SD-EE – 10%			100 (0)	> 100%
06-00C1&2-W-T-SD-EE – 50%			100 (0)	
06-00C1&2-W-T-SD-EE – 100%	7	NA	100 (0)	
06-00C3_6-L-T-FI-EE – 10%			100 (0)	> 100%
06-00C3_6-L-T- FI -EE – 50%			100 (0)	
06-00C3_6-L-T- FI -EE – 100%	2	NA	98.0 (4)	
06-0C1_6N-B-N-SS-EE – 10%			96.0 (5)	> 100%
06-0C1_6N-B-N-SS-EE – 50%			98.0 (4)	
06-0C1_6N-B-N-SS-EE – 100%	NA	NA	100 (0)	
07-00C1_4-W-T-SD-EE – 10%			100 (0)	> 100%

07-00C1_4-W-T-SD-EE – 50%			100 (0)	
07-00C1_4-W-T-SD-EE – 100%	> 8	NA	100 (0)	
07-00C5_9-L-T- FI -EE – 10%			100 (0)	> 100%
07-00C5_9-L-T- FI -EE – 50%			100 (0)	
07-00C5_9-L-T- FI -EE – 100%	NA	NA	100 (0)	
Sample ID	**Fish (*Cyprinodon variegatus*)**			
	Day 0 Overlying Total Ammonia Values (mg/L)	**Day 4 Overlying Total Ammonia Values (mg/L)**	**Mean % Survival (SD)**	**LC_{50} (%)**
07-0C1_9N-B-N-SS-EE – 10%			100 (0)	> 100%
07-0C1_9N-B-N-SS-EE – 50%			96.0 (5)	
07-0C1_9N-B-N-SS-EE – 100%	NA	NA	98.0 (4)	
10-000001-W-T-SD-EE – 10%			100 (0)	> 100%
10-000001-W-T-SD-EE – 50%			100 (0)	
10-000001-W-T-SD-EE – 100%	NA	NA	96.0 (9)	
10-00C3&4-L-T- FI -EE – 10%			100 (0)	> 100%
10-00C3&4-L-T- FI -EE – 50%			100 (0)	
10-00C3&4-L-T- FI -EE – 100%	NA	NA	100 (0)	
10-0C3&4N-L-N-SS-EE – 10%			100 (0)	> 100%
10-0C3&4N-L-N-SS-EE – 50%			96.0 (5)	
10-0C3&4N-L-N-SS-EE – 100%	NA	NA	100 (0)	
Batch 3				
Control	< 1	< 1	98.0 (4)	
04-00C1_8-W-T-SD-EE – 10%			100 (0)	>100
04-00C1_8-W-T-SD-EE – 50%			100 (0)	
04-00C1_8-W-T-SD-EE – 100%	2	3	100 (0)	
05-00C1_8-W-T-SD-EE – 10%			100 (0)	>100
05-00C1_8-W-T-SD-EE – 50%			100 (0)	
05-00C1_8-W-T-SD-EE – 100%	1	2	100 (0)	
45-C1_16N-W-N-SS-EE – 10%			100 (0)	>100
45-C1_16N-W-N-SS-EE – 50%			100 (0)	
45-C1_16N-W-N-SS-EE – 100%	> 8	> 8	98.0 (4)	
09-000001-W-O-SD-EE – 10%			100 (0)	>100
09-000001-W-O-SD-EE – 50%			100 (0)	
09-000001-W-O-SD-EE – 100%	5	4	100 (0)	
09-00C2&4-W-O-SD-EE – 10%			100 (0)	>100
09-00C2&4-W-O-SD-EE – 50%			100 (0)	
09-00C2&4-W-O-SD-EE – 100%	NA	4	96.0 (5)	

Potassium Chloride Reference Toxicant (48 Hour Test)		
Concentration (g/L)	**Mean % Survival**	**LC_{50} (g/L)**
Batch 1		
Control	100	1.59

0.28	100	
0.56	100	
1.13	100	
2.25	0.00	
4.50	0.00	
Potassium Chloride Reference Toxicant (48 Hour Test)		
Concentration (g/L)	**Mean % Survival**	**LC_{50} (g/L)**
Batch 2		
Control	100	0.65
0.28	100	
0.56	70.0	
1.13	0.00	
2.25	0.00	
4.50	0.00	
Batch 3		
Control	100	0.69
0.28	100	
0.56	80.0	
1.13	0.00	
2.25	0.00	
4.50	0.00	

NA = Not available.4

Batch 2
Water quality parameters were within the appropriate limits (Table 12). Temperature values were within the specified means (20 ± 1 °C) and range of instantaneous (20 ± 3 °C) measurements (USEPA, 2002). Mean percent control survival of *C. variegatus* was 100%, which met the minimum acceptable control survival criterion (≥ 90%). Statistical analysis using the simple t-test (SigmaStat, Chicago, IL, USA) determined that no treatments were statistically reduced relative to the performance control (Table 30). LC_{50} values were determined by trimmed Spearman-Karber (Toxstat® software (Gulley 1996, University of Wyoming), however, there was insufficient mortality to calculate LC_{50} values for survival (LC_{50} values > 100%). The laboratory bench sheets are provided in Appendix M.

The potassium chloride reference toxicant test was conducted at concentrations of 0.28, 0.56, 1.13, 2.25, and 4.50 g KCl/L, tested in 15 ppt reconstituted seawater. The 48-hour LC_{50} was determined to be 0.65 g KCl/L, which was inside two standard deviations (± 0.16 g KCl/L) of the ERDC control charts mean of 0.71 g KCl/L (15 ppt reconstituted seawater). This indicates that the sensitivity of *C. variegatus* used in the assessment of test sediments fell within the normal range.

Batch 3
Water quality parameters were within the appropriate limits (Table 12). Temperature values were within

4 While ammonia was not measured in all testing exposures using *C. variegatus*, it was of little toxicological significance for this test species due to the high survival in all DMMUs and treatment levels.

the specified means (20 ± 1 °C) and range of instantaneous (20 ± 3 °C) measurements (USEPA, 2002). Mean percent control survival of *C. variegatus* was 98.0%, which met the minimum acceptable control survival criterion (≥ 90%). Statistical analysis using the simple t-test (SigmaStat, Chicago, IL, USA) determined that no treatments were statistically reduced relative to the performance control (Table 30). LC_{50} values were determined by trimmed Spearman-Karber (Toxstat® software (Gulley 1996, University of Wyoming), however, there was insufficient mortality to calculate LC_{50} values for survival (LC_{50} values > 100%). The laboratory bench sheets are provided in Appendix M.

The potassium chloride reference toxicant test was conducted at concentrations of 0.28, 0.56, 1.13, 2.25, and 4.50 g KCl/L, tested in 12 ppt reconstituted seawater. The 48-hour LC_{50} was determined to be 0.69 g KCl/L, which was inside two standard deviations (± 0.16 g KCl/L) of the ERDC control charts mean of 0.71 g KCl/L (15 ppt reconstituted seawater). This indicates that the sensitivity of *C. variegatus* used in the assessment of test sediments fell within the normal range.

3.10.2 Solid Phase Tests

3.10.2.1Freshwater – Hyalella azteca

Batch 1

Water quality parameters were within the appropriate limits (Table 13). Interstitial ammonia concentrations exceeded 20 mg/L in 03-00C4_6-W-T-SD-FS (48.7 mg/L) and 08-00C1_4-W-O-SD-FS (51.5 mg/L). Twice daily water exchanges were conducted on these treatments for two days prior to test setup to alleviate the high interstitial ammonia concentrations. Interstitial ammonia concentrations were reduced to 14.4 and 19.4 mg/L for 03-00C4_6-W-T-SD-FS and 08-00C1_4-W-O-SD-FS, respectively, prior to test initiation. Conductivity was generally high in all site sediments (650 - > 2000 µS). Since it was unclear as to whether the high conductivity was contaminant related, and, given the high tolerance of *H. azteca*, no attempts to reduce conductivity were conducted beyond a standard initial water exchange.

Mean percent control survival of *H. azteca* was 87.5%, which met the minimum acceptable control survival criterion (≥ 80%). Mean percent reference survival was 88.8%. Mean percent survival of samples 03-00C4_6-W-T-SD-FS, 03-00C1_3-L-T-FI-FS, 03-0C1_6N-B-N-SS-FS, 06-00C1&2-W-T-SD-FS, and 08-00C1_4-W-O-SD-FS was 91.3, 92.5, 95.0, 90.0, and 85.0%, respectively (Table 31). Survival analysis was conducted using SigmaStat Statistical Software (Systat Software, Inc., San Jose, CA). Analysis was conducted using Kruskal-Wallis one way analysis of variance on ranks. The mortality in all project sediments was not significantly different than the reference sediment and did not exceed mortality in the reference sediment by at least 20%. Therefore, the project sediments are predicted to not be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998). The laboratory bench sheets are provided in Appendix M.

The monthly cadmium chloride reference toxicant was conducted at concentrations of 0, 1.0, 2.5, 5.0, 10.0, and 20.0 µg Cd^{2+}/L. The LC_{50} was determined to be 4.77 µg/L Cd^{2+}/L, which was inside two standard deviations (± 2.34 µg Cd^{2+}/L) of the ERDC laboratory mean (3.39 µg Cd^{2+}/L). This indicates that the sensitivity of H. *azteca* used in the assessment of test sediments fell within the normal range.

Table 31. Results of Solid Phase Test Using *Hyalella azteca*

Sample ID	Amphipods – *Hyalella azteca*			
	Day 0 Interstitial Total Ammonia Concentration (mg/L)	Overlying Total Ammonia Concentration (mg/L)		Mean % Survival (SD)
		Day 0	Day 10	
Batch1				
Control	3.0	<1	<1	87.5 (10.4)
MR-00000R-W-O-SD-FS	15.8	2	<1	88.8 (11.3)
03-00C4_6-W-T-SD-FS	14.4	<1	<1	91.3 (8.3)
03-00C1_3-L-T-FI-FS	5.9	<1	<1	92.5 (7.1)
03-0C1_6N-B-N-SS-FS	17.6	1.5	<1	95.0 (7.6)
06-00C1&2-W-T-SD-FS	11.7	1.5	<1	90.0 (9.3)
08-00C1_4-W-O-SD-FS	19.4	<1	<1	85.0 (12.0)
Batch 2				
Control	2.0	1	<1	98.8 (3.5)
MR-00000R-W-O-SD-FS	16.5	1	<1	97.5 (4.6)
04-00C1_8-W-T-SD-FS	19.5	8	<1	82.5 (20.5)
05-00C1_8-W-T-SD-FS	17.0	2	<1	60.0 (33.0)*
06-0C1_6N-B-N-SS-FS	8.5	<1	<1	95.0 (5.3)
07-0C1_9N-B-N-SS-FS	14.1	2	<1	88.8 (8.3)
07-00C1_4-W-T-SD-FS	15.4	2	<1	51.3 (33.1)*
10-000001-W-T-SD-FS	16.5	2	<1	91.3 (9.9)
45-C1_16N-W-N-SS-FS	11.5	1.5	<1	92.5 (7.1)
Batch 3				
Control	3.0	<1	<1	93.8 (9.2)
MR-00000R-W-O-SD-FS	15.5	<1	<1	85.0 (13.1)
06-00C3_6-L-T-FI-FS	6.0	<1	<1	95.0 (7.6)
07-00C5_9-L-T-FI-FS	8.0	<2	<2	95.0 (7.6)
09-000001-W-O-SD-FS	15.2	<1	<1	91.3 (14.6)
09-00C2&4-W-O-SD-FS	27.1	1	<1	88.8 (16.4)
10-00C3&4-L-T-FI-FS	4.5	2	<1	80.0 (33.4)
10-0C3&4N-L-N-SS-FS	12.0	3	1	86.3 (14.1)

Cadmium Chloride Reference Toxicant		
Concentration (µg/L)	**Mean % Survival**	**LC50 (µg/L)**
Batch 1, 2, and 3		
0	100	4.77
1.0	87.0	
2.5	67.0	
5.0	43.0	
10.0	10.0	
20.0	0.00	

*Significant reduction in survival as compared to reference.

Batch 2
Water quality parameters were within the appropriate limits (Table 13). Conductivity was generally high in all site sediments (320 - >2000 µS). Since it was unclear as to whether the high conductivity was contaminant related (e.g., metals), and, given the high tolerance of *H. azteca*, no attempts to reduce conductivity were conducted beyond a standard initial water exchange. Mean percent control survival of *H. azteca* was 98.8%, which met the minimum acceptable control survival criterion (≥ 80%). Mean percent reference survival was 97.5%. Mean percent survival of samples 04-00C1_8-W-T-SD-FS, 05-00C1_8-W-T-SD-FS, 06-0C1_6N-B-N-SS-FS, 07-0C1_9N-B-N-SS-FS, 07-00C1_4-W-T-SD-FS, 10-000001-W-T-SD-FS, and 45-C1_16N-W-N-SS-FS was 82.5, 60.0, 95.0, 88.8, 51.3, 91.3, and 92.5.0%, respectively (Table 31). Survival analysis was conducted using SigmaStat Statistical Software (Systat Software, Inc., San Jose, CA). Analysis was conducted using One Way ANOVA followed by Dunnett's Method for means comparisons to the reference. Significant mortality that exceeded mortality in the reference sediment by 20% was observed in sediments 05-00C1_8-W-T-SD-FS and 07-00C1_4-W-T-SD-FS. Mortality in the remaining projects sediments was not significantly different from the reference sediment and did not exceed mortality in the reference sediment by at least 20%. Project sediments 05-00C1_8-W-T-SD-FS and 07-00C1_4-W-T-SD-FS are predicted to be acutely toxic to benthic organisms. The remaining project sediments are predicted to not be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998). The laboratory bench sheets are provided in Appendix M.

The monthly cadmium chloride reference toxicant was conducted at concentrations of 0, 1.0, 2.5, 5.0, 10.0, and 20.0 µg Cd^{2+}/L. The LC_{50} was determined to be 4.77 µg Cd^{2+}/L, which was inside two standard deviations (±2.34 µg Cd^{2+}/L) of the ERDC laboratory mean (3.39 µg Cd^{2+}/L). This indicates that the sensitivity of *H. azteca* used in the assessment of test sediments fell within the normal range.

Batch 3
With the exception of total ammonia in sediment 09-00C2&4-W-O-SD-FS, water quality parameters were within the appropriate limits (Table 13). Interstitial ammonia concentration exceeded 20 mg/L in 09-00C2&4-W-O-SD-FS (27.1 mg/L) on day 0. Given the relatively high pH (mean 7.9) in the overlying water and the twice daily water exchanges we would not expect ammonia to adversely impact survival at this concentration. This expectation was supported by the fact that no survival effects were observed for this sediment at day 10. Mean percent control survival of *H. azteca* was 93.8%, which met the minimum acceptable control survival criterion (≥ 80%). Mean percent reference survival was 85.0%. Mean percent survival of samples 06-00C3_6-L-T-FI-FS, 07-00C5_9-L-T-FI-FS, 09-000001-W-O-SD-FS, 09-00C2&4-W-O-SD-FS, 10-00C3&4-L-T-FI-FS, and 10-0C3&4N-L-N-SS-FS was 95.0, 95.0, 91.3, 88.8, 80.0, and 86.3%, respectively (Table 31). Survival analysis was conducted using SigmaStat Statistical Software (Systat Software, Inc., San Jose, CA). Analysis was conducted using Kruskal-Wallis one way Analysis of variance on ranks. Mortality in all project sediments was not significantly different from the reference sediment and did not exceed mortality in the reference sediment by at least 20%. The project sediments are predicted to not be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998). The laboratory bench sheets are provided in Appendix M.

The monthly cadmium chloride reference toxicant was conducted at concentrations of 0, 1.0, 2.5, 5.0, 10.0, and 20.0 µg Cd^{2+}/L. The LC_{50} was determined to be 4.77 µg Cd^{2+}/L, which was inside two standard deviations (2.34 µg Cd^{2+}/L) of the ERDC laboratory mean (3.39 µg Cd^{2+}/L). This indicates that the sensitivity of *H. azteca* used in the assessment of test sediments fell within the normal range.

3.10.2.2Marine – Leptocheirus plumulosus

Batch 1
Water quality parameters were within the appropriate limits with the exception of initial interstitial ammonia in sample 0800C1_4WOSDMS (Table 14). Interstitial ammonia concentrations exceeded 20 mg/L in 03-00C4_6-W-T-SD-MS (38.4 mg/L) and 08-00C1_4-W-O-SD-MS (42.1 mg/L). Once daily

water exchanges were conducted on these treatments for six days prior to test setup to alleviate the high interstitial ammonia concentrations. Interstitial ammonia concentrations were reduced to 18.5 and 23.2 mg/L for 03-00C4_6-W-T-SD-FS and 08-00C1_4-W-O-SD-FS, respectively, prior to test initiation. The interstitial ammonia concentration for 0800C1_4WOSDMS (23.2 mg/L) was slightly higher than the recommended limit of 20 mg/L at test initiation. Since the NOEC in the associated ammonium chloride reference toxicant test was 30.5 mg/L, ammonia is not believed to have contributed to toxicity in this sample.

Mean percent control survival of *L. plumulosus* was 98.0%, which met the minimum acceptable control survival criterion ($\geq$ 90%). Mean percent reference survival was 89.0%. Mean percent survival of samples 03-00C1_3-L-T-FI-MS, 03-00C4_6-W-T-SD-MS, 03-0C1_6N-B-N-SS-MS, 08-00C1_4-W-O-SD-MS, and MT-00000R-W-O-SD-MS was 75.0, 42.0, 69.0, 39.0, and 89.0%, respectively (Table 32). The laboratory bench sheets are provided in Appendix M. The mortality in project sediment MT-00000R-W-O-SD-MS was not significantly different than the reference sediment and did not exceed mortality in the reference sediment by at least 20%. The mortality in project sediment 03-00C1_3-L-T-FI-MS was significantly different than the reference sediment but did not exceed mortality in the reference sediment by at least 20%. Therefore, these project sediments are predicted to not be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998). The mortality in project sediments 03-00C4_6-W-T-SD-MS, 03-0C1_6N-B-N-SS-MS, and 08-00C1_4-W-O-SD-MS was significantly different than the reference sediment and exceeded mortality in the reference sediment by at least 20%. Therefore, these project sediments are predicted to be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998).

The cadmium chloride reference toxicant was conducted at concentrations of 0, 0.125, 0.250, 0.500, 1.00, 2.00, and 4.00 mg Cd^{2+}/L. The LC_{50} was determined to be 0.850 mg Cd^{2+}/L, which was inside two standard deviations (± 3.34 mg Cd^{2+}/L) of the Weston historical laboratory control chart mean of 1.48 mg Cd^{2+}/L. This indicates that the sensitivity of *L. plumulosus* used in the assessment of test sediments fell within the normal range.

In the ammonium chloride reference toxicant test, LC_{50} values of 84.8 mg total NH_3/L and 1.40 mg un-ionized NH_3/L were determined from survivorship at measured concentrations of 0, 17.3, 30.5, 63.4, 124, and 298 mg total NH_3/L, and calculated unionized concentrations of 0, 0.672, 0.996, 1.28, 1.61, and 2.48 mg un-ionized NH_3/L. Interstitial total and unionized ammonia concentrations in project materials were below concurrent reference toxicant effect levels (LC_{50} = 84.8 mg total NH_3/L; NOEC = 30.5 mg total NH_3/L). Therefore, ammonia was not expected to have contributed to any toxicity found in tests using project materials.

Table 32. Results of Solid Phase Test Using *Leptocheirus plumulosus*

Sample ID	Amphipods (*Leptocheirus plumulosus*)				
	Overlying Total Ammonia Concentration (mg/L)		Interstitial Total Ammonia Concentration (mg/L)		Mean % Survival (SD)
	Day 0	Day 10	Day 0	Day 10	
Batch 1					
Control	<0.500	<0.500	1.87	<0.500	98.0 (2.7)
SB-00000R-W-O-SD-MS	<0.500	<0.500	0.670	<0.500	89.0 (6.5)
03-00C1_3-L-T-FI-MS	<0.500	<0.500	1.13	<0.500	75.0 (10.0)*
03-00C4_6-W-T-SD-MS	0.962	<0.500	18.5	5.46	42.0 (12.5)*
03-0C1_6N-B-N-SS-MS	0.561	<0.500	0.720	<0.500	69.0 (16.4)*
08-00C1_4-W-O-SD-MS	1.17	<0.500	23.2	6.73	39.0 (6.5)*
MT-00000R-W-O-SD-MS	<0.500	<0.500	2.80	<0.500	89.0 (4.2)
Batch2					
Control	1.02	<0.500	2.87	0.730	95.0 (6.1)
SB-00000R-W-O-SD-MS	<0.500	<0.500	1.27	<0.500	98.0 (4.5)
06-00C1&2-W-T-SD-MS	<0.500	<0.500	9.10	1.38	93.0 (8.4)
06-0C1_6N-B-N-SS-MS	0.921	<0.500	3.82	0.728	85.0 (5.0)*
07-00C5_9-L-T-FI-MS	<0.500	<0.500	<0.5	<0.500	90.0 (6.1)
07-00C1_4-W-T-SD-MS	0.728	<0.500	8.03	1.17	80.0 (13.7)*
10-00C3&4-L-T-FI-MS	0.642	<0.500	6.09	0.840	92.0 (2.7)
10-000001-W-T-SD-MS	2.43	<0.500	7.11	2.43	89.0 (7.4)
10-0C3&4N-L-N-SS-MS	1.73	<0.500	2.98	<0.500	82.0 (9.1)*
06-00C3_6-L-T-FI-MS	<0.50	<0.500	<0.5	<0.500	81.0 (9.6)*
07-0C1_9N-B-N-SS-MS	1.43	<0.500	2.58	<0.500	86.0 (11.9)*
Batch 3					
Control	<0.500	<0.500	3.55	<0.500	94.0 (2.2)
SB-00000R-W-O-SD-MS	<0.500	<0.500	1.12	<0.500	82.0 (5.7)
04-00C1_8-W-T-SD-MS	<0.500	<0.500	7.33	2.85	50.0 (19.4)*
05-00C1_8-W-T-SD-MS	<0.500	<0.500	5.94	0.847	32.0 (14.0)*
45-C1_16N-W-N-SS-MS	0.777	<0.500	10.4	3.14	67.0 (9.7)
09-00C2&4-W-O-SD-MS	<0.500	<0.500	3.68	2.89	67.0 (10.4)
09-000001-W-O-SD-MS	1.38	<0.500	25.0	<0.500	59.0 (10.2)*

Cadmium Chloride Reference Toxicant		
Concentration (mg/L)	**Mean % Survival**	**LC_{50} (mg/L)**
Batch 1		
Control	100	0.850
0.125	100	
0.250	86.7	
0.500	73.3	
1.00	40.0	
2.00	26.7	
4.00	3.30	
Batch 2		
Control	100	0.508
0.125	96.7	

0.250	76.7	
Cadmium Chloride Reference Toxicant		
Concentration (mg/L)	**Mean % Survival**	**LC_{50} (mg/L)**
0.500	53.3	
1.00	16.7	
2.00	13.3	
4.00	3.33	
Batch 3		
Control	96.7	0.511
0.125	96.7	
0.250	90.0	
0.500	40.0	
1.00	23.3	
2.00	3.33	
4.00	0.00	

Ammonium Chloride Reference Toxicant						
Total NH_3	**Un-ionized NH_3**	**Mean % Survival**	**Total NH_3**		**Un-ionized NH_3**	
Actual Concentration (mg/L)	**Calculated Concentration (mg/L)**		**LC_{50} (mg/L)**	**NOEC (mg/L)**	**LC_{50} (mg/L)**	**NOEC (mg/L)**
Batch 1						
Control	Control	100	84.8	30.5	1.40	1.00
17.3	0.672	100				
30.5	1.00	93.3				
63.4	1.28	70.0				
124	1.61	13.3				
298	2.48	0.00				
Batch 2						
Control	Control	96.7	163	78.4	2.59	2.06
19.8	0.993	100				
39.8	1.32	100				
78.4	2.06	100				
155	2.56	56.7				
306	3.15	0.00				
Batch 3						
Control	Control	93.3	98.6	38.5	1.96	1.40
19.0	1.08	96.7				
38.5	1.40	96.7				
75.1	1.78	76.7				
152	2.28	6.67				
300	2.84	0.00				

*Significant reduction in survival as compared to reference.

Batch 2

Water quality parameters were within the appropriate limits (Table 14). The interstitial ammonia concentration exceeded 20 mg/L in 07-00C1_4-W-T-SD-MS (21.6 mg/L). Once daily water exchanges were conducted on this treatment for seven days prior to test setup to alleviate the high interstitial ammonia concentration. Interstitial ammonia concentration was reduced to 8.03 mg/L prior to test initiation.

Mean percent control survival of *L. plumulosus* was 95.0%, which met the minimum acceptable control survival criterion ($\geq$ 90%). Mean percent reference survival was 98.0%. Mean percent survival of samples 06-00C1&2-W-T-SD-MS, 06-0C1_6N-B-N-SS-MS, 07-00C5_9-L-T-FI-MS, 07-00C1_4-W-T-SD-MS, 10-00C3&4-L-T-FI-MS, 10-000001-W-T-SD-MS, 10-0C3&4N-L-N-SS-MS, 06-00C3_6-L-T-FI-MS, and 07-0C1_9N-B-N-SS-MS was 93.0, 85.0, 90.0, 80.0, 92.0, 89.0, 82.0, 81.0, and 86.0%, respectively (Table 32). The laboratory bench sheets are provided in Appendix M. The mortality in project sediments 06-00C1&2-W-T-SD-MS, 07-00C5_9-L-T-FI-MS, 10-00C3&4-L-T-FI-MS, and 10-000001-W-T-SD-MS was not significantly different than the reference sediment and did not exceed mortality in the reference sediment by at least 20%. Therefore, these project sediments are predicted to not be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998). The mortality in project sediments 06-0C1_6N-B-N-SS-MS, 07-00C1_4-W-T-SD-MS, 10-0C3&4N-L-N-SS-MS, 06-00C3_6-L-T-FI-MS, and 07-0C1_9N-B-N-SS-MS was significantly different than the reference sediment but did not exceed mortality in the reference sediment by at least 20%. Therefore, these project sediments also are predicted to not be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998).

The cadmium chloride reference toxicant was conducted at concentrations of 0, 0.125, 0.250, 0.500, 1.00, 2.00, and 4.00 mg Cd^{2+}/L. The LC_{50} was determined to be 0.508 mg Cd^{2+}/L, which was inside two standard deviations (± 3.35 mg Cd^{2+}/L) of the Weston historical laboratory control chart mean of 1.47 mg Cd^{2+}/L. This indicates that the sensitivity of *L. plumulosus* used in the assessment of test sediments fell within the normal range.

In the ammonium chloride reference toxicant test, LC_{50} values of 163 mg total NH_3/L and 2.59 mg un-ionized NH_3/L were determined from survivorship at measured concentrations of 0, 19.8, 39.8, 78.4, 155, and 306 mg total NH_3/L, and calculated unionized concentrations of 0, 0.993, 1.32, 2.06, 2.56, and 3.15 mg un-ionized NH_3/L. Interstitial total and unionized ammonia concentrations in project materials were below concurrent reference toxicant effect levels (LC_{50} = 163 mg total NH_3/L; NOEC = 78.4 mg total NH_3/L). Therefore, ammonia was not expected to have contributed to any toxicity found in tests using project materials.

Batch 3

Water quality parameters were within the appropriate limits with the exception of initial interstitial ammonia in sample 09-000001-W-O-SD-MS (Table 14). Interstitial ammonia concentrations exceeded 20 mg/L in 04-00C1_8-W-T-SD-MS (36.9 mg/L), 05-00C1_8-W-T-SD-MS (29.5 mg/L), and 09-00C2&4-W-O-SD-MS (21.9 mg/L). Once daily water exchanges were conducted on these treatments for eight days prior to test setup to alleviate the high interstitial ammonia concentrations. Interstitial ammonia concentrations were reduced to 7.33, 5.94, and 3.68 mg/L for 04-00C1_8-W-T-SD-MS, 05-00C1_8-W-T-SD-MS, and 09-00C2&4-W-O-SD-MS, respectively, prior to test initiation. The interstitial ammonia concentration for 09000001WOSDMS (25.0 mg/L) increased during the acclimation period and was slightly higher than the recommended limit of 20 mg/L. Since the NOEC in the associated ammonium chloride reference toxicant test was 38.5 mg/L, ammonia was not believed to have contributed to toxicity in this sample.

Mean percent control survival of *L. plumulosus* was 94.0%, which met the minimum acceptable control survival criterion ($\geq$ 90%). Mean percent reference survival was 82.0%. Mean percent survival of samples 04-00C1_8-W-T-SD-MS, 05-00C1_8-W-T-SD-MS, 45-C1_16N-W-N-SS-MS, 09-00C2&4-W-O-SD-MS, and 09-000001-W-O-SD-MS was 50.0, 32.0, 67.0, 67.0, and 59.0%, respectively (Table 32). The laboratory bench sheets are provided in Appendix M. The mortality in project sediments 45-C1_16N-W-

N-SS-MS and 09-00C2&4-W-O-SD-MS was not significantly different than the reference sediment and did not exceed mortality in the reference sediment by at least 20%. Therefore, these project sediments are predicted to not be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998). The mortality in project sediments 04-00C1_8-W-T-SD-MS, 05-00C1_8-W-T-SD-MS, and 09-000001-W-O-SD-MS was significantly different than the reference sediment and exceeded mortality in the reference sediment by at least 20%. Therefore, these project sediments are predicted to be acutely toxic to benthic organisms (ITM; USEPA/USACE, 1998).

The cadmium chloride reference toxicant was conducted at concentrations of 0, 0.125, 0.250, 0.500, 1.00, 2.00, and 4.00 mg Cd^{2+}/L. The LC_{50} was 0.511 mg Cd^{2+}/L, which was inside two standard deviations (± 1.83 mg Cd^{2+}/L) of the Weston historical laboratory control chart mean of 1.12 mg Cd^{2+}/L. This indicates that the sensitivity of *L. plumulosus* used in the assessment of test sediments fell within the normal range.

In the ammonium chloride reference toxicant test, LC_{50} values of 98.6 mg total NH_3/L and 1.96 mg un-ionized NH_3/L were determined from survivorship at measured concentrations of 0, 19.0, 38.5, 75.1, 152, and 300 mg total NH_3/L, and calculated unionized concentrations of 0, 1.08, 1.40, 1.78, 2.28, and 2.84 mg un-ionized NH_3/L. Interstitial total and unionized ammonia concentrations in project materials were below concurrent reference toxicant effect levels (LC_{50} = 98.6 mg total NH_3/L; NOEC = 38.5 mg total NH_3/L). Therefore, ammonia was not expected to have contributed to any toxicity found in tests using project materials.

3.10.3 Bioaccumulation Potential Tests

3.10.3.1Freshwater Benthic- Corbicula fluminea

Batch 1

Water quality parameters were within the appropriate limits with the exception of pH and DO (Table 15). At test termination, low DO values were measured in replicate A and B of sample 06-0C1_6N-B-N-SS-FB. The pH of sample 06-00C1&2-W-T-SD-FB replicate A was slightly above (9.08) the target range on one occasion. The pH of sample 10-000001-W-T-SD-FB replicate A was slightly below (6.90) the target range on one occasion. These deviations were determined to be insignificant to test outcome since survival in the test replicates in question was not different than other replicates within the treatment. Mean percent reference survival was 62.0%. Mean percent survival of samples 03-00C1_3-L-T-FI-FB, 07-00C1_4-W-T-SD-FB, 06-00C1&2-W-T-SD-FB, 06-0C1_6N-B-N-SS-FB, and 10-000001-W-T-SD-FB was 64.0, 53.0, 58.0, 83.0, and 38.0%, respectively (Table 33). The mortality was significantly reduced in 10-000001-W-T-SD-FB relative to the reference.

Survivorship in batch 1 was generally low. Clams in batch 1 were received from a source in Virginia. These organisms were collected and held in water for 24-h and then shipped overnight to ERDC with damp paper towels on ice. It is conceivable that these holding and shipping methods stressed the organisms, leading to reduced survival in the bioassay, since this was observed for all batch 1 sediments (including the reference). Clams from batches 2 to 4 were collected from an Arkansas source, held in an artificial stream, and transported to ERDC the same day in water. Survival for the Arkansas clams was generally high.

Aquatic placement of sediment will be based on results of statistical analysis of resulting tissue chemical concentrations. The laboratory bench sheets are provided in Appendix M.

Table 33. Results of Bioaccumulation Potential Test Using *Corbicula fluminea*

Sample ID	Bivalve – *Corbicula fluminea* Mean % Survival (SD)
Batch 1	
MR-00000R-W-O-FB	62.0 (18)
03-00C1_3-L-T-FI-FB	64.0 (5)
07-00C1_4-W-T-SD-FB	53.0 (7)
06-00C1&2-W-T-SD-FB	58.0 (10)
06-0C1_6N-B-N-SS-FB	83.0 (4)
10-000001-W-T-SD-FB	38.0 (6) *
Batch 2	
Control (BR)	95.0 (4)
MR-00000R-W-O-FB	98.0 (2)
03-0C1_6N-B-N-SS-FB	96.0 (3)
03-00C4_6-W-T-SD-FB	95.0 (4)
06-00C3_6-L-T-FI-FB	96.0 (4)
07-00C5_9-L-T-FI-FB	93.0 (7)
Batch 3	
Control (BR)	95.0 (4)
MR-00000R-W-O-FB	98.0 (2)
07-0C1_9N-B-N-SS-FB	85.0 (6)
04-00C1_8-W-T-SD-FB	91.0 (6)
09-000001-W-O-SD-FB	89.0 (7)
10-0C3&4N-L-N-SS-FB	58.0 (19)*
Batch 4	
Control (BR)	95.0 (4)
MR-00000R-W-O-FB	98.0 (2)
09-00C2&4-W-O-SD-FB	73.0 (27)
08-00C1_4-W-O-SD-FB	85.0 (5)*
10-00C3&4-L-T-FI-FB	37.0 (8)*
05-00C1_8-W-T-SD-FB	94.0 (4)
45-C1_16N-W-N-SS-FB	58.0 (4)*

*Significant reduction in survival as compared to reference.

Batch 2

Water quality parameters were within the appropriate limits (Table 15). Mean percent control survival was 95.0%, which met the generalized minimum acceptable control survival criterion for bioassays (≥ 90%). Mean percent reference survival was 98.0%. Mean percent survival of samples 03-0C1_6N-B-N-SS-FB, 03-00C4_6-W-T-SD-FB, 06-00C3_6-L-T-FI-FB, and 07-00C5_9-L-T-FI-FB was 96.0, 95.0, 96.0, and 93.0%, respectively (Table 33). The mortality in all project sediments was not significant. Aquatic placement of sediment will be based on results of statistical analysis of resulting tissue chemical concentrations. The laboratory bench sheets are provided in Appendix M.

Batch 3

Water quality parameters were within the appropriate limits (Table 15). Mean percent control survival was 95.0%, which met the generalized minimum acceptable control survival criterion for bioassays (≥ 90%). Mean percent reference survival was 98.0%. Mean percent survival of samples 07-0C1_9N-B-N-SS-FB, 04-00C1_8-W-T-SD-FB, 09-000001-W-O-SD-FB, and 10-0C3&4N-L-N-SS-FB was 85.0, 91.0, 89.0, and 58.0%, respectively (Table 33). The mortality was significantly reduced in 10-0C3&4N-L-N-SS-FB. Aquatic placement of sediment will be based on results of statistical analysis of resulting tissue chemical concentrations. The laboratory bench sheets are provided in Appendix M.

Batch 4

Water quality parameters were within the appropriate limits with the exception one DO value (Table 15). The DO for 10-00C3&4-L-T-FI-FB replicate E was 2.5 mg/L on November 28, 2007. Survival in this replicate was 20.0%, compared to the mean of 40.0% for the other four replicates within this treatment. Mean percent control survival was 95.0%, which met the generalized minimum acceptable control survival criterion for bioassays (≥ 90%). Mean percent survival in the reference was 98.0%. Mean percent survival of samples 09-00C2&4-W-O-SD-FB, 08-00C1_4-W-O-SD-FB, 10-00C3&4-L-T-FI-FB, 05-00C1_8-W-T-SD-FB, and 45-C1_16N-W-N-SS-FB was 73.0, 85.0, 37.0, 94.0, and 58.0%, respectively (Table 33). The mortality was significantly reduced in 08-00C1_4-W-O-SD-FB, 10-00C3&4-L-T-FI-FB, and 45-C1_16N-W-N-SS-FB. Aquatic placement of sediment will be based on results of statistical analysis of resulting tissue chemical concentrations. The laboratory bench sheets are provided in Appendix M.

3.10.3.2Marine Benthic – Macoma nasuta

Batch 1

Water quality parameters were within the appropriate limits with the exception of temperature (-0.2ºC) in several chambers at test initiation (Table 16). All subsequent temperatures readings were within limits. This slight deviation was determined to be insignificant to test outcome because no toxicity resulted from exposure to project material. To minimize any potential confounding factors associated with testing terrestrial soils in a marine environment, the soil sample 03-00C1_3-L-T-FI-MB was acclimated for six days prior to test initiation to minimize interstitial ammonia concentrations. For the acclimation, terrestrial soil samples were layered in the test aquaria in the same fashion as the marine sediments. Five replicate, 10-gallon aquaria were layered with six liters of test sediment. Continuous flow-through renewal of overlying seawater (5 to 10 volumes per day) was applied to each aquaria during the acclimation period (prior to the addition of animals). Test chambers had continuous trickle flow aeration and were held at 15 ± 1°C. After the acclimation period the tests were initiated within their respective batch of samples. Concentration of total ammonia measured in this sample on the day of test initiation was 3.94 mg/L. No adverse effects on survival of *M. nasuta* were observed in this sample and sufficient tissue was available for all chemical analyses.

The test acceptability criterion for the marine bioaccumulation potential test was sufficient tissue mass for designated chemical analyses. Target minimum tissue mass for IHNC sediments was 36 grams per replicate. Sufficient tissue for all analyses was obtained from each sample, with the exception of two replicates from 03-0C1_6N-B-N-SS-MB. For these two replicates, tissue was not available for VOC analysis. It was noted during tissue harvest that the tissues in clams exposed to this sediment (all replicates) were not as healthy as those exposed to the control or reference sediments. Mean percent control survival was 87.0%. Mean percent reference survival was 90.0%. Mean test sediment survival ranged from 71.0% to 95.0% (
Table 34). The only mortality resulting in insufficient tissue for all chemical analyses in any project sediment was observed in replicates 1 and 4 of 03-0C1_6N-B-N-SS-MB as described previously.

Disposal options will be based on results of statistical analysis of resulting tissue chemical concentrations. The laboratory bench sheets are provided in Appendix M.

Table 34. Results of Bioaccumulation Potential Test Using *Macoma nasuta*

Sample ID	Bivalve – *Macoma nasuta* Mean % Survival (SD)
Batch 1	
Control	87.0 (6.2)
SB-00000R-W-O-SD-MB	90.0 (6.7)
03-00C1_3-L-T-FI-MB	89.0 (8.4)
03-00C4_6-W-T-SD-MB	91.0 (7.6)
03-0C1_6N-B-N-SS-MB	71.0 (19.5)
08-00C1_4-W-O-SD-MB	95.0 (5.1)
MT-00000R-W-O-SD-MB	92.0 (5.1)
Batch 2	
Control	96.0 (5.5)
SB-00000R-W-O-SD-MB	89.0 (6.4)
06-00C1&2-W-T-SD-MB	92.0 (6.1)
06-00C3_6-L-T-FI-MB	70.0 (20.3)
06-0C1_6N-B-N-SS-MB	62.0 (27.6)
07-00C5_9-L-T-FI-MB	74.0 (11.9)
07-0C1_9N-B-N-SS-MB	86.0 (10.6)
10-00C3&4-L-T-FI-MB	83.0 (11.2)
10-0C3&4N-L-N-SS-MB	74.0 (12.3)
Batch 3	
Control	80.0 (6.7)
SB-00000R-W-O-SD-MB	78.0 (6.1)
07-00C1_4-W-T-SD-MB	82.0 (11.0)
10-000001-W-T-SD-MB	56.0 (19.2)
04-00C1_8-W-T-SD-MB	82.0 (8.4)
05-00C1_8-W-T-SD-MB	80.0 (7.1)
45-C1_16N-W-N-SS-MB	43.0 (15.3)
09-000001-W-O-SD-MB	73.0 (9.7)
09-00C2&4-W-O-SD-MB	69.0 (15.7)

Batch 2

Water quality parameters were within the appropriate limits with the exception of temperature (Table 16). A malfunction in the flow-through seawater system on Day 22 resulted in temperatures slightly below target range (-0.2ºC) in most chambers. Temperatures slightly increased over the 22-hour period without flow-through to 0.4 - 0.5ºC above target range. All previous and subsequent temperatures readings were within limits. While the flow-through system was not operating, aeration was increased slightly to ensure adequate oxygen in the test chambers. The temperature deviations were within the naturally occurring temperatures for *M. nasuta*, and survival was not affected by the deviations as shown by control survival of 96.0% and reference survival of 89.0%. For comparison, reference sediment in Batch 1 had survival of 90.0%. To minimize any potential confounding factors associated with testing terrestrial soils in a marine environment, the soil samples 06-00C3_6-L-T-FI-MB, 07-00C5_9-L-T-FI-MB, and 10-00C3&4-L-T-FI-MB were acclimated for six days prior to test initiation to minimize interstitial ammonia concentrations. For the acclimation, terrestrial soil samples were layered in the test aquaria in the same fashion as the marine sediments. Five replicate, 10-gallon aquaria were layered with six liters of test sediment. Continuous flow-through renewal of overlying seawater (5 to 10 volumes per day) was applied to each aquaria during the acclimation period (prior to the addition of animals). Test chambers had continuous trickle flow aeration and were held at 15 ± 1°C. After the acclimation period the tests were initiated within their respective batch of samples. Concentrations of total ammonia measured prior to test initiation ranged 6.47 to 7.84 mg/L. No adverse effects on survival of *M. nasuta* were observed in these samples and sufficient tissue was available for all chemical analyses in all replicates for 10-00C3&4-L-T-FI-MB. The other two soil samples each had one replicate without sufficient tissue for the VOC analysis.

The test acceptability criterion for the marine bioaccumulation potential test was sufficient tissue mass for designated chemical analyses. Target minimum tissue mass for IHNC sediments was 36 grams per replicate. Sufficient tissue for all analyses was obtained from each sample, with the exception of three replicates (06-00C3_6-L-T-FI-MB, 07-00C5_9-L-T-FI-MB, and 06-0C1_6N-B-N-SS-MB). For these replicates, tissue was not available for VOC analysis. As stated above, mean percent control survival was 96.0% and mean percent reference survival was 89.0%. Mean test sediment survival ranged from 62.0% to 92.0% (
Table 34). Disposal options will be based on results of statistical analysis of resulting tissue chemical concentrations. The laboratory bench sheets are provided in Appendix M.

Batch 3

Water quality parameters were within the appropriate limits with the exception of temperature (Table 16). Temperatures were about 0.3 to 0.5 ºC under the appropriate range at test initiation (Day 0). A malfunction in the flow-through seawater system on Day 1 resulted in temperatures slightly below target range (-0.2ºC) in most chambers. Temperatures rose over the 22-hour period without flow-through to 0.4-0.6ºC above target range. All subsequent temperatures readings were within established limits. While the flow-through system was not operating, aeration was increased slightly to ensure adequate oxygen in the test chambers. The temperature deviations were within the naturally occurring temperatures for *Macoma*.

The test acceptability criterion for the marine bioaccumulation potential test was sufficient tissue mass for designated chemical analyses. Target minimum tissue mass for IHNC sediments was 36 grams per replicate. Sufficient tissue for all analyses was obtained from each sample, with the exception of one replicate from 10-000001-W-T-SD-MB and three replicates from 45-C1_16N-W-N-SS-MB. For these replicates, tissue was not available for VOC analysis. Mean percent control survival was 80.0%. Mean percent reference survival was 78.0%. Mean test sediment survival ranged from 43.0% to 82.0% (
Table 34). Low survival (below 80%) was observed in samples 10-000001-W-T-SD-MB, 45-C1_16N-W-N-SS-MB, 09-000001-W-O-SD-MB, and 09-00C2&4-W-O-SD-MB. Disposal options will be based on results of statistical analysis of resulting tissue chemical concentrations. The laboratory bench sheets are provided in Appendix M.

3.10.3.3Terrestrial – Eisenia fetida

Batches 1 and 2

Measured substrate quality parameters were within the appropriate pH and salinity limits after washing to remove excess salts (Table 16). Other substrate parameters, such as food availability and substrate composition, may influence survival of earthworms. These parameters are generally not measured in upland disposal operations and may directly control the natural integration of terrestrial organisms in an upland CDF. Failure of earthworm survival in the upland CDF disposal operation generally eliminates the earthworm bioaccumulation pathway from further evaluation (Chapter 8 and Appendix G of UTM [USACE 2003] and ASTM E 1676-97 [ASTM 1997]).

The test acceptability criterion for the upland animal bioaccumulation potential test was sufficient tissue biomass for designated chemical analysis, per the guidance of the UTM (USACE 2003). The target tissue mass for IHNC substrates was 30 grams per replicate. Mean survival of *E. fetida* in batch one and two Grenada-Loring controls were 58.3 and 73.6%, respectively. Survivorship was relatively low in the controls; therefore, additional 28-day bioaccumulation experiments were conducted with control culture media (peat moss) to verify that experimental conditions did not cause lethality to E. fetida. Results of the additional control experiment are presented in Appendix M. Mean survival of *E. fetida* in BL-00000R-W-O-SD-EB reference substrate was 69.7%. Mean survival of *E. fetida* in DMMU substrates ranged from 0.0 to 71.2% (Table 35). Thus, fresh tissue biomass did not meet the 30 gram target necessary for chemical analysis of all project contaminants of concern in any replicate. Mean earthworm tissue biomass ranged from 6.24 to 19.3 g, resulting in IHNC sediment. Complete mortality of earthworms occurred in 10-00C3&4-L-T-FI-EB. Survival of earthworms in all samples was less than the BL-00000R-W-O-SD-EB reference, with the exception of 01-00C1_6-W-O-SD-EB and 03-00C1_3-L-T-FI-EB. Resulting tissue mass was insufficient to provide a complete comparison of tissue contaminants of concerns between project substrates and the reference substrate, therefore tissue samples were analyzed according to the contaminant prioritization list for earthworms as described in section 2.4.2.6.

There were generally no observable behavioral or health parameters during the 28 day exposure period that provide incite into the mortality occurring in these samples. As mentioned above, substrate parameters, such as food availability and substrate composition (i.e., % clay, % silt, & % sand), may influence earthworm survival. Earthworms generally do not like substrates with high clay content that fail to form aggregates. Individual chemical contaminants as well as contaminant mixtures could influence earthworm survival. The stress of continuous light exposure, used in the environmental chamber in order to keep the earthworms in the substrate and to maximize contaminant exposure, may also contribute to earthworm survival. These substrates do not provide optimum physical conditions to support earthworm survival. The 24 hr lighting is designed to keep the earthworms in the material through the 28 day exposure period. Under normal light conditions (16 hr day length) earthworms will move to and travel across soil surfaces. Due to the harsh conditions of the substrates, movement for feeding may have been limited, thus resulting in starvation.

Table 35. Results of Bioaccumulation Potential Test Using *Eisenia fetida*

Sample ID	*Eisenia fetida* Mean % Survival (SD)	*Eisenia fetida* Mean Biomass, Grams (SD)
Batch 1		
Grenada-Loring Control 1	58.3 (16.23)	16.4 (3.73)
01-00C1_6-W-O-SD-EB	70.7 (13.89)	13.7 (3.55)
02-00C1_6-W-O-SD-EB	63.9 (18.54)	13.2 (3.51)
03-00C1_3-L-T-FI-EB	71.2 (9.35)	19.3 (3.21)
03-00C4_6-W-T-SD-EB	56.0 (6.10)	13.8 (1.34)
03-0C1_6N-B-N-SS-EB	68.9 (12.98)	16.5 (1.35)
08-00C1_4-W-O-SD-EB	50.0 (11.55)	13.2 (3.45)
Batch 2		
Grenada-Loring Control 2	73.6 (21.95)	18.4 (4.13)
BL-00000R-L-O-SD-EB	69.7 (21.04)	17.7 (5.08)
04-00C1_8-W-T-SD-EB	58.5 (20.87)	12.9 (5.73)

Sample ID	*Eisenia fetida* Mean % Survival (SD)	*Eisenia fetida* Mean Biomass, Grams (SD)
05-00C1_8-W-T-SD-EB	42.1 (7.85)	9.47 (1.51)
45-C1_16N-W-N-SS-EB	52.2 (8.70)	11.6 (1.84)
06-00C1&2-W-T-SD-EB	33.6 (6.42)	7.84 (1.31)
06-00C3_6-L-T-FI-EB	36.2 (6.73)	10.9 (1.23)
06-0C1_6N-B-N-SS-EB	46.2 (31.67)	9.54 (4.95)
07-00C1_4-W-T-SD-EB	46.3 (25.02)	8.46 (5.40)
07-00C5_9-L-T-FI-EB	28.6 (7.13)	7.15 (2.37)
07-0C1_9N-B-N-SS-EB	24.7 (11.14)	6.24 (3.79)
09-000001-W-O-SD-EB	26.1 (10.47)	10.1 (3.62)
09-00C2&4-W-O-SD-EB	63.3 (11.66)	18.5 (3.31)
10-000001-W-T-SD-EB	48.9 (11.07)	13.3 (2.35)
10-00C3&4-L-T-FI-EB	0.00 (0)	0.00 (0)
10-0C3&4N-L-N-SS-EB	47.1 (12.58)	10.1 (4.11)

3.10.3.4Wetland – Spartina alterniflora

Batches 1, 2, and 3

Measured sediment quality parameters were within the appropriate pH and salinity limits (Table 18). Other sediment parameters may influence survival of estuarine wetland plants such as excess or deficiency of major or minor nutrients. These are generally not measured as the excess or absence of these sediment constituents are not normally altered in wetland placement operations although these constituents may directly control the natural establishment of plants in a wetland placement. Failure of plant growth in a wetland placement option generally eliminates the plant bioaccumulation pathway from further evaluation. Note: Sediment received for the SB-00000R-W-O-SD-WP reference had sufficient volume for only three wetland plant replicates.

The test acceptability criterion for the estuarine wetland plant bioaccumulation potential test was sufficient tissue mass for designated chemical analysis. The target tissue mass for IHNC sediments was 36 grams per replicate. Mean survival of *S. alterniflora* plugs was 100% in all DMMU sediments (Table 36). Mean survival in the MT-00000R-W-O-SD-WP and SB-00000R-W-O-SD-WP reference sediments and Greenhouse Control was also 100%. Plant appearance and color indicated various nutrient level or other sediment constituent responses. Most DMMU sediments produced higher biomass than the two reference sediments except for 03-00C1_3-L-T-SD-WP. Fresh weight tissue mass exceeded the 36 gram per replicate target necessary for chemical analysis of all project contaminants of concern, with the exception of replicates 1, 2, and 3 of sample 03-00C1_3-L-T-SD-WP and all replicates of SB-00000R-W-O-SD-WP.

Similar to earthworm bioaccumulation potential tests, sediment parameters other than contaminant concentrations may influence organism survival and growth. In this test, while survival was 100% in all substrates, there were obvious differences in total biomass due to the likely (but unmeasured) differences in nutrient availability.

Most DMMU sediments produced superior growth of *S. alterniflora* compared to the reference sediments. A decision on CDF management options will be based on results of statistical analysis of resulting tissue analysis and subsequent comparison to residues in reference tissue or appropriate benchmark values.

Table 36. Results of Bioaccumulation Potential Test Using *Spartina alterniflora*

Sample ID	*Spartina alterniflora* (Appearance)	*Spartina alterniflora* Mean Above-ground Biomass, Grams (SD)	Mean % Survival (SD)
Batch 1			
MT-00000R-W-O-SD-WP	Yellowish Green, Thick Algae Mat	46.65 (6.19)	100 (0)
SB-00000R-W-O-SD-WP	Yellowish Green, short/thin	25.32 (7.48)	100 (0)
01-00C1_6-W-O-SD-WP	Dark Green	207.32 (21.52)	100 (0)
02-00C1_6-W-O-SD-WP	Dark Green, large	171.78 (9.54)	100 (0)
03-00C1_3-L-T-FI-WP	Yellowish Green	34.88(1.88)	100 (0)
03-00C4_6-W-T-SD-WP	Dark Green	210.54 (13.7)	100 (0)
03-0C1_6N-B-N-SS-WP	Dark Green	124.36 (7.43)	100 (0)
08-00C1_4-W-O-SD-WP	Dark Green, Excellent Growth	248.8 (23.49)	100 (0)
Batch 2			
06-00C1&2-W-T-SD-WP	Light Green, Thick Algae Mat	73.08 (5.93)	100 (0)
06-0C1_6N-B-N-SS-WP	Light Green w/Green Upper	123.4 (9.54	100 (0)
06-00C3_6-L-T-FI-WP	Light Green	61.54 (13.85)	100 (0)
07-0C1_9N-B-N-SS-WP	Dark Green	163.6 (12.08)	100 (0)
07-00C5_9-L-T-FI-WP	Green	96.31 (11.23)	100 (0)
07-00C1_4-W-T-SD-WP	Green, Thick Algae Mat	107.3 (5.40)	100 (0)
10-00C3&4-L-T-FI-WP	Pale Yellowish Green	67.48 (36.8)	100 (0)
10-000001-W-T-SD-WP	Green, Dense Growth	228.7 (13.66)	100 (0)
10-0C3&4N-L-N-SS-WP	Light Green	112.5 (32.54)	100 (0)
Batch 3			
04-00C1_8-W-T-SD-WP	Medium Green	137.6 (11.6)	100 (0)
45-C1_16N-W-N-SS-WP	Medium Green	122.6 (21.9)	100 (0)
05-00C1_8-W-T-SD-WP	Medium Light Green	119.4 (9.93)	100 (0)
09-000001-W-O-SD-WP	Medium Green	156.0 (32.19)	100 (0)
09-00C2&4-W-O-SD-WP	Medium Light Green	124.4 (13.3)	100 (0)
Greenhouse Control	Medium Green	159.5 (16.52)	100 (0)

3.10.3.5Terrestrial – Cyperus esculentus

Batch 1
Measured sediment quality parameters were within the appropriate pH and salinity limits (Table 19) after washing to remove excess salts. However, other sediment parameters that were not measured may have influenced survival of upland plants including excess exchangeable minerals (such as sodium) or deficient major nutrients (such as nitrogen, phosphorus or potassium). Minerals and nutrients are generally not measured as the excess or absence of these sediment constituents are not normally altered in upland disposal operations and may directly control the natural establishment of plants in an upland CDF because salt is a severe stressor to terrestrial plants. Failure of plant growth in the upland CDF disposal option generally eliminates the plant bioaccumulation pathway from further evaluation. Specifically, if there is no plant growth in project sediments, then this is no longer a connected pathway for contaminant transfer in the food web and this pathway can be eliminated as an exposure route from the conceptual model.

The test acceptability criterion for the upland plant bioaccumulation potential test was sufficient tissue mass for designated chemical analysis. The target tissue mass for IHNC sediments was 36 grams per replicate. Mean survival and harvested above-ground biomass is provided in Table 37. Mean survival of *C. esculentus* seedlings was less than 50.0% in 01-00C1_6-W-O-SD-UP and 03-00C4_6-W-T-SD-UP. Survival of seedlings was 100% in 02-00C1_6-W-O-SD-UP, 03-00C1_3-L-T-FI-UP, 03-0C1_6N-B-N-SS-UP, 08-00C1_4-W-O-SD-UP, BL-00000R-W-O-SD-UP, and the greenhouse control (Note: The BL-00000R-W-O-SD-UP and greenhouse control were conducted in conjunction with the Batch 2 delivered sediments). Plant appearance and color indicated severe toxicity response in 01-00C1_6-W-O-SD-UP and 03-00C4_6-W-T-SD-UP while varying nutrient level responses were indicated in the other DMMU sediments and BL-00000R-W-O-SD-UP reference. Fresh weight tissue mass did not meet the 36 gram per replicate target necessary for chemical analysis of all project contaminant of concern, with the exception of replicates 1 and 5 of 08-00C1_4-W-O-SD-UP and replicates 1 to 4 of BL-00000R-W-O-SD-UP. Significant mortality was observed in 01-00C1_6-W-O-SD-UP and 03-00C4_6-W-T-SD-UP. In in all other DMMU sediments, survival was good, but the degree of growth and appearance varied considerable compared to the BL-00000R-W-O-SD-UP reference sediment. Some sediments promoted poor growth (e.g., 03-00C4_6: 2.5 g [almost dead]), whereas other sediments promoted excellent growth (e.g., 10-000001: 188 g [dark green, robust growth]). A decision on CDF management options will be based on results of statistical analysis of resulting tissue analysis and subsequent comparison to residues in reference tissue or appropriate benchmark values.

Table 37. Results of Bioaccumulation Potential Test Using *Cyperus esculentus*

Sample ID	*Cyperus esculentus* (Appearance)	*Cyperus esculentus* Mean Above-ground Biomass, Grams (SD)	Mean % Survival (SD)
Batch 1			
Control*	Green, robust growth	215 (24.5)	100 (0)
BL-00000R-W-O-SD-UP*	Yellowish green, good growth	44.9 (11.9)	100 (0)
01-00C1_6-W-O-SD-UP	Very little growth to dead	1.28 (0.94)	40.0 (37.4)
02-00C1_6-W-O-SD-UP	Mostly green	10.7 (6.3)	100 (0)
03-00C1_3-L-T-FI-UP	Yellowish green	18.1 (3.0)	100 (0)
03-00C4_6-W-T-SD-UP	Very little growth to dead	2.57 (3.45)	48.0 (36.3)
03-0C1_6N-B-N-SS-UP	Green, good growth	24.0 (5.2)	100 (0)
08-00C1_4-W-O-SD-UP	Green, good growth	31.5 (8.7)	100 (0)
Batch 2			
Control*	Dark green, robust growth	215 (24.5)	100 (0)
BL-00000R-W-O-SD-UP*	Yellowish green, good growth	44.9 (11.9)	100 (0)
06-00C1&2-W-T-SD-UP	Green, good growth	41.9 (8.09)	100 (0)
06-0C1_6N-B-N-SS-UP	Green, good growth	53.5 (7.92)	100 (0)
06-00C3_6-L-T-FI-UP	Yellowish green, good growth	52.8 (6.5)	100 (0)
07-0C1_9N-B-N-SS-UP	Green, good growth	66.1 (19.7)	100 (0)
07-00C5_9-L-T-FI-UP	Green with slight yellow, good growth	56.6 (7.51)	100 (0)
07-00C1_4-W-T-SD_UP	Dark green, thin growth	25.1 (13.8)	92.0 (11.0)
10-00C3&4-L-T-FI-UP	Brown, mostly dead	2.96 (1.20)	12.0 (17.9)
10-000001-W-T-SD-UP	Dark Green, robust growth	188 (36.3)	100 (0)
Batch 3			
Control*	Dark green, robust growth	215 (24.5)	100 (0)
BL-00000R-W-O-SD-UP*	Yellowish green, good growth	44.9 (11.9)	100 (0)
04-00C1_8-W-T-SD-UP	Green with brown tips	12.8 (7.62)	96.0 (8.90)
05-00C1_8-W-T-SD-UP	Green with brown tips	26.6 (13.86)	100 (0)
45-C1_16N-W-N-SS-UP	Green, moderate growth	39.8 (15.83)	96.0 (8.90)
09-000001-W-O-SD-UP	Green, good growth	87.9 (35.09)	100 (0)
09-00C2&4-W-O-SD-UP	Green, good growth	53.1 (15.18)	100 (0)
10-0C3&4N-L-N-SS-UP	Green, moderate growth	37.6 (20.52)	100 (0)

* The BL-00000R-W-O-SD-UP and Greenhouse Control were conducted in conjunction with Batch 2 sediments and are included with Batch 1 and 3 for comparison.

Batch 2

Measured sediment quality parameters were within the appropriate pH and salinity limits (Table 19) after washing to remove excess salts. Other sediment parameters may influence survival of upland plants including excess exchangeable minerals (such as sodium) or deficient major nutrients (such as nitrogen, phosphorus or potassium). These are generally not measured as the excess or absence of these sediment constituents are not normally altered in upland disposal operations and may directly control the natural establishment of plants in an upland CDF. Failure of plant growth in the upland CDF disposal option generally eliminates the plant bioaccumulation pathway from further evaluation.

The test acceptability criterion for the upland plant bioaccumulation potential test was sufficient tissue mass for designated chemical analysis. The target tissue mass for IHNC sediments was 36 grams per replicate. Mean survival and harvested above-ground biomass is provided in Table 37. Mean survival of *C. esculentus* seedlings was 100% in 06-00C1&2-W-T-SD-UP, 06-00C3_6-L-T-FI-UP, 06-0C1_6N-B-N-SS-UP, 07-00C5_9-L-T-FI-UP, 07-0C1_9N-B-N-SS-UP, and 10-000001-W-T-SD-UP. Mean survival of seedlings was 12.0% in 10-00C3&4-L-T-FI-UP and 92.0% in 07-00C1_4-W-T-SD-UP. Mean survival of seedlings in the BL-00000R-W-O-SD-UP reference and the greenhouse control was 100%. Plant appearance and color indicated severe initial toxicity response in 10-00C3&4-L-T-FI-UP with little indication of any growth. Plant appearance in 07-00C1_4-W-T-SD-UP indicated reduced growth due to nutrient imbalance or contaminant interaction. Plant appearance the other DMMU sediments, BL-00000R-W-O-SD-UP reference and greenhouse control indicated normal growth with varying nutrient level responses. Fresh weight tissue mass did not meet the 36 gram per replicate target necessary for chemical analysis of all project contaminants of concern, with the exception of replicates 1 and 5 of 08-00C1_4-W-O-SD-UP, replicates 1 to 4 of BL-00000R-W-O-SD-UP, and all replicates of the greenhouse control. A decision on CDF management options will be based on results of statistical analysis of resulting tissue analysis and subsequent comparison to residues in reference tissue or appropriate benchmark values.

Batch 3

Measured sediment quality parameters were within the appropriate pH and salinity limits (Table 19) after washing to remove excess salts. Other sediment parameters may influence survival of upland plants including excess exchangeable minerals (such as sodium) or deficient major nutrients (such as nitrogen, phosphorus or potassium). These are generally not measured as the excess or absence of these sediment constituents are not normally altered in upland disposal operations and may directly control the natural establishment of plants in an upland CDF. Failure of plant growth in the upland CDF disposal option generally eliminates the plant bioaccumulation pathway from further evaluation.

The test acceptability criterion for the upland plant bioaccumulation potential test was sufficient tissue mass for designated chemical analysis. The target tissue mass for IHNC sediments was 36 grams per replicate. Mean survival and harvested above-ground biomass is provided in Table 37. Mean survival of *C. esculentus* seedlings in 05-00C1_8-W-T-SD-UP, 09-000001-W-O-SD-UP, 09-00C2&4-W-O-SD-UP, and 10-0C3&4N-L-N-SS-UP was 100%. Mean survival of seedlings in 04-00C1_8-W-T-SD-UP and 45-C1_16N-W-N-SS-UP was 96%. Mean survival of seedlings in the BL-00000R-W-O-SD-UP reference and the greenhouse control was 100% (Note: The BL-00000R-W-O-SD-UP and greenhouse control were previously grown in conjunction with sediments received in Batch 2). Plant appearance and color provided little indication of severely unfavorable sediment conditions for plant growth. *C. esculentus* grown in 04-00C1_8-W-T-SD-UP and 45-C1_16N-W-N-SS-UP indicated some leaf tip neurosis possible caused by a number of factors. Plant appearance in the other DMMU sediments, BL-00000R-W-O-SD-UP reference, and greenhouse control indicated normal growth with varying nutrient level responses. Fresh weight tissue mass of all samples did not meet the 36 gram per replicate target necessary for chemical analysis of all project contaminant of concerns. While no significant mortality was observed, the reduced growth resulted in failure to meet target tissue biomass for all DMMU replicates. However, sufficient tissue mass was obtained to provide at least priority 1 and 2 contaminants of concern analysis for all DMMU sediments. A decision on CDF management options will be based on results of statistical analysis of resulting tissue analysis and subsequent comparison to residues in reference tissue or appropriate benchmark values.

4.0 REFERENCES

American Society for Testing and Materials (ASTM). 1997. E1676-97 Standard Guide for Conducting Laboratory Soil Toxicity or Bioaccumulation Tests With the Lumbricid Earthworm *Eisenia Fetida. Annual Book of Standards, Water and Environmental Technology, Vol. 11.05*, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2002. D854-02 Standard Test Methods for Specific Gravity of Soils. Annual Book of Standards, Soil and Rock (I), Vol. 04.08, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2007. D422-63. Standard Test Method for Particle-Size Analysis of Soils. Annual Book of Standards, Soil and Rock (I), Vol. 04.08, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 1998. D2217-85. Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants. Annual Book of Standards, Soil and Rock (I), Vol. 04.08, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2005. ASTM D2216-98. Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. Annual Book of Standards, Soil and Rock (I), Vol. 04.08, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2000. D2487-00. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). Annual Book of Standards, Soil and Rock (I), Vol. 04.08, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2000. D2488-00. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Annual Book of Standards, Soil and Rock (I), Vol. 04.08, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2000. D2974-00. Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils. Annual Book of Standards, Soil and Rock (I), Vol. 04.08, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2005. D4318-05 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. *Annual Book of Standards, Soil and Rock (I), Vol. 04.08*, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2006. E1367-99 Standard Guide for Conducting 10-Day Static Sediment Toxicity Tests With Marine and Estuarine Amphipods. *Annual Book of Standards, Water and Environmental Technology, Vol. 11.05*, West Conshohocken, PA.

American Society for Testing and Materials (ASTM). 2006. E1688-00 Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates. *Annual Book of Standards, Water and Environmental Technology, Vol. 11.05*, West Conshohocken, PA.

Buchman, M.F. 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric

Administration.

Burgess, R. M., M. C. Pelletier, K. T. Ho, J. R. Serbst, S. A. Ryba, A. Kuhn, M. M. Perron, P. Raczelowski and M. G. Cantwell. 2003. Removal of ammonia toxicity in marine sediment TIEs: A comparison of *Ulva lactuca*, zeolite and aeration methods. *Mar. Poll. Bull.* **46**: 607-618.

Environmental Laboratory, Engineer Research and Development Center (EL/ERDC). 2008. Conceptual CDF Design for Inner Harbor Navigation Canal Lock Replacement Project. May.

DiGiano, F.A., C.T. Miller and J.Yoon. 1995. Dredging Elutriate Test (DRET) Development. Contract Report D-95-1, U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Gustafsson, Ö., Haghseta, K., Chan, F., McFarlane, A., and Gschwend, P.M. 1997. Quantification of the Dilute Sedimentary Soot Phase: Implications for PAH Speciation and Bioavailability. *Environmental Science and Technology*, 31:203-209.

Hart Crowser, Inc. 2002. Volume I. Lower Willamette River Reference Area Study. Prepared For: U.S. Army Corps of Engineers Portland, Oregon. April 9.

Hockett, J. R. and D. R. Mount .1996. Use of metal chelating agents to differentiate among sources of acute aquatic toxicity. *Environmental Toxicology and Chemistry.* **15**: 1687-1693.

Krone, C.A., D.W. Brown, D.G. Burrows, R.G. Bogar, S.-L. Chan, and U. Varanasi. 1989. A method for analysis of butyltin species and measurement of butyltins in sediments and English Sole livers from Puget Sound. *Marine Environmental Research*, 27:1-18.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management 19:81-97.

Louisiana Department of Environmental Quality, Office of Water Resources. May 2007. Surface Water Quality Standards. LAC 33: IX: 1113.

MacDonald, D.G., R.S. Carr, F.D. Calder, E.R. Long, C.G. Ingersoll. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. Ecotoxicology, 5:253-278.

National Oceanic and Atmoshperic Administration (NOAA). 1984-1992. Sampling and Analytical Methods of the National Status and Trends Program, National Benthic Surveillance and Mussel Watch Projects 1984-1992, Vol. IV, NOAA Technical Memorandum, NOS ORCA 71.

United States Environmental Protection Agency (USEPA). 1979. United States Environmental Protection Agency. 1979. Methods for Chemical analysis of Water and Wastes. USEPA-600/4-79-020. U.S. USEPA, Cincinnati, Ohio.

United States Environmental Protection Agency (USEPA). 1993. Guidance Manual: Bedded Sediment Bioaccumulation Tests. USEPA/600/R-93/183. USEPA Office of Research and Development, Washington, DC. September.

United States Environmental Protection Agency (USEPA). 1994. Methods for Assessing Toxicity of Sediment-Associated Contaminants With Estuarine and Marine Amphipods. USEPA/600/R-94/025. USEPA Office of Research and Development, Narragansett, Rhode Island. June.

United States Environmental Protection Agency (USEPA). 1997. United States Environmental Protection Agency. June 1997. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. USEPA SW-846, 3rd Edition, including Final Update III. U.S. USEPA, Washington, D.C.

United States Environmental Protection Agency (USEPA). 2000. Methods for measuring the toxicity and bioaccumulation of sediment associated contaminants with freshwater invertebrates. 2nd Edition. USEPA/600/R-99/064.

United States Environmental Protection Agency (USEPA). 2002. Methods for measuring the acute toxicity of effluents and receiving waters to freshwater and marine organisms. Fifth edition. US Environmental Protection Agency, Office of Water, Washington, DC. USEPA-821-R-02-012. October.

United States Environmental Protection Agency (USEPA). 2006. National Recommended Water Quality Criteria. Office of Water/Office of Science and Technology.

United States Environmental Protection Agency Region II (USEPA Region II). 1988. Determination of Total Organic Carbon in Sediment (Lloyd Kahn Method). Edison, NJ. 27 July.

United States Army Corps of Engineers New Orleans District (CEMVN) and Environmental Laboratory Engineer Research and Development Center (EL/ERDC). 2007. Scope of Work (SOW). Inner Harbor Navigational Canal. New Orleans, Louisiana – Post-Katrina. May.

United States Army Corps of Engineers New Orleans District (CEMVN) 2004. Sampling and Analysis Plan, Inner Harbor Navigation Canal (Industrial Canal) Lock Replacement Project. October.

United States Army Corps of Engineers (USACE). 2003. Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities - Testing Manual (UTM). ERDC/EL TR-03-1. U.S. Army Corps of Engineers, Engineer Research and Development Center, Washington, DC. January.

United States Environmental Protection Agency and United States Army Corps of Engineers (USEPA/USACE). 1991. Evaluation of Dredged Material Proposed for Ocean Disposal: Testing Manual (Ocean Testing Manual). USEPA 503/8-91/001. USEPA Office of Water, Washington, DC. February.

United States Environmental Protection Agency and United States Army Corps of Engineers (USEPA/USACE). 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Inland Testing Manual). USEPA 823-B-98-004. USEPA Office of Water, Washington, DC. February.

United States Environmental Protection Agency Region VI (USEPA Region VI) and United States Army Corps of Engineers Galveston District and New Orleans District (USACE). 2003. Regional Implementation Agreement (RIA) for Testing and Reporting Requirements for Ocean Disposal of Dredged Material off the Louisiana and Texas Coasts under Section 103 of the Marine Protection, Research and Sanctuaries Act. July.

Weston Solutions, Inc. 2007a. Field Sampling Plan (FSP). Inner Harbor Navigation Canal Sediment, Soil and Water Sampling. New Orleans, Louisiana. July.

Weston Solutions, Inc. 2007b. Quality Assurance Project Plan (QAPP). Inner Harbor Navigation Canal

Sediment, Soil and Water Sampling. New Orleans, Louisiana. July.

Inner Harbor Navigation Canal Evaluation of Materials Generated from Lock Construction

Appendices are available electronically on the enclosed DVDs.