REDACTED VERSION

EA Engineering, Science, and Technology, Inc.

South Central Region
Building C, Suite 100
405 S. Highway 121
Lewisville, TX 75067
Telephone: 972-315-3922
Fax: 972-315-5181
www.eaest.com

23 February 2011

Michael Pheeny
Contracting Officer
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: 75 Percent Notification
Gulfco Marine Maintenance Non Time Critical Removal Support
EPA Region 6 Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Pheeny:

Pursuant to Paragraph B.5 (d) of the subject contract, EA Engineering, Science, and Technology, Inc. (EA) is providing notification to the U.S. Environmental Protection Agency (EPA) on our approaching 75 percent of the expenditure limit for Task Order 0067-NSEE-06JZ.

According to the Task Order Modification No. 1 dated 11 November 2010, EA has an authorized expenditure limit of (b) (4), fully funding the task order. As of 21 February 2011, EA had expended (b) (4) (66 percent) of its funding. Based on the current project status, EA estimates that it will reach 75 percent of its expenditure limit by the end of February 2011. It is anticipated that the Task Order ceiling of (b) (4) will adequately cover the remaining effort. No schedule changes are anticipated and the period-of-performance end date is 31 May 2011.

If you have any questions concerning this information, please contact me at 972-315-3922.

Sincerely,

Tim Startz, PMP
EA RAC2 Program Manager

cc: Rena McClurg, EPA Project Officer
Gary Miller, EPA Task Order Monitor
Jeff Hills, EA Financial Manager
Al Sloan, EA Project Manager
Mark Paddack, EA Alternate Project Manager
File

9458768

Sloan, Alpheus

From: Miller.Garyg@epamail.epa.gov
Sent: Wednesday, March 02, 2011 11:37 AM
To: Sloan, Alpheus
Cc: Mcclurg.Rena@epamail.epa.gov
Subject: Re: Gulfco Marine Maintenance NTCRS TO 67 Close Out

Al,

Please begin close-out activities for this task order.

Thanks,

Gary Miller, P.E.
Remediation Project Manager
EPA Region 6 - Superfund (6SF-RA)
(214) 665-8318
miller.garyg@epa.gov

From: "Sloan, Alpheus" <asloan@eaest.com>
To: Garyg Miller/R6/USEPA/US@EPA
Cc: "Paddack, Mark" <mpaddack@eaest.com>, "Startz, Tim" <tstartz@eaest.com>, "Ballweg, April" <aballweg@eaest.com>
Date: 03/02/2011 11:07 AM
Subject: Gulfco Marine Maintenance NTCRS TO 67 Close Out

Gary,

EA has delivered all required reports for the Task Order up to this date. It is our understanding that you will not require us to support any other activities on this Task Order. The end of the period of performance for the Task Order is 31 May 2011. We are prepared to initiate close out of the Task Order as soon as you respond to this e-mail authorizing us to begin close out activities.

Al

Alpheus (Al) Sloan III
Project Manager
Telephone 972-315-3922
Direct 972-459-5033
Cellular 214-500-8525
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asloan@eaest.com

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22 November 2010

Mr. Michael Pheeny
Contracting Office
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 75202-2733

Subject: **EA Project Manager Change**
Gulfco Marine Maintenance Superfund Site
Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Pheeny:

This letter is written to inform EPA of a change in Project Manager for this project. Effective 22 November 2010, EA's Project Manager for the Gulfco Marine Maintenance Site will be Al Sloan. Mr. Sloan is a senior project manager with over 36 years of technical and project management experience providing environmental consulting to government and private clients. Mr. Sloan has successfully managed or provided oversight on over 100 other projects under the EPA Region 6 Remedial Action Contract. Mr. Mark Paddack has institutional knowledge of this site and will be designated the Alternate Project Manager for the project and will be available to ensure a seamless transition on project management. Moreover, Mr. Paddack will remain engaged in the project and provide project insight and guidance, as appropriate.

If you should have any questions concerning this action, please contact me at (972) 315-3922.

Sincerely,

Tim Startz, PMP
Program Manager

cc: Rena McClurg, EPA Project Officer
Gary Miller, EPA Task Order Monitor
Jeff Hills, EA Financial Manager
Al Sloan, EA Project Manager
Mark Paddack, EA Alternate Project Manager
File

EA Engineering, Science,
and Technology, Inc.

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www.eaest.com

11 February 2011

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Data Evaluation Summary Report (Revision 01)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Data Evaluation Summary Report (Revision 01) for the above-referenced Task Order. An electronic copy was submitted via email on 11 February 2011.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

EA Engineering, Science,
and Technology, Inc.

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21 December 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Technical Memorandum Ecological and Habitat Health Assessment Wetlands A, B, and C (Revision 00) and Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the above-referenced Technical Memoranda (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 21 December 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 21 December 2010	TRANSMITTAL NO. 0005
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
3.0	Technical Memorandum Ecological and Habitat Health Assessment Wetlands A, B, and C (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
3.0	Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

Technical Memorandum

Ecological and Habitat Health Assessment
Wetlands A, B, and C

Gulfco Marine Maintenance Superfund Site
906 Marlin Avenue
Freeport, Brazoria County, Texas
EPA Identification No. TXD0055144539

Non-Time Critical Removal Support
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
Building C, Suite 100
Lewisville, Texas 75067
(972) 315-3922

December 2010
EA Project No. 1434267

1.0 INTRODUCTION

This technical memorandum documents the Ecological and Habitat Health Assessment performed by EA Engineering, Science, and Technology, Inc. (EA) for the former Gulfco Marine Site (Site) located in Freeport, Brazoria County, Texas. The site reconnissance was conducted on 15 December 2010 for the U.S. Environmental Protection Agency (EPA) Region 6 as part of Task Order No. 0067-NSEE-06JZ under EPA Contract No. EP-W-06-004, in accordance with a Statement of Work (SOW) issued by EPA in October 2010.

The site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek to the east and the Old Brazos River Channel to the west. During the 1960's, the Site was used for occasional welding and was used as a barge cleaning facility 1971 through 1999. Occasional sandblasting and barge repair/refurbish also occurred onsite. The surface impoundments were closed under the Texas Water Commission's (Texas Commission on Environmental Quality (TCEQ) predecessor agency) direction in 1982 (PBW, 2010).

2.0 ECOLOGICAL AND HABITAT HEALTH

Site reconnaissance was performed on 15 December 2010 by Ann B. Shortelle, Ph.D. The primary objective was to visually evaluate the ecological and habitat health of wetlands A, B, and C (Figure 3, PBW, 2010) onsite.

2.2 ECOLOGICAL HABITAT

Wetlands A and B are part of the contiguous high marsh/salt pan area between the site and Oyster Creek. These wetland areas were inundated with water (surface to 4 cm below grade), and connecting ditches (wetland A) and marsh pan (wetland B) held several centimeters of water (Photo 1).

Photo 1: Water inundation in Wetland A (foreground) and B

Wetland C occurs along Marlin Avenue, is higher and dryer than Wetlands A and B. This entire area was predominately dry during the site visit. No standing water was observed.

2.3 VEGETATION

Common vegetation in Wetlands A and B were typical of halophytic vegetation for estuarine wetlands, both obligate and facultative (Table 1).

Table 1. Common obligate and facultative wetland vegetation

	Wetland A	Wetland B	Wetland C
Distichlis spicata	X	X	
Batis maritime	X	X	
Salicornia spp.	X	X	
Spartina spartinae		X	X
Monanthochloe littoralis		X	X
Lycium carolinianum	X	X	
Scirpus maritimus	X	X	
Eleocharis sp.		X	X
Iva frutescens			X

Vegetation was dense in wetland areas interspersed with salt pan (Photo 2). Vegetation diversity and density were not noticeably different between Wetland A/B and surrounding wetlands.

Photo 2: High marsh salt pan

Common facultative wetland vegetation (Table 1) found in Wetland C was present in most areas and similar in extent and composition to surrounding road bordering wetlands (Photo 3).

Photo 3: Wetland C

2.4 BIOLOGY

Evidence of benthic macroinvertebrates were observed throughout Wetland A and B. Crab burrows and tube-dwelling organisms were plentiful throughout (Photo 4), with similar densities in Wetlands A/B visually compared to the surrounding areas. Multiple species of crab were observed in Wetland A and B.

Photo 4: Typical benthic macroinvertebrate dwelling density in Wetland B (approximate spacing 10 cm).

Pooled water in Wetland A supported numerous aquatic taxa (fish and invertebrates). Similar taxa were not observed in the pooled areas of Wetland B, perhaps due to diminished water transparency in that pool.

Both Wetland A and B appear to support wildlife. Numerous wading birds and shore birds were observed throughout both areas, and overhead. Osprey were also present. Additional signs of wildlife use were observed throughout the wetlands, including mammal and avian tracks.

Invertebrates were not observed in Wetland C. However, the area does support some wildlife use. Wetland C is similar to the rest of the wetland area bordering the road.

2.5 EXISTING CONDITION

Near the Former surface Impoundment Area, some areas of Wetland B are degraded due to vehicular traffic, but otherwise both wetland areas appear to be healthy, high functioning, and are indistinguishable from the surrounding wetlands.

Wetland C, along with other similar wetland areas along Marlin Avenue, has been impacted by fill placement, and some trampling by people, dogs, etc., from the surrounding areas (Photo 5).

Photo 5: Typical disturbance in Wetland C

2.6 SUMMARY

Observed human impacts to wetland habitats are minor. Wetlands A, B, and C are not visually distinguishable from surrounding wetlands in terms of wetland species composition and approximate density, presence of invertebrates, and wildlife usage. These wetlands are providing valuable wetland marsh functions, such as wildlife habitat, food, flood storage, water quality enhancement, and groundwater recharge.

Any disturbance, such as excavation of sediments or other remedial activities, would require decades for sediments in this area to return to the salty sediment marsh type environment present today.

REFERENCES

Pastor, Behling & Wheeler, LLC (PBW). 2010. Final Screening-Level Ecological Risk Assessment, Gulfco Marine Maintenance Superfund Site, Freeport, Brazoria County, Texas, EPA Facility ID: TXD0055144539, May.

EPA. 2010. RAC II Statement of Work for Non-Time Removal Support, Gulfco Marine Maintenance, Freeport, Texas. Contract No. EP-W-06-004. 6 October.

Technical Memorandum

Surface Impoundment Cap Evaluation for Erosion

Gulfco Marine Maintenance Superfund Site
906 Marlin Avenue
Freeport, Brazoria County, Texas
EPA Identification No. TXD0055144539

Non-Time Critical Removal Support
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
Building C, Suite 100
Lewisville, Texas 75067
(972) 315-3922

December 2010
EA Project No. 14342.67

1.0 INTRODUCTION

This technical memorandum documents the visual observations of the Surface Impoundment Cap performed by EA Engineering, Science, and Technology, Inc. (EA) for the former Gulfco Marine Site (Site) located in Freeport, Brazoria County, Texas. Inspection of the CAP was conducted on 15 December 2010. This work was completed for the U.S. Environmental Protection Agency (EPA) Region 6 as part of Task Order No. 0067-NSEE-06JZ under EPA Contract No. EP-W-06-004, in accordance with a Statement of Work (SOW) issued by EPA in October 2010.

The site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek to the east and the Old Brazos River Channel to the west. During the 1960's, the Site was used for occasional welding and was used as a barge cleaning facility 1971 through 1999. Occasional sandblasting and barge repair/refurbish also occurred onsite. The surface impoundments were closed under the Texas Water Commission's (Texas Commission on Environmental Quality (TCEQ) predecessor agency) direction in 1982 (PBW, 2010). Previous reports and observations have document erosion and or rutting in the cover.

2.0 SURFACE IMPOUNDMENT COVER EVALUATION

A visual Site reconnaissance was performed on 15 December 2010 by John Conquest, a State of Texas licensed Professional Engineer. The primary objective of the site visit was to visually observe the existing conditions.

2.1 EXISTING CONDITIONS

The elevation of the surface impoundment cap is approximately 2 feet higher than the surrounding existing natural surface grade. The existing cap is approximately 2.5 to 3.5 feet thick. The clay cap appeared to be in good condition with no surface cracking during the site investigation. The photo below shows the typical elevation differences between the cap (photo right) and the surrounding areas (photo left).

2.2 VEGETATION

The surface of the clay cap is covered with a layer of oyster shells and vegetation. Cap vegetation consists of mostly grasses with some brush. The majority of the brush is located along the perimeter of the cap with isolated patches within the interior portions of the cap. The photo below shows typical cap vegetation.

2.3 VEHICULAR TRAFFIC

Evidence of vehicular traffic along the perimeter of the cap was observed during the site investigation. Wheel tracks have formed ruts in portions of the vegetation along the western side of the cap. The rutting was generally no more than 3 inches deep with one location found to be approximately 6 inches deep. The photo below is an example of typical vehicle paths through the ground cover.

The photo below details the area of deepest rutting (approximately 6-inches).

2.4 SURROUNDING AREA

The perimeter of the cap was inspected during site reconnaissance. It was found to be in good condition with no visible rill erosion.

REFERENCES

Pastor, Behling & Wheeler, LLC (PBW). 2010. Final Screening-Level Ecological Risk Assessment, Gulfco Marine Maintenance Superfund Site, Freeport, Brazoria County, Texas, EPA Facility ID: TXD0055144539, May.

EPA. 2010. RAC II Statement of Work for Non-Time Removal Support, Gulfco Marine Maintenance, Freeport, Texas. Contract No. EP-W-06-004. 6 October.

EA Engineering, Science,
and Technology, Inc.

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11 February 2011

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: Engineering Evaluation/Cost Analysis (Revision 02)
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing three original hard copies of the above-referenced Engineering Evaluation/Cost Analysis (Revision 02) for the above-referenced Task Order. An electronic copy was submitted via email on 11 February 2011.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

EA Engineering, Science,
and Technology, Inc.

South Central Region
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www.eaest.com

24 November 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Health and Safety Plan (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Health and Safety Plan (HASP) (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 24 November 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 24 November 2010	TRANSMITTAL NO. 0003
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
1.2.1	Health and Safety Plan (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

Health and Safety Plan for Non-Time Critical Removal Support Gulfco Marine Maintenance Superfund Site Freeport, Brazoria County, Texas EPA Identification No. TXD055144539

EPA Region 6 Remedial Action Contract 2 Contract: EP-W-06-004 Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
Building C, Suite 100
Lewisville, Texas 75067

November 2010
Revision: 00
EA Project No. 14342.67

Health and Safety Plan for
Non-Time Critical Removal Support
Gulfco Marine Maintenance Superfund Site
Freeport, Brazoria County, Texas

Remedial Action Contract 2
Contract No.: EP-W-06-004
Task Order: 0067-NSEE-06JZ

11/24/10

Tim Startz, PMP — Date
EA Program Manager

11/24/10

Brian Yost — Date
EA Dallas Health and Safety Officer

11/24/10

Peter Garger, CIH, CSP — Date
EA Corporate Health and Safety Director

November 2010
Revision: 00
EA Project No. 14342.67

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1. INTRODUCTION

On 19 November 2010, the U.S. Environmental Protection Agency (EPA) issued Task Order 0067 under Remedial Action Contract No. EP-W-06-004 to EA Engineering, Science, and Technology, Inc (EA). Under this Task Order, EA is authorized to conduct Non-Time Critical Support (NTCRS) activities at the Gulfco Marine Maintenance (Gulfco) Superfund site (EPA Identification No. TXD055144539) located in Freeport, Brazoria County, Texas. The NTCRS includes preparation of project plans, field work that will include the collection of additional samples of the Site's existing impoundment cap and wetlands sediment material, laboratory analyses of these samples, evaluation of existing site data applicable to the Task Order Statement of Work (SOW), completion of a streamlined ecological risk evaluation and Engineering Evaluation and Cost Analysis (EE/CA) for repair of the impoundment cap and possible hot spot wetlands sediment removal, and community relations functions throughout the EE/CA and decision making process. This site-specific Health and Safety Plan (HSP) was developed to address health and safety concerns associated with the oversight of field investigation activities.

1.1 PURPOSE

The purpose of this HSP is to provide personnel with protection standards and mandatory safety practices, procedures, and contingencies to be followed while performing field activities at the site. This HSP, as developed, defines actions to be taken in respect to personal safety during work activities associated with the field activities to be performed as part of this Task Order, and described further in this HSP.

EA considers the health and safety of its employees, clients, and visitors and the prevention of work-related accidents and illness and property loss to be of the highest priority. Proactively implemented, a comprehensive and systematic health and safety program will result in more efficient and profitable operations by improving employee health and morale, and by reducing worker's compensation costs, lost time, fire and liability insurance premiums, and property damage. The objectives of EA's Health and Safety Program are to ensure:

- Sound health and safety practices and conditions necessary for the protection of the health and welfare of employees, clients, and visitors
- Compliance with federal and state health and safety regulations and standards
- Effective safety and fire prevention practices necessary for protection of company-owned or operated property.

This HSP addresses the following regulations and guidance documents:

- National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR 300.150

- Occupational Safety and Health Administration (OSHA) Standards for General Industry, 29 CFR 1910

- National Institute of Occupational Safety and Health, OSHA, U.S. Environmental Protection Agency, and U.S. Coast Guard *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities,* October 1985.

One copy of this HSP will be maintained for use during the entire duration of field activities and made available for site use/employee review at all times.

EA personnel who enter the site are required to read and understand this HSP and sign the site HSP Review Record (Appendix A).

1.2 BACKGROUND

This section provides a description of the site, lists the Scope of Work (as determined by EPA), and provides a list of potential constituents of concern for the site.

1.2.1 Site Description

The Gulfco site is located at 906 Marlin Avenue approximately 3 mi northeast of Freeport, Texas, Brazoria County; the site coordinates are 28°58'07" north latitude and 95°17'23" west longitude (Figures 1 and 2). The Gulfco site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek to the east and the Old Brazos River Channel to the west. Marlin Avenue divides the site into two primary areas (Figures 1 and 2). The area south of Marlin Avenue drains toward the south where it enters into the Intracoastal Waterway. Drainage from the site north of Marlin Avenue is to the northeast into adjacent wetlands. The wetlands are classified as estuarine, intertidal, emergent, persistent, and irregularly flooded.

The property to the north of Marlin Avenue (the North Area) contains three closed surface impoundments and a former product storage tank area. The property south of Marlin Avenue (the South Area) contains two barge slips connected to the Intracoastal Waterway and an aboveground storage tank farm area within a concrete berm. However, there was no berm present around the aboveground storage tank area during a 1989 inspection. The property located north, west, and east of the North Area is unused and undeveloped. Adjacent property to the east of the South Area is developed and currently used for industrial purposes, while to the west, the South Area is currently vacant and previously served as a commercial marina. A residential community and marina are located west of the former marina.

The Gulfco site operated between 1971 and approximately 1998, after which time bankruptcy was filed. The primary site operations consisted of draining, cleaning, servicing, and repairing chemical barges. The barge repair work included welding, sandblasting, and painting. Beginning in 1971, wastes from the barges were placed in the former surface impoundments, which were earthen pits located on Lot 56 in the North Area. The wastes included oils, caustics,

various organic chemicals, and waste washwaters generated during barge cleaning activities. Several inspections during the 1970s reported overflow releases from the impoundments. The volume of waste materials placed in the impoundments is unknown. The impoundments were deactivated in October 1981 and closed in 1982. Impoundment closure included removal of liquids and most of the impoundment sludge. A portion of the contaminated sludge was mixed with soil and left in place, primarily in Impoundment 2 (the larger impoundment). The impoundments were capped with 3 ft of clay of unknown quality. Following closure of the impoundments, floating barges and aboveground storage tanks were used to store the barge washwaters.

In March 1999, sampling of the tanks in the aboveground storage tank area identified the presence of the following chemicals: acetone, benzene, 2-butanone, chloroform, 1,1-dichloroethane, 1,2-dichloroethane, carbon tetrachloride, ethylbenzene, 4-methyl-2-pentanone, methylene chloride, naphthalene, styrene, tetrachloroethene, toluene, 1,1,1-trichloroethane, trichloroethene, Arochlor 1254, and xylenes.

The two primary hydrogeological units beneath the Gulfco site are the Chicot and Evangeline aquifers. The shallower Chicot aquifer is subdivided into two zones: the Lower and Upper Chicot. The Upper Chicot is comprised of interconnected sands that are found within 300 ft below ground surface. Ground water flow in the aquifer is reported to be to the southwest. A shallow, briny ground water zone exists within a few feet of the surface.

A number of chemicals have been detected in the uppermost ground water at the site, including benzene, carbon disulfide, chloroform, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, ethylbenzene, methylene chloride, tetrachloroethene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 4-methyl-2-pentanone, trichloroethene, vinyl chloride, and xylene. Some of the chemical concentrations are greater than 10 percent of their solubility in water; therefore, the presence of nonaqueous-phase liquid is anticipated.

On 2 September 2002, EPA proposed to add the Gulfco site to the National Priorities List of Superfund sites (see Federal Register Listing FRL-7490-4, Volume 68, No. 83, Pages 23094-23101, Proposed Rule No. 39). The Final National Priorities List listing for the site was signed on 30 May 2003.

1.2.2 Scope of Work

The Scope of Work covered by this HSP includes, but is not limited to, health and safety hazards anticipated for field activities including:

- Collection of cores from the Site's existing clay cap material using a Geoprobe® rig to collect soil cores with Shelby tubes.
- If necessary, collection of wetland sediment samples to fill data gaps for existing Site data.
- Conducting a site reconnaissance as part of the ecological risk assessment and EE/CA being performed for the Task Order.

1.2.3 Potential Constituents of Concern

A brief summary of the potential constituents of concern that may be encountered during activities associated with this project are described below:

- Volatile organic compounds (VOCs)
- Semivolatile organic compounds (SVOCs)
- Organochlorine pesticides and polychlorinated biphenyls (PCBs)
- Arsenic and lead

1.3 HEALTH AND SAFETY PLAN ORGANIZATION

This HSP presents the approach to safety during execution of the project activities conducted at the site. This section presents an introduction and outlines the report organization. Section 2 summarizes the project management team. Section 3 outlines the hazard communications and environmental monitoring during field operations. Section 4 presents the required employee training. Section 5 details personal protective equipment (PPE). Section 6 summarizes emergency response reactions to site contingencies. Section 7 outlines site controls and work zones.

Prior to entering the site, this HSP must be reviewed and an agreement to comply with the requirements must be signed by all EA personnel (Appendix A). Personnel onsite will be informed of the site emergency response procedures and any potential health and safety hazards associated with site operations.

A list of personnel entering the Site will be recorded in a Daily Site Log (Appendix B). In addition, personnel will participate in the daily safety meetings and sign the Daily Safety Meeting Form (Appendix C).

2. PROJECT MANAGEMENT

This section discusses the project management roles and responsibilities for the Gulfco site.

2.1 KEY PERSONNEL

Table 1 contains information on key project personnel.

TABLE 1 PROJECT PERSONNEL

Name	Position	Work Phone	Cell Phone
Gary Miller	EPA Task Order Monitor	214-665-8318	---
Alpheus Sloan	Project Manager	972-315-3922	214-500-8525
Mark Paddack	Alternate Project Manager	972-315-3922	214-535-1844
John Bonner	Field Team Leader	713-896-4111	281-935-1638
John Bonner	Site Health and Safety Officer	713-896-4111	281-935-1638
Tim Startz	Program Manager	972-315-3922	214-616-7027
Pete Garger, CIH	Corporate Health and Safety Director	410-527-2425	410-790-6338

2.2 RESPONSIBILITIES

Clear lines of authority will be established for enforcing compliance with the health, safety, and contingency procedures consistent with industry policies and procedures.

Designated EA personnel are responsible for implementation of the HSP during field activities. This includes field supervision; enforcing safe work practices and decontamination procedures (if needed); ensuring proper use of PPE; communicating site safety program modifications and requirements to site personnel; proper reporting of injuries, illnesses, and incidents to the appropriate internal and external organizations; and containing and controlling the loss of potentially hazardous materials to soil, air, and surface/ground water during all phases of NTCRS field activities.

In the event of an onsite injury, occupational illness, near miss, or environmental contamination incident involving EA personnel, the following organizations/individuals will be notified as appropriate:

- Field Team Leader/Site Health and Safety Officer
- Project Manager
- Corporate Health and Safety Director
- Program Manager.

2.2.1 Project Manager

The ***Project Manager*** has overall responsibility for site activities and will be the primary contact during field activities. The Project Manager will regularly confer with site personnel regarding health and safety compliance.

2.2.2 Corporate Health and Safety Director

The ***Corporate Health and Safety Director*** has overall project responsibility for the development and implementation of this HSP and conformance with project requirements. The Corporate Health and Safety Director will act in an advisory capacity to the Field Team Leader and site personnel for project-specific health and safety issues.

2.2.3 Site Health and Safety Officer

The ***Site Health and Safety Officer*** is responsible for coordination of onsite contingency operations, as well as the implementation of the EA Site Health and Safety Program. The Site Health and Safety Officer will be onsite throughout the project and will be responsible for daily compliance with site health and safety requirements, including air monitoring, establishing decontamination protocols, conducting and documenting safety meetings, and ensuring that all EA personnel review the HSP and sign the HSP Review Record (Appendix A), as applicable.

In the event of an emergency situation involving EA personnel, the Field Team Leader/Site Health and Safety Officer will be responsible for initiating and coordinating emergency responses/contingency operations with the EA Site Health and Safety Officer.

The Corporate Health and Safety Director, Field Team Leader, and Site Health and Safety Officer will have the authority to make on-the-spot corrections concerning health, safety, and environmental pollution infractions.

2.2.4 Field Team Leader

The ***Field Team Leader*** reports to the EA Project Manager and Corporate Health and Safety Director. The Field Team Leader will oversee and direct field activities and has day-to-day responsibility for ensuring implementation of the HSP. The Field Team Leader's responsibilities include, but are not limited to, providing technical support, evaluating onsite environmental monitoring results, coordinating site activities, communicating with offsite emergency responders, and coordinating activities of onsite and offsite emergency responders, as applicable.

2.2.5 Employee Responsibilities

EA employees are responsible for reading, understanding, and meeting the health and safety requirements contained in this HSP. A HSP Review Record sign-off sheet is provided in Appendix A. Employees are required to implement these procedures when conducting daily operations. This will also include receiving appropriate training and medical monitoring (if required) and utilization of EA-provided health and safety equipment (to include all forms of PPE) to safely conduct site operations. Employees will review each task prior to commencement to consider the potential health and safety hazards, and the measures to be taken in the event of an emergency. Employees should know where material safety data sheets (MSDS), first aid supplies, and emergency equipment is maintained. The Field Team Leader/Site Health and Safety Officer should be notified of potential health and safety hazards, near-miss conditions, or incidents present on the job site or unusual effects believed to be related to hazardous chemical exposures. Failure to follow established health and safety procedures could result in immediate dismissal from the site and, if repeated, a potential loss of employment.

2.2.6 Subcontractors

Responsibilities of subcontractor personnel include following the HSP and applicable health and safety rules, regulations, and procedures. This may include:

- Using required controls, procedures, and safety devices, including PPE
- Notifying his/her supervisor of identified or suspected emergencies, safety, or health hazards
- Complying with training and medical requirements (if required).

Subcontractor personnel are responsible for reading, understanding, and meeting the health and safety requirements contained in this HSP in addition to their own HSP. The Health and Safety Plan Review Record in Appendix A must be signed by all subcontractors. The subcontractors may elect to prepare a HSP Addendum, or they may adopt this HSP.

2.2.7 Visitors

Site visitors will be required to comply with the requirements of this HSP and applicable health and safety rules, regulations, and procedures. Site visitors are responsible for reading, understanding, and meeting the health and safety requirements contained in this HSP. The Health and Safety Plan Review Record in Appendix A must be signed by all site visitors.

3. HAZARD EVALUATION AND CONTROL

The following is a list of field activities to be completed for this project:

1. Collect cores of the existing cap material using a Geoprobe® rig equipped with Shelby tubes.

2. If necessary, collect wetlands sediment samples to fill data gaps for existing site data. The areas to be sampled are accessible by foot.

3. Perform a Site reconnaissance as part of the Screening Level Ecological Risk Assessment (SLERA) and EE/CA being completed for the Task Order.

4. Collect soil samples from a local borrow pit that is identified as part of the EE/CA as a source for material to repair the existing Site's existing clay cap.

3.1 PHYSICAL AND BIOLOGICAL HAZARDS

Potential physical hazards and appropriate control measures are summarized in Table 2 for each of the above-listed tasks.

TABLE 2 PHYSICAL AND BIOLOGICAL HAZARD EVALUATION AND CONTROL

Hazard	Activities	Control Measures
Fire and Explosion	1, 4	• Inform personnel of the locations of potential fire/explosion hazards • Identify subsurface utility lines, if possible • Establish site-specific procedures for working around flammable materials • Ensure that appropriate fire suppression equipment and systems are available and in good condition
Heat Stress	1, 2, 3, 4	• Promote heat stress awareness • Provide cool break areas and adequate breaks • Provide non-caffeinated beverages
Cold Stress	1, 2, 3, 4	• Provide warm break area and adequate breaks • Provide non-caffeinated beverages • Promote cold stress awareness
Heavy Equipment Operations	1,4	• Ensure that the operators are properly trained and equipment has been properly inspected and maintained • Establish equipment routes, traffic pattern, and site-specific safety measures • Assign spotters and inform of proper hand signals and protocols • Wear reflective vests while working around heavy equipment • Maintain safe distances from all heavy equipment • Lifting capacities and load limits of equipment will not be exceeded • Locate “kill-switch” of the drill rig to stop the rig in case of emergency • No activities during thunderstorms • Maintain line of sight with rig operator during activities
Noise	1,4	• Maintain safe distance from the noise-generating equipment • Implement hearing protection measures • Establish noise level standards for onsite equipment
Electrical	1, 2, 3, 4	• Survey work area for the presence of buried and above-ground electrical lines. • Identify and locate areas marked for subsurface electrical lines by utility companies. • If drilling activities are to occur near overhead power lines, a safe working distance must be maintained between the drilling mast and the power line (Refer to Section 3.1.6 of this HSP for determining this distance).
Utility Lines	1, 2	• Identify and locate existing utilities prior to work • Contact local utility company, if required • Maintain safe distances from utility lines
Weather		• Site is in a location favorable for thunderstorms and flooding; field crews should be aware of predicted weather condition and periodically monitor changes in weather conditions as field work progresses.
Biological	1, 2, 3, 4	Potential hazard—poison ivy, poison oak, snakes, insect bites, and stings • Establish site-specific procedures for working around identified hazards • Avoid areas of heavy vegetation • Wear long-sleeve shirts, pants, and gloves • Use insect repellant as necessary. • Wear snake chaps or snake boots when working in areas favorable for snake habitat.

Hazard	Activities	Control Measures
Motor Boat and Water Operations	NA	• Ensure that the operators are properly trained and equipment has been properly inspected and maintained • Use life preserver when within 10 feet of water (as needed) • Have life preservers or flotation devices available for all personnel when on the water • Locate "kill-switch" of the boat to stop the motor in case of emergency • No activities during thunderstorms
Overhead Obstructions	1,4	• Wear hard hat • Reconnoiter work area and alert field personnel before execution of work
Site Debris	1, 2, 3, 4	• Trip/fall hazards exist at the site —inspect work areas for site debris and muddy conditions that can result in trip/fall hazards; walk carefully in these areas. • Wear proper PPE—hard hat, safety glass, and steel-toed boots • Watch for flying debris—wear hard hat and safety glass to protect against these debris • Work will be conducted only during daylight hours • Contact local utility company, if required

The following section provides greater detail for particular physical hazards that may potentially be present during field activities. These physical hazards may include, but are not limited to:

- Fire/explosion
- Heat/cold stress
- Heavy equipment
- Noise
- Electrical
- Utilities
- Weather
- Biological
- Motor boat and water.

The site will be visually inspected for the presence of general safety hazards (e.g., trip/slip hazards, unstable surfaces or steep grades, vehicle and pedestrian traffic, sharp objects, and water/drowning) prior to beginning work. If hazards are identified, these hazards will be recorded and precautionary measures taken to prevent injury.

3.1.1 Fire/Explosion

The potential for fire and/or explosive conditions will exist. Workers must continuously monitor the work area for combustible or explosive gases when operations have the potential to generate sparks. Employees should always be alert for unexpected events, such as ignition of chemicals or sudden release of materials under pressure, and be prepared to act in these emergencies.

NOTE: Smoking is not allowed at any time within the work area.

Company-owned field vehicles will be equipped with a fire extinguisher. Employees must be trained in the proper use of fire suppression equipment. However, professionals should handle large fires that cannot be controlled with a fire extinguisher. The proper authorities should be notified in these instances.

3.1.2 Heat Stress and Heat-Related Illness

Effects of heat stress and illness are possible during the performance of field activities at the site. Injury from heat exposure may occur to persons working outdoors during a period of high temperature conditions. This is a major concern when personnel are working in PPE clothing. The body's principal means of cooling is through the evaporation of sweat. When personnel are working in PPE, sweat is trapped inside the clothing and cannot evaporate, thus raising the body's core temperature and resulting in a heat-related illness. Monitoring will commence at temperatures of 70°F and above when employees are wearing impervious full-body clothing.

Personnel should be familiar with the signs and symptoms of heat stress. These include:

- **Heat Cramps**—Painful contraction of voluntary muscles
- **Heat Exhaustion**—Dizziness, lightheadedness, slurred speech, rapid pulse, confusion, fainting, fatigue, copious perspiration, cool skin that is sometimes pale and clammy, and nausea
- **Heat Stroke**—Hot, dry, flushed skin; delirium; and coma (in some cases).

Resting frequently in a shaded area and consuming large quantities of fresh, potable water and electrolyte replenishing fluids (i.e., Gatorade) can prevent heat stress. If heat exhaustion symptoms are observed, the person will be required to rest in a shaded area and consume liquids. If symptoms are widespread or observed frequently, an appropriate work/rest regimen will be instituted. This may involve limiting the work period so that after 1 minute of rest, a person's heart rate does not exceed 110 beats per minute.

If the heart rate is higher than 110 beats per minute, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the heart rate is 110 beats per minute at the beginning of the next rest period, then the next cycle should be shortened by another 33 percent. Resting heart rate should be determined prior to starting onsite activities. A healthy individual's resting heart rate is usually 60-72 beats per minute. If symptoms of heat stroke are observed, the victim will be cooled immediately and transported to the nearest hospital. Workers should not hesitate to seek medical attention if heat stroke is suspected.

3.1.3 Effects of Cold Exposure

Effects of cold exposure are possible during the performance of field activities at the site. Cold stress can be caused by exposure to temperatures at or below freezing or to excessive wind at higher temperatures. When an individual's body temperature falls below 98.6°F, cold stress injuries may occur. The body's cells are composed primarily of water that can freeze when

exposed to low temperatures, resulting in cell damage or death. Primary effects of cold exposure include frostnip, frostbite, and hypothermia:

- **Frostnip** commonly occurs as a result of surface tissue freezing at the tips of the ears, nose, cheeks, chin, fingertips, and toes. Symptoms of frostnip include the appearance of white shiny skin. If frostnip occurs, gradually warm the affected areas with a warm hand or warm breath. Do not rub.

- **Frostbite** occurs as the result of surface and subsurface tissues freezing. Symptoms include erythema, blistering, throbbing pain, numbness, and swelling. If frostbite is suspected, move to a warm location and provide slow and steady re-warming.

- **Hypothermia** is the result of prolonged exposure to cold temperatures and body heat loss. Symptoms of hypothermia include body shivers, slow reaction time, mental confusion, glassy eyes, low body temperature, low pulse rate, and difficult respiration. Death can occur within 2 hours if not treated. If hypothermia is suspected, move to a warm location, remove wet and/or cold clothing, and provide re-warming as rapidly as possible. Provide both external heat (fire, electric blanket, body heat) and internal heat (hot liquids for conscious victims). Seek medical attention immediately.

In order to avoid potential cold stress, field personnel should take precautions against the cold and maintain body temperatures. This is most easily done by wearing the proper protective clothing, including insulated head and ear covering, gloves, insulated socks and/or boots, and insulated clothing in layers. If the potential exists for clothing to become wet, then the outer layer of clothing should be water repellent. Clothing that becomes wet with either water or sweat should be replaced immediately. In addition, the work area can be protected by the placement of vehicles or tarps to reduce wind chill.

3.1.4 Heavy Equipment

The use of heavy equipment (e.g., drill rigs, generators, compressors) may pose safety hazards to site workers. Only trained, experienced personnel will conduct heavy equipment work. If possible, personnel must remain outside the turning radius of large, moving equipment. At a minimum, personnel must maintain visual contact with the equipment operator. No guards, safety appliances, or other devices may be removed or made ineffective unless repairs or maintenance are required, and then only after power has been shut off and locked out. Safety devices must be replaced once repair or maintenance is complete. Exhaust from equipment must be directed so that it does not endanger workers or obstruct the view of the operator. When not operational, equipment must be set and locked so that it cannot be activated, released, dropped, etc.

Personnel are required to stand away from any vehicle being loaded or unloaded to avoid being struck by falling material. Personnel will wear highly visible, reflective vests while onsite to aid in being seen by equipment operators.

3.1.5 Noise

Work around large equipment often creates excessive noise. Noise can cause workers to be startled, annoyed, or distracted; can cause physical damage to the ear, pain, and temporary and/or permanent hearing loss; and can interfere with communication. If workers are subjected to noise exceeding an 8-hour time-weighted average sound level of 85 dBA (decibels on the A-weighted scale), hearing protection will be selected with an appropriate noise reduction rating to comply with 29 CFR 1910.95 and to reduce noise levels to or below the permissible values. Therefore, during field activities where workers are using heavy equipment, hearing protection must be utilized.

3.1.6 Electrical

Overhead power lines, electrical wiring, electrical equipment, and buried cables pose risks to workers of electric shock, burns, muscle twitches, heart fibrillation, and other physical injuries, as well as fire and explosion hazards. Workers will take appropriate protective measures when working near live electrical parts, including inspection of the work area, to identify potential spark sources, maintenance of a safe distance, proper illumination of the work areas, provision of barriers to prevent inadvertent contact, and use of nonconductive equipment. If overhead lines cannot be de-energized prior to the start of work, a 10-ft distance must be maintained between overhead energized power lines with a voltage of 50 kV and elevated equipment parts. This distance will be increased 4 in. for every 10 kV greater than 50 kV. For example, workers must maintain a distance of 11.7 ft from energized power lines with a voltage of 100 kV.

3.1.7 Utilities

Underground utilities pose hazards to workers involved in drilling and other invasive operations such as excavation. These hazards include electrical hazards, explosion, and asphyxiation, as well as costly and annoying hazards associated with damaging communication, sewer, and water lines. Prior to commencement of invasive operations, utility companies will be contacted to inspect and flag the area of investigation, if required.

Personnel should be aware that although an area may be cleared, it does not mean that unanticipated hazards will not appear. Workers should always be alert for unanticipated events such as snapping cables, drilling into unmarked underground utilities, and drilling into a heavily contaminated zone, etc. Such occurrences should prompt involved individuals to halt work immediately and take appropriate corrective measures to gain control of the situation.

3.1.8 Weather

Weather conditions should always be taken into consideration. Heavy rains, electrical storms, high winds, and extreme temperatures, for example, may create extremely dangerous situations for employees. Equipment performance may also be impaired because of inclement weather. Whenever unfavorable conditions arise, the Site Health and Safety Officer will evaluate both the

safety hazards and ability of the employees to effectively perform given tasks under such conditions. Activities will be halted at their discretion.

Wind direction should be accounted for when positioning equipment at sampling locations. If exposure to organic vapors is anticipated, workers should locate upwind of sampling points. Wind direction often changes abruptly and without warning, so personnel should always be prepared to reposition, if necessary.

3.1.9 Biological

Any grassy, freshwater marsh, or wetland area at the site may be territory for deer ticks or other insects, which may carry Lyme disease. Precautions that will be taken to reduce these hazards are clearing high vegetation within the work zones, minimizing movement through uncleared areas, wearing long pants while onsite, applying insect repellant to clothing, and checking employees' clothing and bodies for ticks periodically. Workers should be particularly sensitive to the freshwater marsh and wetland areas to ensure that there is minimal disturbance of the wetlands during sampling activities.

Due to the location of the site, the known animal species that may potentially be encountered include squirrels, skunks, rats, deer, mice, snakes, raccoon, etc. These animals are typically afraid of human beings and will stay away from workers. However, any animal that acts aggressively should be considered dangerous due to the possibility of rabies or potential infections from bites or punctures.

Poisonous plants (poison ivy, poison oak, poison sumac, etc.) may potentially be encountered at the site. Precautions should be taken to minimize exposure to plants by clearing vegetation, when necessary, within the work zone and wearing snake boots (if necessary), long-sleeve shirts, pants, safety glasses, and gloves. In addition to the biological and plant life hazards listed above, the following biohazard may be present.

During site operations, EA employees may be exposed to blood and body secretions in support of emergency response operations where site personnel have been injured, and require first aid and/or cardiopulmonary resuscitation (CPR) (see Section 6.5). Due to the potential that blood and body secretions may contain disease-causing organisms such as the Hepatitis B Virus, and Human Immunodeficiency Virus, employees electing to provide first aid and CPR support (until the arrival of a competent onsite medical responder) should take appropriate measures to reduce or eliminate their potential for contact and exposure. The concept of "Universal Precautions" will be followed, assuming a potential hazard is present. Employees providing first aid support should wear the appropriate PPE to prevent or reduce their potential for contact and exposure. This will typically be accomplished through the use of nitrile gloves, splash-proof eye protection, and the use of mouth-to-mouth guards and proper cleanup (good sanitation and hygiene) following the incident. The hands and face should be thoroughly washed with water and antiseptic soap or cleanser following an incident, or antiseptic containing disposable towelettes used in the absence of appropriate field washing facilities. The Program Health and

Safety Officer should be notified of potential employee exposure to blood and body fluids while conducting work in support of this project.

3.1.10 Motor Boat and Water

Field activities for the Task Order will not involve of motor boats and/or sample collection from surface water bodies

3.1.11 Overhead Obstructions and Site Debris

Field crews should survey the work area for overhead obstructions and wear appropriate PPE (hard hats and safety glasses) to prevent or reduce injury resulting from coming into contact with these overhead obstructions.

Portions of the site contain discarded debris and areas of thick vegetation, and much of the site is covered by fine-grained wetlands sediment, which can be slippery when wet. Due to these conditions, field crews should wear steel-toed boots that provide good traction in slippery/wet conditions. Field crews should also survey the work areas for site debris which could represent slip/fall/impaling hazards, and to the extent possible, limit accessing/working in these areas. Field crews should also watch their footing when walking/working in areas that are slippery and/or contain nearby site debris.

3.2 CHEMICAL HAZARDS

This section provides information on hazard communication, chemical hazards, and equipment for equipment calibration and operation.

3.2.1 Hazard Communication

The Site Health and Safety Officer will keep a MSDS onsite for each chemical, if any, brought onsite by EA during field activities. Chemicals brought onsite must be labeled in accordance with OSHA Hazard Communication Requirement 29 CFR 1910.

3.2.2 Chemical Hazards

Assumptions regarding potential chemical constituents were made by reviewing information from past investigation activities conducted at the site. The following chemicals were either detected at concentrations that exceeded potential human health risk-based levels or they were determined to be constituents of concern from the list of chemicals identified in Section 1.2.1.

Any newly identified constituents detected from the sampling activities will be evaluated and, if required, this HSP will be amended to address any new chemical hazards. In the absence of sufficient data, the concept of “Universal Precautions” will be followed, assuming that all potential constituents of concern are present while sampling. Concentrations detected are relatively low, and the likelihood of adverse health effects should be considered equally low.

Potential chemical hazards and their evaluation are provided in Table 3 for each of the identified activities.

TABLE 3 CHEMICAL HAZARD EVALUATION

Activity No.	Compound	Exposure Limits (Time Weighted Average)		Routes of Exposure	Symptoms (Acute)	Dermal Hazard
		Permissible Exposure Limit	Threshold Limit Value			
1, 2, 3	**Arsenic** in soil/sediment Metal: Silver-gray or tin-white, brittle, odorless solid	0.010 mg/m^3	0.010 mg/m^3	Inhalation, skin absorption, skin and/or eye contact, ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, potential occupational carcinogen	Yes
1, 2, 3	**Benzo(a)anthracene** in soil/sediment Black or dark-brown amorphous residue	0.2 mg/m^3 benzene-soluble fraction	0.2 mg/m^3	Inhalation, skin and/or eye contact, ingestion	Dermatitis, bronchitis, potential occupational carcinogen	Yes
1, 2. 3	**Benzo(a)pyrene** in soil/sediment Black or dark-brown amorphous residue	0.2 mg/m^3 benzene-soluble fraction	0.2 mg/m^3	Inhalation, skin and/or eye contact, ingestion	Dermatitis, bronchitis, potential occupational carcinogen	Yes
1, 2, 3	**Benzo(b)fluoranthene** in soil/sediment Black or dark-brown amorphous residue	0.2 mg/m^3 benzene-soluble fraction	0.2 mg/m^3	Inhalation, skin and/or eye contact, ingestion	Dermatitis, bronchitis, potential occupational carcinogen	Yes
1, 2, 3	**Lead** in soil/sediment Gray in pure form	0.05 mg/m^3	0.15 mg/m^3	Inhalation, skin and/or eye contact, ingestion	Lassitude, insomnia, facial pallor, anorexia, malnutrition, constipation, abdominal pain, colic, anemia, gingival lead line, tremor, paralysis of wrists/ankles, irritation to eyes	Yes

3.2.3 Chemicals for Equipment Calibrations and Operations

The following chemicals may be supplied by the primary field program team:

- Hydrochloric acid (sample preservative)
- Nitric acid (sample preservative)

Laboratory supplied sample jars with preservatives will be used to prevent handling of preservatives in the field.

As discussed in Section 4.3.3, the Site Health and Safety Officer will maintain a current alphabetical file of complete MSDSs for each hazardous substance stored or used at the work site by EA personnel.

3.3 SAFE WORK PRACTICES

Safe work practices that must be followed by site workers include:

- Cleaning of hands immediately, or as soon as feasible, after removal of gloves by the use of antiseptic cleanser in conjunction with clean paper towels.

- Washing of hands and any other exposed skin with antiseptic cleanser and water immediately or as soon as feasible following contact with blood or other potentially infectious material; staff will also wash hands:
  - After removing PPE
  - After handling potentially infectious materials
  - After cleaning or decontaminating equipment
  - After using the bathroom
  - Before eating
  - Before and after handling or preparing food.

- Eat, drink, and smoke only in those areas designated by the Site Health and Safety Officer. These activities will not take place within work zones.

- In the event a potential for chemical contamination exists onsite, employees will wash and conduct appropriate decontamination activities.

- Wear appropriate PPE all the time.

- Defective PPE must be repaired or replaced immediately.

- Each employee required to take prescription drugs will notify the Field Team Leader and/or Site Health and Safety Officer/Emergency Coordinator prior to the start of work. Controlled or unauthorized drugs will **not** be permitted onsite at any time.

- Procedures for sampling and/or analysis will be performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets. The slow and careful transfer of all potentially infectious liquids will accomplish this.

- Potentially infectious materials will be placed in a clearly marked container which prevents leakage during collection, handling, and transporting.

- If outside contamination of the primary container occurs, the primary container will be placed within a second container, which prevents leakage during handling and transporting.

- Equipment that may become contaminated will be decontaminated as necessary.

3.4 ENVIRONMENTAL MONITORING

Due to the site-related contaminants being bound to soil and sediment particles and planned field activities causing minimal disturbance which could the particles to become air-borne, environmental monitoring will not be required for the project. Precautions will be taken, which include use of PPE, and having personnel working upwind of drilling activities while advancing borings with Shelby tubes. If dust is observed during drilling activities or collection of wetlands sediment samples, dust masks will be utilized by field crew to minimize inhalation of the dust particles.

3.5 BUDDY SYSTEM

Work at the site will be scheduled to minimize the amount of time an employee works alone at any time. Each worker will maintain visual contact or communication with another worker during intrusive activities and/or in the exclusion zone. The buddy system will ensure against an employee becoming stressed without a co-worker being aware of his or her condition. Workers must "watch out" for each other while working close to potential chemical and physical hazards. In situations where line of sight may be limited, radio or telephone communication must be maintained at a minimum.

If a telephone is not immediately available for emergency use, an alarm or horn should be sounded to summon further help from others on the job site.

4. EMPLOYEE TRAINING

This section discusses OSHA-mandated training, medical surveillance, and hazard communication requirements for the Gulfco site.

4.1 SITE PERSONNEL

All onsite personnel who may be exposed to hazardous conditions, including EA and subcontractor personnel, as well as site visitors who will participate in onsite activities, will be required to meet the training requirements outline in 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response). Training will include:

- Minimum of 40 hours of initial offsite instruction
- Minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor
- 8-hour "refresher" training period annually

- Additional training that addresses unique or special hazards/operational requirements

- At least one person onsite at any time should be currently trained in first aid/cardiopulmonary resuscitation.

Onsite management and supervisors who are directly responsible for or who supervise employees will receive at least 8 additional hours of specialized management training.

Copies of training certificates and dates of attendance will be available through the Site Health and Safety Officer upon request.

4.1.1 Subcontractor Training

Prior to start of work operations, the PM will obtain a written list of subcontractor personnel to be onsite and written certification from subcontractor management that these workers meet the training requirements for their assigned tasks.

4.1.2 Pre-Entry Orientation Session

Prior to entering the Site, personnel will attend a pre-entry orientation session presented by the SHSO. Personnel will verify attendance of this meeting by signing the review record provided in Attachment A. Visitors entering designated work areas will be subject to applicable health and safety regulations during field operations at the Site. The SHSO is responsible for briefing the onsite personnel of potential hazards that may be encountered on the Site, the presence and location of the HSP, and emergency response procedures. Visitors will be under the direct supervision of the Field Team Leader/SHSO or his/her representative.

At a minimum, the pre-entry orientation session will discuss the contents of this HSP and will discuss the following items:

- Nature and degree of potential health and safety hazards associated with each task
- PPE to be worn for each task
- Decontamination procedures
- Training and medical surveillance requirements
- Safe work practices
- Emergency procedures.

A question and answer period will also be provided.

4.2 MEDICAL SURVEILLANCE

Hazardous waste site workers must have satisfactorily completed a comprehensive medical examination by a licensed physician within 12 months (or 24 months pending physician's approval) prior to the start of site operations. This information will be available onsite.

A licensed physician who is certified in Occupational Medicine by the American Board of Preventative Medicine will review medical surveillance protocol and examination results. Medical surveillance protocols will comply with 29 CFR 1910.120. The content of medical examinations will be determined by the attending physician and will be based upon the guidelines in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.* Medical examinations and consultations will be provided for employees covered by this program on the following schedule:

- Prior to field work assignment
- At least annually for employees covered by the program (or biennial with the approval of the occupational physician)
- At termination of employment or reassignment to an area where the employee would not be covered if the employee has not been examined within the past 6 months
- As soon as possible upon the development of signs or symptoms that may indicate an overexposure to hazardous substances or other health hazards, or that an unprotected person has been exposed in an emergency situation
- More frequently if the physician deems such examination necessary to maintain employee health.

An accurate record of the medical surveillance will be maintained for each employee for a period of no less than 30 years after the termination of employment. Records will be managed and maintained per recordkeeping provisions of EA's Safety and Health Program Manual. Records must include at least the following information about the employee:

- Name and social security number
- Physician's written opinions, recommendations, limitations, and test results
- Employee medical complaints related to hazardous waste operations
- Information provided to the physician by the employee concerning possible exposures, accidents, etc.

4.3 HAZARD COMMUNICATION PROGRAM

EA's hazard communication program consists of hazard communication, hazard communication labeling, material safety data sheets, and hazard communication training. Each of these elements is further explained below.

4.3.1 Hazard Communication

The SHSO will conduct regularly scheduled safety meetings with site workers to discuss the planned activities, since these activities and workers may change over the duration of the task order. The objective of instituting a Hazard Communication Program is to ensure that hazards associated with the Site and with chemicals brought onsite by EA or subcontractors are evaluated, and that information concerning these hazards is transmitted to site employees. Site personnel include EA and subcontractor employees, manufacturer's representatives, or local agency employees, and other workers who observe or perform services onsite. Employee awareness of chemical identities, health and physical hazards, properties, and characteristics is essential to safely handle chemicals and to minimize potential hazards. The Hazard Communication Program must follow OSHA requirements listed in 29 CFR 1926.59.

4.3.2 Hazard Communication Labeling

The Site Health and Safety Officer will ensure that EA containers are properly labeled and that workers know the contents of containers. Container labels will contain, at a minimum, information on name of product on container, chemical(s) in product, manufacturer's name and address, protective equipment required for the safe handling of the product, and first aid procedures in case of overexposure to product contents.

4.3.3 Material Safety Data Sheets

Material safety data sheets (MSDS) for each hazardous substance brought to, stored, or used at the work site is located in Appendix E of this Health and Safety Plan. The file will be easily accessible to all employees. Subcontractors and visitors to the work place will be informed of the existence and location of the MSDS. Workers and visitors will be instructed on how to read and understand the information shown on the MSDS. Subcontractors must inform the SHSO about hazardous substances that they bring onsite and provide MSDS.

4.3.4 Hazard Communication Training

Site workers and visitors will be informed of the Hazard Communication Program, their legal rights under the program, the location of the chemical inventory, and the location of the material safety data sheets file. Prior to site work or potential exposure to hazardous substances, the SHSO will describe hazardous substances routinely used and provide information about:

- Nature of potential chemical hazards
- Appropriate work practices
- Appropriate control programs
- Appropriate protective measures
- Methods to detect presence or release of hazardous substances
- Emergency procedures.

5. PERSONAL PROTECTIVE EQUIPMENT

This section describes the PPE requirements for field activities at the Gulfco site.

5.1 PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

Based upon currently available information and the nature of the anticipated tasks, the level of protection selected for all the work tasks is Level D.

In the event that potential chemical hazards are identified, the level of protection may be upgraded appropriately to the potential hazard conditions by the Site Health and Safety Officer. Only those personnel identified and qualified for hazardous waste work as defined in 29 CFR 1910.120 will be allowed to upgrade beyond Level D or provide support of hazardous material/ substance contingency operations. Only the EA Site Health and Safety Officer will be allowed to approve PPE upgrade for EA personnel beyond Level D and site re-entry for the purpose of hazardous conditions assessment.

The following is a list of the Level D PPE components for the minimum level of protection authorized for use during this project:

- Coveralls or appropriate work clothes
- Steel-toe, steel-shank safety boots/shoes
- Hard hats (if overhead hazards are present)
- Chemical resistant gloves (neoprene or nitrile) as appropriate to prevent contact during sample collection activities
- Leather work gloves (as needed)
- Safety glasses with side shields and face shield (as needed) or impact-resistant chemical goggles; safety glasses, goggles, and face shields will meet American National Standards Institute requirements for impact resistance and safety
- Hearing protectors (as needed) (NOTE: Hearing protection must be available and must be worn whenever noise levels exceed 85 dBA [noise level at which a shouted conversation cannot be understood at a 1-ft distance]).

5.2 MAINTENANCE AND IN-USE INSPECTION OF PERSONAL PROTECTIVE EQUIPMENT

Effective use of protective equipment requires that the equipment be properly used, maintained, and inspected periodically during the day. Site-specific issues and standard procedures will be reiterated during pre-entry training. Gloves and body coverings will be regularly inspected and

replaced promptly if torn. Disposable coveralls will be replaced daily at a minimum. Reusable gloves will be decontaminated whenever exiting the area.

6. EMERGENCY RESPONSE AND REACTION TO SITE CONTINGENCIES

This section details emergency response actions and provides site-specific emergency procedures.

6.1 EMERGENCY RECOGNITION

Prior to work startup, personnel must be familiar with emergency condition identification, notification, and response procedures. The emergency telephone numbers for local emergency response and reporting organizations are provided in Table 4. Figure 1 shows directions to the nearest hospital.

TABLE 4 EMERGENCY TELEPHONE NUMBERS

Organization	Phone Number
Emergency – Ambulance	911
Non-Emergency	979-297-4411
Freeport Fire Department	911 or 979-239-1211
Freeport Police Department	911 or 979-239-1211
Freeport City Hall	979-233-2111
Hospital – Brazosport Memorial Hospital	General: 979-297-4411 Emergency: 911 100 Medical Drive Lake Jackson, Texas 77566
Texas Commission on Environmental Quality	512-239-1000 (Austin, TX)

Directions to Hospital: From site, (906 Marlin Lane, Freeport, TX 77541), travel southwest on Marlin Lane approximately 0.7 mile. The road becomes Tarpon Lane; travel on Tarpon Lane for approximately 0.2 mile. Turn right (west) on Sailfish Street for approximately 0.1 mile and turn right (north) onto SR-332. Travel on SR-332 for approximately 11.1 miles and turn left (west) onto Plantation Drive. Travel on Plantation Drive for approximately 0.7 mile. The road name changes to Medical Drive. Arrive at 100 Medical Drive, Lake Jackson, Texas.

EA Project Personnel

Name	Position	Work Phone	Cell Phone
Alpheus Sloan	Project Manager	972-315-3922	214-500-8525
Mark Paddack	Alternate Project Manager	972-315-3922	214-535-1844
John Bonner	Field Team Leader	713-896-4111	281-935-1638
John Bonner	Site Health and Safety Officer	713-896-4111	281-935-1638
Tim Startz	Program Manager	972-315-3922	214-616-7027
Pete Garger, CIH	Corporate Health and Safety Director	410-527-2425	410-790-6338

EPA Project Personnel

Name	Position	Work Phone	Cell Phone
Gary Miller	EPA Region 6 Task Order Monitor	214-665-8318	---

The Field Team Leader/Site Health and Safety Officer will rehearse/review emergency procedures and/or applicable site contingencies prior to initiation of field activities. Offsite emergency personnel will ultimately handle onsite emergencies. Initial response and first aid treatment, however, will be provided onsite.

Person(s) identifying an accident, injury, emergency condition, or a scenario requiring implementation of a response in support of this HSP will immediately take actions to report the situation to the Field Team Leader/Site Health and Safety Officer. Notification may take place by runner, hand-held radio, or cell phone. The Field Team Leader/Site Health and Safety Officer will initiate the required response based upon the type of incident, following the procedures contained in this HSP. Chain-of-command and sign-in sheets for personnel on the site will be established at the beginning of each work day to ensure personnel are accounted for and who will take control should the Field Team Leader/Site Health and Safety Officer become injured. The following items constitute those site conditions requiring an emergency response or contingency action in accordance with this HSP:

- Fire/explosion
- Heavy equipment accident
- Natural disaster
- Medical emergency
- Discovery of unanticipated hazards (e.g., unmarked utility lines, heavily contaminated material).

Follow-on operations to evaluate and control the source of fire, explosion, and hazardous material incidents will occur only after discussion with the EA Project Manager, Field Team Leader/Site Health and Safety Officer, and Program Health and Safety Officer, along with EPA personnel.

The Field Team Leader/Site Health and Safety Officer will act as the emergency coordinator at the site to coordinate onsite activities and contingencies with outside response organizations. If the Field Team Leader is unable to act as the Emergency Coordinator, then the authority to take action will be transferred to the other designee, as indicated in the daily updated chain-of-command.

6.2 PRE-EMERGENCY PLANNING

The Site Health and Safety Officer will contact applicable local emergency response organizations contained in Table 4 prior to beginning of the project to identify the emergency response requirements and commitments required to support this project. The Project Manager, or designee, will contact those local authorities potentially required to respond in the event of an onsite emergency incident or contingency. This notification will inform each applicable agency

of the starting date, anticipated scope of work, and existence of the HSP. A copy of the HSP will be made available to each emergency response agency upon request to the Project Manager. Emergency activities will be coordinated (as applicable) with the local emergency planning committee, as required in accordance with Superfund Amendments and Reauthorization Act Title III requirements.

6.3 OPERATIONS SHUTDOWN

The Site Health and Safety Officer may mandate operations shutdown in coordination with EPA. Conditions warranting work stoppage will include (but are not limited to):

- Fire
- Explosion
- Uncovering potentially dangerous buried hazardous materials
- Conditions immediately dangerous to life and health or the environment
- Potential for electrical storms
- Treacherous weather-related conditions
- Limited visibility
- Air contaminant concentrations in excess of the action levels contained in Table 3
- Upgrading of site security threat conditions.

6.4 PROCEDURES FOR HANDLING EMERGENCY INCIDENTS

In the event of an emergency, the information available at that time must be properly evaluated and the appropriate steps taken to implement the emergency response plan as outlined in this HSP. The Site Health and Safety Officer will assume command of the situation in coordination with EPA. He/she will alert the emergency management system per Table 4, and evacuate personnel to the pre-designated evacuation location. The Site Health and Safety Officer/Emergency Coordinator will make required notifications to include, but not be limited to, the EA Project Manager, EA Program Health and Safety Officer, EPA Points-of-Contact, and the appropriate federal and state agencies, as applicable.
Site personnel will have the capability of notifying emergency responders directly from the site using the onsite cell phone.

The Project Manager will complete and submit to EPA an Accident/Loss and Incident Report (Appendix D), within 24 hours. The following information will be provided when reporting an emergency:

- Name and location of person reporting
- Location of accident/incident
- Name and affiliation of injured party
- Description of injuries, fire, spill, or explosion
- Status of medical aid and/or other emergency control efforts
- Details of chemicals involved
- Summary of accident, including suspected cause and time it occurred

- Temporary control measures taken to minimize further risk.

This information is not to be released under any circumstances to parties other than those listed in this section and emergency response team members. Once emergency response agencies have been notified, the Project Manager and EPA will be immediately notified.

6.5 MEDICAL EMERGENCIES

Personnel should always be alert for signs and symptoms of illnesses related to chemical, physical, and onsite health hazards. Severe injuries resulting from accidents must be recognized as emergencies and treated as such. At least one person currently trained in first aid/CPR must be present onsite during the field activities. This will normally be the Site Health and Safety Officer.

In a medical emergency, the EA Site Health and Safety Officer must sound the emergency alarm, upon which work must stop and personnel must move to the predesignated evacuation location. **If the emergency situation cannot be conveyed by word of mouth, a whistle or other horn will be sounded. Three short blasts, separated by a 2-second silence, will be used as the emergency signal.** Personnel currently trained in first aid will evaluate the nature of the injury, decontaminate the victim (if necessary), and initiate first aid assistance immediately and transport if appropriate. First aid will be administered only to limit further injury and stabilize the victim. The local Emergency Medical Services must be notified immediately if needed.

Although not anticipated, victims who are heavily contaminated with toxic or dangerous materials must be decontaminated before being transported from the site. Decontamination will consist of removal of contaminated coveralls/clothing, and wrapping the victim in a sheet or other clothlike material. No persons will re-enter the site of injury/illness until the cause of the injury or symptoms has been determined and controlled. At no time will personnel transport victims to emergency medical facilities unless the injury does not pose an immediate threat to life and transport to the emergency medical facility can be accomplished without the risk of further injury. Emergency Medical Services will be used to transport serious injuries offsite unless deemed otherwise by the EA Site Health and Safety Officer/Emergency Coordinator.

The EA Site Health and Safety Officer/Emergency Coordinator must complete an Accident/Loss and Incident Report (Appendix D) and submit it to the Project Manager within 24 hours of the following types of incidents involving EA staff:

- Job-related injuries and illnesses
- Accidents resulting in loss or damage to property
- Accidents involving vehicles and/or vessels, whether or not they result in damage to property or personnel

- Accidents in which there may have been no injury or property damage, but which have a high probability of recurring with at least a moderate risk to personnel or property
- Near-miss incidents that could have resulted in any of the conditions defined above.

An accident that results in a fatality or the hospitalization of three or more employees must be reported within 8 hours to the U.S. Department of Labor through the Project Manager and Program Health and Safety Officer. Subcontractors are responsible for their reporting to the U.S. Department of Labor.

In order to support onsite medical emergencies, EA will have first aid/emergency medical equipment available onsite, which may include the following:

- Portable emergency eyewash.
- One 20-lb multipurpose (ABC-rated) fire extinguisher
- An adequately stocked first aid kit
- Adequate supplies of potable water for decontamination, personal hygiene, and emergency use
- An emergency siren or horn
- Copy of this EA HSP

EA personnel will carry a cell phone and the copy of this EA HSP during all onsite activities.

6.6 FIRE/EXPLOSION EMERGENCIES

Fire and explosion must be immediately recognized as an emergency. The EA Site Health and Safety Officer must sound an emergency signal, and personnel must be decontaminated (if necessary) and evacuated to the pre-designated evacuation location. Only persons properly trained in fire suppression and other emergency response procedures will support control activities. Control activities will consist of the use of onsite portable fire extinguishers for limited fire suppression and employee evacuation. Upon sounding the emergency alarm, personnel will evacuate the hazard location and assemble at the designated site meeting area. Only the EA Site Health and Safety Officer, or those site personnel trained in the use of portable fire extinguishers, will attempt to suppress a site fire. Small, multi-purpose dry chemical extinguishers will be maintained in each EA company-owned vehicle onsite. Fires not able to be extinguished using onsite extinguishers will require the support of the local Fire Department. The EA Site Health and Safety Officer should take measures to reduce injury and illness by evacuating personnel from the hazard location as quickly as possible. The EA Site Health and Safety Officer must then notify the local Fire Department. The EA Site Health and Safety Officer will determine proper followup actions. Site personnel will not resume work during or after a fire/explosion incident until the EA Site Health and Safety Officer has directed that the

incident is over and work may resume. During the incident, site personnel will remain outside the incident area and obey the instructions of the EA Site Health and Safety Officer.

6.7 EMERGENCY TELEPHONE NUMBERS

Communications will be via cell phone onsite or offsite telephone (if cellular coverage is poor in the area) for field personnel to contact offsite emergency response organizations. Refer to Table 4 for a listing of emergency telephone numbers.

6.8 CONTROL OF SITE PRODUCED AMBIENT NOISE LEVELS

Not Applicable

7. SITE CONTROL AND WORK ZONES

The following work zones will be established by EA during implementation of the field activities as a means of site control. Work zones will be established, if needed, during the sampling, removal, and disposal of hazardous waste/sludge from the site, in accordance with the following:

- **Exclusion Zone (EZ)**—This area has either known or potential contamination and has the highest potential for exposure to chemicals onsite. The EZ will be the area immediately around the sampling activities. The outer boundary of the EZ is called the hotline. The hotline separates the area of known or potential contamination from the rest of the site. The hotline should initially be established by visually surveying the site for signs of contamination, providing sufficient space to protect personnel outside the zone, allowing an adequate area in which to conduct site operations, and for reducing the potential for contaminant migration. The hotline will be physically secured or clearly marked. During subsequent site operations, the boundary may be adjusted as more

  information becomes available. Persons who enter the EZ must wear the appropriate level of PPE for the degree and types of hazards present at the site.

- **Contamination Reduction Zone (CRZ)**—One access point to the EZ designated by the EA Site Health and Safety Officer.

  The purpose of the CRZ is to reduce the possibility that the Support Zone (SZ) will become contaminated or affected by the site hazards. Because of both distance and decontamination procedures, the degree of contamination in the CRZ generally will decrease as one moves from the hotline to the SZ.

  The CRZ will be established outside the areas of known or potential contamination. Contamination Reduction Corridors, which are access control points between the EZ and CRZ, should be established for both personnel and heavy equipment. These corridors

should consist of an appropriate number of decontamination stations necessary to address the contaminants of the particular site (see National Institute of Occupational Safety and Health/OSHA/U.S. Coast Guard/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985 for information on decontamination procedures and work zones).

- **Support Zone**—Uncontaminated area and may include site vehicles.

  The SZ is the uncontaminated area where workers are unlikely to be exposed to hazardous substances or dangerous conditions. The SZ is the appropriate location for the equipment and supply center and other administrative or support functions that are necessary to keep site operations running efficiently.

  Potentially contaminated clothing, equipment, and samples must remain outside the SZ until decontaminated. However, personnel located in the SZ must receive instruction in proper evacuation procedures in case of a hazardous substance emergency. The SZ should be upwind and as far from the EZ as practicable.

The level of PPE will depend upon the type of work performed and site monitoring data, in compliance with this HSP. Level D will be the minimum protection in the EZ. The CRZ will require a minimum Level D. No specific PPE requirements are needed in the SZ, as contaminated materials are prohibited from being stored in this area. Only authorized personnel will be permitted in the EZ and CRZ. Entering these zones will require donning the required PPE prior to entry. These zones will be established prior to beginning the field activities.

Exiting the EZ will require going through decontamination in the CRZ.

Safe work practices to be followed by site workers include:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited in all the three zones at any given time.

- Hands and face must be thoroughly washed upon leaving the work area.

- Personnel must not take prescription drugs unless specifically approved by a licensed physician who is familiar with the issues of worker exposure to hazardous materials.

- When respirators are required, facial hair that interferes with the face-to-facepiece fit of the respirator will not be permitted.

- Work is allowed during daylight hours only, unless adequate alternate lighting is provided that is compliant with OSHA 29 CFR 1926.56(a).

- If dust is being visually generated in the EZ, the EA Site Health and Safety Officer will advise on procedures for misting or wetting the soil to prevent possible exposure from inhalation of soil contaminants.

- Possessing, using, purchasing, distributing, selling, or having controlled substances in one's system during the workday, including meal or break periods onsite, is strictly prohibited.

- The use or possession of alcoholic beverages onsite is prohibited; similarly, reporting to work or performing one's job assignments with excessive levels of alcohol in one's system will not be permitted.

Figures

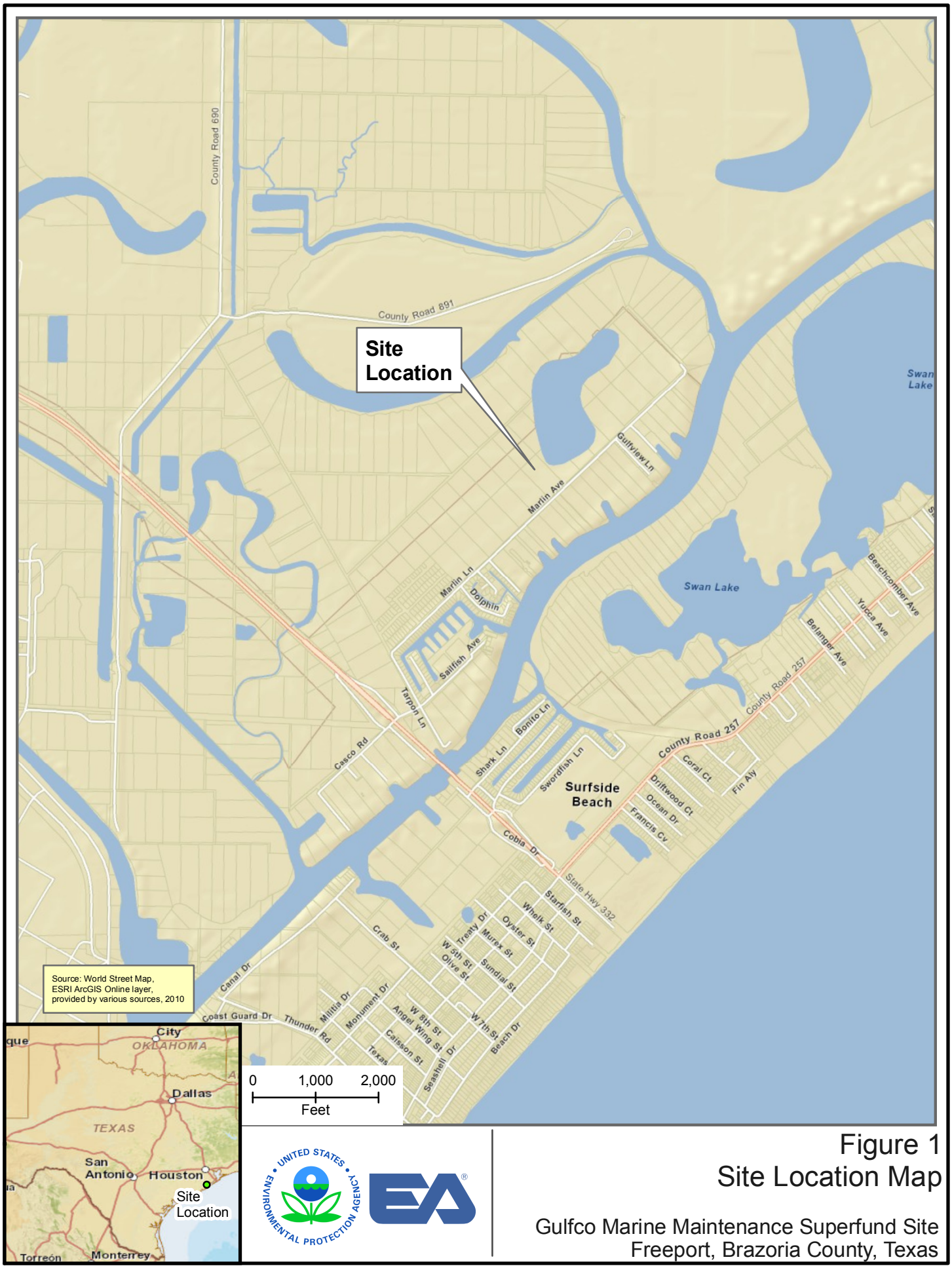


Figure 1
Site Location Map

Gulfco Marine Maintenance Superfund Site
Freeport, Brazoria County, Texas

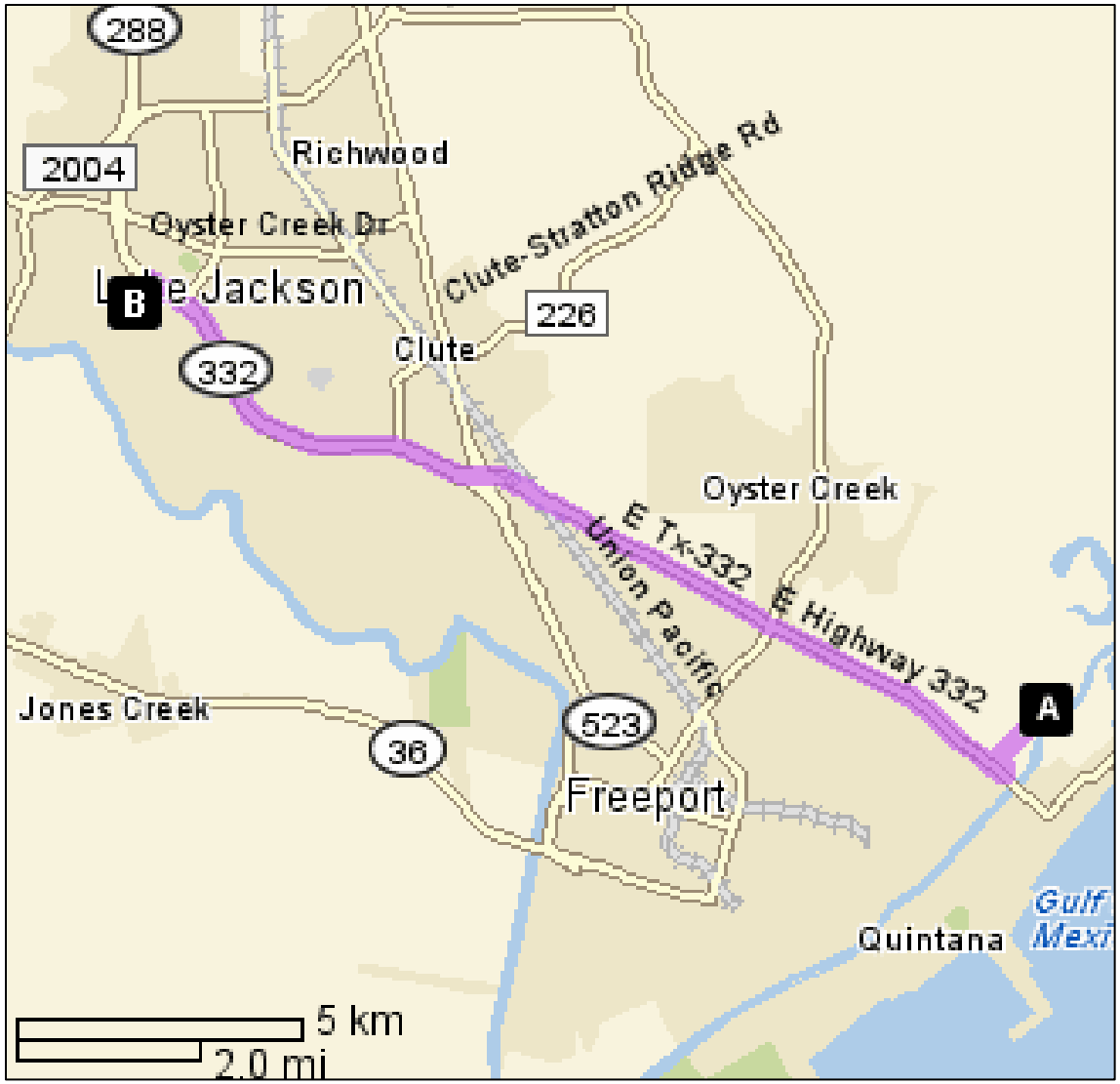
2010-11-22 r:\federal\epa\rac iii\0067-gulfco ntcrs\gis\mxds\sitelocation_a.mxd EA-Dallas jschwertz

Figure 2
Site Area Map

Gulfco Marine Maintenance Superfund Site
Freeport, Brazoria County, Texas

2010-11-22 r:\federal\epa\rac iii\0067-gulfco ntcrs\gis\mxds\siteloctopo_a.mxd EA-Dallas jschwertz

DIRECTIONS TO BRAZOSPORT MEMORIAL HOSPITAL



Directions to Hospital: From site, (906 Mrlin Lane, Freeport, TX 77541), travel southwest on Marlin Lane approximately 0.7 mile. The road becomes Tarpon Lane; travel on Tarpon Lane for approximately 0.2 mile. Turn right (west) on Sailfish Street for approximately 0.1 mile and turn right (north) onto
SR-332. Travel on SR-332 for approximately 11.1 miles and turn left (west) onto Plantation Drive. Travel on Plantation Drive for approximately 0.7 mile. The road name changes to Medical Drive. Arrive at 100 Medical Drive, Lake Jackson, Texas.

Figure 3 – Directions to Hospital

Appendix A

Site Health and Safety Plan Review Record

APPENDIX A

HEALTH AND SAFETY PLAN REVIEW RECORD

I have read the Health and Safety Plan for this site and have been briefed on the nature, level, and degree of exposure likely as a result of participation in this project. I agree to conform to all the requirements of this Plan.

SITE: Gulfco Marine Maintenance, Freeport, Brazoria County, Texas			
Name	Signature	Affiliation	Date

Appendix B

Daily Site Log

DAILY SITE LOG

Site Name: **Gulfco Marine NTCRS** _____ **Date:** _____

Name (Print and Sign)	Company (City and State)	Time	
		In	Out

Comments:

_____

_____

_____

Appendix C

Daily Safety Meeting Form

DAILY SAFETY MEETING FORM

Date:_____ **Time:** _____**Project No.:** _____

Site Name/Location: _____

Site Activities Planned for Today: _____

_____

Safety Topics Discussed
Protective clothing and equipment:
Chemical hazards:
Physical hazards:
Environmental and biohazards:
Equipment hazards:
Decontamination procedures:
Other:
Review of emergency procedures and comments:

DAILY SAFETY MEETING FORM (CONTINUED)

Attendees	
Printed Name	**Signature**

Meeting Conducted by:

_____ _____

Name Title

_____

Signature

Appendix D

Accident/Loss and Incident Report

ACCIDENT/LOSS REPORT

THIS REPORT MUST BE COMPLETED BY THE INJURED EMPLOYEE OR SUPERVISOR AND FAXED TO EA CORPORATE HUMAN RESOURCES WITHIN 24 HOURS OF ANY ACCIDENT. THE FAX NUMBER IS **(410) 771-1780**.

NOTE WHENEVER AN EMPLOYEE IS SENT FOR MEDICAL TREATMENT FOR A WORK RELATED INJURY OR ILLNESS, PAGE 4 OF THIS REPORT MUST ACCOMPANY THAT INDIVIDUAL TO ENSURE THAT ALL INVOICES/BILLS/CORRESPONDENCE ARE SENT TO HUMAN RESOURCES FOR TIMELY RESPONSE.

a. DEMOGRAPHIC INFORMATION:

NAME OF INJURED EMPLOYEE:_____
HOME ADDRESS:_____
HOME PHONE:_____ DATE OF BIRTH:_____
AGE:_____ SEX: M F
MARITAL STATUS:_____ NAME OF SPOUSE (if applicable)_____
SOCIAL SECURITY NUMBER:_____ DATE OF HIRE:_____
NUMBER OF DEPENDENTS:_____
EMPLOYEES JOB TITLE:_____
DEPT. REGULARLY EMPLOYED:_____
WAS THE EMPLOYEE INJURED ON THE JOB: Y N
PRIMARY LANGUAGE OF THE EMPLOYEE: _____

b. ACCIDENT/INCIDENT INFORMATION:

DATE OF ACCIDENT:_____ TIME OF ACCIDENT:_____
REPORTED TO WHOM: _____ NAME OF SUPERVISOR_____
EXACT LOCATION WHERE ACCIDENT OCCURRED (**including street, city, state and County**):
EXPLAIN WHAT HAPPENED (include what the employee was doing at the time of the accident and how the accident occurred): _____
_____
_____
_____

DESCRIBE THE INJURY AND THE SPECIFIC PART OF THE BODY AFFECTED (i.e., laceration, right hand, third finger):
_____
_____

OBJECT OR SUBSTANCE THAT DIRECTLY INJURED EMPLOYEE:_____

NUMBER OF DAYS AND HOURS EMPLOYEE USUALLY WORKS PER WEEK:_____
IS THE EMPLOYEE EXPECTED TO LOSE AT LEAST ONE FULL DAY OF WORK?_____
DOES THE EMPLOYEE HAVE A PREVIOUS CLAIM? Y N if yes, STATUS Open Closed
WAS THE EMPLOYEE ASSIGNED TO RESTRICTED DUTY? _____

c. ACCIDENT INVESTIGATION INFORMATION

WAS SAFETY EQUIPMENT PROVIDED? Y N If yes, was it used? Y N
WAS AN UNSAFE ACT BEING FORMED ? Y N If yes, describe_____
WAS A MACHINE PART INVOLVED? Y N If yes, describe _____
WAS THE MACHINE PART DEFECTIVE? Y N If yes, in what way _____
WAS A 3RD PARTY RESPONSIBLE FOR THE ACCIDENT/INCIDENT? Y N
If yes, list Name, address and phone number_____
_____

WAS THE ACCIDENT/INCIDENT WITNESSED? Y N
If yes, list Name, address and phone number: _____
_____

d. PROVIDER INFORMATION

WAS FIRST AID GIVEN ON SITE? Y N
If yes, what type of medical treatment was given _____
PHYSICIAN INFORMATION (if medical attention was administered)
NAME:_____
ADDRESS (incl. City, state and zip):_____
PHONE:_____

HOSPITAL ADDRESS (incl. Name, address, city, state, zip code & phone)
_____
_____

WAS THE EMPLOYEE HOSPITALIZED? Y N If yes, on what date_____
WAS THE EMPLOYEE TREATED AS AN OUTPATIENT, RECEIVE EMERGENCY TREATMENT OR AMBULANCE SERVICE? _____

PLEASE ATTACH THE PHYSICIANS WRITTEN RETURN TO WORK SLIP

***NOTE* A PHYSICIANS RETURN TO WORK SLIP IS REQUIRED PRIOR TO ALLOWING THE WORKER TO RETURN TO WORK**

e. AUTOMOBILE ACCIDENT INFORMATION (complete if applicable)

AUTHORITY CONTACTED AND REPORT #_____
EA EMPLOYEE VEHICLE YEAR, MAKE AND MODEL_____

V.I.N._____ PLATE/TAG #_____
OWNER'S NAME AND ADDRESS:_____
DRIVER'S NAME AND ADDRESS: _____
RELATION TO INSURED:_____DRIVER'S LICENSE #_____
DESCRIBE DAMAGE TO YOUR PROPERTY:_____
DESCRIBE DAMAGE TO OTHER VEHICLE OR PROPERTY:_____
OTHER DRIVER'S NAME AND ADDRESS: _____
OTHER DRIVER'S PHONE:_____
OTHER DRIVER'S INSURANCE COMPANY AND PHONE:_____
LOCATION OF OTHER VEHICLE:_____
NAME, ADDRESS AND PHONE OF OTHER INJURED PARTIES:_____
WITNESSES

NAME:_____ PHONE:_____
ADDRESS:_____
STATEMENT:_____
SIGNATURE: _____

NAME:_____ PHONE:_____
ADDRESS:_____
STATEMENT:_____
SIGNATURE: _____

f. ACKNOWLEDGEMENT

NAME OF SUPERVISOR:_____
DATE OF THIS REPORT: _____ REPORT PREPARED BY:_____

I have read this report and the contents as to how the accident/loss occurred is accurate to the best of my knowledge.

Signature: _____ Date: _____
Injured Employee

I am seeking medical treatment for a work related injury/illness.

Please forward all bills/invoices/correspondence to:

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

11019 McCORMICK ROAD

HUNT VALLEY, MD 21031

ATTENTION: Michele Bailey
HUMAN RESOURCES

(410) 584-7000

INCIDENT REPORT

THIS REPORT IS TO BE COMPLETED WHEN A NEAR MISS OCCURS THAT COULD HAVE POTENTIALLY RESULTED IN SERIOUS PHYSICAL HARM. PLEASE FAX THIS FORM TO EA HUMAN RESOURCES DEPARTMENT AT **(410) 771-1780**.

EXPLAIN WHAT HAPPENED (include what the employee was doing at the time the near miss and how it occurred: _____

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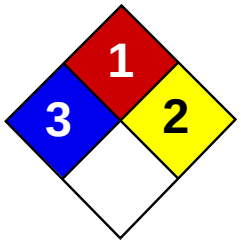
REPORT PREPARED BY: _____ DATE:_____

Appendix E

Material Safety Data Sheets



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 from ACGIH (TLV) [United States] [1995] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic Pennsylvania RTK: Arsenic Massachusetts RTK: Arsenic TSCA 8(b) inventory: Arsenic

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R22- Harmful if swallowed. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:16 PM

Last Updated: 11/06/2008 12:00 PM

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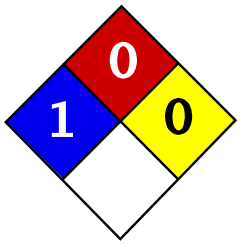

Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator).
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not

present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States]
TWA: 0.05 (mg/m3) from OSHA (PEL) [United States]
TWA: 0.03 (mg/m3) from NIOSH [United States]
TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials.
Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.
May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential:
Skin:
Lead metal granules or dust: May cause skin irritation by mechanical action.
Lead metal foil, shot or sheets: Not likely to cause skin irritation
Eyes:
Lead metal granules or dust: Can irritate eyes by mechanical action.

Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation.
Inhalation:
In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes.
Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death.
Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count.
Ingestion:
Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases.
Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to

cause reproductive harm (male) which would require a warning under the statute: Lead
California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead
Connecticut hazardous material survey.: Lead
Illinois toxic substances disclosure to employee act: Lead
Illinois chemical safety act: Lead
New York release reporting list: Lead
Rhode Island RTK hazardous substances: Lead
Pennsylvania RTK: Lead

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed.
R33- Danger of cumulative effects.
R61- May cause harm to the unborn child.
R62- Possible risk of impaired fertility.
S36/37- Wear suitable protective clothing and gloves.
S44- If you feel unwell, seek medical advice (show the label when possible).
S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 10/10/2005 08:21 PM

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MATERIAL SAFETY DATA SHEET

For R&D use only. Not for drug, household or other uses.

Click http://www.lookchem.com/cas-50/50-32-8.html for suppliers of this product.

Composition/Information on Ingredient

Cas:
50-32-8
Code:
M

RTECS:
DJ0675000
Code:
M

Name:
BENZO (A) PYRENE

Other REC Limits:
N/K

OSHA PEL:
0.2 MG/M3
Code:
M

OSHA STEL:

Code:

ACGIH TLV:
A2. MG/M3:9394
Code:
M

ACGIHSTEL:
N/P
Code:

Control Measures

Respiratory Protection:
USE MSHA/NIOSH APPROVED RESPIRATOR

Ventilation:
GENERAL OR LOCAL EXHAUST TO KEEP
Protective Gloves:
PERMEATION RESISTANT ELASTOMERIC

Eye Protection:
CHEMICAL SPLASH GOGGLES

Other Protective Equipment:
Equipment COVERALLS, LONG-SLEEVED SHIRT, LONG PANTS, ELASTOMERIC BOOTS OR OVERSHOE.

Work Hygienic Practices:
WASH HANDS W/SOAP/WATER AFTER HANDLING &BEFORE EATING/SMOKING. SHOWER AT THE END OF WORK SHIFT.

Supplemental Safety and Health:
BOILING RANGE: 302-999F. OBSERVE MSDS & LABEL PRECAUTION UNTIL CONTAINERS ARE RECONDITIONED.

Health Hazards Data

LD50LC50Mixture:
N/K

Route Of Entry Inds - Inhalation:
YES

Skin:
YES

Ingestion:
YES

Carcinogenicity Inds - NTP:
YES

IARC:
YES

OSHA:
NO

Health Hazards Acute And Chronic:
INHALATION: RESPIRATORY TRACT IRRITATION. EYES: IRRITATION, DAMAGE. SKIN: IRRITATION, DERMATITIS, ACNE, REACTION, BLISTER. INGESTION: GI IRRITATION, NAUSEA, VOMITING & FATAL. 6

Explanation Of Carcinogenicity:
SILICA/COAL TAR/BENZO(A)PYRENE/LIGHTLY TREATD OR UNTREATED MINERAL OILS HAVE BEEN DETERMINED TO BE CARCINOGENS.

Signs And Symptions Of Overexposure:
INHALATION: IT MAY CAUSE CANCER OF THE LUNG, KIDNEYS OR BLADDER. SKIN: PIGMENTATION, GROWTHS, CANCER. EYES: IRRITATION, DAMAGE. INGESTION: GI IRRITATION, NAUSEA, VOMITING & FATAL.

Medical Cond Aggravated By Exposure:
N/K

First Aid:
INHALATION: REMOVE TO FRESH AIR. GIVE ARTIFICAL RESPIRATION IF BREATHING HAS SPED. ADMINISTER OXYGEN IF BREATHING IS DIFFICULT. EYES: FLUSH W/PLENTY OF WATER FOR 15 MINS. SKIN: CLEAN AREA W/CORN OI L/WATERLESS CLEANER, THEN FOLLOW W/SOAP/& WATER. DONT USE SOLVENTS TO CLEAN. USE HYPOCORTISONE CREAM FOR RELIEF. INGESTION: DONT INDUCE VOMITING/GIVE ANYTHING BY MOUTH. OBTAIN MED ATTN IN ALL CASES.

Spill Release Procedures:
VENTILATE AREA & CONTAIN BY DIKING W/SAND EARTH OR OTHER INERT MATERIAL TO PREVENT ENTRY INTO SEWERS OR OPEN BODIES OF WATER. TRANSFER SPILLAGE TO CONTAINERS SUITABLE FOR RECOVERY OR DISPOSAL.

Neutralizing Agent:
N/K

Waste Disposal Methods:
INCINERATE AT A PERMITTED FACILITY IN ACCORDANCE W/LOCAL, STATE & FEDERL REGULATIONS.

Handling And Storage Precautions:
COAL TAR IS A PHOTOTOXIC SUBSTANCE. STORE CONTAINERS SEPERATE FROM OXIDIZERS & IN ACCORDANCE W/ANSI/NFPA 30.

Other Precautions:
EMPTY CONTAINERS MAY CONTAIN HAZARDOUS LIQUID OR SOLID RESIDUES. DONT FLAME-CUT/WELD/PUNCTURE. AVOID SKIN CONTACT. WASH CONTAMINATED CLOTHING BEFORE REUSE. DONT WEAR CONTACT LENSES.

Fire and Explosion Hazard Information

Flash Point Method:
N/P

Flash Point:

Flash Point Text:
180F

Autoignition Temp:

Autoignition Temp Text:
N/A

Lower Limits:
N/K

Upper Limits:
N/K

Extinguishing Media:
DRY CHEMICAL, FOAM, CO2, WATER FOG

Fire fighting Procedures:
WEAR MSHA/NIOSH APPROVED RESPIRATOR (PRESSURE DEMAND, SCBA) & FULL PROTECTIVE GEAR COOL EXPOSED CONTAINERS W/WATER SPRAY.

Unusual Fire/Explosion Hazard:
7 ELIMINATE IGNITION SOURCES IF HEATED >180F. IN CLOSED TANKS, WATER/FOAM MAY CAUSE FROTHING/ERUPTION. COMBUSTIBLE LIQUID. AUTOIGNITION TEM: >410F.

Physical/Chemical Properties

HCC:

NRC/State LIC No:

Net Prop WT For Ammo:

Boiling Point:

B.P. Text:
SEE SUP

Melt/Freeze Pt:

M.P/F.P Text:
N/K

Decomp Temp:

Decomp Text:
N/K

Vapor Pres:
2

Vapor Density:
1.0

Volatile Org Content %:

Spec Gravity:
1-1.2

VOC Pounds/Gallon:

PH: N/K

VOC Grams/Liter:

Viscosity:
N/P

Evaporation Rate & Reference:
N/K

Solubility in Water:
NEGLIGIBLE

Appearance and Odor:
BLACK, SEMI-SOLID PASTE, HYDROCARBON ODOR

Percent Volatiles by Volume:
25%

Corrosion Rate:
N/K

Reactivity Data

Stability Indicator:
YES 8

Stability Condition To Avoid:
N/K

Materials To Avoid:
STRONG OXIDIZERS, LIQUID CHLORINE, SODIUM, POTASSIUM HYPOCHLORITE, NITRIC ACID, &PEROXIDES.

Hazardous Decomposition Products:
OXIDES OF NITROGEN, CARBON, &SULFUR

Hazardous Polymerization Indicator:
NO

Conditions To Avoid Polymerization:
N/K

Toxicological Information

Information:N/P

MSDS Transport Information

Information:N/P

Regulatory Information

Sara Title III Information: N/P

Federal Regulatory Information: N/P

State Regulatory Information: N/P

Other Information

Other Information:N/P

LookChem
Look for Chemicals
www.lookchem.com

For R&D use only. Not for drug, household or other uses.
WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Lookchem shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

LIQUINOX MSDS

Section 1 : PRODUCT AND COMPANY IDENTIFICATION

Chemical family: Detergent.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Supplier: Same as manufacturer.

Product name: Liquinox

Section 2 : INGREDIENT INFORMATION

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3 : HAZARD IDENTIFICATION

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of acute exposure

Eye contact: May cause irritation.

Skin contact: Prolonged and repeated contact may cause irritation.

Inhalation: May cause headache and nausea.

Ingestion: May cause vomiting and diarrhea.
May cause gastric distress.

Effects of chronic exposure: See effects of acute exposure.

Section 4 : FIRST AID MEASURES

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: If irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
If irritation persists, seek medical attention.

Ingestion: Do not induce vomiting, seek medical attention.
Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.

Section 5 : FIRE FIGHTING MEASURES

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.
Use water spray to cool fire exposed containers.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Explosion Data

Sensitivity to static discharge: Not available.

Sensitivity to mechanical impact: Not available.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: Containers may rupture if exposed to heat or fire.

Section 6 : ACCIDENTAL RELEASE MEASURES

Leak/Spill: Contain the spill.
Prevent entry into drains, sewers, and other waterways.
Wear appropriate protective equipment.
Small amounts may be flushed to sewer with water.
Soak up with an absorbent material.
Place in appropriate container for disposal.
Notify the appropriate authorities as required.

Section 7 : HANDLING AND STORAGE

Handling procedures and equipment: Protect against physical damage.
Avoid breathing vapors/mists.

Wear personal protective equipment appropriate to task.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.

Section 8 : EXPOSURE CONTROLS / PERSONAL PROTECTION

Precautionary Measures

Gloves/Type:

Wear appropriate gloves.

Respiratory/Type: None required under normal use.

Eye/Type:

Safety glasses recommended.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

Exposure limit of material: Not available.

Section 9 : PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
17

Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C): 100 (212F)

Freezing point (°C): Not available.

pH: 8.5

Specific gravity @ 20 °C: (water = 1).
1.083

Solubility in water (%): Complete.

Coefficient of water\oil dist.: Not available.

VOC: None

Chemical family: Detergent.

Section 10 : STABILITY AND REACTIVITY

Chemical stability: Product is stable under normal handling and storage conditions.

Conditions of instability: Extreme temperatures.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizing agents.

Hazardous decomposition products: See hazardous combustion products.

Section 11 : TOXICOLOGICAL INFORMATION

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Section 12 : ECOLOGICAL INFORMATION

Environmental toxicity: No data at this time.

Environmental fate: No data at this time.

Section 13 : DISPOSAL CONSIDERATIONS

Waste disposal: In accordance with local and federal regulations.

Section 14 : TRANSPORT INFORMATION

D.O.T. CLASSIFICATION: Not regulated.

Special shipping information: Not regulated.

Section 15 : REGULATORY INFORMATION

Canadian Regulatory Information

WHMIS classification: Not controlled.

DSL status: Not available.

USA Regulatory Information

SARA hazard catagories sections 311/312: Immediate (Acute) Health Hazard: No.
Delayed (Chronic) Health Hazard: No.
Fire Hazard: No.
Sudden Release of Pressure: No.
Reactive: No.

SARA Section 313: None

TSCA inventory: All components of this product are listed on the TSCA Inventory.

NFPA

Health Hazard: 1

Flammability: 0

Physical hazard: 0

Section 16 : OTHER INFORMATION

Supplier MSDS date: 2005/02/24

Data prepared by: Global Safety Management
3340 Peachtree Road, #1800
Atlanta, GA 30326

Phone: 877-683-7460
Fax: (877) 683-7462

Web: www.globalsafetynet.com
Email: info@globalsafetynet.com.

General note: This material safety data sheet was prepared from information obtained from various sources, including product suppliers and the Canadian Center for Occupational Health and Safety.

ExxonMobil
Lubricants and Petroleum Specialties

DATE ISSUED: 08/10/99
SUPERSEDES DATE: 03/22/99

MATERIAL SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

COMPANY: Exxon Mobil Corporation
ExxonMobil Lubricants & Petroleum
Specialties Company
3225 Gallows Road
Fairfax, VA 22037-0001

PRODUCT NAME
EXXON DYED LOW S D2x

PRODUCT CODE
072719 - 00707

PRODUCT CATEGORY
Petroleum Distillate Fuel

MEDICAL EMERGENCY TELEPHONE NUMBER: (713) 656-3424

TRANSPORTATION EMERGENCY TELEPHONE NUMBERS
(BAYTOWN) (281) 834-3296 (CHEMTREC) 1-800-424-9300

Product Information and Technical Assistance: 1-800-443-9966

FAXED MSDSs: 1-800-298-4007 MAILED MSDSs OR OTHER ASSISTANCE: (713) 656-5949

SECTION 2: COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS NO. OF COMPONENTS	APPROXIMATE CONCENTRATION
Fuels, diesel, No. 2	68476-34-6	100%

Contains red dye to meet the IRS requirements for tax-exempt diesel fuel. No data are available on potential detrimental effects of the dye on product performance; ExxonMobil therefore assumes no responsibility for such effects.

SEE SECTION 8 FOR EXPOSURE LIMITS

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

OSHA REQUIRED LABEL INFORMATION
In compliance with hazard and right-to-know requirements, where applicable OSHA Hazard Warnings may be found on the label, bill of lading or invoice

accompanying this shipment.

DANGER!
COMBUSTIBLE
LONG-TERM, REPEATED EXPOSURE MAY
CAUSE SKIN CANCER

Note: Product label may contain non-OSHA related information also.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS)

Health	Flammability	Reactivity	BASIS
1	2	0	Recommended by ExxonMobil

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) - HAZARD IDENTIFICATION

Health	Flammability	Reactivity	BASIS
0	2	0	Recommended by the National Fire Protection Association

VARIABILITY AMONG INDIVIDUALS

Health studies have shown that many petroleum hydrocarbons and synthetic lubricants pose potential human health risks which may vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

EFFECTS OF OVEREXPOSURE (Signs and symptoms of exposure)

Prolonged or repeated liquid contact with the skin will dry and defat the skin, leading to possible irritation and dermatitis.
High vapor concentrations (greater than approximately 1000 ppm, attainable at temperatures well above ambient) are irritating to the eyes and the respiratory tract, and may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death.

PRE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE

Petroleum Solvents/Petroleum Hydrocarbons - Skin contact may aggravate an existing dermatitis.

SECTION 4: FIRST AID MEASURES

EYE CONTACT

If splashed into the eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

SKIN

In case of skin contact, remove any contaminated clothing and wash skin with soap and water. Launder or dry-clean clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

INHALATION

Overexposure may cause gasping, nausea and disorientation.

Vapor pressure is very low. Vapor inhalation under ambient conditions is

normally not a problem. If overcome by vapor from hot product, remove from exposure and call a physician immediately. If breathing is irregular or has stopped, start resuscitation, administer oxygen, if available.

INGESTION
If ingested, DO NOT induce vomiting; call a physician immediately.

SECTION 5: FIRE-FIGHTING MEASURES

FLASH POINT (MINIMUM)
COMBUSTIBLE - Per DOT 49 CFR 173.115
52~C (125~F)
ASTM D 93, Pensky Martens Closed Cup

AUTOIGNITION TEMPERATURE
Greater than 204~C (400~F)

FLAMMABLE OR EXPLOSIVE LIMITS (APPROXIMATE PERCENT BY VOLUME IN AIR)
Estimated values: Lower Flammable Limit 0.9% Upper Flammable Limit 7%

EXTINGUISHING MEDIA AND FIRE FIGHTING PROCEDURES
Foam, water spray (fog), dry chemical, carbon dioxide and vaporizing liquid type extinguishing agents may all be suitable for extinguishing fires involving this type of product, depending on size or potential size of fire and circumstances related to the situation. Plan fire protection and response strategy through consultation with local fire protection authorities or appropriate specialists.

The following procedures for this type of product are based on the recommendations in the National Fire Protection Association's "Fire Protection Guide on Hazardous Materials", Tenth Edition (1991):

Use dry chemical, foam or carbon dioxide to extinguish the fire. "Water may be ineffective", but water should be used to keep fire-exposed containers cool. If a leak or spill has ignited, use water spray to disperse the vapors and to protect persons attempting to stop a leak. Water spray may be used to flush spills away from exposures. Minimize breathing of gases, vapor, fumes or decomposition products. Use supplied-air breathing equipment for enclosed or confined spaces or as otherwise needed.

NOTE: The inclusion of the phrase "water may be ineffective" is to indicate that although water can be used to cool and protect exposed material, water may not extinguish the fire unless used under favorable conditions by experienced fire fighters trained in fighting all types of flammable liquid fires.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS
Fumes, smoke, carbon monoxide, sulfur oxides, aldehydes and other decomposition products, in the case of incomplete combustion.

SECTION 6: ACCIDENTAL RELEASE MEASURES

CLEAN WATER ACT / OIL POLLUTION ACT
This product may be classified as an oil under Section 311 of the Clean Water Act, and under the Oil Pollution Act. Discharges or spills into or leading to surface waters that cause a sheen must be reported to the National Response Center (1-800-424-8802).

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Shut off and eliminate all ignition sources. Keep people away. Recover free product. Add sand, earth or other suitable absorbent to spill area. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Open all windows and doors. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter sewers, watercourses, or extensive land areas.

Assure conformity with applicable governmental regulations. Continue to observe precautions for volatile, combustible vapors from absorbed material.

SECTION 7: STORAGE AND HANDLING

HANDLING PRECAUTIONS

This liquid is volatile and gives off invisible vapors. Either the liquid or vapor may settle in low areas or travel some distance along the ground or surface to ignition sources where they may ignite or explode.

Keep product away from ignition sources, such as heat, sparks, pilot lights, static electricity, and open flames.

"EMPTY" CONTAINER WARNING

"Empty" containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

Do not attempt to refill or clean containers since residue is difficult to remove. "Empty" drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

For work on tanks refer to Occupational Safety and Health Administration regulations, ANSI Z49.1, and other governmental and industrial references pertaining to cleaning, repairing, welding, or other contemplated operations.

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT FOR TOTAL PRODUCT	BASIS
100 ppm (900 mg/m3) for an 8-hour workday	Recommended by ExxonMobil

VENTILATION

Use only with ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air.

RESPIRATORY PROTECTION

Use supplied-air respiratory protection in confined or enclosed spaces, if needed.

PROTECTIVE GLOVES

Use chemical-resistant gloves, if needed, to avoid prolonged or repeated skin contact.

EYE PROTECTION
Use splash goggles or face shield when eye contact may occur.

OTHER PROTECTIVE EQUIPMENT
Use chemical-resistant apron or other impervious clothing, if needed, to avoid contaminating regular clothing, which could result in prolonged or repeated skin contact.

WORK PRACTICES / ENGINEERING CONTROLS
To prevent fire or explosion risk from static accumulation and discharge, effectively bond and/or ground product transfer system in accordance with (THE) National Fire Protection Association PUBLICATIONS.

To minimize fire or explosion risk from static charge accumulation and discharge, effectively bond and/or ground product transfer system in accordance with the National Fire Protection Association standard for petroleum products.

Keep containers closed when not in use. Do not store near heat, sparks, flame or strong oxidants.

In order to prevent fire or explosion hazards, use appropriate equipment.

Information on electrical equipment appropriate for use with this product may be found in the latest edition of the National Electrical Code (NFPA-70). This document is available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

PERSONAL HYGIENE
Minimize breathing vapor, mist or fumes. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before re-use. Remove contaminated shoes and thoroughly clean before re-use; discard if oil-soaked. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

The following data are approximate or typical values and should not be used for precise design purposes.

BOILING RANGE
160-350-C (320-650-F)

SPECIFIC GRAVITY (15.6 Deg C/15.6 Deg C)
0.86

MOLECULAR WEIGHT
Approximately 212 average

pH
Essentially neutral

POUR, CONGEALING OR MELTING POINT

VAPOR PRESSURE
Less than 1 mm Hg @ 20-C

VAPOR DENSITY (AIR = 1)
Greater than 5

PERCENT VOLATILE BY VOLUME
100

EVAPORATION RATE @ 1 ATM. & 25 Deg C (77 Deg F) (n-BUTYL ACETATE = 1)
0.02

SOLUBILITY IN WATER @ 1 ATM. AND 25 Deg C (77 Deg F)

-18 Deg C (0 Deg F)
Pour Point by ASTM D 97

Negligible; less than 0.1%

VISCOSITY
1.9 to 4.1 cSt @ 40~C

PRODUCT APPEARANCE AND ODOR
Clear liquid, contains red dye
Faint petroleum hydrocarbon odor

SECTION 10: STABILITY AND REACTIVITY

This product is stable and will not react violently with water. Hazardous polymerization will not occur. Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, etc., as this presents a serious explosion hazard.

SECTION 11: TOXICOLOGICAL INFORMATION

NATURE OF HAZARD AND TOXICITY INFORMATION
This product contains ethylbenzene. A study conducted by the National Toxicology Program states that lifetime inhalation exposure of rats and mice to high concentrations of ethylbenzene (750 ppm) resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations of ethylbenzene (75 ppm or 250 ppm). The study does not address the relevance of these results to humans.

Prolonged or repeated skin contact with this product tends to remove skin oils, possibly leading to irritation and dermatitis; however, based on human experience and available toxicological data, this product is judged to be neither a "corrosive" nor an "irritant" by OSHA criteria.

Product contacting the eyes may cause eye irritation.

Lifetime skin painting studies conducted by the American Petroleum Institute, ExxonMobil and others have shown that similar products boiling between 175-370 Deg C (350-700 Deg F) usually produce skin tumors and/or skin cancer in laboratory mice. The degree of carcinogenic response was weak to moderate with a relatively long latent period. The implications of these results for humans have not been determined.

Limited studies on oils that are very active carcinogens have shown that washing the animals' skin with soap and water between applications greatly reduces tumor formation. These studies demonstrate the effectiveness of cleansing the skin after contact.

Potential risks to humans can be minimized by observing good work practices and personal hygiene procedures generally recommended for petroleum products. See Section 8 for recommended protection and precautions.

Contains light hydrocarbon components. Lifetime studies by the American Petroleum Institute have shown that kidney damage and kidney cancer can occur in male rats after prolonged inhalation exposures at elevated concentrations of total gasoline. Kidneys of mice and female rats were unaffected. The U.S. EPA Risk Assessment Forum has concluded that the male rat kidney tumor results

are not relevant for humans. Total gasoline exposure also produced liver tumors in female mice only. The implication of these data for humans has not been determined. Certain components, such as normal hexane, may also affect the nervous system at high concentrations (e.g., 1000-1500 ppm).

Product has a low order of acute oral and dermal toxicity, but minute amounts aspirated into the lungs during ingestion or vomiting may cause mild to severe pulmonary injury and possibly death.

This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and an acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.

Inhalation of components of exhaust from burning, such as carbon monoxide, may cause death at high concentrations.

Long-term repeated exposure of laboratory animals to whole diesel exhaust has resulted in an increased incidence of lung cancer.

Exposure to exhaust from burning and diesel exhaust should be minimized.

SECTION 12: ECOLOGICAL INFORMATION

Do not discharge this product into public waters or waterways unless authorized by a National Pollution Discharge Elimination System (NPDES) permit issued by the Environmental Protection Agency (EPA).

Environmental and Ecological data may be available for this product. Write or call ExxonMobil to obtain further information. Refer to Section 6 and Section 15 for Accidental Release information and Regulatory Reporting information.

SECTION 13: DISPOSAL CONSIDERATION

Options for disposal of this product may depend on the conditions under which it was used. To determine the proper method of disposal, refer to RCRA (40 CFR 261), as well as federal EPA and state and local regulations.

Please refer to Sections 5, 6 and 15 for additional information.

SECTION 14: TRANSPORTATION INFORMATION

TRANSPORTATION INCIDENT INFORMATION
For further information relative to spills resulting from transportation incidents, refer to latest Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents.

U.S. DOT HAZARDOUS MATERIALS SHIPPING DESCRIPTION
Transported by highway or rail:

Bulk packagings (capacity greater than 119 gallons)
Fuel Oil, Combustible Liquid, NA 1993, III

Non-bulk packagings (capacity less than or equal to 119 gallons)
Not regulated

Transported by air or marine vessel:

Bulk or non-bulk packagings
Gas Oil, 3, UN 1202, III

SECTION 15: REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS

THE FOLLOWING INFORMATION MAY BE USEFUL IN COMPLYING WITH VARIOUS STATE AND FEDERAL LAWS AND REGULATIONS UNDER VARIOUS ENVIRONMENTAL STATUTES:

THRESHOLD PLANNING QUANTITY (TPQ), EPA REGULATION 40 CFR 355
(SARA Sections 301-304)
No TPQ for product or any constituent greater than 1% or 0.1% (carcinogen).

TOXIC CHEMICAL RELEASE REPORTING, EPA REGULATION 40 CFR 372 (SARA Section 313)
No toxic chemical is present greater than 1% or 0.1% (carcinogen).

HAZARDOUS CHEMICAL REPORTING, EPA REGULATION 40 CFR 370 (SARA Sections 311-312)
EPA Hazard Classification Codes: Chronic, Fire

TOXIC SUBSTANCES CONTROL ACT (TSCA)
This product may contain the following TSCA 12b reportable chemical substance(s):
2-Ethylhexanol CAS # 104-76-7

This product, as manufactured by ExxonMobil, does not contain polychlorinated biphenyls (PCB's).

All components of this product are listed on the U.S. TSCA inventory.

SECTION 16: OTHER INFORMATION

The health and safety information presented herein must be used in conjunction with the pertinent standards for training, work practices and facilities design established by OSHA, NIOSH, NFPA, API, NEC, NSC, UNDERWRITERS, BUREAU OF MINES, and similar organizations.

The information and recommendations contained herein are, to the best of ExxonMobil's knowledge and belief, accurate and reliable as of the date issued. ExxonMobil does not warrant or guarantee their accuracy or reliability, and ExxonMobil shall not be liable for any loss or damage arising out of the use thereof.

The information and recommendations are offered for the user's consideration and examination, and it is the user's responsibility to satisfy itself that they are suitable and complete for its particular use. If buyer repackages this product, legal counsel should be consulted to insure proper health, safety and other necessary information is included on the container.

The Environmental Information included under Section 15 hereof as well as the Hazardous Materials Identification System (HMIS) and National Fire Protection Association (NFPA) ratings have been included by ExxonMobil Lubricants & Petroleum Specialties Company, in order to provide additional health and hazard classification information. The ratings recommended are based upon the criteria supplied by the developers of these rating systems, together with ExxonMobil's interpretation of the available data.

ExxonMobil
Lubricants and Petroleum Specialties

DATE ISSUED: 03/15/00
SUPERSEDES DATE: 08/10/99

MATERIAL SAFETY DATA SHEET

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

COMPANY: Exxon Mobil Corporation
ExxonMobil Lubricants & Petroleum
Specialties Company
3225 Gallows Road
Fairfax, VA 22037-0001

PRODUCT NAME	PRODUCT CODE
EXXON SUPREME UNLEADED RFG	000007 - 62100

This Material Safety Data Sheet is valid for all EXXON UNLEADED SUPREME and UNLEADED PREMIUM Reformulated Gasolines and CARB Phase II Gasolines.

PRODUCT CATEGORY
Reformulated Motor Gasoline - Certified under Complex Model Standards
Contains minimum 1.5 weight % oxygen

MEDICAL EMERGENCY TELEPHONE NUMBER: (713) 656-3424

TRANSPORTATION EMERGENCY TELEPHONE NUMBERS
(BAYTOWN) (281) 834-3296 (CHEMTREC) 1-800-424-9300

Product Information and Technical Assistance: 1-800-443-9966

FAXED MSDSs: 1-800-298-4007 MAILED MSDSs OR OTHER ASSISTANCE: (713) 656-5949

SECTION 2: COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS NO. OF COMPONENTS	APPROXIMATE CONCENTRATION
Product is a variable complex mixture of components, principally hydrocarbons, blended to performance, rather than chemical specifications and typically contains the following:		
Naphtha (petroleum), light catalytic cracked	64741-55-5	
Naphtha (petroleum), heavy catalytic cracked	64741-54-4	
Naphtha (petroleum), full-range reformed	68919-37-9	
Naphtha (petroleum), full-range alkylate	64741-64-6	
Naphtha (petroleum), sweetened	64741-87-3	

Butane	106-97-8	
Proprietary additives	Proprietary	

It may include varying amounts of the following identifiable components:

Benzene	71-43-2	0-1.3%
Cumene	98-82-8	0-1%
Cyclohexane	110-82-7	0-1%
Ethylbenzene	100-41-4	0-3%
Naphthalene	91-20-3	0-1%
n-Hexane	110-54-3	0-3%
Toluene	108-88-3	0-20%
Xylene	1330-20-7	0-10%
1,2,4-Trimethylbenzene	95-63-6	0-2%

It may also include varying amounts of oxygenates such as the following:

Di-isopropyl ether	108-20-3	0-18%
Ethanol	64-17-5	0-10%
Ethyl-tertiary-butyl ether	637-92-3	0-18.5%
Methyl-tertiary-butyl ether	1634-04-4	0-16%
Tertiary-amyl-methyl-ether	994-05-8	0-18.5%

SEE SECTION 8 FOR EXPOSURE LIMITS

SECTION 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

OSHA REQUIRED LABEL INFORMATION

In compliance with hazard and right-to-know requirements, where applicable OSHA Hazard Warnings may be found on the label, bill of lading or invoice accompanying this shipment.

DANGER!
EXTREMELY FLAMMABLE
LONG-TERM, REPEATED EXPOSURE MAY CAUSE
CANCER, BLOOD AND NERVOUS SYSTEM DAMAGE

CONTAINS: BENZENE

Note: Product label may contain non-OSHA related information also.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS)

Health	Flammability	Reactivity	BASIS
1	3	0	Recommended by ExxonMobil

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) - HAZARD IDENTIFICATION

Health	Flammability	Reactivity	BASIS
1	3	0	Recommended by the National Fire Protection Association

VARIABILITY AMONG INDIVIDUALS

Health studies have shown that many petroleum hydrocarbons and synthetic lubricants pose potential human health risks which may vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

EFFECTS OF OVEREXPOSURE (Signs and symptoms of exposure)
Prolonged or repeated liquid contact with the skin will dry and defat the skin, leading to possible irritation and dermatitis.
High vapor concentrations (greater than approximately 1000 ppm) are irritating to the eyes and the respiratory tract, and may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death.

PRE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE
Benzene - Individuals with liver disease may be more susceptible to toxic effects.

Hexane - Individuals with neurological disease should avoid exposure.

Petroleum Solvents/Petroleum Hydrocarbons - Skin contact may aggravate an existing dermatitis.

SECTION 4: FIRST AID MEASURES

EYE CONTACT
If splashed into the eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

SKIN
In case of skin contact, remove any contaminated clothing and wash skin with soap and water. Launder or dry-clean clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though intial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

INHALATION
If overcome by vapor, remove from exposure and call a physician immediately. If breathing is irregular or has stopped, start resuscitation, administer oxygen, if available.

INGESTION
If ingested, DO NOT induce vomiting; call a physician immediately.

SECTION 5: FIRE-FIGHTING MEASURES

UNUSUAL FIRE AND EXPLOSION HAZARD

EXTREMELY FLAMMABLE VAPORS CAN TRAVEL AND EXPLODE

FLASH POINT (MINIMUM)
FLAMMABLE - Per DOT 49 CFR 173.120
Approximately -38°C (-36°F)

AUTOIGNITION TEMPERATURE
Approximately 456°C (853°F)
National Fire Protection Association's Guide on Hazardous Materials

FLAMMABLE OR EXPLOSIVE LIMITS (APPROXIMATE PERCENT BY VOLUME IN AIR)
Estimated values: Lower Flammable Limit 1.4% Upper Flammable Limit 7.6%

EXTINGUISHING MEDIA AND FIRE FIGHTING PROCEDURES
Foam, water spray (fog), dry chemical, carbon dioxide and vaporizing liquid type extinguishing agents may all be suitable for extinguishing fires involving this type of product, depending on size or potential size of fire and circumstances related to the situation. Plan fire protection and response strategy through consultation with local fire protection authorities or appropriate specialists.

The following procedures for this type of product are based on the recommendations in the National Fire Protection Association's "Fire Protection Guide on Hazardous Materials", Tenth Edition (1991):

Use dry chemical, foam or carbon dioxide to extinguish the fire. "Water may be ineffective", but water should be used to keep fire-exposed containers cool. If a leak or spill has ignited, use water spray to disperse the vapors and to protect persons attempting to stop a leak. Water spray may be used to flush spills away from exposures. Minimize breathing of gases, vapor, fumes or decomposition products. Use supplied-air breathing equipment for enclosed or confined spaces or as otherwise needed.

NOTE: The inclusion of the phrase "water may be ineffective" is to indicate that although water can be used to cool and protect exposed material, water may not extinguish the fire unless used under favorable conditions by experienced fire fighters trained in fighting all types of flammable liquid fires.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS
Fumes, smoke, carbon monoxide, sulfur oxides, aldehydes and other decomposition products, in the case of incomplete combustion.

SECTION 6: ACCIDENTAL RELEASE MEASURES

CLEAN WATER ACT / OIL POLLUTION ACT
This product may be classified as an oil under Section 311 of the Clean Water Act, and under the Oil Pollution Act. Discharges or spills into or leading to surface waters that cause a sheen must be reported to the National Response Center (1-800-424-8802).

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Shut off and eliminate all ignition sources. Keep people away. Recover free product. Add sand, earth or other suitable absorbent to spill area. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Open all windows and doors. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter sewers, watercourses, or extensive land areas.

Assure conformity with applicable governmental regulations. Continue to observe precautions for volatile, flammable vapors from absorbed material.

SECTION 7: STORAGE AND HANDLING

HANDLING PRECAUTIONS
This liquid is volatile and gives off invisible vapors. Either the liquid or

vapor may settle in low areas or travel some distance along the ground or surface to ignition sources where they may ignite or explode.

Keep product away from ignition sources, such as heat, sparks, pilot lights, static electricity, and open flames.

"EMPTY" CONTAINER WARNING
"Empty" containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

Do not attempt to refill or clean containers since residue is difficult to remove. "Empty" drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

For work on tanks refer to Occupational Safety and Health Administration regulations, ANSI Z49.1, and other governmental and industrial references pertaining to cleaning, repairing, welding, or other contemplated operations.

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMIT FOR TOTAL PRODUCT	BASIS
100 ppm (300 mg/m3) for an 8-hour workday	Recommended by ExxonMobil. OSHA Regulation 29 CFR 1910.1000 and the American Conference of Governmental Industrial Hygienists (ACGIH) list Threshold Limit Values (TLV) of 300 ppm (900 mg/m3) for gasoline for an 8-hour workday; 500 ppm (1500 mg/m3) STEL.
50 ppm (180 mg/m3) for n-hexane for an 8-hour workday	OSHA Regulation 29 CFR 1910.1000 and recommended by the American Conference of Governmental Industrial Hygienists (ACGIH)
50 ppm (187 mg/m3) for toluene (skin) for an 8-hour workday	Recommended by the American Conference of Governmental Industrial Hygienists (ACGIH)
25 ppm (90 mg/m3) for methyl-tertiary-butyl ether for an 8-hour workday	Recommended by ExxonMobil
75 ppm (270 mg/m3) for methyl-tertiary-butyl ether for a 15 minute STEL	Recommended by ExxonMobil
The airborne benzene level shall not exceed 1 ppm for an 8-hour workday; 5 ppm STEL	OSHA Regulation 29 CFR 1910.1028

VENTILATION
Use only with ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air. No smoking, or

use of flame or other ignition sources.

RESPIRATORY PROTECTION
Use supplied-air respiratory protection in confined or enclosed spaces, if needed.

PROTECTIVE GLOVES
Use chemical-resistant gloves, if needed, to avoid prolonged or repeated skin contact.

EYE PROTECTION
Use splash goggles or face shield when eye contact may occur.

OTHER PROTECTIVE EQUIPMENT
Use chemical-resistant apron or other impervious clothing, if needed, to avoid contaminating regular clothing, which could result in prolonged or repeated skin contact.

WORK PRACTICES / ENGINEERING CONTROLS
To prevent fire or explosion risk from static accumulation and discharge, effectively bond and/or ground product transfer system in accordance with (THE) National Fire Protection Association PUBLICATIONS.

Keep containers closed when not in use. Do not store near heat, sparks, flame or strong oxidants. Adequate ventilation required sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air. Tanks that have been in leaded gasoline service may have lead-containing residue. Special precautions needed in cleaning. See American Petroleum Institute publications 2013, 2015 and 2015A. No smoking, flame or other ignition sources.

To minimize fire or explosion risk from static charge accumulation and discharge, effectively bond and/or ground product transfer system in accordance with the National Fire Protection Association standard for petroleum products.

Do not use electronic devices (including but not limited to cellular phones, computers, calculators, pagers or other electronic devices, etc.) in or around any fueling operation or storage area unless the devices are certified intrinsically safe by an approved national testing agency and to the safety standards required by the national and/or local laws/regulations.

For use as a motor fuel only. Do not use as a cleaning solvent, or thinner, or for other non-motor fuel uses. Do not siphon by mouth. Minute amounts of liquid gasoline aspirated into the lungs may cause potentially fatal chemical pneumonitis.

In order to prevent fire or explosion hazards, use appropriate equipment.

Information on electrical equipment appropriate for use with this product may be found in the latest edition of the National Electrical Code (NFPA-70). This document is available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

PERSONAL HYGIENE
Minimize breathing vapor or mist. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before re-use. Remove contaminated shoes and thoroughly clean and dry before re-use. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners

followed by washing thoroughly with soap and water.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

The following data are approximate or typical values and should not be used for precise design purposes.

BOILING RANGE
Approximately 21~C (70~F) IBP
to 225~C (437~F) FBP

SPECIFIC GRAVITY (15.6 Deg C/15.6 Deg C)
Approximately 0.74

MOLECULAR WEIGHT
Complex mixture, components vary
from approximately 45 to 185

pH
Essentially neutral

POUR, CONGEALING OR MELTING POINT
Less than -38~C (-36~F)
Pour Point by ASTM D 97

VISCOSITY
Approximately 0.5 cSt @ 25~C

PRODUCT APPEARANCE AND ODOR
Clear colored liquid (typically orange)
Gasoline hydrocarbon odor

VAPOR PRESSURE
Varies seasonally from
approximately 5 to 15 psi
Reid Vapor Pressure

VAPOR DENSITY (AIR = 1)
Approximately 5

PERCENT VOLATILE BY VOLUME
100

EVAPORATION RATE @ 1 ATM. & 25 Deg C
(77 Deg F) (n-BUTYL ACETATE = 1)
Approximately 10-11

SOLUBILITY IN WATER @ 1 ATM.
AND 25 Deg C (77 Deg F)
Negligible; less than 0.1%

SECTION 10: STABILITY AND REACTIVITY

This product is stable and will not react violently with water. Hazardous polymerization will not occur. Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, etc., as this presents a serious explosion hazard.

SECTION 11: TOXICOLOGICAL INFORMATION

NATURE OF HAZARD AND TOXICITY INFORMATION
WARNING: Concentrated, prolonged or deliberate inhalation of this product may cause brain and nervous system damage. Prolonged and repeated exposure of pregnant animals to high levels of toluene (levels greater than approximately 1500 ppm) has been reported to cause adverse fetal developmental effects.

This product contains ethylbenzene. A study conducted by the National Toxicology Program states that lifetime inhalation exposure of rats and mice to high concentrations of ethylbenzene (750 ppm) resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations of ethylbenzene (75 ppm or 250 ppm). The study does not address the relevance of these results to humans.

Prolonged or repeated skin contact with this product tends to remove skin oils, possibly leading to irritation and dermatitis; however, based on human experience and available toxicological data, this product is judged to be neither a "corrosive" nor an "irritant" by OSHA criteria.

Product contacting the eyes may cause eye irritation.

This product may contain up to a maximum of 1.3 weight percent benzene, CAS # 71-43-2, as a natural constituent of various gasoline blend components. Benzene can cause anemia and other blood diseases, including leukemia (cancer of the blood-forming system), after prolonged or repeated exposures at high concentrations (e.g., 50-500 ppm). It has also caused fetal defects in tests on laboratory animals.

Contains light hydrocarbon components. Lifetime studies by the American Petroleum Institute have shown that kidney damage and kidney cancer can occur in male rats after prolonged inhalation exposures at elevated concentrations of total gasoline. Kidneys of mice and female rats were unaffected. The U.S. EPA Risk Assessment Forum has concluded that the male rat kidney tumor results are not relevant for humans. Total gasoline exposure also produced liver tumors in female mice only. The implication of these data for humans has not been determined. Certain components, such as normal hexane, may also affect the nervous system at high concentrations (e.g., 1000-1500 ppm).

The presence of n-hexane (normal-hexane) in this product represents a distinct hazard of producing peripheral polyneuropathy, a progressive disorder of the nervous system, which with sufficient high exposure has the potential of becoming irreversible. This disorder has been observed in individuals exposed repeatedly to high vapor concentrations (1000-1500 ppm) of n-hexane over a period of several months. Exposure to this product should be controlled to keep the maximum level below 100 ppm, which will result in n-hexane exposure of 50 ppm or less. The OSHA 8-hour Time Weighted Average-Permissible Exposure Limit (TWA-PEL) is 50 ppm for n-hexane.

Simultaneous exposure to the vapors of n-hexane and methyl ethyl ketone (MEK) or to n-hexane and methyl isobutyl ketone (MIBK) increases the risk of adverse effects from n-hexane. Evidence in laboratory animals and humans indicates that in the presence of MEK or MIBK the neuropathy associated with n-hexane is produced in a shorter time or at lower exposure concentrations. This interaction has not been reported when the exposure to n-hexane is below the American Conference of Governmental Industrial Hygienists (ACGIH) limit of 50 ppm and MEK is below the ACGIH limit of 200 ppm or when MIBK is below the ACGIH limit of 50 ppm.

Product has a low order of acute oral and dermal toxicity, but minute amounts aspirated into the lungs during ingestion or vomiting may cause mild to severe pulmonary injury and possibly death.

This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and an acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.

Inhalation of components of exhaust from burning, such as carbon monoxide, may cause death at high concentrations. Exposure to the exhaust of this fuel should be minimized.

Methyl Tertiary Butyl Ether (MTBE) was tested for carcinogenicity, neurotoxicity, chronic, reproductive and developmental toxicity. The NOEL for all endpoints evaluated in three animal species was 400 ppm or greater. An increase in kidney tumors/damage and liver tumors was observed in animals exposed to high concentrations of MTBE. Some embryo/fetal toxicity and birth defects were observed in the offspring of pregnant mice exposed to maternally toxic doses of MTBE, however the offspring of exposed pregnant rabbits were unaffected. The significance of the animal findings at high exposures are not believed to be directly related to potential human health hazards in the workplace.

SECTION 12: ECOLOGICAL INFORMATION

Do not discharge this product into public waters or waterways unless authorized by a National Pollution Discharge Elimination System (NPDES) permit issued by the Environmental Protection Agency (EPA).

Environmental and Ecological data may be available for this product. Write or call ExxonMobil to obtain further information. Refer to Section 6 and Section 15 for Accidental Release information and Regulatory Reporting information.

SECTION 13: DISPOSAL CONSIDERATION

Options for disposal of this product may depend on the conditions under which it was used. To determine the proper method of disposal, refer to RCRA (40 CFR 261), as well as federal EPA and state and local regulations.

Please refer to Sections 5, 6 and 15 for additional information.

SECTION 14: TRANSPORTATION INFORMATION

TRANSPORTATION INCIDENT INFORMATION
For further information relative to spills resulting from transportation incidents, refer to latest Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents.

U.S. DOT HAZARDOUS MATERIALS SHIPPING DESCRIPTION
Gasoline, 3, UN 1203, II

SECTION 15: REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS

THE FOLLOWING INFORMATION MAY BE USEFUL IN COMPLYING WITH VARIOUS STATE AND FEDERAL LAWS AND REGULATIONS UNDER VARIOUS ENVIRONMENTAL STATUTES:

THRESHOLD PLANNING QUANTITY (TPQ), EPA REGULATION 40 CFR 355
(SARA Sections 301-304)
No TPQ for product or any constituent greater than 1% or 0.1% (carcinogen).

TOXIC CHEMICAL RELEASE REPORTING, EPA REGULATION 40 CFR 372 (SARA Section 313)
This product may contain:
Up to 1.3% benzene.
Up to 1% cumene.
Up to 1% cyclohexane.
Up to 3% ethylbenzene.
Up to 16% methyl-tertiary-butyl ether.
Up to 1% naphthalene.
Up to 3% n-hexane.
Up to 20% toluene.
Up to 10% xylene.
Up to 2% 1,2,4-Trimethylbenzene

HAZARDOUS CHEMICAL REPORTING, EPA REGULATION 40 CFR 370 (SARA Sections 311-312)
EPA Hazard Classification Codes: Acute, Chronic, Fire

TOXIC SUBSTANCES CONTROL ACT (TSCA)
This product may contain the following TSCA 12b reportable chemical substance(s):
Isopropanol (IPA) CAS # 67-63-0
Methyl-tertiary-butyl ether (MTBE) CAS # 1634-04-4
Tertiary-amyl-methyl-ether (TAME) CAS # 994-05-8

This product, as manufactured by ExxonMobil, does not contain polychlorinated biphenyls (PCB's).

All components of this product are listed on the U.S. TSCA inventory.

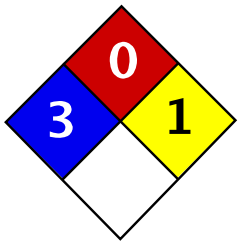
SECTION 16: OTHER INFORMATION

The health and safety information presented herein must be used in conjunction with the pertinent standards for training, work practices and facilities design established by OSHA, NIOSH, NFPA, API, NEC, NSC, UNDERWRITERS, BUREAU OF MINES, and similar organizations.

The information and recommendations contained herein are, to the best of ExxonMobil's knowledge and belief, accurate and reliable as of the date issued. ExxonMobil does not warrant or guarantee their accuracy or reliability, and ExxonMobil shall not be liable for any loss or damage arising out of the use thereof.

The information and recommendations are offered for the user's consideration and examination, and it is the user's responsibility to satisfy itself that they are suitable and complete for its particular use. If buyer repackages this product, legal counsel should be consulted to insure proper health, safety and other necessary information is included on the container.

The Environmental Information included under Section 15 hereof as well as the Hazardous Materials Identification System (HMIS) and National Fire Protection Association (NFPA) ratings have been included by ExxonMobil Lubricants & Petroleum Specialties Company, in order to provide additional health and hazard classification information. The ratings recommended are based upon the criteria supplied by the developers of these rating systems, together with ExxonMobil's interpretation of the available data.



Health	3
Fire	0
Reactivity	1
Personal Protection	

Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer).
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid].
MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible.
Calcium carbide reacts with hydrogen chloride gas with incandescence.
Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine.
Rubidium acetylene carbides burns with slightly warm hydrochloric acid.
Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved.
Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas.
Cesium acetylene carbide burns hydrogen chloride gas.
Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute.
Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:
Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate.
Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid.
Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture.
May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States]
CEIL: 7 (mg/m3) from OSHA (PEL) [United States]
CEIL: 5 from NIOSH
CEIL: 7 (mg/m3) from NIOSH
TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)]
TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water)
83 C @ 760 mm Hg (for 31% HCl in water)
50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water)
-46.2 C (31.24% HCl in water)
-25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1)
1.10 (20%and 22% HCl solutions)
1.12 (24% HCl solution)
1.15 (29.57% HCl solution)
1.16 (32% HCl solution)
1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals.
Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316).
Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product.
Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C.
Sodium reacts very violently with gaseous hydrogen chloride.
Calcium phosphide and hydrochloric acid undergo very energetic reaction.
It reacts with oxidizers releasing chlorine gas.
Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates.
Reacts with most metals to produce flammable Hydrogen gas.
Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure)
Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid.
Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction.
Hydrogen chloride causes aldehydes and epoxides to violently polymerize.
Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:
Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions).
It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys.
No corrosivity data on zinc, steel.
Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse].
Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid].
May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin,

eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, .
Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL)
LDL [Man] -Route: Oral; 2857 ug/kg
LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M
LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity).
May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Corrosive. Causes severe skin irritation and burns.
Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis.
Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure,
occur, particularly if exposure is prolonged. May affect the liver.
Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis).
Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel.
Chronic Potential Health Effects:
dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid
Illinois toxic substances disclosure to employee act: Hydrochloric acid
Illinois chemical safety act: Hydrochloric acid
New York release reporting list: Hydrochloric acid
Rhode Island RTK hazardous substances: Hydrochloric acid
Pennsylvania RTK: Hydrochloric acid
Minnesota: Hydrochloric acid
Massachusetts RTK: Hydrochloric acid
Massachusetts spill list: Hydrochloric acid
New Jersey: Hydrochloric acid
New Jersey spill list: Hydrochloric acid
Louisiana RTK reporting list: Hydrochloric acid
Louisiana spill reporting: Hydrochloric acid
California Director's List of Hazardous Substances: Hydrochloric acid
TSCA 8(b) inventory: Hydrochloric acid
TSCA 4(a) proposed test rules: Hydrochloric acid
SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid
SARA 313 toxic chemical notification and release reporting: Hydrochloric acid
CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns.
R37- Irritating to respiratory system.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves.
Full suit.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Face shield.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 05:45 PM

Last Updated: 10/09/2005 05:45 PM

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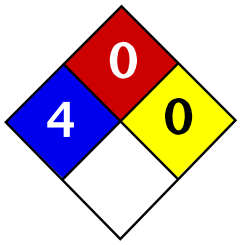

Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet
Nitric acid, 70% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nitric acid, 70%

Catalog Codes: SLN1963, SLN1549

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Water; Nitric acid, fuming

CI#: Not applicable.

Synonym: Nitric Acid, 70%

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Water	7732-18-5	30
Nitric acid, fuming	7697-37-2	70

Toxicological Data on Ingredients: Nitric acid, fuming: VAPOR (LC50): Acute: 244 ppm 0.5 hours [Rat]. 344 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to lungs, mucous membranes, upper respiratory tract, skin, eyes, teeth.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of combustible materials

Explosion Hazards in Presence of Various Substances:
Explosive in presence of reducing materials, of metals, of alkalis.
Slightly explosive in presence of combustible materials.
Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Flammable in presence of cellulose or other combustible materials.
Phosphine, hydrogen sulfide, selenide all ignite when fuming nitric acid is dripped into gas.
Phosphine ignites in concentrated nitric acid.
Nickel tetraphosphide ignites with fuming nitric acid.
Contact with metals may evolve flammable hydrogen gas.
A jet of ammonia will ignite nitric acid vapor.
Cellulose may be converted to the highly flammable nitrate ester on contact with the vapor of nitric acid as well as the liquid itself.

Special Remarks on Explosion Hazards:
Reacts exlposively with metallic powders, carbides, cyanides, sulfides, alkalies and turpentine.
Can react explosively with many reducing agents.
Arsine, phosphine, tetraborane all oxidized explosively in presence of nitric acid.
Cesium and rubidium acetylides explode in contact with nitric acid.
Explosive reaction with Nitric Acid + Nitrobenzene + water.
Detonation with Nitric Acid + 4-Methylcyclohexane.
The addition of warm fuming nitric acid to phosphine causes explosion.
Addition of water to nitration mixture diluted with an equal volume of water can cause a low order explosion.
Cyclopentadiene reacts explosively with fuming nitric acid.
Mixtures of fuming nitric acid and acetonitrile are high explosives.
(Nitric acid, fuming)

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Oxidizing material. Poisonous liquid.
Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, metals, acids, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 23°C (73.4°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their

respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 2 STEL: 4 (ppm) from ACGIH (TLV) [United States]
TWA: 2 STEL: 4 from OSHA (PEL) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Acrid. Disagreeable and choking. (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point: 121°C (249.8°F)

Melting Point: -41.6°C (-42.9°F)

Critical Temperature: Not available.

Specific Gravity: 1.408 (Water = 1)

Vapor Pressure: 6 kPa (@ 20°C)

Vapor Density: 2.5 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.29 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in cold water, hot water.
Soluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances:
Highly reactive with alkalis.
Reactive with reducing agents, combustible materials, organic materials, metals, acids.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of brass.
Non-corrosive in presence of glass, of stainless steel(304), of stainless steel(316)

Special Remarks on Reactivity:
A strong oxidizer.
Reacts violently with alcohol, organic material, turpene, charcoal.
Violent reaction with Nitric acid + Acetone and Sulfuric acid.
Incompatible with combustible materials, metallic powders, hydrogen sulfide, carbides, aldehydes, cyanides, chromic acid, hydrogen sulfide, metals, metal powders, organic solvents, acetic acid, alcohols.
Nitric Acid will react with water or steam to produce heat and toxic, corrosive and flammable vapors.
(Nitric acid, fuming)

Special Remarks on Corrosivity:
In presence of traces of oxides, it attacks all base metals except aluminum and special chromium steels.
It will attack some forms of plastics, rubber, and coatings.
Nitric Acid corrodes almost all metals except gold, and white gold, forming nitrates.
No corrosive effect on bronze.
No corrosivity data for zinc, and steel

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
Contains material which may cause damage to the following organs: lungs, mucous membranes, upper respiratory tract, skin, eyes, teeth.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive).
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals: LDL - Lowest Published Lethal Dose [Human] - Route: Oral; Dose: 430 mg/kg (Nitric acid, fuming)

Special Remarks on Chronic Effects on Humans: May cause adverse reproductive effects based on animal data (effects on newfborn, fetotoxicity)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Severely irritates skin. Causes skin burns and may cause deep and penetrating ulcers of the skin with a characteristic yellow to brownish discoloration. May be fatal if absorbed through skin.
Eyes: Severely irritates eyes. Causes eye burns. May cause irreversible eye injury.
Ingestion: May be fatal if swallowed. Causes serious gastrointestinal tract irritation or burns with nausea, vomiting, severe abdominal pain, and possible "coffee grounds" appearance of the vomitus . May cause perforation of the digestive tract.

Inhalation: May be fatal if inhaled. Vapor is extremely hazardous. Vapor may cause nitrous gas poisoning. Effects may be delayed. May cause irritation of the mucous membranes and respiratory tract with burning pain in the nose and throat, coughing, sneezing, wheezing, shortness of breath and pulmonary edema. Other symptoms may include nausea, and vomiting.
Chronic Potential Health Effects:
Repeated inhalation may produce changes in pulmonary function and/or chronic bronchitis. It may also affect behavior (headache, dizziness, drowsiness, muscle contaction or spasticity, weakness, loss of coordinaton, mental confusion), and urinary system (kidney faillure, decreased urinary output after several hours of uncorrected circulatory collapse).
Repeated exposure may cause discoloration and/or errosion of teeth (dental enamel).
Eye irritation and respiratory tract signs and symptoms resembling those of frequent upper respiratory viral infections have been associated with chronic nitric acid exposure.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Nitric acid (Nitric acid, fuming) UNNA: 2031 PG: II

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
New York release reporting list: Nitric acid, fuming
Rhode Island RTK hazardous substances: Nitric acid, fuming
Pennsylvania RTK: Nitric acid, fuming
Florida: Nitric acid, fuming
Minnesota: Nitric acid, fuming
Massachusetts RTK: Nitric acid, fuming
New Jersey: Nitric acid, fuming
TSCA 8(b) inventory: Water; Nitric acid, fuming
SARA 302/304/311/312 extremely hazardous substances: Nitric acid, fuming
SARA 313 toxic chemical notification and release reporting: Nitric acid, fuming 70%
CERCLA: Hazardous substances.: Nitric acid, fuming: 1000 lbs. (453.6 kg);

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
CLASS E: Corrosive liquid.

DSCL (EEC):
R8- Contact with combustible material may cause fire.
R35- Causes severe burns.
S23- Do not breathe gas/fumes/vapour/spray [***]
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S36- Wear suitable protective clothing.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 4

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Full suit.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 10/10/2005 10:58 AM

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EA Engineering, Science,
and Technology, Inc.

South Central Region
405 S. Highway 121, Suite C-100
Lewisville, TX 75067
Telephone: 972-315-3922
Fax: 972-315-5181
www.eaest.com

29 November 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Sampling and Analysis Plan (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Sampling and Analysis Plan (SAP) (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 29 November 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 29 November 2010	TRANSMITTAL NO. 0004
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
1.2.2	Sampling and Analysis Plan (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

Sampling and Analysis Plan for Non-Time Critical Removal Support Gulfco Marine Maintenance Site Freeport, Brazoria County, Texas EPA Identification No. TXD055144539

Remedial Action Contract 2 Full Service Contract: EP-W-06-004 Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
Building C, Suite 100
Lewisville, Texas 75067
(972) 315-3922

November 2010
Revision: 00
EA Project No. 14342.67

Sampling and Analysis Plan for
Non-Time Critical Removal Support
Gulfco Marine Maintenance Site
Freeport, Brazoria County, Texas
EPA Identification No. TXD055144539

Remedial Action Contract 2 Full Service
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

29 November 2010

Tim Startz, P.M.P. Date
EA Program Manager

29 November 2010

David S. Santoro, P.E., L.S. Date
EA Quality Assurance Officer

Gary Miller Date
U.S. Environmental Protection Agency Region 6 Task Order Monitor

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1	Project Organization
2	Proposed Sample Locations

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1	Elements of U.S. Environmental Protection Agency QA/R-5 in Relation to this Sampling and Analysis Plan
2	Data Quality Objectives
3	Quality Assurance Indicator Criteria
4	Chemicals of Potential Ecological Concern Sediment Benchmarks
5	Analytical Program and Methods
6	Sample Location Coordinates
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8	Frequency of Field Quality Control Samples

LIST OF ACRONYMS AND ABBREVIATIONS

AST	Aboveground Storage Tank
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limits
DQO	Data Quality Objective
EE/CA	Engineering Evaluation and Cost Analysis
EA	EA Engineering, Science, and Technology, Inc.
EDD	Electronic Data Deliverable
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
ft	Feet
Gulfco	Gulfco Marine Maintenance
HSP	Health and Safety Plan
LCS	Laboratory Control Sample
MACTEC	MACTEC Engineering and Consulting, Inc.
MDL	Method Detection Limit
MD	Matrix Duplicate
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NTCRS	Non-time Critical Removal Support
OSHA	Occupational Safety and Health Administration
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PRP	Potentially Responsible Party
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAC 2	Remedial Action Contract 2
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Statement of Work
SVOC	Semivolatile Organic Compound
TCEQ	Texas Commission on Environmental Quality
TOM	Task Order Monitor
VOC	Volatile Organic Compound

1. PROJECT DESCRIPTION AND MANAGEMENT

EA Engineering, Science, and Technology, Inc. (EA) has been authorized by the U.S. Environmental Protection Agency (EPA), under Remedial Action Contract (RAC) No. EP-W-06-004, Task Order 0062-RICO-067Z, to provide non-time critical removal support (NTCRS) services at the Gulfco Marine Maintenance (Gulfco) Superfund site, located at 906 Marlin Avenue, Freeport, Brazoria County, Texas. EA has prepared this Sampling and Analysis Plan (SAP) in accordance with: (1) specifications provided in the EPA Task Order Statement of Work (SOW), dated 6 October 2010 (EPA 2010c); (2) the EPA-approved EA Work Plan (EA 2010b); and (3) subsequent discussions with EPA.

This SAP is a combination Quality Assurance Project Plan and Field Sampling Plan that has been prepared to detail sample collection procedures and analytical methods needed to collect sufficient data for the NTCRS activities at the Gulfco site. Combining these two standard deliverables into a single document allows a streamlining of the planning process, while ensuring that data collected are of sufficient quality for its intended use.

This SAP was prepared in conjunction with the Health and Safety Plan (HSP) (EA 2010c), which together, present the overall approach for implementing the RI field program. The HSP specifies employee training, protective equipment, personal air monitoring procedures, medical surveillance requirements, standard operating procedures, and contingency planning procedures. This SAP was prepared in accordance with EA's Quality Management Plan (EA 2010a) and meets requirements set forth in *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5* (EPA 2001) and *EPA Guidance for Quality Assurance Project Plans, QA/G-5* (EPA 2002). This SAP describes procedures to assure that the project-specific data quality objectives (DQOs) are met, and that the quality of data (represented by precision, accuracy, completeness, comparability, representativeness, and sensitivity) is known and documented. The SAP presents the project description, project organization and responsibilities, and quality assurance (QA) objectives associated with the sampling and analytical services to be provided in support of NTCRS activities at the Gulfco site. Table 1 demonstrates how this SAP complies with all elements of a QAPP currently required by EPA guidance (EPA 2001, 2002).

The overall QA objectives are as follows:

- Attain quality control (QC) requirements for analyses specified in this SAP
- Obtain data of known quality for the NTCRS and ecological risks
- Document performance of the PRP's quality program including performance of the work and any required changes to work at the site.

The EA Project Manager, Mr. Al Sloan, is responsible for implementing all activities required by this Task Order. Figure 1 presents the proposed project organization for this Task Order. The EPA Region 6 Task Order Monitor (TOM), Mr. Gary Miller, is responsible for the NTCRS activities. EA and its team subcontractor, MACTEC Engineering and Consulting, Inc. (MACTEC), will perform all tasks under this Task Order in accordance with this SAP.

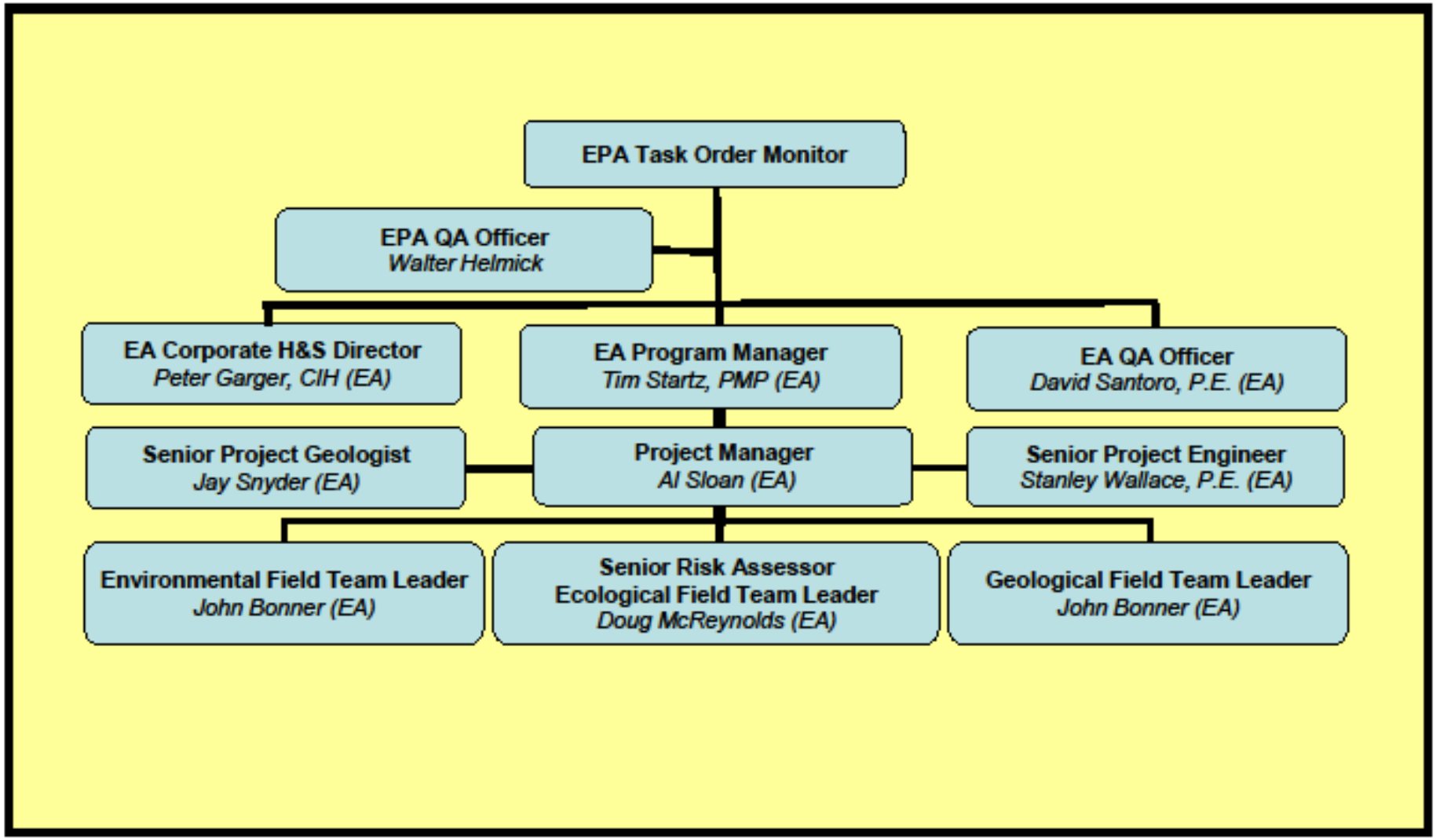


Figure 1. Project Organization.

TABLE 1 ELEMENTS OF U.S. ENVIRONMENTAL PROTECTION AGENCY QA/R-5 IN RELATION TO THIS SAMPLING AND ANALYSIS PLAN

EPA QA/R-5 Quality Assurance Project Plan Element		EA SAP	
A1	Title and Approval Sheet	Title and Approval Sheet	
A2	Table of Contents	Table of Contents	
A3	Distribution List	Distribution List	
A4	Project/Task Organization	1.0	Project Description and Management
A5	Problem Definition/Background	1.1	Site Background and Problem Definition
A6	Project/Task Description	1.2	Description of Project Objectives and Tasks
A7	Quality Objectives and Criteria	1.3	Data Quality and Measurement Objectives
A8	Special Training/Certification	1.4	Special Training Requirements and Certification
A9	Documents and Records	1.5	Documentation and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody Requirements
B4	Analytical Methods	2.4	Analytical Methods Requirements
B5	Quality Control	2.5	Quality Control Requirements
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Instrument and Equipment Testing, Inspection, and Maintenance Requirements
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Requirements for Inspection and Acceptance of Supplies and Consumables
B9	Non-Direct Measurements	2.9	Data Acquisition Requirements (Non-Direct Measurements)
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review and Reduction Requirements
D2	Validation and Verification Methods	4.2	Validation and Verification Methods
D3	Reconciliation with User Requirements	4.3	Reconciliation with Data Quality Objectives

1.1 SITE BACKGROUND AND PROBLEM DEFINITION

This section describes the following:

- Site background and description (Section 1.1.1)
- Problem definition (Section 1.1.2).

1.1.1 Site Background

The Gulfco site is located in Freeport, Texas, at 906 Marlin Avenue (also referred to as County Road 756). The site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek approximately 1 mile to the east and the Texas Highway 332 bridge approximately 1 mile to the west. The site

includes approximately 1,200 feet (ft) of shoreline on the Intracoastal Waterway, a coastal shipping canal that extends from Port Isabel to West Orange on the Texas Gulf Coast.

Marlin Avenue divides the Gulfco site into two areas. The property to the north of Marlin Avenue consists of wetlands and the closed surface impoundments. The property south of Marlin Avenue was developed for industrial uses with a dry dock, sand blasting areas, an aboveground storage tank (AST) tank farm, and two barge slips connected to the Intracoastal Waterway. The site was operated as a barge cleaning and repair facility from 1971 until 1999.

The former surface impoundments were three contiguous earthen pits with natural clay liners located in Lot 56 on the north side of Marlin Avenue. These former impoundments were used for storage of waste oils, caustics, various organic chemicals, and wash waters generated during barge cleaning activities. The former impoundments were closed in 1982 when the liquids and majority of sludges were removed and the remaining sludge was solidified with soil and left in place. The former impoundments were then capped with 3-feet of clay cover and a hard wearing (shell) surface. During recent investigations at the site, the cap was found to be between 2.5-ft and 3.6-ft thick, and was rutted on the western end.

Previous investigations at the Gulfco site found that the sediment north of Marlin Avenue contained several chemicals of potential ecological concern at concentrations exceeding the screening levels (see Appendix A). These chemicals include polynuclear aromatic hydrocarbons and several metals. Subsequent investigations by the PRP have shown that the sediments are not toxic to the polycheate worm Neanthes arenaceodentata and the amphipod Leptocheirus plumulosus (PBW 2010).

1.1.2 Problem Definition

The purpose of this Task Order is to implement the NTCRS at the Gulfco site to select a removal action alternative to eliminate, reduce, or control risks to human health and the environment. The NTCRS will consist of preparation of an Engineering Evaluation and Cost Analysis (EE/CA) report and a Preliminary Draft Action Memorandum for the repair of an existing cap over the former impoundments and for a wetlands sediment hot-spot removal. However, EPA will determine the selected removal alternative. Toxicity sampling recently performed at the Gulfco site by the potentially responsible parties (PRPs) is being used to determine whether the wetland sediment hot-spot removal will be required. For planning purposes, the sediment removal has been included in the scope of the EE/CA, and will remain a part of the Task Order until or unless the PRP data and EA sampling results indicate that the sediment hot-spot removal is not required to protect human health and the environment. The data to be collected as part of this Task Order work scope are expected to be available sometime in the March 2011 timeframe.

The EPA SOW (2010c) and approved Work Plan (EA 2010b) sets forth the framework and requirements for the NTCRS activities. The goal for completion of this Task Order is 31 May 2011.

1.2 DESCRIPTION OF PROJECT OBJECTIVES AND TASKS

This section describes the project objectives and tasks for this SAP.

1.2.1 Project Objectives

The primary objectives for this SAP are as follows:

- Collect sufficient sediment data to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP.
- Collect sufficient data to evaluate lithology and hydraulic conductivity of existing cap material.
- Determine suitability of soil from the borrow area onsite for use in repairing the existing cap.

Based on technical direction provided by EPA during the scoping meeting, EA will submit samples for chemical analysis to the Contract Laboratory Program (CLP) l. EA anticipates CLP laboratory analysis of the following sample quantities (subject to change):

- Eight (8) wetland sediment samples will be analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, and pesticides.
- Three (3) soil cores through the existing cap material for vertical hydraulic conductivity testing.
- Two (2) borrow area clay samples will be analyzed for VOCs, SVOCs, metals, pesticides, and physical geotechnical parameters.

The analytical parameters, number of samples, and sample media are discussed in greater detail in Section 2.

1.2.2 Tasks

To complete the NTCRS activities, EA will perform the following tasks (with subtasks), which are outlined in the approved Work Plan (EA 2010b):

- Project Planning and Support
- Community Involvement
- Field Investigation/Data Acquisition
- Sample Analysis
- Analytical Support and Data Validation
- Data Evaluation
- Risk Assessment
- Identification and Screening of Removal Alternatives

- Analysis of Removal Alternatives
- Engineering Evaluation/Cost Analysis Report
- Post-EE/CA Support
- Task Order Closeout.

To meet the project objective, EA's tasks include the collection of samples. EA's field activities will be conducted in accordance with this SAP to ensure the proper management of samples, including accurate chain-of-custody procedures for sample tracking, protective sample-packing techniques, and proper sample-preservation techniques. The requirements of EA's site-specific HSP (EA 2010c) will be followed. Sample management will be conducted using the EPA-approved Forms II Lite software. EA will document the characterization and disposal of investigation-derived wastes in accordance with local, state, and federal regulations, as appropriate.

1.3 DATA AND MEASUREMENT QUALITY OBJECTIVES

The following subsections present the DQOs and measurement quality objectives (MQOs) identified for this project.

1.3.1 Data Quality Objectives

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000; 2006a). The DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify acceptance criteria that will be used to evaluate whether the quantity and quality of data collected are sufficient to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. The seven steps of the DQO process for this project are as follows:

- Step 1 – State the Problem
  - Define the problem that necessitates the study.
  - Identify the planning team.
  - Examine budget and schedule.

- Step 2 – Identify the Goal of the Study
  - State how environmental data will be used in meeting objectives and solving the problem.
  - Identify study questions.
  - Define alternative outcomes.

- Step 3 – Identify Information Inputs
  - Identify data and information needed to answer study questions.

- Step 4 – Define the Boundaries of the Study
  - Specify the target population and characteristics of interest.
  - Define spatial and temporal limits.

— Define the scale of inference.

- Step 5 – Develop the Analytical Approach
  — Define the parameter of interest.
  — Specify the type of inference.
  — Develop the logic for drawing conclusions from findings.

- Step 6 – Specify the Performance or Acceptance Criteria
  — Specify probability limits for false rejection and false acceptance decision errors.
  — Develop performance criteria for new data being collected or acceptance criteria for existing data being considered for use.

- Step 7 – Develop the Plan for Obtaining Data
  — Select the resource-effective sampling and analysis plan that meets the performance criteria.

The 7-step iterative process used to prepare the DQOs for this project is presented in Table 2.

TABLE 2 DATA QUALITY OBJECTIVES

STEP 1: STATE THE PROBLEM
• Wetland areas north of Marlin Avenue have not been adequately delineated by the PRP. Additional sediment data is required to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP. • The existing cap that covers the former surface impoundments requires repair. Additional data is required to evaluate the vertical hydraulic conductivity of existing cap material. • Additional information is required to determine the suitability of soil from the onsite borrow area for use in repairing the existing cap.
STEP 2: IDENTIFY THE GOALS FOR THE STUDY
• Collect sediment samples from designated wetland areas to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP. • Collect soil core samples to evaluate the vertical hydraulic conductivity of existing cap material. • Determine the suitability of the borrow materials from onsite borrow area for use in repairing the existing cap.
STEP 3: IDENTIFY INPUTS TO THE DECISIONS
• Analytical results for wetland sediment samples • Geotechnical testing data for existing cap material • Analytical and geotechnical data for onsite borrow material.

STEP 4: DEFINE STUDY BOUNDARIES
• For wetland sediments, the horizontal study boundary is defined by the Former Surface Impoundment Area (Figure 2), and the vertical boundary is 6 inches deep. • For samples collected from the existing cap, the horizontal study boundary is the existing cap over the former surface impoundments, and the vertical boundary is no deeper than 5 feet into the existing cap. • For borrow area samples, the horizontal study boundary is the borrow area, and the vertical boundary approximately one foot.
STEP 5: DEVELOP THE ANALYTIC APPROACH
• Sediment samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and metals using CLP SOM01.2 (EPA 2005; 2007a) and ISM01.2 (EPA 2010a); analytical results will be compared to TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006) and PRP data. • Soil cores from the existing cap material will undergo vertical hydraulic conductivity testing to determine the permeability of the existing cap to moisture. • Borrow material samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and metals using CLP SOM01.2 (EPA 2005; 2007a) and ISM01.2 (EPA 2010a); analytical results will be compared to TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006) and PRP data. Samples will be also undergo geotechnical testing. • .
STEP 6: SPECIFY THE PERFORMANCE OR ACCEPTANCE CRITERIA
• Sediment samples will be analyzed by CLP and EPA methods that have been selected based on the reporting limits capable of evaluating concentrations below TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006). • QA samples will be collected during each phase of sampling to evaluate sampling techniques and consistency. • Analytical results will be evaluated within their own tolerance limits and compared to TCEQ ecological screening sediment benchmarks (TCEQ 2001; 2006) and PRP data.
STEP 7: DEVELOP THE PLAN FOR OBTAINING DATA
• Sediment sample data will be compared to TCEQ ecological screening sediment benchmarks (TCEQ 2006) and PRP data to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; (2) resolve any data gaps; and (3) evaluate the usability of collocated PRP data. • Vertical hydraulic conductivity data will be used to determine the permeability of the existing cap to moisture. • Borrow material data will be used to establish the suitability of the material for use in repairing the existing cap.

Key to systematic planning is determining whether the problem to be solved requires a quantitative or qualitative answer (EPA 2000a,b,c; 2006a). Only data from fixed laboratories will be collected and analyzed during the investigation. The fixed-laboratory analyses for the sediment samples collected from wetlands areas and soil/sediment samples collected from the borrow area will be conducted by a EPA-designated Contract Laboratory Program (CLP) laboratory. However, if the CLP does not have capacity or cannot perform a specific analysis to a level of precision determined through the measurement quality objective (MQO) evaluation, a subcontracted non-CLP laboratory may be used. Testing of geotechnical soil samples will be performed by a non-CLP fixed laboratory.

1.3.2 Measurement Quality Objectives

Analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters to document the quality of the data and to ensure that the data are of sufficient quality to meet the project objectives. Of these PARCCS parameters, precision and accuracy will be evaluated quantitatively by utilizing

both the field and laboratory QC samples listed in Table 3. Field QC samples utilized are field duplicate samples, trip blanks, and field blanks (to be collected only if field conditions render them necessary). In addition, additional sample volume may need to be collected in the field to ensure that the laboratory has sufficient material to prepare the matrix spike (MS) and matrix spike duplicates (MSD), as appropriate; the laboratory will be contacted prior to mobilization to clarify which analyses require this additional volume. Laboratory QC samples are composed of laboratory control samples, method blanks, calibration blanks, MS/MSDs, and matrix duplicates (MDs). The subsections below describe each of the PARCCS parameters and how they will be assessed within this project.

TABLE 3 QUALITY ASSURANCE INDICATOR CRITERIA

Indicator Parameter	Analytical Parameter	QC Sample	Acceptance Criteria for Laboratory Analysis
Accuracy (percent recovery)	VOCs, SVOCs, pesticides	MS, MSD Blanks	50 to 150 percent recovery Less than CRQL
	Metals	MS LCS Blanks	75 to 125 percent recovery 80 to 120 percent recovery Less than CRDL
Precision (RPD)	VOCs, SVOCs, pesticides	MS, MSD Field duplicates	30 percent RPD 50 percent RPD
	Metals	MS, MD Field duplicates	35 percent RPD (solid) 50 percent RPD
Sensitivity (quantitation limits)	All analytical tests	MS, MD, MSD Field duplicates	Not applicable
Completeness	The objective for data completeness is 90 percent.		
Representativeness	The sampling network analytical methods for this site are designed to provide data that are representative of site conditions.		
Comparability	The use of standard published sampling and analytical methods, and the use of QC samples, will ensure data of known quality. These data can be compared to any other data of known quality.		

NOTE: CRDL = Contract-required detection limit
CRQL = Contract-required quantitation limit
LCS = Laboratory control sample
LCSD = Laboratory control sample duplicate
MD = Matrix duplicate
MS = Matrix spike
MSD = Matrix spike duplicate
RPD = Relative percent difference.

1.3.2.1 Precision

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Usually, combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD).

RPD is calculated as follows:

$$\text{RPD} = \frac{|A - B|}{(A + B)/2} \times 100\%$$

where

A = First duplicate concentration.
B = Second duplicate concentration.

Field sampling precision is evaluated by analyzing field duplicate samples. For every 10 samples collected, 1 blind duplicate sample will be collected.

Laboratory analytical precision is evaluated by analyzing laboratory duplicates or MSs and MSDs. For this project, MS/MSD samples will be generated for all organic analytes and MS only for the inorganic (specifically metals) analyses. The results of the analysis of each MS/MSD pair will be used to calculate the RPD as a measure of laboratory precision for organic compounds, while the MS and MD will be used for this purpose in the case of inorganic compounds.

1.3.2.2 Accuracy

A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control samples (LCSs) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent. LCS or blank spikes are also analyzed at a frequency of 5 percent. Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100\%$$

where

S = Measured spike sample concentration
C = Sample concentration
T = True or actual concentration of the spike.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through the consistent application of established field and laboratory procedures. Trip and field blanks (if appropriate) and laboratory blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data usability will be determined by comparison with existing data. If deemed usable but non-representative, it will be used only accompanied by appropriate qualifiers and limits of uncertainty.

1.3.3 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when all of the QC criteria that affect data usability are met.

When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

Completeness will also be evaluated as part of the data quality assessment process (EPA 2006b; 2006c). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.4 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data.

1.3.5 Detection and Quantitation Limits (Sensitivity)

The analytical parameters and their quantitation limits for use on this project are determined under the EPA CLP SOWs (EPA 2005; 2007a; 2010a). The Contract-required Detection Limit (CRDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a sample matrix. Contract-required Quantitation Limits (CRQLs) are contractually specified maximum quantitation limits for specific analytical methods and sample matrices, such as soil or water, and are typically several times the method detection limit (MDL) to allow for matrix effects.

For this project, CLP analytical methods have been selected for sediment samples in an attempt to have CRQLs for each target analyte below the action levels, if possible. Table 4 compares the CRQLs for Gulfco wetland area sediment chemicals of potential ecological concern to their associated screening levels (i.e., Texas Commission on Environmental Quality [TCEQ] ecological screening sediment benchmarks [2001, 2006]). For this project, samples results will be reported as estimated values if concentrations are less than CRQLs but greater than CRDLs. The CRDL for each analyte will be listed as the detection limit in the laboratory's electronic data deliverable (EDD).

TABLE 4 CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN SEDIMENT BENCHMARKS

Chemical	CRQL ug/kg (EPA 2007a,b)			TCEQ Marine Sediment Benchmark ug/kg (TCEQ 2006)
	Low soil by SIM	Soil	Low Soil	
2-Methylnaphthelene	3.3		170	70
4,4,DDT		3.3		1.19
Acenaphthene	3.3		170	16
Acenaphthylene	3.3		170	44
Antracene	3.3		170	85.3
Arsenic		1,000		8.2
Benzo (a) anthracene	3.3		170	261
Benzo (a) pyrene	3.3		170	430
Benzo (g, h, i) perylene	3.3		170	----
Chrysene	3.3		170	384
Copper		2,500		34,000
Dibenzo (a,h) anthracene	3.3		170	63.4
Endrin Aldehyde		3.3		----
Endrin Ketone		3.3		----
Fluoranthene	3.3		170	600
Fluorene	3.3		170	19
Gamma-chlordane		1.7		2.26
Indeno (1, 2, 3-cd) pyrene	3.3		170	----
Lead		1,000		46,700
Nickel		4,000		20,900
Phenanthrene	3.3		170	240
Pyrene	3.3		170	665
Zinc		6,000		150,000

1.4 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for the EA team and subcontractor personnel working onsite.

1.4.1 Safety and Health Training

EA team personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in 29 Code of Federal Regulations (CFR) 1910.120(e). These requirements include: (1) 40 hours of formal offsite instruction; (2) a minimum of 3 days of actual onsite field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training. Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. At least one member of the field team will maintain current certification in first aid and cardiopulmonary resuscitation.

Copies of the field team's safety and health training records, including course completion certifications for the initial and refresher safety and health training, specialized supervisor training, and first aid and cardiopulmonary resuscitation training, are maintained in project files. Before work begins at a specific hazardous waste project site, EA personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for safety and health at a hazardous waste project site
- Safety and health hazards present onsite
- Selection of the appropriate personal protective equipment
- Correct use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment onsite
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances.

For more safety and health details, see EA's site-specific HSP (EA 2010c).

1.4.2 Subcontractor Training

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites, except in select instances where the subcontractor is performing work of a limited and non-intrusive nature, such as mowing vegetation. Training will meet OSHA requirements defined in 29 CFR 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to EA.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the Safety Meeting Sign-Off Sheet before they conduct onsite work. This briefing is conducted by the EA health and safety officer or other qualified person.

Subcontractors are responsible for conducting their own safety briefings. EA personnel may audit these briefings.

1.5 DOCUMENTATION AND RECORDS

The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of this project.

1.5.1 Field Documentation

Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities and will follow Standard Operating Procedure (SOP) No. 16 (Appendix C). The logbook will list the Task Order name and number; site name; and names of

subcontractors, service client, and Project Manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all onsite personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken.

1.5.2 Laboratory Documentation

This section describes the data reporting requirements for (1) EA field personnel, (2) CLP laboratories (e.g., EPA CLP laboratories or EPA Region 6 Laboratory), and (3) subcontracted (non-CLP laboratories) that submit field and laboratory measurement data under the EPA Region 6 RAC program.

EA will require fixed offsite non-CLP laboratories to prepare and submit data packages in accordance with the EPA CLP protocols (EPA 2005; 2007a; 2008; 2010a; 2010b) for hardcopy and electronic data deliverable format of VOC, SVOC, pesticide, and metal data. Data packages will include all applicable documentation for independent validation of data and verification of the DQOs. The following documentation will be required for full data validation, if applicable:

- Case narratives, which will describe all QC non-conformances that are encountered during the analysis of samples in addition to any corrective actions that are taken
  - Statement of samples received
  - Description of any deviations from the specified analytical method
  - Explanations of data qualifiers that are applied to the data
  - Any other significant problems that were encountered during analysis
- Tables that cross-reference field and laboratory sample numbers
- Chain-of-custody forms, which pertain to each sample delivery group or sample batch that is analyzed
- Laboratory reports, which must show traceability to the sample analyzed and must contain specified information
  - Project identification
  - Field sample number
  - Laboratory sample number
  - Sample matrix description

  - Dates and times of sample collection, receipt at the laboratory, preparation, and analysis
  - Description of analytical method and reference citation
  - Results of individual parameters, with concentration units, including second column results, second detector results, and other confirmatory results, where appropriate
  - Quantitation limits achieved
  - Dilution or concentration factors.

- Data summary forms and QC summary forms showing analytical results, if applicable

  - Samples
  - Surrogates
  - Blanks
  - Field QC samples
  - LCS
  - Initial and continuing calibrations
  - Other QC samples

- Laboratory control charts

  - Raw data
  - Instrument printouts
  - Laboratory bench sheets for preparation of samples

- MDL study results.

EA's Project Manager, in cooperation with the QA Officer, will define site-specific requirements for data reporting. Requests for analytical services (discussed in Section 2.4) clearly define these requirements, the turnaround time for receipt of the data deliverables specified, and any requirements for retaining samples and laboratory records. Laboratory QA Managers are responsible for ensuring that all laboratory data reporting requirements in the SAP are met.

1.5.3 Full Data Package

When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA CLP SOW (EPA 2005; 2007a; 2008; 2010a; 2010b). Full data packages will contain all of the information from the summary data package and all associated raw data. In the case where a non-CLP subcontract laboratory is used, full data packages are due to EA within 35 days after the last sample in the sample delivery group is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package.

1.5.4 Reports Generated

During the NTCRS field program, EA will prepare weekly field activity reports. Following the completion of the NTCRS field program and receipt of validated data, EA will prepare the following reports associated with the Gulfco site NTCRS Task Order:

- Data Validation Report
- Data Evaluation Summary Report
- EE/CA Report
- Action Memorandum.

2. DATA GENERATION AND ACQUISITION

This section describes the design and details for the planned field investigation activities. Data evaluation procedures are discussed in Section 4.3.

2.1 SAMPLING PROCESS DESIGN

As stated previously, the primary objectives for this SAP are as follows:

- Collect sufficient sediment data to (1) visually delineate the nature and extent of the contamination and evaluate the underlying soil conditions; and (2) resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP.
- Collect sufficient data to evaluate lithology and hydraulic conductivity of existing cap material.
- Determine suitability of soil from the borrow area onsite for use in repairing the existing cap.

For the activities associated with this Task Order and SAP, main elements of the sampling design include the numbers and types of samples to be collected, sampling locations, sampling frequencies, and sample matrices. The EPA TOM has established the number of samples that will be collected, as well as the media types. If directed by the EPA TOM, EA will modify this SAP. At EPA's request, this SAP will be made available to regional, state, and local stakeholders.

The following media will be sampled during NTCRS activities at the Gulfco site:

- Wetland sediments
- Borrow area clay
- Soil borings from existing cap material.

Table 5 describes the required sample volume, containers, preservatives, and holding times for split sample analyses.

TABLE 5 ANALYTICAL PROGRAM AND METHODS

Parameter	Method	Volume and Container	Preservatives	Holding Time [(a)]
Soil/Sediment				
VOCs (soil/dry sediment)	CLP SOM01.2[b]	Option 1: At least three 40-mL glass containers with PTFE-lined septa and open tip screw-caps, pre-weighed and containing magnetic stir bars; One 4-oz glass jar with Teflon™-lined cap (filled with no headspace for determination of moisture content) Option 2: At least three 40 mL glass containers with PTFE-lined septa and open tip screw-caps, pre-weighed and containing magnetic stir bars. Two of the containers will also contain 5mL of water; One 4-oz glass jar with Teflon™-lined cap (filled with no headspace for determination of moisture content) Option 3: At least three coring tools used as transport devices; One 4-oz glass jar with Teflon™-lined cap (filled with no headspace for determination of moisture content)	Store at 4±2°C	48 hours
VOCs (wet sediment)	CLP SOM01.2[b]	Two 4-ounce glass jars with Teflon-lined caps	Store at 4±2°C	14 days
SVOCs	CLP SOM01.2[b]	One 8-ounce glass jar with Teflon-lined cap	Store at 4±2°C	14 days
Metals	CLP ISM01.2[c]	One 8-ounce glass jar with Teflon-lined cap	Store at 4±2°C	6 months
Organochlorine pesticides	CLP SOM01.2[b]	One 8-ounce glass jar with Teflon-lined cap	Store at 4±2°C	14 days
Moisture Content	ASTM D2216	One sealed 5-gallon bucket, one cubic foot of clay, for this and all following analyses		
Particle Size	ASTM D421, D422	See previous	None	None
Atterberg Limits	ASTM D423, D424	See previous	None	None
Modified Proctor	ASTM D1557	See previous	None	None
Vertical Hydraulic Conductivity	ASTM D5084	See previous	None	None

Notes:
(a) Holding time is shown as the time from sample collection to the time of sample extraction/time from sample extraction to analysis(as appropriate)
(b) EPA 2005, 2007a
(c) EPA 2010a

EA will obtain eight sediment samples, per SOP 21, 6 inches deep, from the locations shown in Figure 2 and listed in Table 6. The wetland sediment samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and total metals. The wetland sediment samples will be submitted to the CLP for analysis, and will be delivered via overnight courier.

TABLE 6 SAMPLE LOCATION COORDINATES

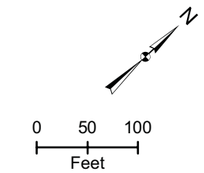
Cap Boring Location	Coordinates (Latitude/Longitude)
Central Cap Boring	28” 58’ 07.35N, 95” 17’ 24.08W
West Cap Boring	28” 58’ 06.35N, 95” 17’ 25.33W
South Cap Boring	28” 58’ 06.42N, 95” 17’ 23.08W
Wetland Sediment Sample Location	**Coordinates (Latitude/Longitude)**
EASED 01	28” 58’ 10.33N, 95” 12’ 24.23W
EASED 02	28” 58’ 11.52N, 95” 17’ 24.54W
EASED 03	28” 58’ 07.26N, 95” 17’ 18.28W
EASED 04	28” 58’ 05.87N, 95” 17’ 21.72W
EASED 05	28” 58’ 01.08N, 95” 17’ 24.79W
EASED 06	28” 58’ 07.62N, 95” 17’ 16.78W
EASED 07	28” 58’ 07.26N, 95” 17’ 18.28W
EASED 08	28” 58’ 00.64N, 95” 17’ 24.34W
Offsite Borrow Clay	**To be determined**

During the soil assessment, EA will visually inspect the soils for evidence of contamination. Observations and sketches of the boring locations will be included in the EA field logbook.

2.2 SAMPLING METHODOLOGY

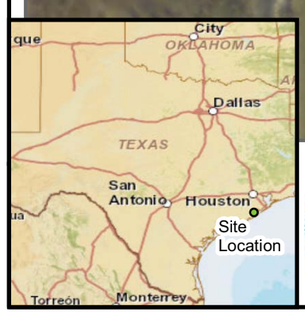
This section briefly summarizes the procedures for sample collection, including sampling methods and equipment, sample preservation requirements, decontamination procedures, and management of IDW. Table 7 lists the SOPs that will be implemented during this field program, which are included as Appendix C.

Sample collection and handling procedures for samples that will be analyzed using CLP will follow CLP protocols as required in EPA’s *Contract Laboratory Program Guidance for Field Samplers* (EPA 2007d).



Legend:

- Existing Soil Bore Location
- Proposed Soil Bore Location
- Existing Sediment Sample Location
- Proposed Sediment Sample Location
- Site Boundary (approximate)



Gulfco Marine Maintenance Superfund Site
Freeport, Brazoria County, Texas

Image Source: 2008-2009 Texas Orthoimagery Program,
Texas Strategic Mapping Program, TNRIS, 2009.

Figure 2
Proposed Sample Locations
November 2010

2010-11-22 r:\federal\epa\rac iii\0064-midessa gw plume\gis\mxds\gulfoopropsampleloc.mxd EA-Dallas jschwertz

TABLE 7 STANDARD OPERATING PROCEDURES

SOP Number	SOP Title
001	Labels
002	Chain-of-Custody Form
003	Subsurface/Utility Clearance
004	Sample Packing and Shipping
005	Field Decontamination
016	Surface Water, Groundwater, and Soil/Sediment Logbooks
024	Photo-Ionization Detector
025	Soil Sampling
039	Sample Preservation and Container Requirements
042	Disposal of Investigation-Derived Material
047	Direct-Push Technology Sampling

2.2.1 Collection of Wetland Sediment Samples

The wetland sediment samples will be assessed in order to visually delineate the nature and extent of the contamination and to evaluate the underlying soil conditions through sample collection and analysis. The data will also be used to resolve any data gaps identified for the wetland areas located north of Marlin Avenue following evaluation of the recent data collected by the PRP.

2.2.2 Collection of Borrow Area Clay Samples

EA will collect two clay samples to a depth of one foot, using a shovel to fill a five gallon bucket, from the offsite borrow area in order to evaluate the usability of the material for capping purposes, at locations to be determined.

Table 5 describes the required sample volume, containers, preservatives, and holding times for chemical sample analyses. The samples will be analyzed for VOCs, SVOCs, organochlorine pesticides, and total metals. In addition, two bulk clay samples (approximately five gallons each, cubic foot) will be collected from the borrow area and analyzed by an non-CLP offsite laboratory for physical parameters, such as moisture content (ASTM D2216), particle size (ASTM D421 and D422), Atterberg limits (ASTM D423 and D424), modified proctor (ASTM D1557), and vertical hydraulic conductivity (ASTM D5084).

2.2.3 Collection of Soil Cores from Former Surface Impoundment Area

EA will obtain three soil cores from locations presented on Figure 2 and listed in Table 6, using Shelby tubes and direct push technology. The cores will be submitted to an non-CLP offsite laboratory for vertical hydraulic conductivity testing (ASTM D5084), and will be delivered to the non-CLP subcontracted laboratory via overnight courier. The cores will be obtained from 3-

inch diameter Shelby tubes advanced no deeper than 5 ft into the cap of the former surface impoundment area.

2.2.4 Sample Container, Volume, Preservation, and Holding Time Requirements

The required sample volume, container type, preservation technique, and holding time for each analysis to be conducted for samples is presented in Table 5. Required containers, preservation techniques, and holding times for field QC samples, such as field duplicates, field blanks, trip blanks, and MS/MSD samples, will be the same as for field samples.

2.2.5 Decontamination

Decontamination of the equipment will follow general practices listed in SOP No. 005 (Appendix C). Cleaned equipment will not be handled with soiled gloves. All water derived from decontamination will be collected and temporarily stored at the staging area established by the PRP for characterization.

2.2.6 Investigation-Derived Waste

All decontamination and purge water generated during the various phases of work will be suitably disposed. Any necessary IDW characterization samples will be analyzed using an EA-subcontracted laboratory.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Each sample collected by EA will be traceable from the point of collection through analysis and final disposition to ensure sample integrity. Sample integrity helps to ensure the legal defensibility of the analytical data and subsequent conclusions. Sample handling will follow CLP protocols as required in EPA's *Contract Laboratory Program Guidance for Field Samplers* (EPA 2007d).

EA will use EPA's data management system known as "Forms II Lite" to generate all chain-of-custody records in the field. Applicable copies of generated Forms II Lite files will be delivered to EPA data management personnel as required by CLP protocols. EA's field team will follow SOPs found in Appendix C.

2.3.1 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. EA personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in permanent ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout.

- Any serialized documents will be maintained at EA and referenced in the site logbook.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

The EA field representative is responsible for ensuring that sampling activities are properly documented.

2.3.1.1 Sample Labels

A sample label will be affixed to each sample container. The label will be completed with the following information written in indelible ink:

- Project name and location
- Sample identification number
- Date and time of sample collection
- Sample collector's initials
- Analysis required.

2.3.1.2 Chain-of-Custody

EA will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Analysis requested
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)

- Project contact and phone number.

Unused lines on the chain-of-custody record will be crossed out. Field personnel will sign chain-of-custody records that are initiated in the field, and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped.

The following procedures will be implemented when samples collected during this project are shipped to analytical laboratories (with shipping considerations applicable to laboratories other than geotechnical laboratories):

- The shipping box will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment.

- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The airbill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.

- The shipping box will be closed and taped shut with strapping tape around both ends.

- Signed and dated custody seals will be placed on the front and side of each shipping box. Wide clear tape will be placed over the seals to prevent accidental breakage.

- The chain-of-custody record will be transported within the taped sealed shipping box. When the shipping box is received at the analytical laboratory, laboratory personnel will open the shipping box and sign the chain-of-custody record to document transfer of samples.

Sample handling procedures for geotechnical samples will be in accordance with the relevant ASTM methods.

2.4 ANALYTICAL METHODS REQUIREMENTS

The source of analytical services to be provided will be determined in part by DQOs and the intended use of the resulting data. EA will use EPA-approved methods for laboratory analyses of the samples.

EA will follow the analytical services request procedures that are outlined EA's Analytical Services Delivery Plan (EA 2005). If an analytical system fails, the QA Officer will be notified,

and corrective action will be taken. In general, corrective actions will include stopping the analysis, examining instrument performance and sample preparation information, and determining the need to re-prepare and reanalyze the samples.

2.4.1 Field Analytical Methods

EA may also field screen soil samples for organic vapors using a photoionization detector.

2.4.2 Laboratory Analytical Methods

Fixed laboratory analyses of samples will be conducted using a CLP laboratory. Table 5 outlines the anticipated laboratory analytical methods for samples collected by EA. In all cases, appropriate methods of sample preparation, cleanup, and analyses are based on specific analytical parameters of interest, sample matrices, and required detection limits.

2.5 QUALITY CONTROL REQUIREMENTS

Various field and laboratory QC samples and measurements will be used to verify that analytical data meet the QA objectives. Field QC samples and measurements will be collected to assess the influence of sampling activities and measurements on data quality. Similarly, laboratory QC samples will be used to assess how the laboratory's analytical program influences data quality. This section describes the QC samples that are to be analyzed during the investigation oversight activities for: (1) each field and laboratory environmental measurement method; and (2) each sample matrix type. Table 8 provides a summary of the types and frequency of collection of field QC samples anticipated for EA samples.

TABLE 8 FREQUENCY OF FIELD QUALITY CONTROL SAMPLES

Field QC Sample	Frequency [a]
Trip blank	1 per cooler containing aqueous samples for VOC analysis
Field blank	1 per day, if site conditions render this sample necessary
Field duplicate	1 per 10 samples
Equipment rinsate blank	1 per non-dedicated equipment type per day or 1 per 20 samples
MS/MD [b] (inorganics)	1 per 20 samples (or per EPA Region 6 Laboratory requirements)
MS/MSD[b] (organics)	1 per 20 samples (or per EPA Region 6 Laboratory requirements)
Temperature blank	1 per cooler

Notes:
[a] The QC sample collection frequency applies to samples collected for fixed-laboratory analysis (EPA 2005; 2007a; 2010a).
[b] MS, MSD, and MD analyses are technically not field QC samples; however, they generally require that the field personnel collect additional volumes of samples and are, therefore, included on this table for easy reference.

Table 3 summarizes the acceptance criteria for each type of QC sample.

2.5.1 Field Quality Control Requirements

Field QC samples will be collected and analyzed to assess the quality of data that are generated by sampling activities. These samples will include laboratory QC samples collected in the field, field duplicates, equipment rinsates, MS/MSDs, and temperature blanks. QC samples collected in the field for fixed-laboratory analysis are presented in Table 8.

Contamination can be introduced from many external sources during collection of field samples. Field blanks will be collected based on field conditions—that is, if either winds or construction that create dust are encountered during sampling.

Field duplicates are independent samples that are collected as close as possible, in space and time, to the original investigative sample. Field duplicates can measure the influence of sampling and field procedures on the precision of an environmental measurement. They can also provide information on the heterogeneity of a sampling location. Field duplicates will be collected at a frequency of one for every 10 aqueous samples, as listed in Table 8. Immediately following collection of the original sample, the field duplicates are collected using the same collection method.

Equipment rinsate blanks are collected when non-dedicated or non-disposable sampling equipment is used to collect samples and put the samples into containers. These blanks assess the cleanliness of the sampling equipment and the effectiveness of equipment decontamination. Equipment rinsate blanks are collected by pouring analyte-free water over the decontaminated surfaces of sampling equipment that contacts sampling media. Equipment rinsate blanks are collected after sampling equipment has been decontaminated, but before the equipment is reused for sampling. If non-dedicated or non-disposable equipment is used, equipment rinsate blanks will be collected at a frequency as listed in Table 8.

MS and MSD samples are laboratory QC samples that are collected for organic methods. MS and laboratory duplicate samples are typically collected for analysis of inorganics. For aqueous samples, MS/MSDs require double or triple the normal sample volume, depending on analytical laboratory specifications. Each MS and laboratory duplicate sample is one sample, usually collected from one location at double the normal sample volume. In the laboratory, MS/MSDs and MSs are split and spiked with known amounts of analytes. Analytical results for MS/MSDs and MSs and laboratory duplicate samples are used to measure the precision and accuracy of the laboratory's organic and inorganic analytical programs, respectively. Each of these QC samples will be collected and analyzed at a frequency of one for every 20 investigative samples for CLP laboratories or subcontract non-CLP laboratories.

Temperature blanks are containers of deionized or distilled water that are placed in each cooler shipped to the laboratory. Their purpose is to provide a container to test the temperature of the samples in the respective cooler.

2.5.2 Laboratory Quality Control Requirements

All laboratories that perform analytical work under this project must adhere to a QA program that is used to monitor and control all laboratory QC activities. Each laboratory must have a written QA manual that describes the QA program in detail. The laboratory QA Manager is responsible for ensuring that all laboratory internal QC checks are conducted in accordance with EPA methods and protocols, the laboratory's QA manual, and the requirements of this SAP.

Many of the laboratory QC procedures and requirements are described in EPA-approved analytical methods, laboratory method SOPs, and method guidance documents.

The EPA methods specify the preparation and analysis of QC samples, and may include, but are not limited to, the following types: (1) LCS, (2) method blanks, (3) MS, MSD, and MD samples, (4) surrogate spikes, and (5) standard reference materials or independent check standards. The following subsections discuss the QC checks that will be required for this project.

2.5.2.1 Laboratory Control Sample

Laboratory control samples are thoroughly characterized laboratory-generated samples that are used to monitor the laboratory’s day-to-day performance of analytical methods. The results of LCS analyses are compared to well-defined laboratory control limits to determine whether the laboratory system is in control for the particular method. If the system is not in control, corrective action will be implemented. Appropriate corrective actions will include: (1) stopping the analysis, (2) examining instrument performance or sample preparation and analysis information, and (3) determining whether samples should be re-prepared or reanalyzed.

2.5.2.2 Method Blanks

Method blanks, which are also known as preparation blanks, are analyzed to assess the level of background interference or contamination in the analytical system and the level that may lead to elevated concentration levels or false-positive data. Method blanks will be required for all laboratory analyses and will be prepared and analyzed at a frequency of one method blank per every 20 samples or one method blank per batch, if the batches consist of fewer than 20 samples. A method blank consists of reagents that are specific to the analytical method and are carried through every aspect of the analytical procedure, including sample preparation, cleanup, and analysis. The results of the method blank analysis will be evaluated in conjunction with other QC information to determine the acceptability of the data generated for that batch of samples. Ideally, the concentration of a target analyte in the method blank will be below the reporting limit for that analyte. For some common laboratory contaminants, a higher concentration may be allowed.

If the method blank for any analysis is beyond control limits, the source of contamination must be investigated, and appropriate corrective action must be taken and documented. This investigation includes an evaluation of the data to determine the extent of the contamination and

its effect on sampling results. If a method blank is within control limits but analysis indicates a concentration of analytes that is above the reporting limit, an investigation should be conducted to determine whether any corrective action could eliminate an ongoing source of target analytes.

For organic and inorganic analyses, the concentration of target analytes in the method blank must be below the reporting limit for that analyte for the blank to be considered acceptable. An exception may be made for common laboratory contaminants (such as methylene chloride, acetone, 2-butanone, and phthalate esters) that may be present in the blank at up to five times the reporting limit. These compounds are frequently detected at low levels in method blanks from materials that are used to collect, prepare, and analyze samples for organic parameters.

2.5.2.3 Matrix Spikes and Matrix Spike Duplicates

MS and MSD are aliquots of an environmental sample to which known concentrations of target analytes and compounds have been added. The MS is used to evaluate the effect of the sample matrix on the accuracy of the analysis. If there are many target analytes, they will be divided into 2-3 spike standard solutions. Each spike standard solution will be used alternately. The MS, in addition to an unspiked aliquot, will be taken through the entire analytical procedure, and the recovery of the analytes will be calculated. Results will be expressed in terms of percent recoveries and RPD. The percent recoveries of the target analytes and compounds are calculated and used to determine the effects of the matrix on the precision and accuracy of the method. The RPD between the MS and MSD results is used to evaluate method precision.

The MS/MSD is divided into three separate aliquots, two of which are spiked with known concentrations of target analytes. The two spiked aliquots, in addition to an unspiked sample aliquot, are analyzed separately, and the results are compared to determine the effects of the matrix on the precision and accuracy of the analysis. Results will be expressed as RPD and percent recovery and compared to control limits that have been established for each analyte. If results fall outside control limits, corrective action will be performed.

2.5.2.4 Laboratory (Matrix) Duplicates

MDs, which are also called laboratory duplicates, are prepared and analyzed for inorganic analyses to assess method precision. Two aliquots of sample material are taken from the sample and processed simultaneously without adding spiking compounds. The MD and the original sample aliquot are taken through the entire analytical procedure, and the RPD of the duplicate result is calculated. Results are expressed as RPD and are compared to control limits that have been established for each analyte.

2.5.2.5 Surrogate Spikes

Surrogates are organic compounds that are similar to the analytes of interest in chemical properties but are not normally found in environmental samples. Surrogates are added to field and QC samples, before the samples are extracted, to assess the efficacy of the extraction procedure and to assess the bias that is introduced by the sample matrix. Results are reported in

terms of percent recovery. Individual analytical methods may require sample reanalysis based on surrogate criteria.

The laboratory will use surrogate recoveries mainly to assess matrix effects on sample analysis. Obvious problems with sample preparation and analysis (such as evaporation to dryness or a leaking septum) that can lead to poor surrogate spike recoveries must be eliminated before low surrogate recoveries can be attributed to matrix effects.

2.6 INSTRUMENT AND EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

This section outlines testing, inspection, and maintenance procedures for field equipment and instruments and for laboratory instruments.

2.6.1 General Requirements

Testing, inspection, and maintenance methods and frequency will be based on: (1) type of instrument; (2) instrument's stability characteristics; (3) required accuracy, sensitivity, and precision of the instrument; (4) instrument's intended use, considering project-specific DQOs; (5) manufacturer's recommendations; and (6) other conditions that affect measurement or operational control. For most instruments, preventive maintenance is performed in accordance with procedures and schedules recommended in: (1) the instrument manufacturer's literature or operating manual, or (2) SOPs associated with particular applications of the instrument.

In some cases, testing, inspection, and maintenance procedures and schedules will differ from the manufacturer's specifications or SOPs. This can occur when a field instrument is used to make critical measurements or when the analytical methods that are associated with a laboratory instrument require more frequent testing, inspection, and maintenance.

2.6.2 Field Equipment and Instruments

If field equipment or instruments become necessary to conduct the oversight activities, EA will maintain the field equipment as described below.

Leased field equipment and instruments will be used to conduct field oversight activities. The vendor will be responsible for thoroughly checking and calibrating field equipment and instruments before they are shipped or transported to the field. Copies of testing, inspection, and maintenance procedures will be shipped to the field with the equipment and instruments.

After the field equipment and instruments arrive in the field, they will be inspected for damage. Damaged equipment and instruments will be replaced or repaired immediately. Battery-operated equipment will be checked to ensure full operating capacity; if needed, batteries will be recharged or replaced.

Following use, field equipment will be decontaminated properly before being returned to the source. When the equipment is returned, copies of any field notes regarding equipment problems will be included so that problems are not overlooked and any necessary equipment repairs are performed.

2.6.3 Laboratory Instruments

All laboratories that analyze samples collected under the EPA Region 6 RAC 2 program must have a preventive maintenance program that addresses: (1) testing, inspection, and maintenance procedures; and (2) the maintenance schedule for each measurement system and required support activity. This program is usually documented by an SOP for each analytical instrument that is to be used. Typically, the program will be laboratory-specific; however, it should follow requirements outlined in EPA-approved guidelines. Some of the basic requirements and components of such a program are as follows:

- As a part of its QA/QC program, each laboratory will conduct a routine preventive maintenance program to minimize instrument failure and other system malfunction.
- An internal group of qualified personnel will maintain and repair instruments, equipment, tools, and gauges. Alternatively, manufacturers' representatives may provide scheduled instrument maintenance and emergency repair under a repair and maintenance contract.
- The laboratory will perform instrument maintenance on a regularly scheduled basis. The scheduled service of critical items should minimize the downtime of the measurement system. The laboratory will prepare a list of critical spare parts for each instrument. The laboratory will request the spare parts from the manufacturer and will store the parts.
- Testing, inspection, and maintenance procedures described in laboratory SOPs will be performed in accordance with manufacturer's specifications and the requirements of the specific analytical methods that are used.
- All maintenance and service must be documented in service logbooks (or the site-specific log book) to provide a history of maintenance records. A separate service logbook should be kept for each instrument; however, due to the limited scope of this project, the service records will be maintained in the site-specific field log book. All maintenance records will be traceable to the specific instrument, equipment, tool, or gauge.
- The laboratory will maintain and file records that are produced as a result of tests, inspections, or maintenance of laboratory instruments. These records will be available for review by internal and external laboratory system audits that are conducted under the EPA Region 6 RAC 2 program.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

This section describes the procedures for maintaining the accuracy of field equipment and laboratory instruments that are used for field tests and laboratory analyses. The equipment and instruments should be calibrated before each use or, when not in use, on a scheduled periodic basis.

2.7.1 Field Equipment

EA will be required to conduct field activities using the equipment calibration procedure described below.

Equipment will be maintained and calibrated with sufficient frequency and in such a manner that the accuracy and reproducibility of results are consistent with the manufacturer's specifications and with project-specific DQOs. Upon arrival of the field sampling and measurement equipment, EA field personnel will examine it to verify that it is in good working condition. The manufacturer's operating manual and instructions that accompany the equipment will be consulted to ensure that all calibration procedures are followed. Measuring and testing equipment may be calibrated either internally—by using in-house reference standards—or externally—by agencies, manufacturers, or commercial laboratories. Calibration records will contain a reference identifying the source of the procedure and, where feasible, the actual procedure. Each piece of measuring and testing equipment will also be accompanied by an equipment use log. The equipment use log (which may be contained within the site-specific field log book) will be kept current and may contain the following information: (1) date of use, (2) times of use, (3) operating and assisting technicians, (4) calibration status, and (5) comments.

2.7.2 Laboratory Instruments

All laboratory equipment that is used to analyze samples collected under the EPA Region 6 RAC 2 program will be calibrated on the basis of written SOPs that are maintained by the laboratory. Calibration records (including the dates and times of calibration and the names of the personnel performing the calibration) will be filed at the location at which the analytical work was performed and maintained by the laboratory personnel who performed QC activities. Subcontractor laboratories may conduct laboratory work under the EPA Region 6 RAC 2 program. The laboratory QA Manager is responsible for ensuring that all laboratory instruments are calibrated in accordance with the requirements of this SAP.

The laboratories will follow the method-specific calibration procedures and requirements for laboratory measurements. Calibration procedures and requirements will also be provided, as appropriate, for laboratory support equipment, such as balances, mercury thermometers, pH meters, and other equipment that is used to take chemical and physical measurements.

2.8 REQUIREMENTS FOR INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The EA Project Manager is responsible for identifying the types and quantities of supplies and consumables that are needed for collecting the split samples for this Task Order. The Project Manager is also responsible for determining acceptance criteria for these items. Supplies and consumables can be received at either an equipment distribution center or a site. When supplies are received, the EA field personnel will sort the supplies according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before the supplies are accepted for use on a project. If the supplies do not meet the acceptance criteria, deficiencies

will be noted on the packing slip and purchase order. In addition, a form will be completed describing the problem and circumstances, and noting the purchase order number of the item. Afterward, the item will be returned to the vendor for replacement or repair.

2.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

For this project, EA anticipates acquiring data from non-direct measurements such as databases, spreadsheets, and literature files.

2.10 DATA MANAGEMENT

Data for this project will be obtained from a combination of sources, including field measurements, a CLP laboratory, and the subcontracted laboratories. The data-gathering process requires a coordinated effort and will be conducted by project staff members in conjunction with all potential data producers. The data will be obtained from the analytical service provider, when appropriate, in the form of an electronic data deliverable, in addition to the required hard copy analytical data package. Formal verification (or validation) of data will be conducted before associated results are presented or are used in subsequent activities.

Data tracking is essential to ensure timely, cost-effective, and high-quality results. Data tracking begins with sample chain of custody. When the analytical service provider receives custody of the samples, the provider will send a sample acknowledgment to EA. The sample acknowledgment will confirm sample receipt, condition, and required analyses. The EPA tracking software (Forms II Lite) will contain all pertinent information about each sample and can track the data at each phase of the process. The tracking software carries the data through completion of the data validation.

EA will validate 10 percent of the investigative analytical data received from subcontract laboratories (other than the EPA Region 6 Houston laboratory or CLP laboratories) to ensure that the confirmatory data are accurate and defensible, as described in Section 4 of this SAP. A partial review will be conducted on the remaining 90 percent of the data received from subcontract laboratories. All data will be evaluated for usability by EA.

As a part of the data validation process, electronic data deliverables will be reviewed against hard copy deliverables to ensure accurate transfer of data. In addition, the hard copy will be evaluated for errors in the calculation of results. After the data validation, qualifiers can be placed on the data to indicate the usability of the data. These qualifiers will be placed into an electronic data file. Upon approval of the data set with the appropriate data qualifiers, the electronic data will be released to the Project Manager for reporting.

3. ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to EA and EPA.

3.1 ASSESSMENT AND RESPONSE ACTIONS

Under the EPA Region 6 RAC 2 program, performance and system audits of field and laboratory activities may be conducted to verify that sampling and analysis are performed in accordance with the following:

- Performance and system audits
  - Audit personnel
  - Audit scope of work
  - Audit frequencies
  - Audit reports
- Corrective action
  - Sample collection and field measurements
  - Laboratory analyses.

Non-conforming items and activities are those that do not meet the project requirements, procurement document criteria, and approved work procedures. Non-conformance may be detected and identified by the following personnel:

- Project Personnel—During field operations, supervision of subcontractors, and field inspections
- Testing Personnel—During preparation for and performance of tests, equipment calibration, and QC activities
- QA Personnel—During the performance of audits, surveillance, and other QA activities.

Each non-conformance that affects quality will be documented by the person who identifies or originates the nonconformance. Documentation of nonconformance will include the following components:

- Description of nonconformance
- Identification of personnel who are responsible for correcting the nonconformance and, if verification is required, for verifying satisfactory resolution

- Method(s) for correcting the nonconformance (corrective action) or description of the variance granted
- Proposed schedule for completing corrective action and the corrective action taken.

Non-conformance documentation will be made available to the Project Manager, QA Manager, and subcontractor (e.g., non-CLP subcontract laboratories) management personnel, as appropriate.

The field personnel and QA personnel, as appropriate, are responsible for notifying the Project Manager and the QA Manager of the non-conformance. In addition, the Project Manager and the project staff, as appropriate, will be notified of significant non-conformances that could affect the results of the work. The Project Manager is responsible for determining whether notification of EPA is required.

The completion of corrective actions for significant non-conformances will be documented by QA personnel during future auditing activities. Any significant recurring non-conformance will be evaluated by project and QA personnel, as appropriate, to determine its cause. Appropriate changes will be instituted, under corporate or project procedures, to prevent recurrence. When such an evaluation is performed, the results will be documented.

3.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection operations requires timely assessment and review of measurement activities. It is essential that open communication, interaction, and feedback be maintained among all project participants, including the: (1) EA QA Manager, Program Manager, Project Manager, technical staff, and laboratory subcontractors; and (2) EPA Region 6 TOM and QA Officer. EA prepares monthly progress reports for each Task Order that is conducted under the EPA Region 6 RAC 2 program. These reports address any QA issues that are specific to the Task Order and facilitate timely communication of such issues.

At the program level, the QA Manager prepares quarterly status reports of QA issues that are related to EA's work on the EPA Region 6 RAC 2 program. These reports are distributed to EA's President, corporate QA Manager, RAC 2 Program Manager, and, upon request, the EPA Region 6 Project Officer. QA status reports address the following areas:

- Results of QA audits and other inspections, including any quality improvement opportunities that have been identified for further action
- Instrument, equipment, or procedural problems that affect QA
- Subcontractor performance issues
- Corrective actions
- Status of previously reported activities and continuous quality improvement initiatives
- Work planned for the next reporting period.

4. DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discussed procedures for verifying that the data are sufficient to meet DQOs and measurement quality objectives for the project.

Section 4.1 focuses on data review and reduction requirements for work conducted under the EPA Region 6 RAC 2 program. Section 4.2 addresses data validation and verification requirements. Section 4.3 addresses reconciliation with DQOs.

4.1 DATA REVIEW AND REDUCTION REQUIREMENTS

Data reduction and review are essential functions for preparing data that can be used effectively to support project decisions and DQOs. These functions must be performed accurately and in accordance with EPA-approved procedures and techniques. Data reduction includes all computations and data manipulations that produce the final results that are used during the investigation. Data review includes all procedures that field or laboratory personnel conduct to ensure that measurement results are correct and acceptable in accordance with the QA objectives that are stated in this SAP. Field and laboratory measurement data reduction and review procedures and requirements are specified in previously discussed field and laboratory methods, SOPs, and guidance documents.

Field personnel will record, in a field logbook and/or on the appropriate field form, all raw data from chemical and physical field measurements. The EA field representative has the primary responsibility for: (1) verifying that field measurements were made correctly, (2) confirming that sample collection and handling procedures specified in this task order-specific SAP were followed, and (3) ensuring that all field data reduction and review procedures requirements were followed. The EA field representative is also responsible for assessing preliminary data quality and for advising the data user of any potential QA/QC problems with field data. If field data are used in a project report, data reduction methods will be fully documented in the report.

The Region 6, CLP laboratories, and/or subcontracted non-CLP laboratories will complete data reduction for chemical and physical laboratory measurements and will complete an in-house review of all laboratory analytical results. The Laboratory QA Manager will be responsible for ensuring that all laboratory data reduction and review procedures follow the requirements that are stated in this SAP. The Laboratory QA Manager will also be responsible for assessing data quality and for advising the EA QA Manager of possible QA/QC problems with laboratory data.

4.2 VALIDATION AND VERIFICATION METHODS

All data that are used to support activities under the EPA Region 6 RAC 2 program must be valid for their intended purposes. This section outlines the basic data validation procedures that will be followed for all field and laboratory measurements. The following subsections identify personnel who are responsible for data validation and the general data validation process and EPA data validation guidance that will be followed.

4.2.1 Data Validation Responsibilities

When analytical services are provided by laboratories subcontracted by EA, EA is responsible for data validation. The QA Manager has primary responsibility for coordinating EA's data validation activities. EA will conduct full validation on 10 percent of all subcontracted laboratory data for investigation samples. Partial validation will be conducted on the remaining 90 percent of all subcontracted laboratory data. Data validation and review will be completed by one or more experienced data reviewers. When data is generated by the EPA Region 6 laboratory in Houston, Texas, it will be used as received from the laboratory, with no further validation. Data from CLP laboratories are validated by EPA's Environmental Services Assistance Team.

4.2.2 Data Validation Procedures

The validity of a data set is determined by comparing the data with a predetermined set of QC limits. EA data reviewers will conduct a systematic review of the data for compliance with established QC limits (such as sensitivity, precision, and accuracy), on the basis of spike, duplicate, and blank sampling results that are provided by the laboratory. The data review will identify any out-of-control data points or omissions. EA data reviewers will evaluate laboratory data for compliance with the following information:

- Method and project-specific analytical service requests
- Holding times
- Initial and continuing calibration acceptance criteria
- Field, trip, and method blank acceptance criteria
- Surrogate recovery
- Field duplicates and MS and MSD acceptance criteria
- MD precision
- LCS accuracy
- Other laboratory QC criteria specified by the method or on the project-specific analytical service request form
- Compound identification and quantitation
- Overall assessment of data, in accordance with project-specific objectives.

EA will follow the most current EPA CLP guidelines (EPA 2008 and 2010b) for completing data validation for all applicable test methods. General procedures in the CLP guidelines will be

modified, as necessary, to fit the specific analytical method that is used to produce the data. In all cases, data validation requirements will depend on: (1) DQO levels that are defined in Section 1.3, (2) reporting requirements that are defined in Section 1.5, and (3) data deliverables that are requested from the laboratory, as discussed in Section 1.5.

4.3 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The main purpose of a QA system is to define a process for collecting data that are of known quality, are scientifically valid, are legally defensible, and fully support decisions that will be based on the data. To achieve this purpose, the QAPP requires that DQOs be fully defined (Section 1.3). Other parts of the QA system must then be planned and implemented in a manner that is consistent with the DQOs. QA system components that follow directly from the DQOs include documentation and reporting requirements (Section 1.5), sample process design and sampling methods requirements (Sections 2.1 through 2.4), analytical methods and analytical service requests (Section 2.5), QC requirements (Section 2.6), and data reduction and validation and reporting methods (Sections 4.1 and 4.2).

After environmental data have been collected, reviewed, and validated, the data will undergo a final evaluation to determine whether the DQOs specified in this QAPP have been met. EA will follow EPA's data quality assessment process to verify that the type, quality, and quantity of data that are collected are appropriate for their intended use (EPA 2006b; 2006c).

The data quality assessment process involves (1) verifying that the data have met the assumptions under which the data collection design and DQOs were developed, (2) taking appropriate corrective action if the assumptions have not been met, and (3) evaluating the extent to which the data support the decision that must be made so that scientifically valid and meaningful conclusions can be drawn from the data. To the extent possible, EA will follow DQA methods and procedures that have been outlined by EPA (2006b; 2006c).

When the five-step data quality assessment process is not completely followed because the DQOs are qualitative, EA will systematically assess data quality and data usability. This assessment will include:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives.
- A review of project-specific data quality indicators for PARCCS to determine whether acceptance criteria have been met.
- A review of project-specific DQOs to determine whether they have been achieved by the data collected.
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

EA will compile analytical and field data into a format that is compatible with EPA Region 6 or National Electronic Data Management Network. EA will use the data to prepare the following documents:

- Data Validation Report
- Data Evaluation Summary Report
- EE/CA Report
- Action Memorandum

The specific requirements and elements of each of these reports are discussed in detail in the EPA-approved RI/FS Work Plan (EA 2010b).

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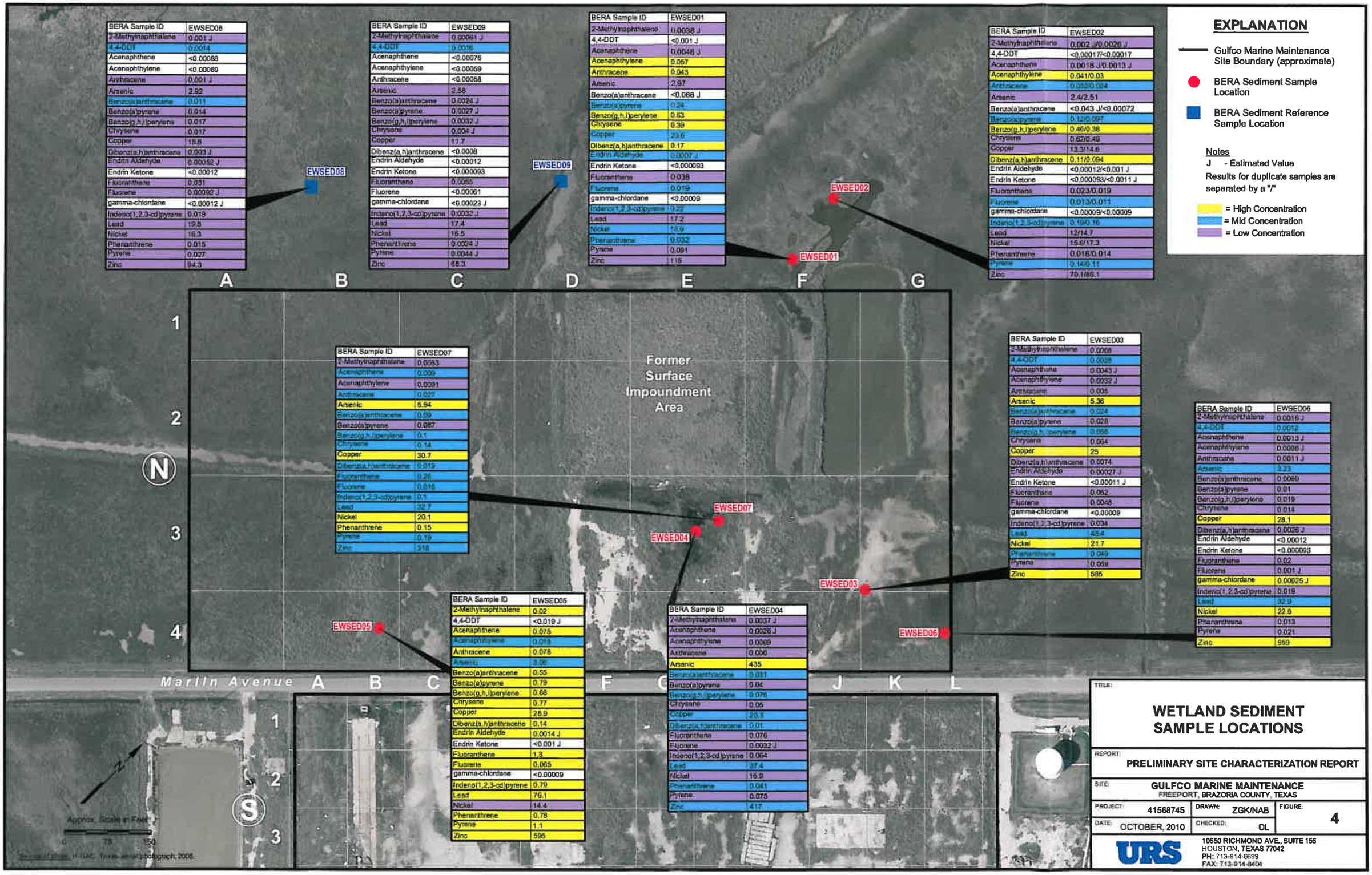
Appendix A
FIGURE (PRP Wetland Sediment Sample Locations)



BERA Sample ID	EWSED08
2-Methylnaphthalene	0.001 J
4,4-DDT	0.0014
Acenaphthene	<0.00088
Acenaphthylene	<0.00089
Anthracene	0.001 J
Arsenic	2.92
Benzo(a)anthracene	0.011
Benzo(a)pyrene	0.014
Benzo(g,h,i)perylene	0.017
Chrysene	0.017
Copper	19.8
Dibenz(a,h)anthracene	0.003 J
Endrin Aldehyde	0.00052 J
Endrin Ketone	<0.00012
Fluoranthene	0.031
Fluorene	0.00092 J
gamma-chlordane	<0.00012 J
Indeno(1,2,3-cd)pyrene	0.019
Lead	19.8
Nickel	16.3
Phenanthrene	0.015
Pyrene	0.027
Zinc	94.3

BERA Sample ID	EWSED09
2-Methylnaphthalene	0.00061 J
4,4-DDT	0.0016
Acenaphthene	<0.00076
Acenaphthylene	<0.00059
Anthracene	<0.00058
Arsenic	2.58
Benzo(a)anthracene	0.0024 J
Benzo(a)pyrene	0.0027 J
Benzo(g,h,i)perylene	0.0032 J
Chrysene	0.004 J
Copper	11.7
Dibenz(a,h)anthracene	<0.0008
Endrin Aldehyde	<0.00012
Endrin Ketone	<0.000093
Fluoranthene	0.0055
Fluorene	<0.00061
gamma-chlordane	<0.00023 J
Indeno(1,2,3-cd)pyrene	0.0032 J
Lead	17.4
Nickel	16.5
Phenanthrene	0.0024 J
Pyrene	0.0044 J
Zinc	68.3

BERA Sample ID	EWSED01
2-Methylnaphthalene	0.0038 J
4,4-DDT	<0.001 J
Acenaphthene	0.0046 J
Acenaphthylene	0.057
Anthracene	0.043
Arsenic	2.97
Benzo(a)anthracene	<0.066 J
Benzo(a)pyrene	0.24
Benzo(g,h,i)perylene	0.63
Chrysene	0.39
Copper	23.6
Dibenz(a,h)anthracene	0.17
Endrin Aldehyde	0.0007 J
Endrin Ketone	<0.000093
Fluoranthene	0.038
Fluorene	0.019
gamma-chlordane	<0.00009
Indeno(1,2,3-cd)pyrene	0.22
Lead	17.2
Nickel	18.9
Phenanthrene	0.032
Pyrene	0.091
Zinc	115

BERA Sample ID	EWSED02
2-Methylnaphthalene	0.002 J/0.0026 J
4,4-DDT	<0.00017/<0.00017
Acenaphthene	0.0018 J/0.0013 J
Acenaphthylene	0.041/0.03
Anthracene	0.032/0.024
Arsenic	2.4/2.51
Benzo(a)anthracene	<0.043 J/<0.00072
Benzo(a)pyrene	0.12/0.097
Benzo(g,h,i)perylene	0.46/0.38
Chrysene	0.62/0.49
Copper	13.3/14.6
Dibenz(a,h)anthracene	0.11/0.094
Endrin Aldehyde	<0.00012/<0.001 J
Endrin Ketone	<0.000093/<0.0011 J
Fluoranthene	0.023/0.019
Fluorene	0.013/0.011
gamma-chlordane	<0.00009/<0.00009
Indeno(1,2,3-cd)pyrene	0.19/0.16
Lead	12/14.7
Nickel	15.6/17.3
Phenanthrene	0.016/0.014
Pyrene	0.14/0.11
Zinc	70.1/86.1

BERA Sample ID	EWSED07
2-Methylnaphthalene	0.0083
Acenaphthene	0.009
Acenaphthylene	0.0091
Anthracene	0.027
Arsenic	5.94
Benzo(a)anthracene	0.09
Benzo(a)pyrene	0.087
Benzo(g,h,i)perylene	0.1
Chrysene	0.14
Copper	30.7
Dibenz(a,h)anthracene	0.019
Fluoranthene	0.26
Fluorene	0.016
Indeno(1,2,3-cd)pyrene	0.1
Lead	32.7
Nickel	20.1
Phenanthrene	0.15
Pyrene	0.19
Zinc	318

BERA Sample ID	EWSED03
2-Methylnaphthalene	0.0068
4,4-DDT	0.0028
Acenaphthene	0.0043 J
Acenaphthylene	0.0032 J
Anthracene	0.005
Arsenic	5.36
Benzo(a)anthracene	0.024
Benzo(a)pyrene	0.028
Benzo(g,h,i)perylene	0.055
Chrysene	0.064
Copper	25
Dibenz(a,h)anthracene	0.0074
Endrin Aldehyde	0.00027 J
Endrin Ketone	<0.00011 J
Fluoranthene	0.052
Fluorene	0.0048
gamma-chlordane	<0.00009
Indeno(1,2,3-cd)pyrene	0.034
Lead	45.4
Nickel	21.7
Phenanthrene	0.040
Pyrene	0.059
Zinc	585

BERA Sample ID	EWSED06
2-Methylnaphthalene	0.0016 J
4,4-DDT	0.0012
Acenaphthene	0.0013 J
Acenaphthylene	0.0008 J
Anthracene	0.0011 J
Arsenic	3.23
Benzo(a)anthracene	0.0069
Benzo(a)pyrene	0.01
Benzo(g,h,i)perylene	0.019
Chrysene	0.014
Copper	28.1
Dibenz(a,h)anthracene	0.0026 J
Endrin Aldehyde	<0.00012
Endrin Ketone	<0.000093
Fluoranthene	0.02
Fluorene	0.001 J
gamma-chlordane	0.00025 J
Indeno(1,2,3-cd)pyrene	0.019
Lead	32.9
Nickel	22.5
Phenanthrene	0.013
Pyrene	0.021
Zinc	959

BERA Sample ID	EWSED05
2-Methylnaphthalene	0.02
4,4-DDT	<0.019 J
Acenaphthene	0.075
Acenaphthylene	0.015
Anthracene	0.078
Arsenic	3.06
Benzo(a)anthracene	0.55
Benzo(a)pyrene	0.79
Benzo(g,h,i)perylene	0.68
Chrysene	0.77
Copper	28.9
Dibenz(a,h)anthracene	0.14
Endrin Aldehyde	0.0014 J
Endrin Ketone	<0.001 J
Fluoranthene	1.3
Fluorene	0.065
gamma-chlordane	<0.00009
Indeno(1,2,3-cd)pyrene	0.79
Lead	76.1
Nickel	14.4
Phenanthrene	0.78
Pyrene	1.1
Zinc	595

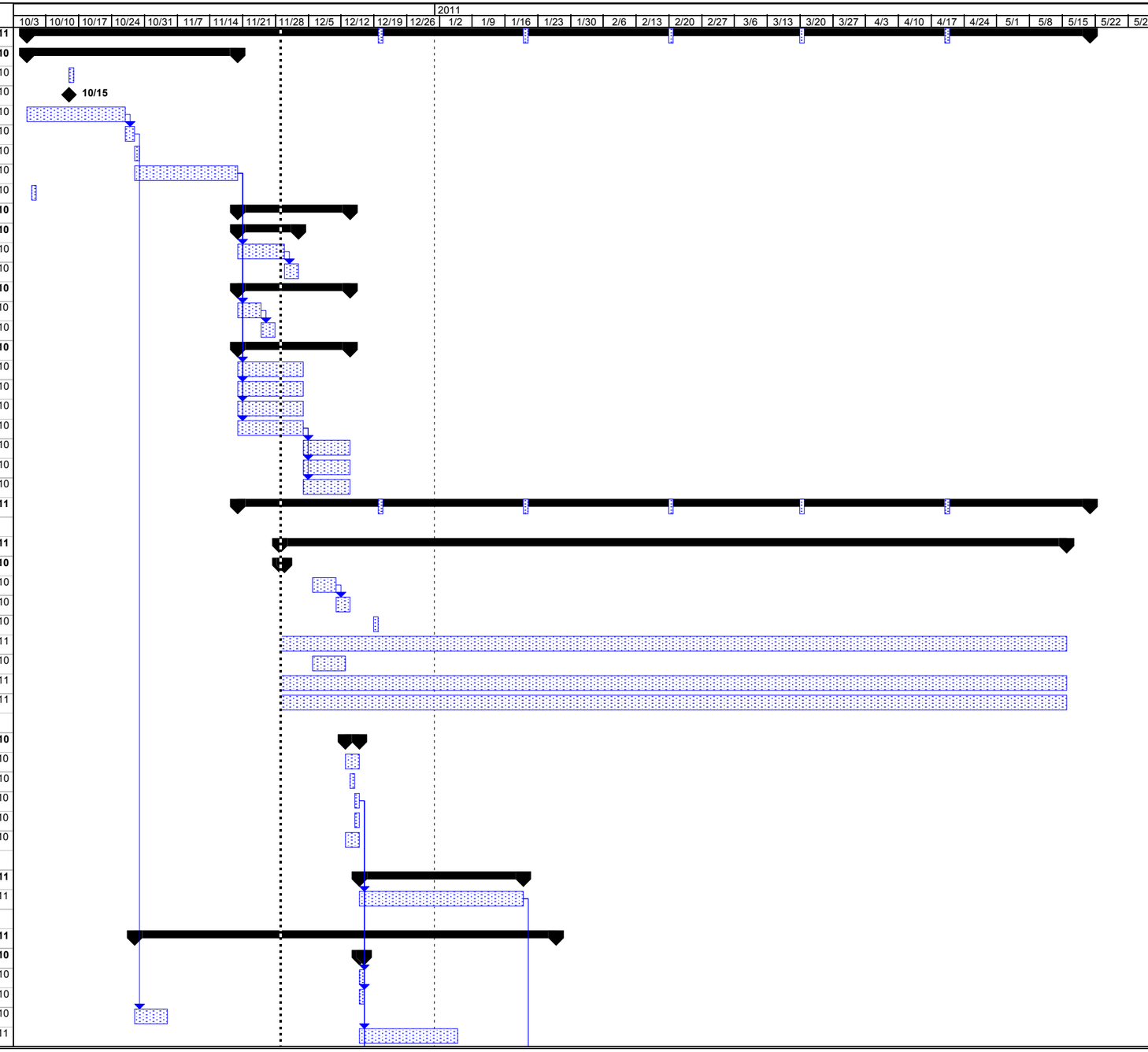
BERA Sample ID	EWSED04
2-Methylnaphthalene	0.0037 J
Acenaphthene	0.0026 J
Acenaphthylene	0.0069
Anthracene	0.006
Arsenic	435
Benzo(a)anthracene	0.031
Benzo(a)pyrene	0.04
Benzo(g,h,i)perylene	0.076
Chrysene	0.05
Copper	20.3
Dibenz(a,h)anthracene	0.01
Fluoranthene	0.076
Fluorene	0.0032 J
Indeno(1,2,3-cd)pyrene	0.064
Lead	37.4
Nickel	16.9
Phenanthrene	0.041
Pyrene	0.075
Zinc	417

Appendix B

Revised Task Order Schedule

TASK ORDER SCHEDULE
EPA REGION 6, RAC2, Contract EP-W-06-004,
Gulfco Marine Maintenace Superfund Site Non-Time Critical Removal Action Support

ID	WBS	Task Name	Start	Finish
1	**1**	**Non-Time Critical Removal Support (NTCRS)**	**Wed 10/6/10**	**Fri 5/20/11**
2	**1.1**	**Project Planning and Support**	**Wed 10/6/10**	**Fri 11/19/10**
3	1.1.1	Attend Scoping Meeting (Meeting Not Warranted - Response Questions received 10/15/10)	Fri 10/15/10	Fri 10/15/10
4	1.1.2	Conduct Site Visit (Visit Not Warranted - Response Questions received 10/15/10)	Fri 10/15/10	Fri 10/15/10
5	1.1.3	Develop Work Plan and Cost Estimate (Rev 00)	Wed 10/6/10	Tue 10/26/10
6	**EPA**	EPA Review/Approval of Work Plan	Wed 10/27/10	Thu 10/28/10
7	1.1.3	Revise and Submit Work Plan and Cost Estimate (Rev 01)	Fri 10/29/10	Fri 10/29/10
118	EPA	EPA Review/Approval of Work Plan	Fri 10/29/10	Fri 11/19/10
8	1.1.4	Provide Conflict of Interest Disclosure	Thu 10/7/10	Thu 10/7/10
10	**1.2**	**Preparation of Site Specific Plans**	**Sat 11/20/10**	**Mon 12/13/10**
11	**1.2.1**	**Sampling and Analysis Plan (SAP)**	**Sat 11/20/10**	**Thu 12/2/10**
12	1.2.1	Draft SAP	Sat 11/20/10	Mon 11/29/10
13	**EPA**	EPA Review/Approval of SAP	Tue 11/30/10	Thu 12/2/10
14	**1.2.2**	**Health and Safety Plan**	**Sat 11/20/10**	**Mon 12/13/10**
15	1.2.2	Draft HASP	Sat 11/20/10	Wed 11/24/10
16	**EPA**	EPA Review/Approval of HASP	Thu 11/25/10	Sat 11/27/10
17	**1.5**	**Project Initiation and Support**	**Sat 11/20/10**	**Mon 12/13/10**
18	1.5.1	Develop Data Summaries	Sat 11/20/10	Fri 12/3/10
19	1.5.2	Compile Exisitng Data and Reports	Sat 11/20/10	Fri 12/3/10
20	1.5.3	Identify Significant Data Gaps	Sat 11/20/10	Fri 12/3/10
21	1.5.4	Conceptual Understanding of the Site (assumes no revisions necessary)	Sat 11/20/10	Fri 12/3/10
22	1.5.5	Identify Likely Response Scenarios	Sat 12/4/10	Mon 12/13/10
23	1.5.6	Prepare Conceptual Exposure Pathway Analysis	Sat 12/4/10	Mon 12/13/10
24	1.5.7	Initiate Identificaiton of ARARS	Sat 12/4/10	Mon 12/13/10
25	**1.4**	**Project Management/Submit MSR/Invoice**	**Sat 11/20/10**	**Fri 5/20/11**
33				
34	**2**	**Community Involvement**	**Mon 11/29/10**	**Sun 5/15/11**
108	**2.3**	**Provide Public Meeting/Open House Support**	**Mon 11/29/10**	**Mon 11/29/10**
35	2.4	Prepare Fact Sheets	Mon 12/6/10	Fri 12/10/10
116	**EPA**	EPA Review/Approval of Fact Sheets	Sat 12/11/10	Mon 12/13/10
37	2.7	Publish Public Notice in Newspaper	Sun 12/19/10	Sun 12/19/10
38	2.8	Maintain Public Information	Mon 11/29/10	Sun 5/15/11
39	2.11	Prepare Presentation materials	Mon 12/6/10	Sun 12/12/10
40	2.12	Inplement Other Community Involvement Activites	Mon 11/29/10	Sun 5/15/11
41	2.13	Provide Technical Support to Review Community Involvement Deliverables	Mon 11/29/10	Sun 5/15/11
43				
44	**3**	**Field Investigation and Data Acquisition**	**Mon 12/13/10**	**Wed 12/15/10**
107	10.2	Mobilization/Demobilization	Mon 12/13/10	Wed 12/15/10
45	3.3	Soil Boring, Drilling, and Testing	Tue 12/14/10	Tue 12/14/10
46	3.4	Environmental Sampling	Wed 12/15/10	Wed 12/15/10
47	3.7	IDW Disposal	Wed 12/15/10	Wed 12/15/10
48	3.8	Site Reconnissance	Mon 12/13/10	Wed 12/15/10
50				
51	**4**	**Sample Anaysis**	**Thu 12/16/10**	**Wed 1/19/11**
52	4.1	Sample Analysis and Production of Analytical data	Thu 12/16/10	Wed 1/19/11
53				
54	**5**	**Analytical Support and Data Validation**	**Fri 10/29/10**	**Wed 1/26/11**
55	**5.1**	**Collect, Prepare, and Ship Environmental Samples**	**Thu 12/16/10**	**Thu 12/16/10**
56	5.1.3	Surface and Subsurface Soil Sampling	Thu 12/16/10	Thu 12/16/10
57	5.1.4	Surface Water and Sediment Sampling	Thu 12/16/10	Thu 12/16/10
58	5.2	Develop DQOs	Fri 10/29/10	Thu 11/4/10
59	5.3	Oversight of Analytical Services	Thu 12/16/10	Wed 1/5/11

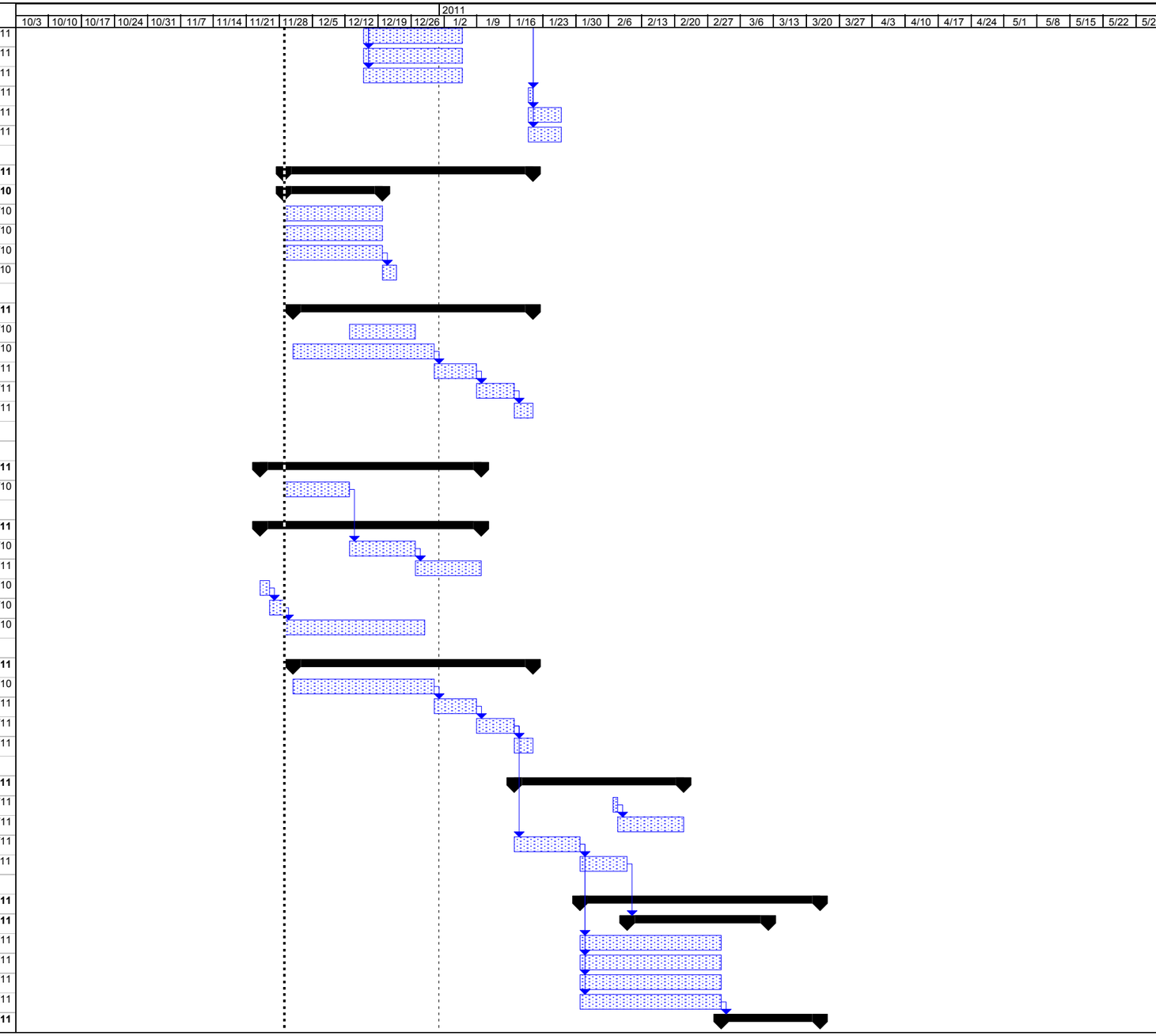


Gulfco Marine NTCRS
October 2010
Revision No. 1

Task | Progress | Summary | Rolled Up Split | Rolled Up Progress | Project Summary | Deadline
Split | Milestone | Rolled Up Task | Rolled Up Milestone | External Tasks | External Milestone

TASK ORDER SCHEDULE
EPA REGION 6, RAC2, Contract EP-W-06-004,
Gulfco Marine Maintenace Superfund Site Non-Time Critical Removal Action Support

ID	WBS	Task Name	Start	Finish
60	5.4	Coordinate with Applicable Laboratory	Thu 12/16/10	Wed 1/5/11
61	5.5	Implement EPA-Approved Laboratory QA Program	Thu 12/16/10	Wed 1/5/11
62	5.6	Provide Sample Management	Thu 12/16/10	Wed 1/5/11
63	5.7	Data Validation	Thu 1/20/11	Thu 1/20/11
64	5.8	Review Data for Usability	Thu 1/20/11	Wed 1/26/11
65	5.9	Prepare and Provide Data Validation/Usability Reports	Thu 1/20/11	Wed 1/26/11
66				
67	**6**	**Data Evaluation**	**Mon 11/29/10**	**Thu 1/20/11**
68	**6.1**	**Combine Analytical and Field Data and Produce DESR**	**Mon 11/29/10**	**Sun 12/19/10**
109	10.3.1	Data Usability Evaluation and QA/QC	Mon 11/29/10	Sun 12/19/10
69	6.1.1	Data Reduction and Tabulation	Mon 11/29/10	Sun 12/19/10
70	6.2	Data Reduction, Tabulation, and Evaluation	Mon 11/29/10	Sun 12/19/10
72	**EPA**	EPA Review of Data Evaluation Summary Report	Mon 12/20/10	Wed 12/22/10
73				
74	**7**	**Risk Assessment**	**Wed 12/1/10**	**Thu 1/20/11**
110	7.2	Conduct Ecological Risk Evaluation Baseline Ecological Risk Assessment	Mon 12/13/10	Sun 12/26/10
75	7.3	Prepare Draft Risk Evaluation Assesment Report (to be included with Draft EE/CA Report)	Wed 12/1/10	Thu 12/30/10
77	**EPA**	EPA Review of Draft Risk Evaluation Summary Report	Fri 12/31/10	Sat 1/8/11
78	7.4	Prepare Final Risk Evaluation Assesment Report (to be included with Final EE/CA Report)	Sun 1/9/11	Sun 1/16/11
79	**EPA**	EPA Review of Final Risk Evaluation Summary Report	Mon 1/17/11	Thu 1/20/11
80				
81				
82	**8**	**Identification of Removal Alternatives**	**Wed 11/24/10**	**Sun 1/9/11**
83	8.1	Identify and Screen Appropriate Removal Alternatives	Mon 11/29/10	Sun 12/12/10
84				
85	**9**	**Analysis of Removal Alternatives**	**Wed 11/24/10**	**Sun 1/9/11**
86	9.1	Assess Individual Removal Alternatives	Mon 12/13/10	Sun 12/26/10
87	9.2	Perform Comparative Analysis of Options	Mon 12/27/10	Sun 1/9/11
111	9.3	Recommend Treatability Studies	Wed 11/24/10	Thu 11/25/10
89	**EPA**	EPA Review of Treatibility Study Recommendations	Fri 11/26/10	Sun 11/28/10
90	9.4	Conduct Treatability Studies at Direction of EPA	Mon 11/29/10	Tue 12/28/10
91				
92	**10**	**Engineering Evaluation/Cost Analysis (EE/CA) Report**	**Wed 12/1/10**	**Thu 1/20/11**
93	10.1	Draft EE/CA	Wed 12/1/10	Thu 12/30/10
94	**EPA**	EPA Review of Draft EE/CA Report	Fri 12/31/10	Sat 1/8/11
95	10.2	Prepare Final EE/CA Report	Sun 1/9/11	Sun 1/16/11
96	**EPA**	EPA Review of Fina EE/CA Report	Mon 1/17/11	Thu 1/20/11
97				
98	**11**	**Post EE/CA Support**	**Mon 1/17/11**	**Mon 2/21/11**
99	11.1	Attend Public Meetings	Mon 2/7/11	Mon 2/7/11
100	11.2	Provide Techncial Assitance for Responsiveness Summary	Tue 2/8/11	Mon 2/21/11
101	11.3	Provide Techncial Assistance for Action Memorandum	Mon 1/17/11	Sun 1/30/11
102	**EPA**	EPA Review of Draft Action Memo	Mon 1/31/11	Wed 2/9/11
103				
104	**13**	**Task Order Closeout**	**Mon 1/31/11**	**Tue 3/22/11**
105	**13.1**	**Package and Return Documents**	**Thu 2/10/11**	**Fri 3/11/11**
112	13.2	Duplicate, Distribute, and Store Files	Mon 1/31/11	Tue 3/1/11
113	13.3	Archive Files	Mon 1/31/11	Tue 3/1/11
114	13.4	Produce EPA-Approved Data Storage Format	Mon 1/31/11	Tue 3/1/11
115	13.5	Prepare and Submit Task Order Closeout Report	Mon 1/31/11	Tue 3/1/11
117	**EPA**	**EPA Review of Task Order Cloesout Report**	**Wed 3/2/11**	**Tue 3/22/11**



Gulfco Marine NTCRS
October 2010
Revision No. 1

Task | Progress | Summary | Rolled Up Split | Rolled Up Progress | Project Summary | Deadline
Split | Milestone | Rolled Up Task | Rolled Up Milestone | External Tasks | External Milestone

Appendix C

Standard Operating Procedures

Standard Operating Procedure No. 001
for
Sample Labels

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

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5. PRECAUTIONS 3

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   5.2 Duplicate Sample 3

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for the use of sample labels. Every sample will have a sample label uniquely identifying the sampling point and analysis parameters. An example label is provided below. Other formats with similar levels of detail are acceptable.

PROJECT NAME _____ PROJECT NUM. _____
SAMPLE LOCATION/SITE ID _____
DATE: ____/____/____ TIME: _____:_____
ANALYTES: METALS VOC EXPLOSIVES ORGANICS OTHER
FILTERED: [NO] [YES]
PRESERVATIVE: [NONE] [HNO_3] [OTHER _____]
SAMPLER: _____

2. MATERIALS

The following materials may be required: sample label and indelible laboratory marker.

3. PROCEDURE

The following sections describe how to use the sample labeling system.

3.1 LABEL INFORMATION

As each sample is collected/selected, fill out a sample label. Enter the following information on each label:

- Project name
- Project number
- Location/site identification—Enter the media type (i.e., well number, surface water, soil, etc.) sampling number, and other pertinent information concerning where the sample was taken
- Date of sample collection

- Time of sample collection
- Analyses to be performed (NOTE: Due to number of analytes, details of analysis should be arranged with laboratory *prior to start of work)*
- Whether filtered or unfiltered (water samples only)
- Preservatives (water samples only)
- Number of containers for the sample (e.g., 1 of 2, 2 of 2).

3.2 ROUTINE CHECK

Double-check the label information to make sure it is correct. Detach the label, remove the backing, and apply the label to the sample container. Cover the label with clear tape, ensuring that the tape completely encircles the container.

3.3 RECORD INFORMATION

Record the sample number and designated sampling point in the field logbook, along with the following sample information:

- Time of sample collection (each logbook page should be dated)
- Location of the sample
- Organic vapor meter or photoionization meter readings for the sample (when appropriate)
- Any unusual or pertinent observations (oily sheen on groundwater sample, incidental odors, soil color, grain size, plasticity, etc.)
- Number of containers required for each sample
- Whether the sample is a quality assurance sample (split, duplicate, or blank).

3.3.1 Logbook Entry

A typical logbook entry might look like this:

- 7:35 a.m. Sample No. MW-3. PID = 35 ppm
- Petroleum odor present. Sample designated MW-3-001.

NOTE: Duplicate samples will be given a unique sample designation rather than the actual sample number with an added prefix or suffix. This will prevent any indication to the laboratory that this is a duplicate sample. This fictitious sample number will be listed in the logbook along with the actual location of the sample.

3.4 SHIPMENT

Place the sample upright in the designated sample cooler. Make sure there is plenty of ice in the cooler at all times.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

5.1 INCIDENTAL ODORS

Note that although incidental odors should be noted in the logbook, it is unwise from a safety and health standpoint to routinely “sniff test” samples for contaminants.

5.2 DUPLICATE SAMPLE

No indication of which samples are duplicates is to be provided to the laboratory.

6. REFERENCES

U.S. Environmental Protection Agency. 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans. QAMS-005/80.

Standard Operating Procedure No. 002
for
Chain-of-Custody Form

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

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2. MATERIALS 1

3. PROCEDURE 1

4. MAINTENANCE 1

5. PRECAUTIONS 2

6. REFERENCES 2

1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for use of the chain-of-custody form. An example is provided as Figure SOP002-1. Other formats with similar levels of detail are acceptable.

2. MATERIALS

The following materials may be required: chain-of-custody form and indelible ink pen.

3. PROCEDURE

- Give the site name and project name/number.
- Enter the sample identification code.
- Indicate the sampling dates for all samples.
- List the sampling times (military format) for all samples.
- Indicate “grab” or “composite” sample with an “X.”
- Specify the sample location.
- Enter the total number of containers per cooler.
- List the analyses/container volume.
- Obtain the signature of sample team leader.
- State the carrier service and airbill number, analytical laboratory, and custody seal numbers.
- Sign, date, and time the “relinquished by” section.
- Upon completion of the form, retain the shipper copy, and affix the other copies to the inside of the sample cooler, in a zip-seal bag to protect from moisture, to be sent to the designated laboratory.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

None.

6. REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.

U.S. EPA. 1990. Sampler's Guide to the Contract Laboratory Program. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C. December.

U.S. EPA. 1991. User's Guide to the Contract Laboratory Program. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January.

Company Name:				Project Manager or Contact: Phone:	Parameters/Method Numbers for Analysis															Chain of Custody Record	
Project No. Dept.: Task:				Project Name:																EA Laboratories 19 Loveton Circle Sparks, MD 21152 Telephone: (410) 771-4950 Fax: (410) 771-4077	
Sample Storage Location:				ATO Number:																**Report Deliverables:** **1 2 3 4 D E** **EDD: Yes/No** **DUE TO CLIENT: _____**	
Page of				**Report #:**																	
Date	Time	Water	Soil	Sample Identification 19 Characters	**No. of Containers**															**EA Labs Accession Number**	Remarks
																					LPM:

Samples by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by Laboratory: (Signature)	Date/Time	Airbill Number:	Sample Shipped by: (Circle) Fed Ex. Puro. UPS Hand Carried Other:

Cooler Temp. _____C pH: ___ Yes ___ No Comments: Custody Seals Intact ___ Yes ___ No

NOTE: Please indicate method number for analyses requested. This will help clarify any questions with laboratory techniques.

Standard Operating Procedure No. 003
for
Subsurface/Utility Clearance

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

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   1.2 Limitations 1
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APPENDIX A: SUBSURFACE CLEARANCE PROCEDURE CHECKLIST
APPENDIX B: UNIFORM COLOR CODES FOR MARKING OF UNDERGROUND FACILITIES

1. SCOPE AND APPLICATION

1.1 PURPOSE

The purpose of this Standard Operating Procedure is to prevent injury to workers and damage to subsurface structures (including tanks, pipe lines, water lines, gas lines, electrical service, etc.) during ground disturbance activities (including drilling, augering, sampling, use of direct-push technologies, excavation, trenching, concrete coring or removal, fence post installation, grading, or other similar operations).

1.2 LIMITATIONS

The procedures set forth in this document are the suggested procedures but may not be applicable to particular sites based on the site-specific considerations. The Project Manager is responsible for making a site-specific evaluation of each site to determine whether the Subsurface/Clearance Procedures should be utilized or require modification. If safety or other site-specific considerations require a modified or different procedure, the Project Manager should review the modified procedure with the Business Unit Director, Profit Center Manager, or Senior Technical Reviewer.

1.3 SCOPE

This procedure provides minimum guidance for subsurface clearance activities, which must be followed prior to and during ground disturbance activities at EA project sites. Even after completing the subsurface clearance activities required in this procedure, all ground disturbance activities should proceed with due caution.

Deviations from this procedure may be provided on an exception basis for specific situations, such as underground storage tank systems removals, verified aboveground/overhead services/lines, undeveloped land/idle facilities, shallow groundwater conditions, soil stability, or well construction quality assurance/quality control concerns, etc.

EA or its subcontractors are responsible for, and shall ensure that, all ground disturbance activities are completed safely, without incident, and in accordance with applicable federal, state, and local regulations.

This procedure shall not override any site-specific or consultant/contractor procedures that are more stringent or provide a greater degree of safety or protection of health or the environment.

2. PROCEDURES

The EA Project Manager or his designee must complete the Subsurface Clearance Procedure Checklist (Appendix A) in conjunction with the following procedures. The checklist must be completed before initiating any ground disturbance activities. The completed checklist must be submitted to the appropriate team individuals, subcontractors, and/or the client and included in the project files.

2.1 SAFETY

A Health and Safety Plan must be available onsite and followed by all contractors and subcontractors.

All work areas shall be defined and secured with safety cones, safety tape, construction fence, other barriers, or signs as appropriate.

Site work permits must be obtained as required by site procedures. Based on site conditions or classification, the use of intrinsically-safe equipment may be required.

To ensure the safety of all onsite personnel and subsurface structure integrity, consideration should be given to de-energizing and locking out selected site utilities or temporarily shutting down a portion of or the entire facility.

2.2 PREPARATION TASKS

Objective—To gather all relevant information about potential subsurface structures prior to the actual site visit.

2.2.1 Obtain Permits and Site Access

The consultant/contractor is responsible for following all applicable laws, guidance, and approved codes of practice; obtaining all necessary permits and utility clearances; and securing site access permission.

2.2.2 Historic Site Information

Obtain most recent as-built drawings and/or site plans (including underground storage tank, product, and vent lines) as available.

NOTE: As-built drawings may not accurately depict the locations and depths of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

EA should obtain any other site information such as easements, right-of-ways, historical plot plans, fire insurance plans, tank (dip) charts, previous site investigations, soil surveys, boring logs, and aerial photographs, etc. as relevant to the planned ground disturbance activities.

Where applicable, EA should also contact contract personnel who may have historic site knowledge.

2.2.3 Mark-Outs

Objective—To identify location of subsurface structures on surface.

EA must ensure that a thorough mark-out at the site is completed to locate electrical, gas, telephone, water, sewer, low voltage electric lines, product delivery pipelines, fiber optic, and all other subsurface utilities/services.

- Where available, public utility companies must be contacted to identify underground utilities. (This can be accomplished through the One-Call system in most instances.)

- In addition, where available and warranted by site conditions, a private utility/pipeline mark-out company should be contracted to perform an electronic subsurface survey to identify the presence of suspected hazardous or critical underground utilities and subsurface structures. In some cases, this is necessary to confirm public utility mark-outs in the vicinity of planned ground disturbance activities.

EA will review all available site plan subsurface information with the private mark-out company to assist in locating utilities and other subsurface structures.

NOTE: Mark-outs may not accurately depict the exact locations of improvements and subsurface structures and should, therefore, not be **solely** relied upon.

Where possible, EA personnel are encouraged to be onsite at the time of subsurface mark-outs. This is to ensure accuracy and understanding of subsurface structures identified and provides an opportunity to exchange information with mark-out company personnel regarding planned work activities.

Subsurface structures should be marked throughout the entire work area(s) with adequate materials (e.g., site conditions may require paint and tape/flags). Ground disturbance activities must be started within 30 days of mark-out, unless local ordinances specify a shorter time period. If activities are not started within required time period or markings have faded, mark-outs must be redone.

EA personnel will record time and date of mark-out request and list all companies contacted by the service and confirmation number. This should be available for review onsite and checked off after visual confirmation of markings.

2.2.4 Initial Site Visit

Objective—To compare the site plan to actual conditions based on information gathered in Procedures 2 and 3 above, obtain additional site information needed, and prepare a vicinity map.

EA will document all findings and update the site plan with this information. On third party sites, close coordination with the site owner's representatives for mark-outs, review of as-builts, and other information reviews should be conducted prior to work. Project Managers are encouraged to provide updated as-built information to the client.

In some regions, it may be more effective and efficient to conduct the site visit at the same time the contractor and drill rig are mobilized to the site. The inspection should include the following activities and may include others as determined by the consultant/contractor and the Project Manager.

2.2.5 Utilities

EA shall perform a detailed site walk-through for the purpose of identifying all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within the planned work area. The inspection shall include, but not be limited to, the following:

- Utility mark-outs
- Aboveground utilities
- Area lights/signs
- Phones
- Drains
- Junction boxes
- Natural gas meters or connections
- Other utilities including: fire hydrants, on/below grade electrical transformers, splice cages, sewer lines, pipeline markers, cable markers, valve box covers, clean-outs/traps, sprinkler systems, steam lines (including insulated tanks that may indicate steam lines), and cathodic protection on lines/tanks
- Observe paving scars (i.e., fresh asphalt/concrete patches, scored asphalt/concrete).

NOTE: In many cases, the onsite location of low-voltage electrical lines and individual property water and sewer line branches may be approximated by using the following technique:

- Locate the entry/connection location at the facility building
- Attempt to identify utility connections for the mains (water sewer, etc.) by locating clean-outs, valve manways, etc. The location path of the utility is likely with the area between the main connection and facility building connection. Subsurface electrical line locations from the facility building to signs, lamps, etc. can be estimated with the same process.

2.2.6 Other Subsurface Systems

Some other subsurface systems to be cognizant of during subsurface activities include product delivery systems (i.e., at gas stations) and existing remediation systems.

2.2.7 Selection of Ground Disturbance Locations

EA will utilize the information collected to this point in combination with regulatory requirements and project objectives to select ground disturbance locations. Ground disturbance locations should also consider the location of overhead obstructions (e.g., power lines). Work at active gasoline retail locations must consider several special considerations that should be outlined in the site-specific safety and health plan.

2.2.8 Review of Selected Locations with the Client

EA will review the selected ground disturbance locations with the client. EA will not proceed with the subsurface activities until the plan has been discussed with the client. During execution of the project, subsurface activities are required outside of the area previously approved by the client. EA will submit these changes to the client for approval prior to execution.

2.2.9 Ground Disturbance Activity Sequence

EA will plan ground disturbance activities starting at the point farthest from the location of suspected underground improvements. This is done to determine the natural subsurface conditions and to allow EA site personnel to recognize fill conditions.

Experience has shown that the following warning signs may indicate the presence of a subsurface structure:

- Warning tape (typically indicative of underground services).
- Pea gravel/sand/non-indigenous material (typically indicative of tanks or lines).
- Red concrete (typically indicative of electrical duct banks).

- The abrupt absence of soil recovery in a hand auger. This could indicate pea gravel or sand that has spilled out of the auger. This may not be indicative in areas where native soil conditions typically result in poor hand auger recoveries.

- Any unexpected departure from the native soil or backfill conditions as established by prior onsite digging.

If any of these conditions is encountered by EA site personnel, digging should stop and the client should be contacted.

3. SUBSURFACE CLEARANCE METHODS

The method used to delineate the subsurface should be compatible with the inherent associated risk given the type of facility/property, soil stratigraphy, and the location of the ground disturbance activity, such that required delineation is obtained. It should be noted that in areas where there is paving, sufficient paving should be removed to allow clear visibility of the subsurface conditions during clearance activities. The following is a list of potential clearance methods that may be used on a job site:

- Vacuum digging
- Probing
- Hand digging
- Hand augering
- Post-hole digging.

EA personnel will evaluate the potential for electrical shock or fire/explosion for each subsurface disturbance project and will evaluate as necessary the use of non-conductive or non-sparking tools (i.e., fiberglass hand shovels, and thick electrically insulating rubber grips on hand augers or probes). The potential need for the use of non-conductive materials, electrical safety insulated gloves, and footwear will also be evaluated on a case-by-case basis.

3.1 SUBSURFACE CLEARANCE PROCEDURES FOR DRILLING, DIRECT-PUSH TECHNOLGY, AUGERING, FENCE POST INSTALLATION, OR OTHER BOREHOLE INSTALLATION ACTIVITIES

The area to be delineated will exceed the diameter of the largest tool to be advanced and sufficiently allow for visual inspection of any obstructions encountered.

3.2 SUBSURFACE CLEARANCE PROCEDURES FOR TRENCHING/ EXCAVATION ACTIVITIES

Appropriate subsurface clearance methods should be conducted along the length and width of the excavation at a frequency sufficient to ensure adequate precautions have been applied to the entire work area. The frequency and density of investigations will be based on site knowledge, potential hazards, and risks of the work area to surrounding locations (e.g., proximity to a residential area or school).

Whenever subsurface structures are exposed, EA will cease work and mark the area (e.g., flags, stakes, cross bracing) to ensure the integrity of these exposed structures is maintained during subsequent trenching/excavation/backfilling.

Uniform color codes for marking of underground facilities are provided in Appendix B.

Appendix A

Subsurface Clearance Procedure Checklist

Subsurface Clearance Procedure Checklist

Site Identification: _____

Project Consultant/Contractor: _____

Section 1: Safety, Preparation Tasks, and Mark-Outs

Activity	Yes	No	N/A	Comments including Justification if Response Is No or Not Applicable
Health and Safety Plan is available and all contractors and subcontractors are familiar with it.				
All applicable local, state, and federal permits have been obtained.				
Site access/permission has been secured.				
Most recent as-built drawings and/or site plans (including underground storage tank, product, and vent lines) obtained.				
Reviewed site information to identify subsurface structures relevant to planned site activities (easements, rights-of-way, historical plot plans, fire insurance plans, tank dip charts, previous site investigations, soil surveys, boring logs, aerial photographs, etc.).				
Utility mark-outs have been performed by public utility company(s). Mark-outs clear/visible.				
Subsurface structure mark-outs performed by private mark-out company. Mark-outs clear/visible.				
Additional Activities: Were dig locations reviewed with site representative?				

Section 2: Initial Site Visit and Selecting Ground Disturbance Locations

Activity	Yes	No	N/A	Comments including Justification if Response Is No or Not Applicable
Location of all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within the planned work area has been identified.				
Location of utility mark-outs by all utility companies previously contacted has been identified within required time period.				
Location of all subsurface structure mark-outs by private mark-out company has been identified within required time period.				
Location of area lights/signs and associated subsurface lines identified.				
Location of all phones and associated subsurface lines identified.				
Location of all drains and associated interconnecting lines identified.				
Location of all electrical junction boxes and associated interconnecting lines identified				
Location of all natural gas meters or connections and all interconnecting lines identified				

Completed by: _____
Name

Signature: _____ _____
Company Date

Appendix B

Uniform Color Codes for Excavation

APWA UNIFORM COLOR CODE

WHITE - Proposed Excavation

PINK - Temporary Survey Markings

RED - Electric Power Lines, Cables, Conduit and Lighting Cables

YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials

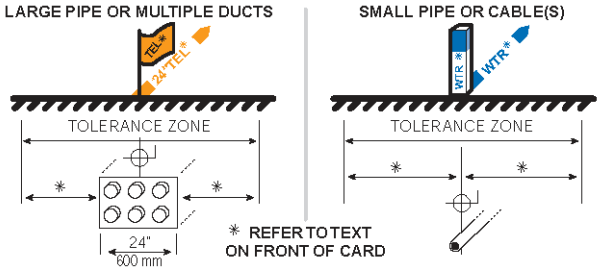
ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit

BLUE - Potable Water

PURPLE - Reclaimed Water, Irrigation and Slurry Lines

GREEN - Sewers and Drain Lines

TYPICAL MARKING



Customize with your center's phone and address information

GUIDELINES FOR UNIFORM TEMPORARY MARKING OF UNDERGROUND FACILITIES

This marking guide provides for universal use and understanding of the temporary marking of subsurface facilities to prevent accidents and damage or service interruption by contractors, excavators, utility companies, municipalities or any others working on or near underground facilities.

ONE-CALL SYSTEMS
The One-Call damage prevention system shall be contacted prior to excavation.

PROPOSED EXCAVATION
Use white marks to show the location, route or boundary of proposed excavation. Surface marks on roadways do not exceed 1.5" by 18" (40 mm by 450 mm). The facility color and facility owner identity may be added to white flags or stakes.

USE OF TEMPORARY MARKING
Use color-coded surface marks (i.e., paint or chalk) to indicate the location or route of active and out-of-service buried lines. To increase visibility, color coded vertical markers (i.e., stakes or flags) should supplement surface marks. Marks and markers indicate the name, initials or logo of the company that owns or operates the line, and width of the facility if it is greater than 2" (50 mm). Marks placed by other than line owner/operator or its agent indicate the identity of the designating firm. Multiple lines in joint trench are marked in tandem. If the surface over the buried line is to be removed, supplementary offset markings are used. Offset markings are on a uniform alignment and clearly indicate the actual facility is a specific distance away.

TOLERANCE ZONE
Any excavation within the tolerance zone is performed with non-powered hand tools or non-invasive method until the marked facility is exposed. The width of the tolerance zone may be specified in law or code. If not, a tolerance zone including the width of the facility plus 18" (450 mm) measured horizontally from each side of the facility is recommended.

ADOPT UNIFORM COLOR CODE
The American Public Works Association encourages public agencies, utilities, contractors, other associations, manufacturers and all others involved in excavation to adopt the APWA Uniform Color Code, using ANSI standard Z535.1 Safety Colors for temporary marking and facility identification.

Rev. 4/99

Standard Operating Procedure No. 004
for
Sample Packing and Shipping

Prepared by

EA Engineering, Science, and Technology, Inc.
11019 McCormick Road
Hunt Valley, Maryland 21031

Revision 0
August 2007

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to delineate protocols for the packing and shipping of samples to the laboratory for analysis.

2. MATERIALS

The following materials may be required:

Clear tape	Plastic garbage bags
Custody seals	Sample documentation
Ice	Waterproof coolers (hard plastic or metal)
Metal cans with friction-seal lids (e.g., paint cans)	Zip-seal plastic bags
Packing material[1]	

3. PROCEDURE

Check cap tightness and verify that clear tape covers label and encircles container. Wrap sample container in bubble wrap or closed cell foam sheets. Enclose each sample in a clear zip-seal plastic bag.

Place several layers of bubble wrap, or at least 1 in. of vermiculite on the bottom of the cooler. Line cooler with open garbage bag, place all the samples upright inside a garbage bag, and tie the bag.

Double bag and seal loose ice to prevent melting ice from soaking the packing material. Place the ice outside the garbage bags containing the samples.

Pack shipping containers with packing material (closed-cell foam, vermiculite, or bubble wrap). Place this packing material around the sample bottles or metal cans to avoid breakage during shipment.

Enclose all sample documentation (i.e., Field Parameter Forms, chain-of-custodies) in a waterproof plastic bag and tape the bag to the underside of the cooler lid. If more than one cooler is being used, each cooler will have its own documentation.

Seal the coolers with signed and dated custody seals so that if the cooler were opened, the custody seal would be broken. Place clear tape over the custody seal to prevent damage to the seal.

1. Permissible packing materials are: (a) (non-absorbent) bubble wrap or closed cell foam packing sheets, or (b) (absorbent) vermiculite. Organic materials such as paper, wood shavings (excelsior), and cornstarch packing “peanuts” will not be used.

Refer to SOP Nos. 001, 002, 016, and 039.

Tape the cooler shut with packing tape over the hinges and place tape over the cooler drain. Ship all samples via overnight delivery on the same day they are collected if possible.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

Any samples suspected to be of medium/high contaminant concentration or containing dioxin must be enclosed in a metal can with a clipped or sealable lid (e.g., similar to a paint can). Label the outer metal container with the sample number of the sample inside.

6. REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1980. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005/80.

U.S. EPA. 1990. Sampler's Guide to the Contract Laboratory Program. EPA/540/P-90/006, Directive 9240.0-06, Office of Emergency and Remedial Response, Washington, D.C. December.

U.S. EPA. 1991. User's Guide to the Contract Laboratory Program. EPA/540/O-91/002, Directive 9240.0-01D, Office of Emergency and Remedial Response. January.

Standard Operating Procedure No. 005
for
Field Decontamination

Prepared by

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1. SCOPE AND APPLICATION

All personnel or equipment involved in intrusive sampling, or which enter a hazardous waste site during intrusive sampling, must be thoroughly decontaminated prior to leaving the site to minimize the spread of contamination and prevent adverse health effects. This Standard Operating Procedure describes the normal decontamination of sampling equipment and site personnel.

2. MATERIALS

The following materials may be required:

0.01N HCl	Non-phosphate laboratory detergent (liquinox)
0.10N nitric acid	Plastic garbage bags
Aluminum foil or clean plastic sheeting	Plastic sheeting, buckets, etc. to collect wash water and rinsates
Approved water	Pressure sprayer, rinse bottles, brushes
High performance liquid chromatography (HPLC)-grade water[1]	Reagent grade alcohol[2]

3. PROCEDURE

3.1 SAMPLE BOTTLES

At the completion of each sampling activity, the exterior surfaces of the sample bottles must be decontaminated as follows:

- Ensure the bottle lids are on tight.
- Wipe the outside of the bottle with a paper towel to remove gross contamination.

3.2 PERSONNEL DECONTAMINATION

Review the project Health and Safety Plan for the appropriate decontamination procedures.

1. For the purposes of this Standard Operating Procedure, HPLC-grade water is considered equivalent to "deionized ultra filtered water," "reagent-grade distilled water," and "deionized organic-free water." The end product being water which is pure with no spurious ions or organics to contaminate the sample. The method of generation is left to the individual contractor.
2. For the purposes of this Standard Operating Procedure, the term "reagent grade alcohol" refers to either pesticide grade isopropanol or reagent grade methanol.

3.3 EQUIPMENT DECONTAMINATION

3.3.1 Water Samplers

3.3.1.1 Bailers

After each use, polytetrafluoroethelyne (PTFE) double check valve bailers used for groundwater sampling will be decontaminated as follows:

- Discard all ropes used in sampling in properly marked sealable container, or as directed by the Health and Safety Plan. NOTE: No tubing is to be used in conjunction with a bailer in collecting samples.
- Scrub the bailer to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate detergent.
- Rinse off detergent three times with approved water.
- Rinse bailer with reagent grade alcohol.
- Rinse bailer three times with HPLC-grade water.
- Rinse bailer with 0.10N nitric acid solution.
- Rinse bailer three times with HPLC-grade water.
- Allow bailer to air dry.[3]
- Wrap bailer in aluminum foil or clean plastic sheeting, or store in a clean, dedicated polyvinyl chloride or PTFE storage container.
- Dispose of used decontamination solutions with drummed purge water.
- Rinse bailer with HPLC-grade water immediately prior to re-use.

3.3.1.2 Pumps

Submersible pumps will be decontaminated as follows:

3. If the bailer has just been used for purging and is being decontaminated prior to sampling, do not air dry. Double rinse with HPLC-grade water and proceed to collect samples.

- Scrub the exterior of the pump to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate detergent. (Steam cleaning may be substituted for detergent scrub.)

- Calculate the volume of pump plus any tubing which is not disposable and not dedicated to a single well. Pump three volumes of non-phosphate laboratory detergent solution to purge and clean the interior of the pump.

- Rinse by pumping no less than nine volumes of approved water to rinse.

- Rinse pump exterior with reagent grade alcohol.

- Rinse pump exterior with HPLC-grade water.

- Allow pump to air dry.

- Wrap pump in aluminum foil or clean plastic sheeting, or store in a clean, dedicated polyvinyl chloride or PTFE storage container.

- Prior to reusing pump rinse exterior again with HPLC-grade water. (Double rinse in Bullet 5 above may be substituted for this step).

3.3.1.3 Dip Samplers

All dip samplers, whether bucket, long-handled, or short-handled, will be decontaminated in the same manner as provided in Section 3.3.1.1.

3.3.1.4 Labware

Labware, such as beakers, which are used to hold samples for field measurements, water chemistry, etc. will be decontaminated according to the procedures in Section 3.3.1.1.

3.3.1.5 Water Level Indicators

Electric water level indicators, weighted measuring tapes, or piezometers used in the determination of water levels, well depths, and/or non-aqueous phase liquid levels will be decontaminated in accordance with Section 3.3.1.1. Clean laboratory wipes may be substituted for brushes. Tapes, probes, and piezometers should be wiped dry with clean laboratory wipes, and coiled on spools or clean plastic sheeting rather than allowed to air dry.

3.3.2 Solid Materials Samplers

Solid materials samplers include soil sampling probes, augers, trowels, shovels, sludge samplers, and sediment samplers, which will be decontaminated as follows:

- Scrub the sampler to remove gross (visible) contamination, using appropriate brush(es), approved water, and non-phosphate laboratory detergent.
- Rinse off detergent with approved water.
- Rinse sampler with reagent grade alcohol.
- Rinse sampler with HPLC-grade water.
- For non-metallic samplers only, rinse sampler with 0.10N nitric acid solution.
- For non-metallic samplers only, rinse sampler with HPLC-grade water.
- Allow sampler to air dry.
- Wrap sampler in aluminum foil clean plastic sheeting, or store in a new zipseal bag (size permitting) or clean, dedicated polyvinyl chloride or PTFE storage container.
- Dispose used decontamination solutions properly according to the site-specific Health and Safety Plan.
- Rinse sampler with HPLC-grade water immediately prior to re-use.

3.3.3 Other Sampling and Measurement Probes

Soil gas sampling probes will be decontaminated as solids sampling devices.

Temperature, pH, conductivity, redox, and dissolved oxygen probes will be decontaminated according to manufacturer's specifications. If no such specifications exist, remove gross contaminant and triple rinse probe with HPLC-grade water. A summary of the decontamination procedures to be used must be included in the instrument-specific standard operating procedure.

Measuring tapes that become contaminated through contact with soil during field use will be decontaminated as follows:

- Wipe tape with a clean cloth or laboratory wipe that has been soaked with non-phosphate laboratory detergent solution to remove gross contamination. Rinse cloth in the solution and continue wiping until tape is clean.
- Wipe tape with a second clean, wet cloth (or laboratory wipe) to remove soap residues.
- Dry tape with a third cloth (or laboratory wipe) and rewind into case, or re-coil tape.

3.3.4 Drilling Rigs and Other Heavy Equipment

All drilling rigs and associated equipment such as augers, drill casing, rods, samplers, tools, recirculation tank, and water tank (inside and out) will be decontaminated prior to site entry after over-the-road mobilization and immediately upon departure from a site after drilling a hole. Supplementary cleaning will be performed prior to site entry when there is a likelihood that contamination has accumulated on tires and as spatter or dust enroute from one site to the next.

- Place contaminated equipment in an enclosure designed to contain all decontamination residues (water, sludge, etc.).
- Steam clean equipment until all dirt, mud, grease, asphaltic, bituminous, or other encrusting coating materials (with the exception of manufacturer-applied paint) have been removed.
- Water used will be taken from an approved source.
- Containerize in 55-gal drums; sample; characterize; and, based on sample results, dispose of all decontamination residues properly.

Other heavy equipment includes use of backhoes, excavators, skid steers, etc. If heavy equipment is utilized during field activities, i.e., a backhoe for test pitting, the bucket should not come in contact with soil to be sampled. If the bucket contacts the soil to be sampled, then it should be decontaminated between sample locations, following the same procedures as listed above for a drill rig.

3.3.5 High Performance Liquid Chromatography-Grade Water Storage

Dedicated glass storage containers will be used solely for dispensing HPLC-grade water. New HPLC-grade water containers will be decontaminated as follows:

- Clean with tap water from approved source and non-phosphate laboratory detergent while scrubbing the exterior and interior of the container with a stiff-bristled brush.
- Rinse thoroughly with approved water.
- Rinse with 0.01N nitric acid.
- Rinse with approved water.
- Rinse thoroughly with HPLC-grade water.
- Fill clean container with HPLC-grade water. Cap with one layer of PTFE-lined paper and one layer of aluminum foil. Secure cap with rubber band and date the container.

Used HPLC-grade water containers will be decontaminated as follows:

- Clean the exterior with tap water from an approved source, non-phosphate laboratory detergent, and a stiff-bristled brush.
- Rinse the exterior thoroughly with HPLC-grade water.
- Rinse the interior twice with pesticide-grade isopropanol.
- Rinse interior thoroughly with HPLC-grade water.
- Fill clean container with HPLC-grade water. Cap with one layer of PTFE-lined paper and one layer of aluminum foil. Secure cap with rubber band and date the container.

3.3.6 Ice Chests and Reusable Shipping Containers

- Scrub exterior/interior with approved brush and liquinox detergent.
- Rinse off detergent three times with approved water.
- Let air dry and properly store until re-use.

NOTE: If container/ice chest is severely contaminated, clean as thoroughly as possible, render unusable, and properly dispose.

4. MAINTENANCE

HPLC-grade water will be stored only in decontaminated glass containers with aluminum foil lids as stipulated above. The water may not be stored for more than nor used more than 3 days after manufacture.

HPLC-grade water will be manufactured onsite. An approved tap water source will be used as the influent to the system. Procedures for system setup, operation, and maintenance will conform to manufacturer's specifications.

5. PRECAUTIONS

Dispose of all wash water, rinse water, rinsates, and other sampling wastes (tubing, plastic sheeting, etc.) in properly marked, sealable containers, or as directed by the Health and Safety Plan.

Once a piece of equipment has been decontaminated, be careful to keep it in such condition until needed.

Do not eat, smoke, or drink onsite.

6. REFERENCES

Site-specific Health and Safety Plan.

Standard Operating Procedure No. 015
for
Document Control System

Prepared by

EA Engineering, Science, and Technology, Inc.
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Revision 0
August 2007

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for identifying and storing a complete set of documents relating to project tasks. Each document will receive a unique identification number comprised of elements describing the document.

2. MATERIALS

Not applicable.

3. PROCEDURE

Each project-related document will be given to the Document Control Officer. The Document Control Officer will record information for each document on a Document Control Sheet which will be retained as a backup record. The information from each Document Control Sheet will be maintained in a computer database.

The individual Document Control Number will be entered on the Document Log Sheet and will be written on the document.

The storage location for each document will be recorded on the Document Control Log Sheet and the documents will be stored in the recorded location.

The database file will be backed up on a regular basis to prevent accidental loss of the data.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

None.

6. REFERENCES

None.

Standard Operating Procedure No. 021
for
Sediment Sampling

Prepared by

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1. SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) delineates protocols for sampling sediments from streams, rivers, ditches, lakes, ponds, lagoons, and marine and estuarine systems.

EA recognizes that other protocols have been developed that meet the criteria of quality and reproducibility. Clients may have their own sediment sampling protocols which may contain methodologies and procedures that address unique or unusual site-specific conditions or may be in response to local regulatory agency requirements. In such cases, EA will compare its and the client's protocols. The goal is to provide the client with the most quality; therefore, if the client's protocols provide as much or more quality assurance than EA's protocols for the particular site or project, EA will adopt those particular protocols and this SOP will be superseded in those respects. If EA is required to implement the client's protocols in lieu of EA's protocols, EA will make the client formally aware of any concerns regarding differences in protocols that might affect data quality and will document such concerns in the project file.

2. PROCEDURES

The water content of sediment varies. Sediments range from soft to dense and fine to rocky. A variety of equipment may be necessary to obtain representative samples, even at a single site. Factors to consider in selecting the appropriate sampling equipment include sample location (edge or middle of the waterbody), depth of water and sediment, grain size, water velocity, and analytes of interest.

3. GENERAL PROCEDURES

1. Surface water and sediment samples are to be collected at the same location (if both are required in the project-specific Sampling and Analysis Plan).

2. Collect the surface water sample first. Sediment sampling usually results in disturbance of the sediments, which may influence the analytical results of the surface water samples.

3. Wear gloves when collecting samples. Comply with the Health and Safety Plan specifications for proper personal protective equipment.

4. If sampling from a boat or near waterbodies with depths of 4 ft or more, the sampling team will wear life jackets.

5. Wading into a waterbody disturbs the sediment. Move slowly and cautiously, approach the sample location from downstream. If flow is not strong enough to move entrained particles away from the sample location, wait for the sediment to resettle before sampling.

6. Collect samples first from areas suspected of being the least contaminated, thus minimizing the risk of cross-contamination.

7. Collecting samples directly into sample containers is not recommended. Sediment samples should be placed in Teflon®, stainless steel, or glass trays, pans, or bowls for sample preparation.

8. Use the proper equipment and material construction for the analytes of interest. For example, for volatile organic compound analysis, the sampling material in direct contact with the sediment or surface water must consist of Teflon, polyethylene, or stainless steel.

9. Refer to EA SOP No. 005 (Field Decontamination) for proper decontamination methods before and after sampling and between samples.

10. Collect samples for volatile organic compound analysis first. Do not mix such samples before placing them in the sample containers. For composite volatile organic compound samples, place equal aliquots of each subsample in the sample container.

11. Sediment that will be analyzed for other than volatile organic compounds should be prepared as follows:

    - Place the sediment in a mixing container.
    - Divide the sediment into quarters.
    - Mix each quarter separately and thoroughly.
    - Combine the quarters and mix thoroughly.
    - For composite samples, mix each subsample as described above. Place equal aliquots of each subsample in a mixing container and follow the procedure described above.

12. Mark the sampling location on a site map. Record sampling location coordinates with a Global Positioning System unit, photograph (optional, recommended) and describe each location, and place a numbered stake above the visible high water mark on the bank closest to the sampling location. The photographs and description must be adequate to allow the sampling station to be relocated at a future date.

13. Dispose of investigation-derived wastes according to applicable rules and regulations.

4. CORERS

A corer provides a vertical profile of the sediment, which may be useful in tracing historical contaminant trends. Because displacement is minimal, a corer is particularly useful when sampling for trace metals and organics. Corers can be constructed out of a variety of materials.

For example, a 2-in. diameter polyvinyl chloride pipe with a Teflon or polyethylene liner can be lowered into the sediment; a 2-in. diameter well cap can be used to form an airtight seal and negative pressure as the pipe is withdrawn.

- Ensure that the corer and (optional) liner are properly cleaned.
- Stand downstream of the sample location.
- Force the corer into the sediment with a smooth continuous motion. Rotate (not rock) the corer if necessary to penetrate the sediment.
- Twist the corer to detach the sample; then withdraw the corer in a single smooth motion. If the corer does not have a nosepiece, place a cap on the bottom to keep the sediment in place.
- Remove the top of the corer and decant the water (into appropriate sample containers for surface water analysis, if required).
- Remove the nosepiece or cap and deposit the sample into a stainless steel, Teflon, or glass tray.
- Transfer the sample into sample containers using a stainless steel spoon (or equivalent device).

5. SCOOPS AND SPOONS

When sampling at the margins of a waterbody or in shallow water, scoops and spoons may be the most appropriate sampling equipment. For collecting samples several feet from shore or in deeper water, the scoop or spoon may be attached to a pole or conduit.

- Stand downstream of the sample location.
- Collect the sample slowly and gradually to minimize disturbing the fine particles.
- Decant the water slowly to minimize loss of fine particles.
- Transfer the sediment to sample containers or mixing trays, as appropriate.

6. DREDGES

Three types of dredges are most frequently used: Peterson, Ponar, and Eckman. Many other dredge types are available; their applicability will depend upon site-specific factors.

6.1 PETERSON AND PONAR DREDGES

These dredges are suitable for hard, rocky substrates, deep waterbodies, and streams with fast currents. Ponars have top screens and side plates to prevent sample loss during retrieval.

- Open the jaws and place the cross bar into the proper notch.
- Lower the dredge to the bottom, making sure it settles flat.
- When tension is removed from the line, the cross bar will drop, enabling the dredge to close as the line is pulled upward during retrieval.
- Pull the dredge to the surface. Make sure the jaws are closed and that no sample was lost during retrieval.
- Open the jaws and transfer the sediment to sample containers or to a mixing tray.

6.2 ECKMAN DREDGE

The Eckman dredge works best in soft substrates in waterbodies with slow or no flow.

- Open the spring-loaded jaws and attach the chains to the pegs at the top of the sampler.
- Lower the dredge to the bottom, making sure it settles flat.
- Holding the line taut, send down the message to close the jaws.
- Pull the dredge to the surface. Make sure the jaws are closed and that no sample was lost during retrieval.
- Open the jaws and transfer the sediment to sample containers or a mixing tray.

7. REFERENCES

None.

Standard Operating Procedure No. 025
for
Soil Sampling

Prepared by

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to delineate protocols for sampling surface and subsurface soils. Soil samples give an indication of the area and depth of site contamination, so a representative sample is very important.

2. MATERIALS

The following materials may be required:

Bucket auger or push tube sampler	Split-spoon, Shelby tube, or core barrel sampler
Drill rig and associated equipment	Stainless steel bowl
Personal protective equipment as required by the Health and Safety Plan	Stainless steel spoon, trowel, knife, spatula (as needed)

3. PROCEDURE

3.1 SUBSURFACE SAMPLES

Don personal protective equipment. Collect split-spoon, core barrel, or Shelby Tube samples during drilling. Upon opening sampler, or extruding sample, immediately screen soil for volatile organic compounds using either a photoionization detector or flame ionization detector. If sampling for volatile organic compounds, determining the area of highest concentration, use a stainless steel knife, trowel, or laboratory spatula to peel and sample this area. Log the sample in the Field Logbook while it is still in the sampler. Peel and transfer the remaining sample in a decontaminated stainless steel bowl. Mix thoroughly with a decontaminated stainless steel spoon or trowel. Place the sample into the required number of sample jars. Preserve samples as required. Discard any remaining sample into the drums being used for collection of cuttings. Decon sampling implements. All borings will be abandoned.

NOTE: If sample recoveries are poor, it may be necessary to composite samples before placing them in jars. In this case, the procedure will be the same, except that two split-spoon samples will be mixed together. The Field Logbook should clearly state that the samples have been composited, which samples were composited, and why the compositing was done.

Samples taken for geotechnical analysis will be undisturbed samples, collected using a thin-walled (Shelby tube) sampler.

3.2 SURFICIAL SOIL SAMPLES

Don personal protective equipment. Remove vegetative mat. Collect a sample from under the vegetative mat with a stainless steel trowel, push tube sampler, or bucket auger. If a representative sample is desired over the depth of a shallow hole or if several shallow samples are to be taken to represent an area, composite as follows:

- As each sample is collected, place a standard volume in a stainless steel bowl.
- After all samples from each hole or area are in the bucket, homogenize the sample thoroughly with a decontaminated stainless steel spoon or spatula.

If no compositing is to occur, place sample directly into the sample jars. Place the leftover soil in the auger borings and holes left by sampling. If necessary, add clean sand to bring the subsampling areas back to original grade. Replace the vegetative mat over the disturbed areas. Samples for volatile organic compounds will not be composited. A separate sample will be taken from a central location of the area being composited and transferred directly from the sampler to the sample container. Preserve samples as required. Decon sampling implements.

4. MAINTENANCE

Not applicable.

5. PRECAUTIONS

Refer to the Health and Safety Plan.

Soil samples will not include vegetative matter, rocks, or pebbles, unless the latter are part of the overall soil matrix.

6. REFERENCES

American Society for Testing and Materials (ASTM). Method D1586-84, Penetration Test and Split-Barrel Sampling of Soils.

ASTM. Method D1587-83, Thin Walled Sampling of Soils.

Department of the Army, Office of the Chief of Engineers. 1972. Engineer Manual 1110-2-1907 Soil Sampling. 31 March.

Standard Operating Procedure No. 028
for
Well and Boring Abandonment

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to establish the protocols by which all wells and borings will be safely abandoned. The primary objective of well abandonment is to ensure that the abandoned well or boring does not provide a conduit for the vertical migration of contamination between aquifers.

2. MATERIALS

The following materials may be required:

Drill rig	Bentonite pellets (seal)
Filter pack material	Cement (Portland Type II)
Pure sodium bentonite with no additives (bentonite) powder (grout)	Approved water

3. PROCEDURE

The procedures used in boring abandonment will ideally accomplish two objectives: (1) protect aquifers from cross-contamination by sealing the borehole, and (2) restore the strata in the borehole to nearly original conditions by selective placement of fill material.

Any casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, grout will be placed from the bottom of the hole to within 3 ft of the ground surface, and allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with “ABD,” for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site or cluster.

If the hole is within 10 ft of a monitoring well in the same aquifer, or a replacement well is to be installed within 10 ft of the well, any temporary casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, the hole will then be backfilled with filter pack material opposite sand strata and bentonite or grout opposite substantial (2 ft or thicker) clay and silt strata. Where sand as backfill approaches the ground surface, 2 ft of bentonite will be placed above the sand and a 3-ft concrete plug will be placed at the surface. Otherwise, backfill materials will be placed from the bottom of the hole to within 3 ft of the ground surface. These materials will be allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with “ABD,” for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

If the well is not within 10 ft of another monitoring well, or if there are no substantial, continuous sand bodies, and no replacement well is planned within 10 ft of the original well location, then the hole may be grouted from the bottom to the top.

3.1 GROUT

Grout used in construction will be composed by weight of:

- 20 parts cement (Portland cement, Type II or V)
- 0.4-1 part (maximum) (2-5 percent) bentonite
- 8 gal (maximum) approved water per 94-lb bag of cement.

Neither additives nor borehole cuttings will be mixed with the grout. Bentonite will be added after the required amount of cement is mixed with the water.

All grout material will be combined in an aboveground container and mechanically blended to produce a thick, lump-free mixture. The mixed grout will be recirculated through the grout pump prior to placement.

Grout placement will be performed using a commercially available grout pump and a rigid tremie pipe removal and grouting will be accomplished in stages, aquifer by aquifer, sealing the boring from the bottom to ground surface. This will be accomplished by placing a grout pipe to the bottom and pumping grout through the pipe until undiluted grout reaches the bottom of the next higher section of casing or, for the top-most section, until grout flows from the boring at ground surface. Efforts will be made to grout incrementally as the temporary casing is removed.

After 24 hours, the abandoned drilling site will be checked for grout settlement. On that day, any settlement depression will be filled with grout and rechecked 24 hours later. This process will be repeated until firm grout remains at the ground surface.

3.2 BORINGS

The term “Borings” as used in this Standard Operating Procedure applies to any drilled hole made during the course of a remedial investigation which is not completed as a well. This includes soil test borings, soil sampling borings, and deep stratigraphic borings. Whether completed to the planned depth or aborted for any reason prior to reaching that depth, borings will be grouted and normally closed within 4 hours, or within 4 hours or completion of logging of completion of logging.

3.2.1 Shallow Borings not Penetrating Water Table

Shallow borings made for the collection of subsurface soil samples will be abandoned by backfilling the hole with cuttings from the hole, **if and only if the boring does not penetrate the water table.** Clean sand will be used to make up any volume not filled by the cuttings.

3.2.2 Borings Penetrating the Water Table

Shallow borings made for the collection of subsurface soil samples **which penetrate the water table** will be abandoned by grouting the hole from the bottom to the top.

3.2.3 Deep Stratigraphic Borings

Deep stratigraphic borings will normally be located in areas which, by virtue of the historical record, are presumed relatively uncontaminated. Therefore, these borings are usually over 100 ft from any sampling well locations. Any boring located within 10 ft of a proposed well location, or located directly upgradient or downgradient (on anticipated flow line) of a proposed well location, will be abandoned by placing clean sand in the aquifer intervals and bentonite or grout in aquitard intervals as described above. If the boring is over 10 ft from and/or not upgradient of a proposed well location, the boring will be completely filled with grout.

3.3 WELLS

The following procedure applies to wells aborted prior to completion and existing wells determined to be ineffective or otherwise in need of closure.

Prior to abandoning any developed well, the proper well licensing body will be provided written notification along with an abandonment plan for that well.

If the well is within 10 ft of another monitoring well in the same aquifer, or a replacement well is to be installed within 10 ft of the well, casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, the hole will then be backfilled with filter pack material opposite sand strata and bentonite or grout opposite substantial (2 ft or thicker) clay and silt strata. Where sand as backfill approaches the ground surface, 2 ft of bentonite will be placed above the sand and below the concrete plug near the surface. Backfill materials will be placed from the bottom of the hole to within 3 ft of the ground surface. These materials will be allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with “ABD,” for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

If the well is not within 10 ft of another monitoring well, and is not to be replaced by another well within 10 ft of the original location, casing will be pulled, drilled out, or thoroughly pierced. Using tremie pipe, grout will be placed from the bottom of the hole to within 3 ft of the ground surface, and allowed to settle for 24 hours. The remainder of the hole will be filled with concrete. The surface of the concrete will be mounded, smoothed, and inscribed with “ABD,” for abandoned, any assigned well or boring designation, and the date the hole was abandoned. All boring logs, samples, completion records, and abandonment procedures will be included in the records of work on the site cluster.

4. REPLACEMENT WELLS

Replacement wells (if any) will normally be offset at least 10 ft from any abandoned well in a presumed upgradient or crossgradient groundwater direction. Site-specific conditions may necessitate variation to this placement.

5. PRECAUTIONS

None.

Standard Operating Procedure No. 039
for
Sample Preservation and Container Requirements

Prepared by

EA Engineering, Science, and Technology, Inc.
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1. PURPOSE AND SCOPE

The purpose of this Standard Operating Procedure (SOP) is to define the preservatives and techniques to be employed in preserving environmental samples between collection and analysis.

2. MATERIALS

The following materials may be required:

Containers (see Section 3 for description)	NaOH
HNO_3	Ice chests
H_2SO_4	Ice

3. DEFINITION OF CONTAINER TYPES

Type A **Container**: 80 oz amber glass, ring handle bottle/jug, 38-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 38-430 size, 0.015-mm polytetrafluoroethelyne (PTFE) liner.

Type B **Container**: 40-mL glass vial, 24-mm neck finish
Closure: White polypropylene or black phenolic, open top, screw cap, 15-mm opening, 24-400 size.
Septum: 24-mm disc of 0.005-in PTFE bonded to 0.120-in. silicon for total thickness of 0.125-in.

Type C **Container**: 1-L high density polyethylene, cylinder-round bottle, 28-mm neck finish.
Closure: White polyethylene cap, white ribbed, 28-410 size; F217 polyethylene liner.

Type D **Container**: 120-mL wide mouth glass vial, 48-mm neck finish.
Closure: White polyethylene cap, 40-480 size; 0.015-mm PTFE liner.

Type E **Container**: 250-mL boston round glass bottle
Closure: White polypropylene or black phenolic, open top, screw cap.
Septum: Disc of 0.005-in PTFE bonded to 0.120-in silicon for total thickness of 0.125-in.

Type F **Container**: 8-oz short, wide mouth, straight-sided, flint glass jar, 70-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.030-mm PTFE liner.

Type G **Container**: 4-oz tall, wide mouth, straight -sided, flint glass jar, 48-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 48-400 size; 0.015-mm PTFE liner.

Type H **Container**: 1-L amber, Boston round, glass bottle, 33-mm pour-out neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 33-430 size; 0.015-mm PTFE liner.

Type K **Container**: 4-L amber glass ring handle bottle/jug, 38-mm neck finish.
Closure: White polypropylene or black phenolic, baked polyethylene cap, 38-430 size; 0.015-mm PTFE liner.

Type L **Container**: 500-mL high-density polyethylene, cylinder bottle, 28-mm neck finish.
Closure: White polypropylene, white ribbed, 28-410 size; F217 polyethylene liner.

4. PROCEDURE

All containers must be certified clean, with copies of laboratory certification furnished upon request.

Water samples will be collected into pre-preserved containers appropriate to the intended analyte as given in Quality Assurance Project Plan. Samples taken for volatile organic compounds will be collected in accordance with SOP No. 003, Section 3.3.8. Samples taken for metals analysis will be verified in the field to a pH <2. The container should be tightly capped, then swirled to thoroughly mix the sample. The cap will then be loosened to release any excess pressure this operation may have generated. Samples taken for total phosphorous content will be verified in the field to a pH <2. The container should be tightly capped and swirled to thoroughly mix the sample. The cap will then be loosened to release any excess pressure this operation may have generated. Samples taken for cyanide will be verified for a pH >12. No preservatives will be added to any other water samples. These samples will be immediately placed on ice and cooled to 4°C.

Soil and sediment samples will be collected into containers appropriate to the intended analyte as given in the Quality Assurance Project Plan. Samples taken for volatile organic compound analysis will collected in accordance with the site-specific SOP. Samples taken for metals

analysis will be tightly capped, placed on ice, and maintained at a temperature of 4°C. Samples taken for total phosphorous content will be tightly capped, placed on ice, and maintained at a temperature of 4°C. Samples taken for cyanide will be alkalized to a pH > 12 by the addition of NaOH. No preservatives will be added to any other soil samples. These samples will be immediately placed on ice and cooled to 4°C.

5. MAINTENANCE

Not applicable.

6. PRECAUTIONS

Note that acidifying a sample containing cyanide may liberate HCN gas.

- Avoid breathing any fumes emanating from acidified samples.
- Acidify samples only in the open, rather than in closed spaces such as a vehicle.
- Hold suspected HCN-generating sample away from body and downwind while manipulating it.
- See the Health and Safety Plan for other safety measures

7. REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1986. Test Methods for Evaluating Solid Waste, SW-845.

U.S. EPA. 1987. A Compendium of Superfund Field Operations Methods, EPA 540-P87-001.

U.S. EPA. 1991. A Compendium of ERT Soil Sampling and Surface Geophysics Procedures.

Standard Operating Procedure No. 042
for
Disposal of
Investigation-Derived Material

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1. SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure is to define the required steps for disposing of investigation-derived material (IDM) generated during field activities.

IDM, as used herein, includes soil cuttings, drilling muds, purged groundwater, decontamination fluids, and disposable personal protective equipment. For the sake of clarity and ease in use, this Standard Operating Procedure is subdivided into procedures for disposal of liquid IDM and solid IDM as follows:

- Liquid IDM (Section 3.2) includes the following materials:
  - Water from initial development of new wells and the redevelopment of existing wells.
  - Purge water from groundwater sampling.
  - Decontamination fluids (Section 3.4)
- Solid IDM (Section 3.3) consists of the following materials:
  - Drill cuttings from monitoring well installation
  - Grout, a mixture of cement and bentonite, generated during installation of monitoring wells
  - Disposable personal protective equipment (Section 3.4).

2. MATERIALS

The following materials may be required:

Any additional equipment that may be dictated by project or site-specific plans	Hazardous waste labels
Bar codes	Permanent marker
Chain-of-custody forms	Field Logbook (bound)
Department of Transportation 17C spec. metal containers	Waste identification labels

3. PROCEDURE

3.1 GENERAL

No container will be labeled as a “Hazardous Waste” unless the contents are in fact known to be hazardous as defined by 40 CFR 261.

IDM may be disposed onsite if it is: (1) initially screened, or evaluated to determine whether it is contaminated; (2) not abandoned in an environmentally unsound manner; and (3) not inherently waste-like.

IDM are to be considered contaminated if they: (1) are visually or grossly contaminated, (2) have activated any field monitoring device which indicates that the level exceeds standard Level 1, (3) have previously been found to exhibit levels of contamination above environmental quality standards, and (4) the responsible party and/or appropriate regulator deem(s) that records of historical uses indicate that additional testing of the IDM is needed, or additional caution is warranted handling IDM from a given site.

3.2 PROCEDURES FOR LIQUID INVESTIGATION-DERIVED MATERIAL DISPOSAL

1. All water from initial development of new wells, and purge water generated during the first round of groundwater sampling will be containerized in Department of Transportation approved 55-gal drums. Decontamination fluids may be bulk-containerized until completion of field task.

2. Label all containers as to type of media, the date the container was sealed, the point-of-generation, and the points-of-contact. The well number and container number will be identified on the container.

3. The contractor/support personnel will log all media generated onsite into a bound Field Logbook. Media information should include the following: the date of generation, contents of containers, the number of containers with the same contents (if applicable), location of containers, the well number the media is associated with, personnel sampling the media, sampling dates, and sampling results.

4. Containers of well development water and purge water may be stored at the well site pending first round analytical results.

5. Laboratory turnaround time must be no greater than 30 days. Upon receipt of the analytical results, a copy will be furnished to the client within 3 working days. Both the client and contractor will evaluate the data to determine disposal requirements, per state and local regulations. A disposal decision is required within 10 days of receipt of sampling results. Appropriate disposal must be performed no later than 50 days from the decision date unless prevented by inclement weather (e.g., rain and muddy conditions may preclude site access, freezing weather may freeze media).

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1. This value is defined as two times background, where “background” values are to be determined as follows: (1) regional background values will be used where they are available; and (2) if regional values are not available, background may be empirically determined at uncontaminated sampling sites using onsite sensors such as organic vapor analyzers (photoionization detector or flame ionization detector), scintillometers, etc.

Dispose of non-hazardous media in accordance with Step 6 et seq. through 8 et seq. of this procedure.

Dispose of hazardous waste in accordance with Step 9 et seq. of this procedure.

6. If the first round analytical data of the liquid media is below the Maximum Contaminant Levels established by the Federal Safe Drinking Water Act, the water may be gradually infiltrated into the ground at least 50 ft downgradient of the well.

   If the well location has no downgradient area, the water will be infiltrated into the ground in an area deemed appropriate by the client and the contractor/support personnel.

   Disposal locations must allow percolation of the water and prohibit "ponding."

   Upon completion of water discharge to ground, enter type of media, amount of media, date of disposal, and discharge point(s) in a bound Field Logbook and provide this information to the client.

   Empty containers are to be properly decontaminated, stored, and reused by the appropriate personnel.

   If the liquid media sampling results do not meet the required Maximum Contaminant Levels and cannot be discharged to the ground, then determine if the waste meets the sanitary sewer discharge criteria (National Pollutant Discharge Elimination System standards).

7. If at any time visual contamination of purge/development water is observed, or if organic vapor monitor readings (HNu, photoionization detector) register more than 5 ppm above background and/or rad meters register more than twice the background mrems, then the liquid will be drummed and a composite sample will be taken that day. A disposal decision will be based on the analytical results of this sample rather than the first round of analytical results.

3.3 PROCEDURE FOR SOLID INVESTIGATION-DERIVED MATERIAL DISPOSAL

1. If the conditions outlined in Section 3.1 are met, proceed to Section 3.3, Step 2; otherwise, go to Section 3.3, Step 7.

2. During drilling operations, the resulting cuttings and mud will be discharged onto the ground near the well if the following conditions are met: (1) no visual contamination is observed, (2) organic vapors are less than 5 ppm above background, (3) rad meter readings (if applicable) are under two times background, and (4) if the potential for metals contamination exists, the medium has been screened and found to be less than two times background.

Proper sediment and erosion control measures will be implemented as follows:

- Drill cuttings will be uniformly spread and contoured to blend with the surroundings of the site.
- If amount of solid IDM exceeds 5,000 ft^2 or 100 yd^3 of material, a Sediment and Erosion Control Plan is required.
- If the amount of solid IDM is under 5,000 ft^2 or 100 yd^3, the site will be stabilized as soon as possible. Stabilization includes mulch, seed, and tack.
- Critical areas require stabilization within 7 days from the date of well completion. Critical areas include swales, water sources, drainage ditches, etc.
- All other disturbed areas require stabilization within 14 days from the date of well completion.

3. If the well location is in or near a wetland, the drill cuttings will be drummed and transported away from the site for spreading.

4. Label all IDM containers that will not be spread on the day of generation. Each container should be labeled with the type of media, the date the container was sealed, the point-of-generation, and the name of the contact person. The well number and container number should be identified on the container.

5. The contractor/support personnel will log all media generated onsite into a bound Field Logbook. Media information should include: the date of generation, contents in containers, the number of containers with the same contents, location of containers, and the well number the media is associated with.

6. Containers will be staged at the well site until contractor/support personnel spread the cuttings in the appropriate locations, using proper sediment and erosion control measures per Section 3.3 et seq.

7. If drilling mud and cuttings show visible contamination, or organic vapor readings are more than 5 ppm above background levels, or rad meter readings (if applicable) show greater than two times background levels, media will immediately be containerized, labeled appropriately (Section 3.2), and sampled on the same day.

8. The solid IDM should be sampled and appropriate Toxicity Characteristic Leaching Procedure analyses conducted prior to determining disposition. Laboratory turn-around time must be no greater than 30 days. Upon receipt of analytical results, a copy will be furnished to the client within 3 working days. The contractor will evaluate the data to determine disposal requirements within 10 days. Appropriate disposal must be performed no later than 50 days after the decision date if weather permits (Section 3.2).

- If the solid IDM are determined to be non-hazardous and uncontaminated, go to Section 3.3.

- If the solid IDM are determined to be non-hazardous but contaminated , go to Section 3.3.

- If the solid IDM are found to be hazardous wastes, go to Section 3.3.

9. If the solid IDM are not a hazardous waste **and** analytical data shows contaminant concentrations below the U.S. Environmental Protection Agency Region 3 (or applicable Region where work is being performed) Risk-Based Concentrations, contact the appropriate federal, state, or local agency for approval to discharge onto the ground near the site of generation.

    - Follow steps detailed in Section 3.3, Step 2 et seq. (above) pertaining to sediment and erosion control.

    - Upon completion of the solid IDM discharge to the ground, enter type of media, amount of media, date of disposal, and discharge point(s) in a bound Field Logbook. This information must be provided to the client.

    - Empty containers are to be properly decontaminated, stored and reused by appropriate personnel.

10. If the intrusive media is not a hazardous waste but analytical data shows concentrations above the screening criteria, dispose of the IDM according to state and local regulations.

    - Ensure that the waste containers are properly labeled as applicable in accordance with Section 3.3, Step 4.

    - Inform the client of the type and amount of waste, and the location of the waste.

    - When the waste is removed, enter the type of waste, amount of waste, date of pickup, and the destination of the waste in a bound Field Logbook. This information must be provided to the client.

3.4 PROCEDURES FOR DECONTAMINATION SOLUTION AND PERSONAL PROTECTIVE EQUIPMENT DISPOSAL

Decontamination solutions include catch water from steam-cleaning operations performed on large sampling equipment, drill rigs, and drums, as well as smaller quantities of soapy water and rinse solutions used in decontaminating field sampling equipment. At the completion of the field event, a composite sample of the decontamination solution will be taken. The decontamination solution will be treated as liquid IDM pending results (Section 3.2 et seq.).

Personal protective equipment will be containerized onsite, appropriately labeled, and disposed of in a designated trash receptacle.

4. MAINTENANCE

Not applicable.

5. REFERENCES

Environment Article Section 7-201(t).

U.S. Environmental Protection Agency. 1991. Management of Investigation-Derived Wastes during Site Inspections PB91-921331, OERR Directive 9345.3-02. Office of Emergency and Remedial Response U.S. Environmental Protection Agency, Washington, D.C. May.

Standard Operating Procedure No. 047
Direct-Push Technology Sampling

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1. SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) establishes the protocol for using direct-push technology (DPT) in media sampling and performing subsurface characterization. This SOP includes the following DPT methods: Geoprobe®, Hydropunch®, Cone Penetrometer Testing (CPT), and Site Characterization and Analysis Penetrometer System (SCAPS).

2. MATERIALS

The following materials may be required:

Appropriately sized, all-terrain vehicle-skid-or track-mounted; DPT equipment; and supplies (i.e., hydraulic derrick and hammer assembly)	Personal protective equipment
Bentonite grout and clean sand for DPT hole abandonment	Phosphate-free, laboratory-grade detergent (e.g., Liquinox, Alconox, etc.)
DPT stainless steel rods	Source of approved water
Heavy plastic sheeting	Steam cleaner/sprayer and water obtained from approved source for decontaminating DPT equipment
Logbook	Steel drums for intrusion derived wastes (e.g., contaminated personal protective equipment, decon solutions, etc.)
Long-handled bristle brushes	Wash and rinse tubs
Mini-bailer or tubing and peristaltic pump (groundwater sampling only)	

3. GEOPROBE® AND HYDROPUNCH®

3.1 MATERIALS

Water sources for Geoprobe® and Hydropunch® activities, grouting, sealing, filter placement, well installation, and equipment decontamination must be approved by the Project Manager prior to arrival of the Geoprobe® and Hydropunch® equipment. Information required for the water source includes: water source, manufacturer/owner, address and telephone number, type of treatment and filtration prior to tap, time of access, cost per gallon (if applicable), dates and results associated with all available chemical analysis over the past 2 years, and the name and address of the analytical laboratory (if applicable).

Pure sodium bentonite with no additives will be the only additive allowed, and its use must be approved by the Project Manager prior to the arrival of the Geoprobe® and Hydropunch® equipment. The information required for evaluation includes: brand name, manufacturer, manufacturer's address and telephone number, product number, product description, and intended use for the product.

Portland Type II cement will be used for grout (refer to SOP No. 019).

3.2 GROUNDWATER – HYDRAULIC PUSHING AND SAMPLING

The objective of the selected DPT sampling technique is to allow grab samples to be taken at a selected site to facilitate aquifer characterization and analysis of potential contaminants. The analytical results from sampling can also be used to determine the placement of monitoring wells.

A site geologist will be present during all sampling and installation procedures, and will fully document all procedures and soil characteristics in the Field Logbook. Refer to SOP No. 003 (Field Logbook).

The site geologist will have on hand, at a minimum, a copy of the approved Health and Safety Plan, this SOP, the Field Investigation Work Plan, a hand lens (10X), a standard color chart, and a grain size chart.

Only solid vegetable shortening (e.g., Crisco®) without flavoring or additives may be used on downhole Geoprobe® and Hydropunch® equipment.

Surface runoff or other fluids will not be allowed to enter any DPT location or well during or after DPT activities.

The subcontractor will use the equipment specific guidelines for installation of the Geoprobe® DPT equipment. Probe rods will be forced into the ground by hydraulic means.

- Drive the sampler to the desired groundwater sampling interval. At the desired depth, insert extension rods down the inside diameter of the probe rods until the extension reaches the bottom of the screen. Remove the probe rods and sampler sheath while holding the screen in place.

- Collect the groundwater sample in the screen interval with a mini-bailer, peristaltic or vacuum pump, or other acceptable small diameter sampling device.

- The head of the rod may be equipped with a sensing device for characterization of soil properties or the contaminant content.

The subcontractor will use the equipment-specific guidelines for installation of the Hydropunch® equipment. Rods will be forced into the ground by hydraulic means.

- The Hydropunch® tool is a double cylinder, designed to be sealed until the desired sampling depth is reached. Upon reaching the desired sampling depth, the outer cylinder is pulled back, exposing a perforated, stainless steel sampling barrel covered with filter material.

- The water sample enters the barrel and the sample is retrieved by pulling the probe rods from the hole with the hydraulic derrick and hammer assembly. Groundwater is the only media that is sampled by Hydropunch® equipment.

- The head of the rod may be equipped with a sensing device for characterization of the soil properties or the contaminant content.

- The sample volume collected with this technique is approximately 500-1,000 ml. Larger sample volumes can be collected by inserting tubing attached to a peristaltic pump into the rods to obtain water samples.

If desired, a small diameter monitoring well may be installed at this point. Refer to SOP No. 019 (Monitoring Well Installation).

If a well will not be installed, the rods will be removed as the borehole is simultaneously filled with a bentonite/grout mixture. A polyvinyl chloride (PVC) tube fed into the rod casing will allow the addition of grout.

3.3 SUBSURFACE SOIL – HYDRAULIC PUSHING AND SAMPLING

The objective of the selected DPT sampling technique is to allow grab samples to be taken at a selected site for characterization of the stratigraphy and for analysis of potential contaminants. The analytical results from sampling can also be used to determine the placement of monitoring wells.

A site geologist will be present during all DPT sampling and soil characterization. All procedures and soil characteristics will be fully documented in the Field Logbook (refer to SOP No. 003 [Field Logbook]).

The site geologist will have on hand, at a minimum, a copy of the approved Health and Safety Plan, this SOP, the Field Investigation Plan, a hand lens (10X), a standard color chart, and a grain-size chart.

Only solid vegetable shortening (e.g., Crisco®) without flavoring or additives may be used on downhole Geoprobe® equipment.

Surface runoff or other fluids will not be allowed to enter any DPT location or well during or after DPT activities.

The subcontractor will use the equipment specific guidelines for installation of the Geoprobe® DPT equipment. Probe rods will be forced into the ground by hydraulic means. Additional rods will be added in 3- to 4-ft increments until the leading edge of the sampler reaches the top of the desired sampling interval.

Once the desired sampling depth has been reached, insert extension rods down the inside diameter of the probe rods until it reaches the top of the sampler assembly. Attach the extension rod handle to

the top extension rod. Turn the handle clockwise until the stop-pin detaches from the drive head. Remove the extension rods and the stop-pin. Attach a drive cap to the probe and drive the sampler approximately 2 ft using hydraulic derrick.

The DPT sampler can be retrieved by pulling the probe rods from the hole with the hydraulic derrick and hammer assembly.

The liner will be capped with Teflon® tape and vinyl end caps. The liners can be split open to remove samples for composition analysis or for transfer to other containers for shipment to the laboratory for analysis.

The head of the rod may be equipped with a sensing device for characterization of the soil properties or the contaminant content.

3.4 DECONTAMINATION

All Geoprobe® and Hydropunch® DPT equipment must be thoroughly cleaned before and after each use to allow retrieval of representative groundwater samples. Geoprobe® soil sample liners are disposed of after each use. Scrub all metal parts with a stiff, long bristle brush and a non-phosphate soap solution. Steam cleaning may be substituted where available. Rinse with distilled water and allow to air-dry before assembly.

After decontamination, a new clean liner will be installed and all parts will be inspected for wear or damage.

Refer to SOP No. 005 (Decontamination).

3.5 ABANDONMENT

Pure bentonite or a bentonite/grout mixture (20:1) will be used to fill the resulting borehole if the water table is penetrated. Boreholes that do not penetrate the water table will be backfilled with cuttings from the hole and topped with a bentonite seal. Clean sand will be used to fill any remaining volume in the borehole.

Abandonment of Geoprobe® and Hydropunch® generated DPT boreholes will meet the standards established under SOP No. 028 (Well and Boring Abandonment).

4. CONE PENETROMETER TESTING

4.1 MATERIALS

A CPT rig typically consists of an enclosed 20- to 40-ton truck equipped with vertical hydraulic rams that are used to force a sensor probe into the ground. The weight of the CPT rig is dependent upon the thrust required at the site. The majority of CPT rigs are mounted in heavy-duty trucks that are ballasted to a total dead weight of approximately 15 tons. Screw anchors are utilized to develop the extra reaction to reach the maximum thrust of 20 tons. The rig is separated into two separate workspaces: data acquisition and hydraulic push areas.

Water sources for CPT activities and decontamination must be approved by the Project Manager prior to arrival of the CPT equipment. Information required for the water source includes: water source, manufacturer/owner, address and telephone number, type of treatment and filtration prior to tap, time of access, cost per gallon (if applicable), dates and results associated with all available chemical analysis over the past 2 years, and the name and address of the analytical laboratory (if applicable).

Pure sodium bentonite with no additives will be the only additive allowed, and its use must be approved by the Project Manager prior to the arrival of the DPT equipment. The information required for evaluation includes: brand name, manufacturer, manufacturer's address and telephone number, product number, product description, and intended use for the product.

Portland Type II cement will be used for grout (refer to SOP No. 019).

4.2 SUBSURFACE CHARACTERIZATION

The objective of this technology is to collect stratigraphic information using CPT equipment to determine subsurface stratigraphy and geotechnical properties at a particular site. CPT activities will be in accordance with American Society for Testing and Materials D 3441-86 and American Society for Testing and Materials D 5778-95. The stratigraphic information gathered can be used to facilitate the selection of DPT sampling screen intervals. At the same time, it is possible to install a 0.25-in. diameter pre-packed PVC monitoring well.

CPT rods are used to hydraulically push the CPT probe into the subsurface. Probes cannot be pushed into hard rock, and significant gravel or cobble content in the formation may impede or preclude penetration of the probe. The depth of penetration achievable depends on the type of formation, type of sampling probe, and size of the hydraulic equipment used.

The CPT probe includes the following components:

- A conical tip to measure vertical resistance beneath the tip.
- A friction sleeve to measure frictional resistance on the side of the probe, as a function of depth.

- Two internal strain gauge-type load cells, which independently measure the vertical resistance and side friction.

- A cone pressure gauge to measure the water pressure as the probe is pushed into the ground.

- Inclinometer to determine potential drifting of the probe (optional).

- Seismic transducers to perform downhole seismic surveys (optional). Therefore, stratigraphic data collected with the CPT include: tip resistance, local friction, friction ratio, pore pressure, and resistivity.

Data will be transferred from the probe to the data acquisition system or logger through an electrical cable. The hole will be advanced continuously at a rate of 0.6-1.0 in. per second. The data will be logged at every 0.4-0.8 in. of penetration. Monitor the probe's stratigraphic position will be monitored as it advances downward. Perform pore water pressure dissipation tests in representative hydrostratigraphic intervals. Record dissipated pore water pressures to represent hydraulic head values.

Once the confining unit underlying the surficial aquifer or the required depth has been reached, the CPT is pulled from the ground. Target interval samples can be collected during CPT hole advancement using direct push sampling techniques, i.e., Geoprobe® or Hydropunch® (Section 3).

4.3 DECONTAMINATION

All CPT equipment must be thoroughly cleaned before arrival at the work site, between test holes, and prior to being moved out of a work area. Scrub all metal parts with a stiff, long bristle brush and a non-phosphate soap solution. Steam cleaning may be substituted where available. Rinse with distilled water and allow to air-dry before assembly.

Refer to SOP No. 005 (Decontamination).

4 .4 ABANDONMENT

If the push hole was developed for the stratigraphic test only, once the testing is completed, grout the hole from bottom to top. If the hole has not collapsed after removing the CPT, PVC piping will be used to grout the hole. If the hole has collapsed after removing the CPT, then hollow CPT rods and a sacrificial tip will be used to grout the hole. The PVC pipe or CPT rods will be pushed to the bottom of the hole. Grout will then be pumped to the bottom of the hole as the PVC pipe or CPT rods are withdrawn.

Refer to SOP No. 028 (Well and Boring Abandonment).

5. SITE CHARACTERIZATION AND ANALYSIS PENETROMETER SYSTEM

5.1 MATERIALS

SCAPS cone penetrometer and laser induced fluorescence (LIF) technology requires the use of a specialized 20-ton truck. The truck has two separate enclosed compartments. Each compartment is temperature controlled and monitored for air quality. The two rooms are the data acquisition and processing room, and the hydraulic ram/rod handling room. Approximately 20 ft of overhead clearance is required to fully extend the hydraulic ram and allow for leveling jack movement.

All materials required to complete SCAPS analysis are provided by the subcontractor to include cone penetrometer equipment. All hydraulic equipment, SCAPS rods, nitrogen lasers, etc. are included within the vehicle. A decontamination water source and a source of water for mixing the grout are required.

Water sources for equipment decontamination must be approved by the Project Manager prior to arrival of the SCAPS equipment. Information required for the water source includes: water source, manufacturer/owner, address and telephone number, type of treatment and filtration prior to tap, time of access, cost per gallon (if applicable), dates and results associated with all available chemical analysis over the past 2 years, and the name and address of the analytical laboratory (if applicable).

Pure sodium bentonite with no additives will be the only additive allowed, and its use must be approved by the Project Manager prior to the arrival of the SCAPS equipment. The information required for evaluation includes: brand name, manufacturer, manufacturer's address and telephone number, product number, product description, and intended use for the product.

Portland Type II cement will be used for grout (refer to SOP No. 019).

5.2 HYDRAULIC PUSHING AND SAMPLING

The objective of the SCAPS technique is to allow grab samples and stratigraphic information to be collected at a selected site to facilitate subsurface characterization and for analysis of potential contaminants. The analytical results obtained can also be used to determine the placement of monitoring wells. At the same time, it is possible to install a small diameter well for sampling purposes. Refer to SOP No. 019 (Monitoring Well Installation). If a well will not be installed, the borehole can be grouted as the equipment is removed.

A site geologist will be present during all installation and sampling procedures and will fully document all procedures and soil characteristics in the Field Logbook (refer to SOP No. 003 [Field Logbook]).

The site geologist will have on hand, at a minimum, a copy of the approved Health and Safety Plan, this SOP, the Field Investigation Work Plan, a hand lens (10X), a standard color chart, and a grain-size chart.

Only solid vegetable shortening (e.g., Crisco®) without flavoring or additives may be used on downhole SCAPS equipment.

Surface runoff or other fluids will not be allowed to enter any DPT location or well during or after direct-push activities.

The subcontractor will use the equipment specific guidelines for installation of the SCAPS DPT equipment. Prior to SCAPS field activities, calibration soil samples will be collected and analyzed in order to determine the LIF sensor fluorescence threshold and detection limits for the site.

SCAPS LIF technology uses a pulsed nitrogen laser coupled with an optical detector to make fluorescence measurements via optical fibers. The LIF sensor is mounted on a cone penetrometer probe so that soil classification data and fluorescence data are collected simultaneously. The laser consumes nitrogen gas, which is supplied from cylinders stored on the accompanying trailer.

The SCAPS CPT sensors are used to gather stratigraphic information. See Section 4 for CPT operating procedures.

Target interval samples can be collected during SCAPS hole advancement using direct push sampling techniques such as Geoprobe® or Hydropunch® (Section 3).

5.3 DECONTAMINATION

Decontamination of SCAPS equipment is automated after initialization by a field team member. A pressurized hot water system is used to decontaminate the push rods as they are retracted from the ground. The SCAPS vehicle is equipped with a decontamination collar mounted to the bottom that cleans the rods. The decontamination water is removed by vacuum and transferred to a storage drum prior to disposal or treatment. A trailer attached to the back of the vehicle contains the water pump, heater for decontamination, and decontamination water containment drum.

Worker exposure is reduced by minimizing contact with contaminated media.

Refer to SOP No. 005 (Decontamination).

5.4 ABANDONMENT

SCAPS automatically grouts the penetrometer cavity as the rods are removed. The grout is pumped at high pressure through a 0.25-in. diameter tube in the center of the penetrometer rods. The tip is sacrificed at the bottom of the cavity to allow release of the grout.

A trailer attached to the back of the vehicle contains the 300-gal grout mixing bin and pump.

If the automatic grout feed does not work, the cavity will be manually filled with grout.

Abandonment of SCAPS generated borehole will meet the standards established under SOP No. 028 (Well and Boring Abandonment).

6. MAINTENANCE

Not applicable.

7. PRECAUTIONS

Refer to the site-specific Health and Safety Plan for discussion of hazards and preventive measures during intrusive activities.

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Streamlined Ecological Risk Evaluation (SERE)

Non-Time Critical Removal Support
Gulfco Marine Maintenance Superfund Site
Freeport,Brazoria County, Texas
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LIST OF ACRONYMS AND ABBREVIATIONS

AST	Above Ground Storage Tank
AVS/SEM	Acid Volatile Sulfides/Simultaneously Extracted Metals
BCMCD	Brazoria County Mosquito Control Department
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
Chromalloy	Chromalloy American Corporation
COPEC	Constituent of Potential Ecological Concern
DDT	dichlorodiphenyltrichloroethane
DESR	Data Evaluation Summary Report
DOW	The DOW Chemical Company
DQO	Data Quality Objective
EA	EA Engineering, Science, and Technology, Inc.
EC20	Effects concentration 20 percent reduction
EPA	Environmental Protection Agency
ESV	Ecological Screening Value
Facts	Brazoria County Facts
FPSCR	Final Preliminary Site Characterization Report
FS	Feasibility Study
ft	feet
FWS	Fish & Wildlife Service
GRG	Gulfco Restoration Group
LC50	Lethal Concentration 50 percent
LDL	LDL Coastal Limited LP
µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/L	milligram per liter
µmol/goc	micromole per gram organic carbon
NPL	National Priorities List
NTCRS	Non Time Critical Removal Support
OC	organic carbon
PAH	Polycyclic Aromatic Hydrocarbon
PBW	Pastor, Behling & Wheeler
PCA	Principal Components Analysis
PSCR	Preliminary Site Characterization Report
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SLERA	Screening Level Ecological Risk Assessment
SMDP	Scientific Management Decision Point
SOP	Standard Operating Procedure
TCEQ	Texas Commission of Environmental Quality
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon

UAO	Unilateral Administrative Order
URS	URS Corporation

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) named the former site of Gulfco Marine Maintenance, Inc. in Freeport, Brazoria County, Texas (the site) to the National Priorities List (NPL) in May 2003. The EPA issued a modified Unilateral Administrative Order (UAO), effective July 29, 2005, which was subsequently amended effective January 31, 2008. The UAO required a Remedial Investigation (RI) and Feasibility Study (FS) be conducted for the site. As part of the RI/FS, a *Screening Level Ecological Risk Assessment* (SLERA) was prepared (Pastor, Behling & Wheeler [PBW] 2010a) on behalf of LDL Coastal Limited LP (LDL), Chromalloy American Corporation (Chromalloy) and The Dow Chemical Company (Dow), collectively known as the Gulfco Restoration Group (GRG). The Scientific/Management Decision Point (SMDP) provided in the final SLERA concluded there was a potential for adverse ecological effects, and a more thorough assessment was warranted.

This document summarizes the site investigation activities and analysis that has been performed in accordance with the *Final Baseline Ecological Risk Assessment (BERA) Work Plan & Sampling and Analysis Plan (SAP)* (URS Corporation [URS] 2010b) and presents the assessment of ecological risk in the form of a Streamlined Ecological Risk Evaluation (SERE) for the Gulfco Marine Maintenance Superfund Site located in Freeport, Texas to assess if there is a need for a Non-Time Critical Removal at this Site north of Martin Avenue.

This SERE has been prepared using EPA guidance (EPA 1997; EPA 1998; EPA 1999) and the Texas Natural Resource Conservation Commission (TNRCC) guidance (TNRCC 2001).

1.1 SITE BACKGROUND

The site is located in Freeport, Texas at 906 Marlin Avenue (also referred to as County Road 756) (Figure 1). The site consists of approximately 40 acres along the north bank of the Intercoastal Waterway between Oyster Creek (approximately one mile to the east) and the Texas Highway 332 bridge (approximately one mile to the west). The site includes approximately 1,200 feet (ft) of shoreline on the Intercoastal Waterway, the third busiest shipping canal in the United States.

Marlin Avenue divides the site into two primary areas (Figure 2). For the purpose of descriptions in this report, Marlin Avenue is approximated to run due west to east. The property north of Marlin Avenue (the North Area) consists of undeveloped land and closed surface impoundments, while the property south of Marlin Avenue (the South Area) was developed for industrial uses with multiple structures, a dry dock, an above ground storage tank (AST) farm, and two barge slips connected to the Intercoastal Waterway. This SERE addresses only the area north of Martin Avenue.

Adjacent property to the north, west, and east of the North Area is undeveloped. Adjacent property to the east of the South Area is currently used for industrial purposes while to the west the property is currently vacant and previously served as a commercial marina. The Intercoastal Waterway bounds the South area to the south. Residential areas are located south of Marlin Avenue, approximately 300 ft west of the site, and 1,000 ft east of the site.

Some of the North Area is upland created from dredge spoil, but most of this area is considered wetlands, as per the U.S. Fish and Wildlife Service (FWS) Wetlands Inventory Map (FWS 2008). The most significant surface features in the North Area are two ponds (the Fresh Water Pond and the Small Pond) and the closed former surface impoundments (Figure 2). The former surface impoundments and the former parking area south of the impoundments and Marlin Avenue comprise the vast majority of the upland area within the North Area.

Field observations during the PRP RI indicate the North Area wetlands are irregularly flooded with nearly all of the wetland area inundated by surface water that can accumulate to a depth of one ft or more during extreme high tide conditions, storm surge events (such as hurricanes), and/or in conjunction with surface flooding of Oyster Creek located northeast of the site. Due to very low topographic slope and low permeability surface sediments, the wetlands are also very poorly draining and can retain surface water after major rainfall events.

During site reconnaissance performed by EA Engineering, Science, and Technology, Inc. (EA) on 15 December 2010 it was noted that the wetlands are part of the contiguous high marsh/salt pan area between the site and Oyster Creek. These wetland areas were inundated with water (surface to 4 cm below grade), and connecting ditches and the marsh pan held several centimeters of water (EA 2010b).

Under normal tide conditions and during periods of normal or below normal rainfall, standing water within the wetlands (outside of the two identified ponds discussed below) is typically more limited. Depending on rainfall and tide conditions, these areas can either be completely full of water or completely dry.

Water in the Fresh Water Pond is approximately 4 to 4.5 ft deep and is relatively brackish (PBW, 2009). This pond appears to be a borrow pit created by the excavation of soil and sediment as suggested by the well-defined pond boundaries and relatively stable water levels. Water levels in the Fresh Water Pond are not influenced by periodic extreme tidal fluctuations as the pond dikes preclude tidal floodwaters in the wetlands from entering the pond, except for during extreme storm surge events.

The small irregularly shaped area immediately north of the Fresh Water Pond (Figure 2) is a salt panne, a shallow depression that retains seawater for short periods of time such that salt accumulates to high levels over multiple tidal cycles.

The Small Pond is a very shallow depression located in the eastern corner of the North Area. The Small Pond is not influenced by daily tidal fluctuations and behaves in a manner consistent with the surrounding wetland (*i.e.*, becomes dry during dry weather, but retains water in response to and following rainfall and extreme tidal events). The Small Pond is also indicative of a salt panne.

Aerial spraying of the wetland areas north of Marlin Avenue, including the North Area, for mosquito control has historically been and continues to be performed by the Brazoria County Mosquito Control District and its predecessor agency, the Brazoria County Mosquito Control Department (both referred to hereafter as BCMCD). Aerial spraying for mosquito control has been performed from altitudes of 50 to 100 ft (Lake Jackson News 1957). Recently, BCMCD

has been using Dibrom©, and organophosphate insecticide, with a diesel fuel carrier through a fogging atomizer application (Brazoria County Facts [Facts] 2006, 2008a, 2008b), as well as other compounds such as Scourge™, Kontrol 30-30, and Fyfanon® (personal communication between Gary Miller [EPA] and Fran Henderson [BCMCD 27 October 2010]). Truck-based spraying has also been performed along Marlin Avenue. Both types of spraying were observed during the performance of site RI activities by the PRP.

1.2 STREAMLINED ECOLOGICAL RISK EVALUATION PROCESS

In the superfund program, ecological risk is evaluated in an eight-step process, as defined in the Ecological Risk Assessment Guidance for Superfund (EPA 1977):

1) Screening Level Problem Formulation
2) Screening Level Exposure Estimate and Risk Calculation
3) BERA Problem Formulation
4) Study Design and Data Quality Objective Process
5) Field Sampling Plan Verification
6) Site Investigation and Data Analysis
7) Risk Characterization
8) Risk Management

The first two steps of the process were completed in the final PRP SLERA for the site (PBW 2010a). At the conclusion of the SLERA, the potential for adverse risk to several ecological receptors was determined and a SMPD was made to continue in the risk assessment process.

The third step in the process (BERA Problem Formulation) was completed for the site by the PRP in the *Final Baseline Ecological Risk Assessment Problem Formulation* (URS 2010a). In the problem formulation step, the list of constituents of potential ecological concern (COPEC) is further refined, contaminant fate and transport is evaluated, assessment endpoints, and a conceptual site model are defined, and questions of risk are developed.

The fourth and fifth steps in the BERA process were completed by the PRP in the *Final Baseline Ecological Risk Assessment Work Plan & SAP* (URS 2010b). In these steps, a work and sampling plan is developed for collecting additional media in support of the PRP BERA(in preparation) and the methods for evaluating the potential for risk at the site (*i.e.,* toxicity testing) are outlined. Data quality objectives (DQOs) are also defined in these steps. The PRP is in the process of completing the BERA (steps 6 through 8).

This document is a focused SERE, evaluating the need for a Non-Time Critical Removal at the Site north of Martin Avenue. As such, this document should not be considered as a formal part of the 8-step ecological risk assessment process discussed above but rather a limited and focused assessment of the wetlands north of Martin Avanue, to determine if sufficient risk is present to warrant a removal action. If the results of the SERE indicate a potential for ecological risk, a risk management decision is developed concerning what future actions, if any, may be warranted to manage that risk.

1.3 SCOPE OF DOCUMENT AND REPORT ORGANIZATION

Because there is no guidance for a focused SERE, this document follows the outline of the site investigation and analysis (Step 6) conducted in support of a BERA and the resulting risk characterization (Step 7) of the ecological risk process. Risks are estimated using both qualitative and quantitative methods (toxicity testing). The results of this SERE will support Step 8 (risk management) if needed. Possible decision outcomes from the SERE include:

- There is adequate information to conclude that no adverse ecological risk is present (i.e., risk is within acceptable limit and further evaluation is not needed)
- There is adequate information to conclude that adverse ecological risk is present and development of remedial alternatives is warranted (i.e., continue to Step 8)
- Available information is not adequate to estimate risk (i.e., data gaps are present)

Section 2 of this document provides a discussion of the site investigation activities that were completed in support of this SERE and outlined in the PRP's *Final Baseline Ecological Risk Assessment Work Plan & SAP* (URS 2010b). Section 3 summarizes the media concentrations and exposure point concentrations for site samples. Section 4 provides an analysis of the effects to ecological receptors. Section 5 provides the risk characterization. Section 6 provides a discussion of the uncertainties associated with the BERA, and Section 7 summarizes the conclusions of the SERE.

2.0 SITE INVESTIGATIONS IN SUPPORT OF THE PRP BERA

This section describes the data collected from North Area surface soil, wetland sediment and surface water samples, and used in this SERE. Sampling activities were conducted by the PRP between August 2010 and September 2010. The sample collection methods, analytical methods, and toxicity testing methods are described in the *Final BERA Work Plan & SAP* (URS 2010b) and summarized below. Overall, the data collected by the PRP in support of the BERA met the DQOs outlined in the *Final BERA Work Plan & SAP* (URS 2010b) and are adequate for evaluation and risk characterization used in this SERE.

2.1 TERRESTRIAL ENVIRONMENT

Investigation of site terrestrial areas was limited to the upland regions in the North Area including the former surface impoundments and the area south of the former impoundment. Soils in these areas likely became contaminated with COPECs due to surface runoff from the former surface impoundment area prior to capping. The final PRP SLERA identified potential risk to lower-trophic receptors such as soil invertebrates in these upland areas (PBW 2010a). Media collected in support of the PRP BERA included surface soils (0-6 inches below ground surface [bgs]), which represents the biologically active zone for soil-dwelling invertebrates. Toxicity tests were also conducted on surface soils to assess potential effects to these invertebrates. The analytical data for each sample are presented in Appendix A of the *Final Preliminary Site Characterization Report* (PSCR) (PBW 2010b) and summarized in Table 1.

2.1.1 North Area Surface Soil Sample Collection and Analysis

A total of six (6) surface soil samples were collected (0-6 inches bgs) from the North Area. Five (5) samples (NAS01 to NAS05) were collected in the area south of the former surface impoundment area, and one sample (NAS06) was collected in the northwest corner of the former surface impoundment area (Figure 3a). An additional three (3) samples were collected in the soil reference area approximately 2000 ft east of the site (Figure 3b). Analytical results are shown in Table 1.

All samples were analyzed for the following metals identified as COPECs in previous steps of the risk assessment process:

- Barium
- Chromium
- Copper, and
- Zinc

In addition, three of the six soil samples from the North Area (NAS02, NAS03, and NAS05) were analyzed for 4,4'- dichlorodiphenyltrichloroethane (DDT) and Aroclor-1254.

2.1.2 North Area Surface Soil Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted using the six surface soil samples collected from the North Area and the three reference samples to evaluate direct toxicity to soil-dwelling invertebrates. A 28-day earthworm (*Eisenia fetida*) chronic bioassay was originally proposed by the PRP in the *Final BERA Work Plan and SAP* (URS 2010b); however, elevated salinity in the surface soil samples made use of the earthworm problematic. When earthworms were introduced to the North Area soil samples there was an immediate avoidance reaction followed by acute mortality in all of the site and background samples. The elevated salinity levels are believed to be due to frequent inundation of estuarine during storm events. Also, much of the soil was originally dredge spoils from the Intercoastal Waterway, which was used as a fill material.

An alternative to the earthworm bioassays was developed following discussion and agreement by the EPA. This alternative treated the soils samples as sediments by adding synthetic seawater and exposing the marine polychaetous annelid, *Neanthes arenaceodentata*, to a 21-day bioassay to assess growth and survival. Polychaetes occupy a similar feeding guild to earthworms. The North Area soil toxicity testing was conducted from September 10 through October 1, 2010.

2.2 AQUATIC ENVIRONMENT

Sediments and surface water in the areas of the North area likely became contaminated with COPECs from direct discharge from barge cleaning operations, surface runoff, and flooding mechanisms. The final PRP SLERA identified potential risk to sediment and surface water dwelling invertebrates (PBW 2010a). Media collected in support of the PRP BERA included bulk sediments (0-6 inches bgs) and surface water from the North Area wetlands. Sediment pore

water was also extracted from bulk sediments. Toxicity tests were conducted using wetland sediments and surface water to assess potential effects to sediment and surface water dwelling invertebrates. The analytical data for each sample are presented in Appendix A of the Final Preliminary Site Characterization Report (FPSCR) and summarized in Table 2 through Table 4.

2.2.1 North Area Wetland Bulk Sediment Sample Collection and Analysis

A total of seven (7) bulk sediment samples were collected by the PRP at depths of 0-6 inches bgs from the North Area wetlands. Five (5) samples (EWSED03 to EWSED07) were collected in the wetland areas south of the former surface impoundment area, and two samples (EWSED01 and EWSED02) were collected north of the Fresh Water Pond (Figure 4). An additional two (2) samples were collected in the sediment reference area north of the site and west of the former surface impoundments (Figure 4). Analytical results are shown in Table 2.

All samples were analyzed for the following parameters identified as COPECs in previous steps of the risk assessment process:

- Polycyclic Aromatic Hydrocarbons (PAHs): 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene
- Pesticides: 4,4'-DDT, endrin aldehyde, endrin ketone, gamma-chlordane
- Metals: arsenic, copper, lead, nickel, zinc
- Acid Volatile Sulfides/Simultaneously Extracted Metals (AVS/SEM)
- Grain size analysis

In addition to the bulk sediment samples, pore water was extracted and analyzed for COPECs for all but one sediment sample (EWSED05)(Table 3). This sample was too dry to extract pore water.

2.2.2 North Area Wetland Bulk Sediment Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted using the seven site sediment samples collected from the North Area and the two reference samples to evaluate direct toxicity to sediment-dwelling invertebrates. Two 28-day chronic bioassays were conducted using the amphipod, *Leptocheirus plumulosus*, and the polychaete, *N. arenaceodentata*. Both organisms were selected for toxicity testing because both are representative of common species found along the Texas gulf coast marshes, are sensitive to site COPECs, and are tolerant to a wide range of sediment and salinity conditions. Study endpoints of growth, mortality, and reproduction were measured for the *L. plumulosus* bioassay, while only the growth endpoint (with mortality data used to assist in the calculations) was used for the *N. arenaceodentata* bioassay.

2.2.3 North Area Wetland Surface Water Sample Collection and Analysis

A total of three (3) surface water samples were collected from the North Area wetlands. One sample (EWSW01) was collected in the area north of the Fresh Water pond. One sample

(EWSW03) was collected in the small, irregularly shaped waterbody south of the former surface impoundment, and one sample (EWSW04) was collected from the near the Small Pond (Figure 5). Surface water was not present at the reference location (EWSW02) and analysis and this location could not be performed. Analytical results are shown in Table 4.

All surface water samples were analyzed for the following parameters identified as COPECs in previous steps of the risk assessment process:

- Acrolein (EWSW01 only)
- Dissolved copper
- Dissolved nickel
- Dissolved silver
- Dissolved zinc

2.2.4 North Area Wetland Surface Water Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted using the three site surface water samples collected from the North Area to evaluate direct toxicity to surface water-dwelling invertebrates. A 7-day chronic bioassay analysis that measured the survival and growth of the mysid shrimp, *Mysidopsis bahia*, was originally proposed in the *Final BERA Work Plan & SAP* (URS 2010b); however, elevated salinity in the surface water samples from the salt panne areas (40% salinity at EWSW01 and 39% at EWSW04) were outside the testing tolerances for this test organism.

An alternative to the mysid shrimp bioassays was developed following discussion and agreement by the EPA. This alternative used the brine shrimp (*Artemia salina*), which is better suited to testing at high salinities. No standards have been established for toxicity testing conducted on brine shrimp and a standard operating procedure (SOP) was developed by the analytical lab by referencing SOPs available for determining toxicity to produced (oil field) waters. The test protocol was shortened from 7 days to 96-hours and measured acute mortality of the organisms as the test endpoint. The shortened test period would likely be more representative of the intermittent nature of the surface water being evaluated in the North Area wetlands.

Surface water toxicity tests were conducted three times between September 16 and October 3, 2010.

3.0 EFFECTS ANALYSIS

This section presents effects analysis of the data collected through the supplemental sampling activities and toxicity testing of site media for the Gulfco site. This analysis evaluates the potential adverse impacts associated with COPCs and calculates effects concentration 20 percent reduction (EC20s), where relevant. The toxicity test reports are available in the *Final Preliminary Site Characterization Report (FPSCR)* (PBW 2010b). The independent evaluation by the EA project team is included in the Data Evaluation Summary Report (DESR) (EA 2010a).

3.1 TERRESTRIAL ENVIRONMENT

The following section discusses the comparison of soil analytical data to benchmarks and the results of the toxicity testing.

3.1.1 Comparison of North Area Surface Soil Concentrations to Literature-Based Ecological Screening Values (ESVs)

Table 1 provides a summary of the 2010 surface soil analytical results generated from implementation of the PRP BERA sampling plan. Table 1 also compares the Texas Commission of Environmental Quality (TCEQ) soil benchmarks to the 2010 North Area surface soil concentrations.

The 2010 surface soil data shows exceedances of soil benchmarks for barium, chromium, copper, and zinc. Barium (which ranges from 52.2 milligram per kilogram [mg/kg] to 502 mg/kg) exceeded the TCEQ soil benchmark of 300 mg/kg in one site location (NAS04) and one reference sample (NAS07). Chromium (which ranges from 7.86 mg/kg to 97.3 mg/kg) exceeded the TCEQ soil benchmark of 30 mg/kg in two site locations (NAS01 and NAS05). Copper (which ranges from 10.1 mg/kg to 221 mg/kg) exceeded the soil benchmark of 61 mg/kg at only one site location (NAS01). Zinc (which ranges from 62.3 mg/kg to 5770 mg/kg) exceeded the TCEQ soil benchmark of 120 mg/kg at five of the six site locations (NAS01 to NAS05) and two of the reference samples (NAS07 and NAS08).

TCEQ soil benchmarks were not available for the organics (4,4'-DDT and Aroclor-1254).

3.1.2 Results of the *N. arenaceodentata* Toxicity Tests

The results of the *N. arenaceodentata* toxicity tests are presented in Table 5 and summarized below from the PSCR (PBW 2010b). The testing of *N. arenaceodentata* over a 21-day exposure period showed no statistically significant difference between the North Area surface soil samples and the reference samples to the survival and growth endpoints for *N. arenaceodentata*. Survival of the six site samples ranged from 76 percent to 96 percent and the survival of the three reference samples ranged from 60 percent to 92 percent. Growth data show a similar relationship between the site and reference samples. The complete report for the 21-day *N. arenaceodentata* is presented in the PSCR (PBW 2010b).

In the evaluation, reference soils in NAS08 and NAS09 were pooled since they showed similar toxicological responses; however, reference soils at NAS07 were compared independently to site samples due to a significant difference at this location for both assessment endpoints. No site samples exhibited reduced survival to *N. arenaceodentata* when compared to either NAS07 or the pooled references consisting of NAS08 and NAS09. For the growth endpoint, however, growth at NAS01 was 57 percent lower than growth in reference NAS07 which is a statistically significant difference. The analytical results for NAS01 and the reference soils are provided on Figures 3a and 3b. No other site samples exhibited reduced growth when compared to NAS07. The output files for the analysis are presented in the DESR (EA 2010a).

3.2 AQUATIC ENVIRONMENT – NORTH AREA WETLANDS

The following section discusses the comparison of sediment and surface water analytical results to benchmarks and toxicity test results.

3.2.1 Comparison of Sediment and Pore Water Concentrations to Literature-Based ESVs

Table 2 summarizes the analytical results for the 2010 wetland sediment samples collected in support of the BERA. There were several exceedances of the sediment benchmarks for multiple individual PAHs (acenaphthene, acenaphthylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, phenanthrene, pyrene) and metals (lead, nickel, and zinc). Acenaphthene (which ranges from 0.0013 mg/kg to 0.075 mg/kg) exceeded the TCEQ sediment benchmark of 0.016 mg/kg in one site location (EWSED05). Acenaphthylene (which ranges from 0.0008 mg/kg to 0.057 mg/kg) exceeded the TCEQ sediment benchmark of 0.044 mg/kg in one site location (EWSED01). Benzo(a)pyrene (which ranges from 0.01 mg/kg to 0.79 mg/kg) exceeded the TCEQ sediment benchmark of 0.43 mg/kg in one site location (EWSED05). Chrysene (which ranges from 0.014 mg/kg to 0.77 mg/kg) exceeded the TCEQ sediment benchmark of 0.384 mg/kg in three site locations (EWSED01, EWSED02, and EWSED05). Dibenzo(a,h)anthracene (which ranges from 0.0026 mg/kg to 0.17 mg/kg) exceeded the TCEQ sediment benchmark of 0.0634 mg/kg in three site locations (EWSED01, EWSED02, and EWSED05). Fluoranthene (which ranges from 0.02 mg/kg to 1.3 mg/kg) exceeded the TCEQ sediment benchmark of 0.6 mg/kg in one site location (EWSED05). Phenanthrene (which ranges from 0.013 mg/kg to 0.78 mg/kg) exceeded the TCEQ sediment benchmark of 0.24 mg/kg in one site location (EWSED05). Pyrene (which ranges from 0.021 mg/kg to 1.1 mg/kg) exceeded the TCEQ sediment benchmark of 0.665 mg/kg in one site location (EWSED05). Lead (which ranges from 12 mg/kg to 76.1 mg/kg) exceeded the TCEQ sediment benchmark of 46.7 mg/kg in two site locations (EWSED03 and EWSED05). Nickel (which ranges from 14.4 mg/kg to 22.5 mg/kg) exceeded the TCEQ sediment benchmark of 20.9 mg/kg in two site locations (EWSED03 and EWSED05). Zinc (which ranges from 70.1 mg/kg to 959 mg/kg) exceeded the TCEQ sediment benchmark of 150 mg/kg in four site locations (EWSED03 to EWSED06).

Analytical results for additional parameters including grain size analysis and SEM/AVS are also presented in Table 2. The SEM/AVS ratios are all above 1.0, except EWSED08 (SEM/AVS ratio of 0.157). Sediment grain sizes are fairly consistent between locations, except for the relatively high fraction of gravel and low fraction of clay found at EWSED02 and EWSED03, which is the opposite of the typical sediment profile (i.e., low fraction of gravel and high fraction of clay).

Table 3 summarizes the analytical results for the 2010 sediment pore water samples. The only exceedances of surface water benchmarks from site sediment pore water samples were for endrin aldehyde, endrin ketone, copper, and zinc. Endrin aldehyde (which ranges from <0.00000046 milligrams per liter [mg/L] to 0.000015 mg/L) exceeded the TCEQ surface water benchmark of 0.000002 mg/L in three site locations (EWSED01 to EWSED03). Endrin ketone (which ranges from <0.00000066 mg/L to 0.000007 mg/L) exceeded the TCEQ surface water benchmark of 0.000002 mg/L in one site location (EWSED03). Copper (which ranges from <0.000342 mg/L

to 0.00702 mg/L) exceeded the TCEQ surface water benchmark of 0.0036 mg/L in two site locations (EWSED03 and EWSED05). Zinc (which ranges from <0.00135 mg/L to 0.626 mg/L) exceeded the TCEQ surface water benchmark of 0.0842 mg/L in two site locations (EWSED04 and EWSED06).

The only exceedances of either sediment or surface water benchmarks in the background samples were 4,4'-DDT in sediment and 4,4'-DDT, endrin aldehyde, and nickel in pore water.

3.2.2 Results of the *N. arenaceodentata* Toxicity Tests

The results of the *N. arenaceodentata* toxicity tests are presented in Table 5 and summarized below from the PSCR (PBW 2010b). For *N. arenaceodentata* and the survival endpoint there were no statistically significant differences between the seven site samples and the two reference samples. Survival rates ranged from 72 percent to 96 percent in site samples and 68 percent to 76 percent in the reference samples. For the primary growth endpoint, there were also no statistical differences between the seven site samples and the two reference samples (PBW 2010b).

In the evaluation, reference soils in NAS08 and NAS09 were pooled since they showed similar toxicological responses. No Site samples exhibited reduced survival or growth to *N. arenaceodentata* when compared to the pooled references consisting of NAS08 and NAS09. The output files for the analysis are presented in the DESR (EA 2010a).

3.2.3 Results of the *L. plumulosus* Toxicity Tests

For the amphipod *L. plumulosus*, there were no statistical differences between the seven site samples and the two reference samples for either the survival or growth endpoint. Survival rates ranged from 13 percent to 58 percent in site samples and between 19 percent and 33 percent in reference samples (Table 5). There were insufficient offspring available for statistical analysis of reproduction as an endpoint.

In the evaluation, reference soils in NAS08 and NAS09 were pooled since they showed similar toxicological responses. Site samples did not exhibit significantly reduced survival when compared to the pooled reference data set.

Growth was lower in sample EWSED06 when compared with the pooled reference data set. The magnitude of the reduced growth was 74 percent in EWSED06. The output files for the analysis are presented in the DESR (EA 2010a).

3.2.4 Comparison of Wetland Surface Water Concentrations to Literature-Based ESVs

Table 4 provides a summary of the 2010 wetland surface water samples collected in support of the PRP BERA and includes the TCEQ surface water benchmarks. The only exceedance of a surface water benchmark was for dissolved copper at EWSW03. The background location (EWSW02) could not be sampled for surface water during the 2010 sampling event as this area was dry.

3.2.5 Results of the *A. salina* Toxicity Tests

The results of the *A. salina* toxicity tests are presented in Table 7 and summarized below from the FPSCR (PBW 2010b). The surface water toxicity tests were conducted three times between September 16 and October 3, 2010. EWSW01 and EWSW04 showed no evidence of acute toxicity since survival in the undiluted samples were greater than or equal to 80 percent for all test durations where the corresponding control survival was greater than or equal to 90 percent. EWSW03 was found to be non-toxic in test runs 1 and 2 (survival in the undiluted sample was greater than or equal to 80 percent for all test durations where the corresponding control survival was greater than or equal to 90 percent. In test run 3, a concentration-related mortality response was observed for EWSW03. The corresponding medial lethal concentrations are as follows:

- 24 hour = 30.7 percent
- 48 hour = 10.6 percent
- 72 hour = 6.2 percent

While the mortality response for EWSW03 in test run 3 is consistent with the detection of copper at a concentration above the TCEQ chronic surface water benchmark (0.00854 mg/L vs. 0.00360 mg/L), the magnitude of the exceedance is not consistent with the observed mortality in test run 3, and is not consistent with the absence of toxicity in the first two runs (PBW 2010b). The TCEQ acute and chronic freshwater values at a hardness of 237mg/L (Oyster Creek USGS,1998) would be 0.032mg/L and 0.0198mg/L respectively.

The evaluation included an independent review of the results for run 3 for all samples, which exhibited an acceptable control survival for 72 hours. By relevant test method guidance (EPA 2002), the Probit Method is the preferred procedure for determining the lethal concentration 50 percent (LC50) if the data passes the chi-square test. The Probit Method was appropriate for the data from these tests, and was used in the analysis. The results were generally consistent with those presented in the FPSCR (PBW 2010b):

- Samples EWSW01 and 4 did not exhibit acute toxicity (LC50 > 100 percent)
- Sample EWSW03 had an LC50 at 6 percent dilution

The analytical results of at sample EWSW03 (the only place to indicate toxicity) are shown on Figure 5 and in Table 4.

3.3 SUMMARY

In the analysis of North Area surface soils, where reference samples were pooled for NAS08 and NAS09 and evaluated independently of reference sample NAS07, site sample NAS01 exhibited reduced growth of *N. arenaceodentata* when compared with reference sample NAS07.

When assessing survival and growth in the polychaete, *N. arenaceodentata*, and the amphipod, *L. plumulosus*, where reference samples were pooled, wetland sediment EWSED06 exhibited significantly reduced growth of *L. plumulosus* when compared with wetland sediment reference samples.

In the analysis, using pooled reference data to evaluate the results of the acute toxicity tests of three surface water samples to brine shrimp (*A. salina*), Samples EWSW01 and EWSE04 did not exhibit acute toxicity (LC50 > 100 percent), and Sample EWSW03 had an LC50 between 5 and 6 percent dilution.

4.0 RISK CHARACTERIZATION

This section serves to analyze the data presented to this point in the SERE and provide an estimate of risk to the identified receptors in the North Area terrestrial environment and the aquatic environments located in the North Area. The risk characterization process will help address the ecological risk questions posed in the *Final BERA Work Plan & SAP (URS 2010b)*:

1) Does direct exposure to COPECs in surface soil adversely affect the abundance, diversity, productivity, and function of the soil invertebrate community?
2) Does direct exposure to COPECs in bulk sediments and pore water adversely affect the abundance, diversity, productivity, and function of benthic invertebrates?
3) Does direct exposure to COPECs in surface water adversely affect the abundance, diversity, productivity, and function of the fish community?

Addressing these assessment endpoints will assist in answering the risk management decision regarding the need for a non-time critical removal action in the north area of the Site.

4.1 IDENTIFICATION OF POTENTIAL STRESSORS

One step in characterizing risk is the identification of potential stressors in each ecological area where toxicity is observed. Initial steps in this dose-response evaluation uses techniques that are occasionally referred to as “data mining” techniques intended to identify relationships between parameters. Procedures used included development of correlation matrices and Principal Components Analysis (PCA). Upon review of findings of these statistical procedures, the concentrations of a selected number of indicator chemicals that are significantly associated with a 20 percent reduction in measurement endpoints (effects concentration 20 percent reduction, or EC20) were estimated. EC20s were estimated by the smoothed linear interpolation procedure recommended by relevant EPA test methods (see for example, EPA 2000, Section 16.2.5.7).

It is generally true that statistical associations are not conclusive regarding cause and effect. Because many of the chemicals are significantly correlated with other chemicals in the samples, the ability to conclude cause and effect from the statistical analyses is difficult. A subset of chemicals with the strongest statistical association with adverse effects was selected as indicator chemicals for estimation of EC20s. It is possible that these chemicals are not the cause of the adverse effect; adverse effects may actually be caused by one or more other chemicals that are correlated with the indicator chemicals. Nonetheless, the indicator chemicals selected have the strongest association with the adverse effects, and may be used to identify sediments that are likely to impair the identified ecological receptors.

Parameters evaluated included concentration of chemicals in bulk sediment, concentrations of organic chemicals normalized by the organic carbon (OC) content of the sediments/soils, concentrations of chemicals in pore water, ΣSEM/AVS, (ΣSEM-AVS)/Total Organic Carbon (TOC), OC, and grain size (indicated by percent gravel, sand, silt, and clay).

The PCA procedure was implemented using SYSTAT 11 (SYSTAT Software, Inc. 2004). Two factors were sought. The first factor is a linear combination of the chemical concentrations that explains the largest portion of the variance in the concentration data. The second factor is orthogonal (not correlated) to the first and explains as much of the remaining variance in the data as possible. The results of this correlation analysis is provided in the DESR (EA 2010a).

4.2 DIRECT EXPOSURE OF SOIL INVERTEBRATES

The potential for adverse effects to the soil invertebrate community were evaluated primarily through comparison of COPEC concentrations in North Area surface soils to literature-based benchmarks and the 21-day bioassay results of *N. arenaceodentata*.

4.2.1 Comparison of North Area Surface Soils to Literature-Based Benchmarks

Only barium, chromium, copper, and zinc exceeded soil benchmarks. Exceedances of these benchmarks were limited to three site samples except zinc, which was present in five of six site samples. Only barium and zinc were present above screening levels in the reference area soils. While comparison to literature-based benchmarks can be a tool for assessing risk, this method has the highest uncertainty and lowest confidence because they are not site-specific toxicity values.

4.2.2 *N. arenaceodentata* Toxicity Testing and Identification Potential Stressors

The evaluation of toxicity testing results for this receptor indicates the potential for reduced growth of *N. arenaceodentata* at NAS01, which had the highest metals concentrations, when compared with reference sample NAS07. A limited number of potential stressors were quantified in the North Area Soils exposure area. These were barium, chromium, copper, and zinc. Chromium, copper, and zinc were significantly correlated with each other (co-located), while barium was not associated with the other metals analyzed. As discussed in the DESR, chromium, copper, and zinc also appeared to be negatively associated with *N. arenaceodentata* growth, however the apparent relationships were not significant at the 0.10 level of significance, and were not investigated further (EA 2010a).

4.3 DIRECT EXPOSURE OF BENTHIC INVERTEBRATES IN WETLANDS SEDIMENTS

The potential for adverse effects to the benthic invertebrate community were evaluated primarily through comparison of COPEC concentrations in North Area sediments to literature-based benchmarks and the bioassay results of *N. arenaceodentata* and *L. plumulosus.*

4.3.1 Comparison of North Area Sediments to Literature-Based Benchmarks

Multiple PAHs and several metals exceeded sediment benchmarks. Exceedances of these benchmarks were limited in number for most COPECs (one to three samples at the most) and exceedances were typically within the same order of magnitude as the benchmark concentrations. The exception to this was zinc, which was present in four of the seven site samples. While comparison to literature-based benchmarks can be a tool for assessing risk, this method has the highest uncertainty and lowest confidence because they are not site-specific toxicity values.

4.3.2 *N. arenaceodentata* and *L. plumulosus* Toxicity Testing and Identification of Potential Stressors.

In the hypothesis analysis, where reference samples were pooled, wetland sediment EWSED06 exhibited reduced growth of *L. plumulosus* when compared with wetland sediment reference samples. No statistical difference was observed between wetland sediment samples and reference sediment samples when assessing survival and growth in the polychaete *N. arenaceodentata*.

Exploratory correlation and PCA revealed that, although PAH compounds were strongly correlated with each other (co-located) they were not closely associated with the toxic endpoint (*L. plumulosus* growth) (EA 2010a). To reduce the number of variables considered in the analysis, Total PAHs and Σ(PAHs/TOC) were determined, and individual PAH compounds were eliminated from the data set.

Correlation analysis showed that sediment grain size was not significantly associated with *Leptocheirus* growth, while zinc in bulk sediment, (ΣSEM-AVS)/TOC, and copper in pore water were negatively associated (i.e. as one goes up the other goes down) with *Leptocheirus* growth (EA 2010a). Significant association is indicated at the 0.05 level of significance.

Pore water was not analyzed in all the samples that were analyzed for bulk sediment chemistry and AVS/SEM. Therefore, the correlation analysis was performed separately (EA 2010a). Copper was the only pore water analyte that was significantly associated with adverse effects to *L. plumulosus* growth at the 0.05 level of significance.

As a result of these analyses, the following analytes appear to be associated with the observed growth effects to *L. plumulosus* in wetland sediments:

- Copper (pore water)
- Zinc (bulk sediment)

- (ΣSEM-AVS)/TOC

Correlation matrices for *L. plumulosus* endpoints versus bulk sediment chemistry and pore water chemistry are included in DESR (EA 2010a).

4.4 DIRECT EXPOSURE OF AQUATIC ORGANISMS IN NORTH AREA SURFACE WATER

The potential for adverse effects to the aquatic organisms were evaluated primarily through comparison of COPEC concentrations in North Area surface water to literature-based benchmarks and the bioassay results of *A.salina*.

4.4.1 Comparison of North Area Sediments to Literature-Based Benchmarks

The only exceedance of a surface water benchmark was for dissolved copper at EWSW03. Comparison to background levels was not available for surface water. While comparison to literature-based benchmarks can be a tool for assessing risk, this method has the highest uncertainty and lowest confidence because they are not site-specific toxicity values.

4.4.2 *A. salina* Toxicity Testing and Identification of Potential Stressors

The results of the acute toxicity tests of three surface water samples to brine shrimp (*A. salina*) were generally consistent between the original analysis presented in the FPSCR and the analysis using pooled reference data: Samples EWSW01 and EWSW04 did not exhibit acute toxicity (LC50 > 100 percent), and Sample EWSW03 had an LC50 between 5 and 6 percent dilution.

Acute toxicity to *A. salina* was indicated in 1 of 3 samples (EWSW03). These samples were analyzed for copper, nickel, silver, and zinc to aid in the determination of potential stressors. The data set is too small for quantitative statistical evaluation; however, concentrations of copper (8.54 microgram per liter [μg/L]) and silver (0.049 μg/L) are greater in the sample that exhibited acute toxicity to brine shrimp than in the other samples. If toxicity is attributable to copper, it appears that concentrations less than 3.4 μg/L would not cause toxicity to *A. salina.*

5.0 UNCERTAINTY

Uncertainty exists in many areas of risk assessment. The nature of the uncertainties depends on the data available, the degree of knowledge of site conditions, and the assumption made throughout the risk assessment process. Site-specific uncertainties inherent in the SERE are provided below:

- Toxicity to soil dwelling invertebrates was assessed using site toxicity data from *N. arenaceodentata*, a sediment dwelling marine polychaete, due to the high salinity of surface soils in the North Area. Site soils were submerged with synthetic seawater for the toxicity tests. The treatment of surface soils as sediments and the use of a marine

invertebrate may over- or underestimate risk to soil-dwelling invertebrates present in the North Area terrestrial environment.

- Site media concentrations were compared to literature-based benchmarks, or ESVs, which are not site-specific. This may over or underestimate risk.
- Toxicity to surface water dwelling invertebrates was assessed using site toxicity test data for the brine shrimp, *A. salina*, for which no established SOP was available. Multiple runs of the surface water toxicity tests were required due to potential feeding issues of test organisms and repeated control failure. Surface water reference data was also not available due to dry conditions in the reference area for comparison to toxicity test results. These factors may over- or underestimate risk to surface water-dwelling invertebrates present in the North Area aquatic environment.
- The results of the toxicity studies are not always well correlated to the results of the analytical chemistry. For example, while reference samples were elevated in soil sample NAS07, the survival of *N. arenaceodentata* in that sample was high (92 percent). Contrastingly, reference concentrations of all metal COPECs were below the TCEQ soil benchmarks at sample location NAS09, yet this sample indicated the highest mortality (60 percent). Factors other than site COPECs may explain the observed toxicity. This could over- or underestimate risk.
- The use of synthetic seawater to treat the soils as sediments for the toxicity test could also over or underestimate risks.
- SEM/AVS ratios for wetland sediments are generally above 1.0, indicating that conditions do not highly favor the formation of metal sulfides making them less bioavailable. The ratio of “excess” SEM to the fraction OC content in sediment is below 130 micromoles per gram organic carbon (µmol/goc) which is the concentration predicted to be non-toxic by the EPA (EPA, 2005) for six of the seven site samples. This may overestimate risk to metals from wetland sediments.
- The differences in how hypothesis testing were performed resulted different outcomes for wetland sediment and surface soils. This may over- or underestimate risk.

6.0 CONCLUSIONS

This SERE focused on characterizing potential risk from surface soils, sediments, and surface waters in the North Area. Potential risk was evaluated through the additional data analysis.

Toxicity tests of North Area surface soils to soil invertebrates, represented by the marine polychaete, *N. arenaceodentata*, indicated a significant difference for growth at one sampling location. Toxicity tests of wetland sediments to sediment dwelling invertebrates, represented by the amphipod, *L. plumulosus*, indicated significant difference in growth at one location. No significant differences were observed for survival and growth of N. *arenaceodentata* for the North Area sediment. Acute toxicity to the brine shrimp, *A. salina*, was indicated in one surface water sample from the North Area.

While the results of the site-specific toxicity test indicate the potential for some adverse effects to benthic invertebrates, risk is likely overestimated due to the intermittent nature of surface

water in the wetlands. Depending on rainfall and tide conditions, many of the areas selected for sediment toxicity analysis can often be completely dry. Significant populations of invertebrates would likely be limited to areas with perennial surface water. While individual effects may be present, it is unlikely that population level effects to growth and survival of invertebrates exist from COPECs in site surface soils, sediments and surface waters.

These findings are similar to those of the EA *Technical Memorandum Ecological and Habitat Health Assessment, Wetlands A, B, and C* (EA 2010b) which indicated that observed human impacts to the Site wetland habitats are minor. The Site wetlands are not visually distinguishable from surrounding wetlands in terms of wetland species composition and approximate density, presence of invertebrates, and wildlife usage. These wetlands are providing valuable wetland marsh functions, such as wildlife habitat, food, flood storage, water quality enhancement, and groundwater recharge. Any disturbance, such as excavation of sediments or other remedial activities, would require decades for sediments in this area to return to the salty sediment marsh type environment present today.

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TABLES

TABLE 1

DATA SUMMARY FOR NORTH AREA SURFACE SOILS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Location**	**Comments**	**4,4'-DDT**	**Aroclor-1254**	**Barium**	**Chromium**	**Copper**	**Zinc**
TCEQ Soil Benchmark			*NA*	*NA*	*300*	*30*	*61*	*120*
NAS01	North Area Soil				272	**97.3**	**221**	**5770**
NAS02	North Area Soil		0.0075 J	0.093 J	163	27.2	26.0	**296** JH
NAS02DUP	North Area Soil		0.015 J	0.16 J	261	23.1	24.9	**307** J
NAS03	North Area Soil		0.0078	--	190	15.4	22.9	**307** J
NAS04	North Area Soil		--	0.01	**502**	7.86	10.8	**321** J
NAS05	North Area Soil		0.008	--	198	**30.9**	27.4	**309** J
NAS06	North Area Soil		--	--	52.2	13.4	10.8	62.3 J
NAS07	North Area Soil	Background location BSS-01	--	--	**340**	12.4	10.1	**501**
NAS08	North Area Soil	Background location BSS-02	--	--	182	13.6	12.6	**182**
NAS09	North Area Soil	Background location BSS-03	--	--	172	13.3	11.0	63.1

Notes:
Values in mg/kg, dry weight
J = Estimated Concentration
H = Concentratin Biased High
mg/kg = milligrams per kilograms
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Location	Date	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene
TCEQ Marine Sediment Benchmark	--	--	*0.07*	*0.016*	*0.044*	*0.0853*
EWSED01	Wetland	8/12/2010	0.0038 J	0.0046 J	**0.057**	0.043
EWSED02	Wetland	8/12/2010	0.002 J	0.0018 J	0.041	0.032
EWSED02DUP	Wetland	8/12/2010	**0.0026** J	0.0013 J	0.03	0.024
EWSED03	Wetland	8/13/2010	**0.0068**	0.0043 J	0.0032 J	0.005
EWSED04	Wetland	8/13/2010	0.0037 J	0.0026 J	0.0069	0.006
EWSED05	Wetland	8/12/2010	**0.02**	**0.075**	0.018	0.078
EWSED06	Wetland	8/12/2010	0.0016 J	0.0013 J	0.0008 J	0.0011 J
EWSED07	Wetland	8/13/2010	**0.0053**	0.009	0.0091	0.027
EWSED08	Wetland	8/13/2010	0.001 J	< 0.00088	< 0.00069	0.001 J
EWSED09	Wetland	8/13/2010	0.00061 J	< 0.00076	< 0.00059	< 0.00058

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Arsenic**	**SEM/AVS**	**Benzo(a)pyrene**	**Benzo(g,h,i)perylene**	**Copper**	**Indeno(1,2,3-cd)pyrene**
TCEQ Marine Sediment Benchmark	*8.2*	*NA*	*0.43*	*NA*	*34*	*NA*
EWSED01	2.97	0.089	0.24	0.63	20.6	0.22
EWSED02	2.4	0.014	0.12	0.46	13.3	0.18
EWSED02DUP	2.51	--	0.097	0.35	14.6	0.16
EWSED03	5.36	0.002	0.028	0.058	25	0.034
EWSED04	4.35	0.039	0.04	0.076	20.3	0.064
EWSED05	3.06	0.002	**0.79**	0.68	28.9	0.79
EWSED06	3.23	0.084	0.01	0.019	28.1	0.019
EWSED07	5.94	0.005	0.087	0.1	30.7	0.1
EWSED08	2.92	6.4	0.014	0.017	15.8	0.019
EWSED09	2.58	0.062	0.0027 J	0.0032 J	11.7	0.0032 J

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Lead**	**Nickel**	**4,4'-DDT**	**Endrin Aldehyde**	**Benzo(a)anthracene**	**Endrin ketone**
TCEQ Marine Sediment Benchmark	*46.7*	*20.9*	*0.00119*	*NA*	*0.261*	*NA*
EWSED01	17.2	18.9	< 0.001 J	0.0007 J	< 0.066 J	< 0.000093
EWSED02	12	15.6	< 0.00017	< 0.00012	< 0.043 J	< 0.000093
EWSED02DUP	14.7	17.3	< 0.00017	< 0.001 J	< 0.00072 J	< 0.0011 J
EWSED03	**48.4**	**21.7**	**0.0028**	0.00027 J	0.024	< 0.00011 J
EWSED04	37.4	16.9	--	--	0.031	--
EWSED05	**76.1**	14.4	< 0.019 J	0.0014 J	**0.55**	< 0.001 J
EWSED06	32.9	**22.5**	**0.0012**	< 0.00012	0.0069	< 0.000093
EWSED07	32.7	20.1	--	--	0.09	--
EWSED08	19.8	16.3	**0.0014**	0.00052 J	0.011	< 0.00012
EWSED09	17.4	16.5	**0.0016**	< 0.00012	0.0024 J	< 0.000093

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Chrysene**	**gamma-Chlordane**	**Dibenz(a,h)anthracene**	**Flourene**	**Flouranthene**
TCEQ Marine Sediment Benchmark	*0.384*	*0.00226*	*0.0634*	*0.019*	*0.6*
EWSED01	**0.39**	< 0.00009	**0.17**	0.019	0.038
EWSED02	**0.62**	< 0.00009	**0.11**	0.013	0.023
EWSED02DUP	**0.49**	< 0.00009	**0.094**	0.011	0.019
EWSED03	0.064	< 0.00009	0.0074	0.0048	0.052
EWSED04	0.05	--	0.01	0.0032 J	0.076
EWSED05	**0.77**	< 0.00009	**0.14**	**0.065**	**1.3**
EWSED06	0.014	0.00025 J	0.0026 J	0.001 J	0.02
EWSED07	0.14	--	0.019	0.016	0.26
EWSED08	0.017	< 0.00012 J	0.003 J	0.00092 J	0.031
EWSED09	0.004	< 0.00023 J	< 0.0008	< 0.00061	0.0055

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Phenanthrene**	**Pyrene**	**Total Organic Carbon**	**Zinc**	**GRAVEL, MEDIUM,%**	**GRAVEL, FINE,%**
TCEQ Marine Sediment Benchmark	*0.24*	*0.665*	*NA*	*150*	*NA*	*NA*
EWSED01	0.032	0.091	59400	115	2.52	3.49
EWSED02	0.016	0.14	24100	70.1	53.7	5.66
EWSED02DUP	0.014	0.11	30500	86.1	--	--
EWSED03	0.049	0.069	18200	**585**	47.9	7.73
EWSED04	0.041	0.075	16700	**417**	0.57	2.19
EWSED05	**0.78**	**1.1**	18100	**595**	0.34	2.64
EWSED06	0.013	0.021	21500	**959**	18.7	0.87
EWSED07	0.15	0.19	23900	**318**	--	--
EWSED08	0.015	0.027	46800	94.3	12.7	12.1
EWSED09	0.0024 J	0.0044 J	11200	88.3	1.97	2.31

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**SAND, VERY COARSE,%**	**SAND, COURSE,%**	**SAND, MEDIUM,%**	**SAND, FINE,%**	**SAND, VERY FINE,%**	**SILT,%**	**CLAY,%**
TCEQ Marine Sediment Benchmark	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
EWSED01	5.58	2.82	1.8	2.12	2.42	61.6	21.2
EWSED02	2.91	1.77	1.15	2.29	1.64	13.7	10.8
EWSED02DUP	--	--	--	--	--	--	--
EWSED03	4.83	3.01	1.75	1.93	0.93	29.2	1.7
EWSED04	2.88	3.18	2.98	7.02	4.59	81.4	0.6
EWSED05	2.83	4.49	4.93	8.91	6.96	38.7	27.5
EWSED06	0.67	0.41	0.27	2.06	1.24	21.6	61.7
EWSED07	--	--	--	--	--	--	--
EWSED08	8.04	3.92	1.93	2.62	2.51	44.3	14.6
EWSED09	1.35	0.54	0.4	1.87	5.24	40.4	48.5

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Acid-volatile sulfide, µmol/gsed**	**Cadmium, SEM, µmol/gsed**	**Copper, SEM, µmol/gsed**	**Lead, SEM, µmol/gsed**	**Nickel, SEM, µmol/gsed**	**Zinc, SEM, µmol/gsed**
TCEQ Marine Sediment Benchmark	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
EWSED01	0.018 J	< 0.0006	0.024	0.015	0.015	0.148
EWSED02	< 0.005	0.0007	0.03	0.029	0.03	0.259
EWSED02DUP	--	--	--	--	--	--
EWSED03	< 0.004	0.0011	0.057	0.038	0.012	1.55
EWSED04	0.05	0.0012	0.16	0.088	0.016	1.02
EWSED05	< 0.004	< 0.0005	0.082	0.055	0.011	1.74
EWSED06	0.33	0.0019	0.092	0.04	0.019	3.79
EWSED07	--	--	--	--	--	--
EWSED08	2.04	< 0.0008	0.016	0.021	0.028	0.255
EWSED09	0.004	< 0.0005	0.011	0.009	0.005	0.039

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**∑SEM, µmol/gsed**	**∑SEM/AVS**	**foc,goc/gsed**	**∑SEM-AVS, µmol/gsed**	**(∑SEM-AVS)/foc, µmol/goc**
TCEQ Marine Sediment Benchmark	*NA*	*NA*	*NA*	*NA*	*NA*
EWSED01	0.2	11.3	0.0594	0.185	3.1
EWSED02	0.3	69.7	0.0273	0.344	12.6
EWSED02DUP	--	--	--	--	--
EWSED03	1.7	415	0.0182	1.654	90.9
EWSED04	1.3	25.7	0.0167	1.235	74
EWSED05	1.9	472	0.0181	1.885	104.1
EWSED06	3.9	11.9	0.0215	3.613	168
EWSED07	0.7	184	0.0239	0.731	30.6
EWSED08	0.3	0.157	0.0468	--	--
EWSED09	0.1	16.1	0.0112	0.061	5.4

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**2-Methylnaphthalene**	**4,4'-DDT**	**Acenaphthene**	**Acenaphthylene**
TCEQ Marine Surface Water Benchmark	*0.03*	*0.000001*	*0.0404*	*NA*
EWSED01	0.000018 U	< 0.000012 J	<0.0000052	0.000024
EWSED02	0.000026 U	< 0.0000047 J	<0.0000044	<0.0000034
EWSED03	0.000022 U	< 0.000016 J	<0.0000047	<0.0000036
EWSED04	0.000046	--	<0.0000085 J	0.000014 J
EWSED04DUP	--	--	--	--
EWSED06	0.000019 U	< 0.00000058	0.0000091 J	<0.0000035
EWSED07	0.000013 U	--	<0.000012	0.000032 J
EWSED08	0.0000083 U	**0.000003** J	<0.000005	<0.0000039
EWSED09	0.000018 U	< 0.0000014 J	<0.0000044	<0.0000034

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Anthracene**	**Arsenic**	**Benzo(a)anthracene**	**Benzo(a)pyrene**	**Benzo(g,h,i)perylene**
TCEQ Marine Surface Water Benchmark	*0.00018*	*0.078*	*NA*	*NA*	*NA*
EWSED01	0.000067	0.0037 J	<0.0000031	<0.0000051	0.000012 J
EWSED02	<0.0000036	0.0041 J	<0.0000026	<0.0000043	0.000012 J
EWSED03	0.000013 J	0.0019 J	<0.0000028	<0.0000046	<0.0000031
EWSED04	0.000047	0.00072 J	<0.0000026	<0.0000043	<0.0000029
EWSED04DUP	--	0.00325	--	--	--
EWSED06	<0.0000037	0.00177 J	0.0000095 U	0.0000097 U	0.000023 U
EWSED07	0.000066	0.00063 J	<0.0000067	<0.000012	<0.0000075
EWSED08	<0.0000041	0.00576 J	<0.000003	<0.0000049	<0.0000033
EWSED09	<0.0000036	0.00171 J	<0.0000026	<0.0000043	<0.0000029

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Chrysene**	**Copper**	**Dibenz(a,h)anthracene**	**Endrin Aldehyde**
TCEQ Marine Surface Water Benchmark	*NA*	*0.0036*	*NA*	*0.000002*
EWSED01	<0.000004	0.000922	<0.000003	**0.000013**
EWSED02	0.000049	0.000342 U	0.0000034 J	**0.0000067** J
EWSED03	<0.0000036	**0.00456**	<0.0000027	**0.000015** J
EWSED04	<0.0000034	**0.00426**	<0.0000025	--
EWSED04DUP	--	**0.00531** U	--	--
EWSED06	0.0000096 U	**0.00702**	0.000015 U	<0.00000046
EWSED07	<0.0000088	0.00303	<0.0000065	--
EWSED08	<0.0000039	0.00137	<0.0000029	**0.0000026** J
EWSED09	<0.0000034	0.000761 U	<0.0000025	<0.0000033 J

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Endrin ketone**	**Fluorene**	**Fluoranthene**	**gamma-Chlordane**
TCEQ Marine Surface Water Benchmark	*0.000002*	*0.05*	*0.00298*	*0.000004*
EWSED01	<0.00000078	0.000013 J	<0.0000052	<0.00000038
EWSED02	<0.0000013 J	<0.0000038	<0.0000044	<0.0000013 J
EWSED03	**0.000007** J	<0.000004	<0.0000047	<0.000016 J
EWSED04	--	0.0000047 J	<0.0000044	--
EWSED04DUP	--	--	--	--
EWSED06	<0.00000066	0.0000091 J	<0.0000045	<0.00000032
EWSED07	--	<0.0000098	<0.000012	--
EWSED08	<0.0000007	<0.0000044	<0.000005	0.0000033 J
EWSED09	<0.0000011	<0.0000038	<0.0000044	<0.000016 J

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Indeno(1,2,3-cd)pyrene**	**Lead**	**Nickel**	**Phenanthrene**	**Pyrene**	**Zinc**
TCEQ Marine Surface Water Benchmark	*NA*	*0.0053*	*0.0131*	*0.0046*	*0.00024*	*0.0842*
EWSED01	0.0000051 J	0.000115 U	0.00944	0.000012 J	<0.0000042	0.0101
EWSED02	0.0000062 J	0.000113 U	0.00486	<0.000005	<0.0000035	0.00135 U
EWSED03	<0.0000028	0.000425 U	0.00749 U	0.0000053 U	<0.0000037	0.0413
EWSED04	<0.0000026	0.00015 U	0.0114	<0.000005	<0.0000035	**0.101**
EWSED04DUP	--	0.000239 U	--	--	--	0.083
EWSED06	0.000014 U	0.000443 U	0.00915	0.0000068 J	<0.0000036	**0.626**
EWSED07	<0.0000067	0.000184	0.00917	<0.000013	<0.000009	0.0599
EWSED08	<0.000003	0.00128 U	**0.0142**	<0.0000057	<0.000004	0.039
EWSED09	<0.0000026	0.000236 U	0.00669	<0.000005	<0.0000035	0.00124 U

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 4
1 of 1
DATA SUMMARY FOR NORTH AREA WETLAND SURFACE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Acrolein**	**Copper**	**Nickel**	**Silver**	**Zinc**
TCEQ Marine Surface Water Benchmark	*0.005*	*0.0036*	*0.0131*	*0.00019*	*0.0842*
EWSW01	<0.00096	0.00338 J	0.00616	0.000020 J	0.029
EWSW01DUP	<0.00096	0.00331	0.00601	0.000021 J	0.0279
EWSW03	--	**0.00854**	0.00474	0.000049	0.0242
EWSW04	--	0.00154	0.00396	0.000011 J	**0.122**

Notes:
Values in mg/L
mg/L = milligrams/liter
< indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 5

SUMMARY OF TOXICITY TESTING FOR NORTH AREA SOIL AND SEDIMENT
GULFCO MARINE MAINTENANCE SUPERFUND SITE

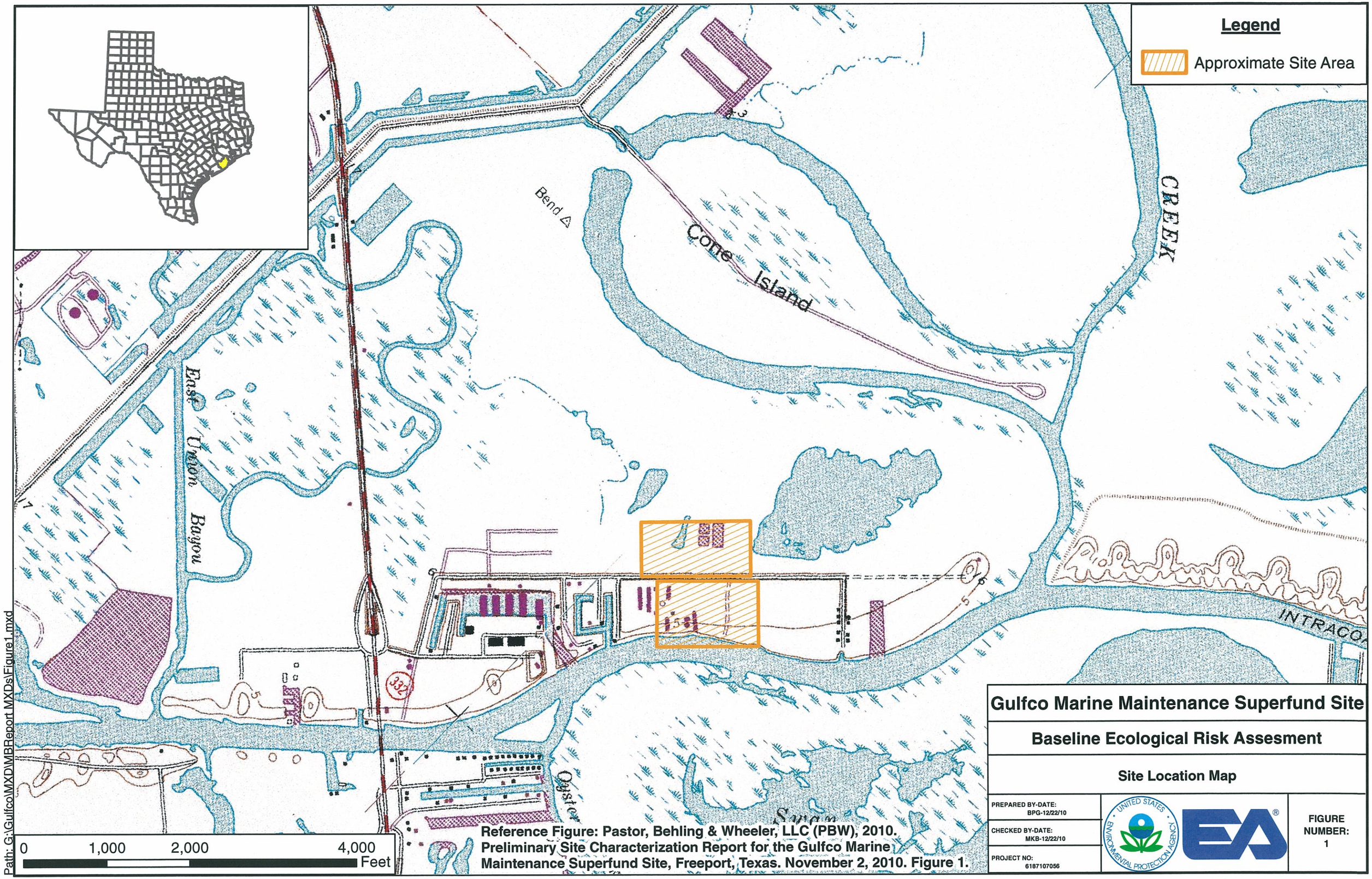
North Area Soils	***21-day Neanthes arenaceodentata:* Survival and Growth**		
Sample ID	**Survival (%)**	**Growth - Biomass (mg)**	**Growth - Dry Wt. (mg)****
Lab Control for North Area Soils	100	2.058	2.058
Site Locations:			
BERA SAmple ID: NAS01	76	0.6648	0.9817
BERA Sample ID: NAS02	88	2.123	2.407
BERA Sample ID: NAS03	96	2.603	2.704
BERA Sample ID: NAS04	84	4.52	5.423
BERA Sample ID: NAS05	76	1.998	2.695
BERA Sample ID: NAS06	88	1.648	1.894
North Area Reference Locations:			
BERA Sample ID: NAS07	92	1.533	1.679
BERA Sample ID: NAS08	64	0.688	1.008
BERA Sample ID: NAS09	60	0.5512	0.9815

Wetlands Sediments	***28-day Neanthes arenaceodentata:* Mean Survival and Growth**			***28-day Leptocheirus plumulosus:* Mean Survival, Growth and Reproduction**			
Sample ID	**Survival (%)**	**Growth - Biomass (mg)**	**Growth - Dry Wt. (mg)****	**Survival (%)**	**Offspring (Mean)**	**Growth - Biomass (mg)**	**Growth - Dry Wt. (mg)****
Lab Control *	96	4.073	4.28	81.5	5.3	0.6773	0.8304
Site Locations:							
BERA Sample ID: EWSED01	96	3.073	3.234	35	0	0.2607	0.6566
BERA Sample ID: EWSED02	76	2.285	3.334	58	0.2	0.2313	0.4916
BERA Sample ID: EWSED03	84	2.004	2.421	20	0	0.2015	0.4202
BERA Sample ID: EWSED04	84	2.53	2.988	23.75	0	0.1518	0.529
BERA Sample ID: EWSED05	72	2.248	3.285	38	0	0.1614	0.4109
BERA Sample ID: EWSED06	80	1.78	2.36	13	0	0.05525	0.3764
BERA Sample ID: EWSED07	72	2.451	3.371	30	0.8	0.124	0.3924
Wetland Sediment Reference Locations:							
BERA Sample ID: EWSED08	66	1.586	2.741	33	0.6	0.2238	0.5988
BERA Sample ID: EWSED09	76	2.15	2.95	19	1.8	0.1162	0.5035

* Average of Lab Control 1 and 2

* * The primary growth endpoint Dry Wt is the dry weight of surviving organisms divided by the number of surviving organisms. Biomass (the dry weight of surviving orgamisms divided by initial number of organisms) is not routinely applied to sediment testing (EPA, 2000)

FIGURES



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 1.

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

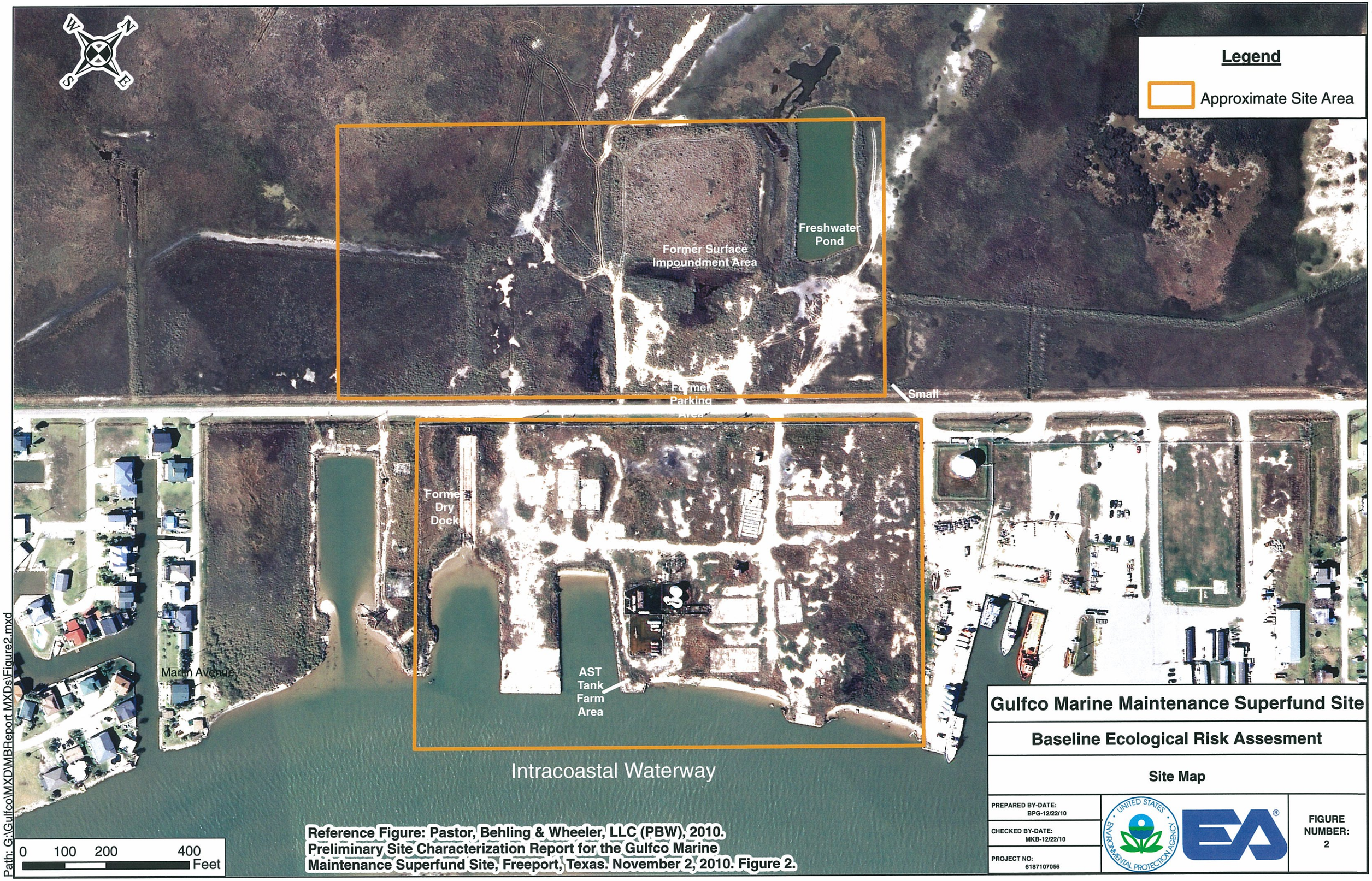
Site Location Map

PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 1



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 2.

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Site Map

PREPARED BY-DATE: BPG-12/22/10	FIGURE NUMBER: 2
CHECKED BY-DATE: MKB-12/22/10	
PROJECT NO: 6187107056	

BERA Sample ID: NAS01	
Constituent	Concentration (mg/kg)
Metals	
Chromium	97
Copper	221
Zinc	5770

Reference Figure: Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 2.

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Sample Locations and Potential Stressors in North Area Soils

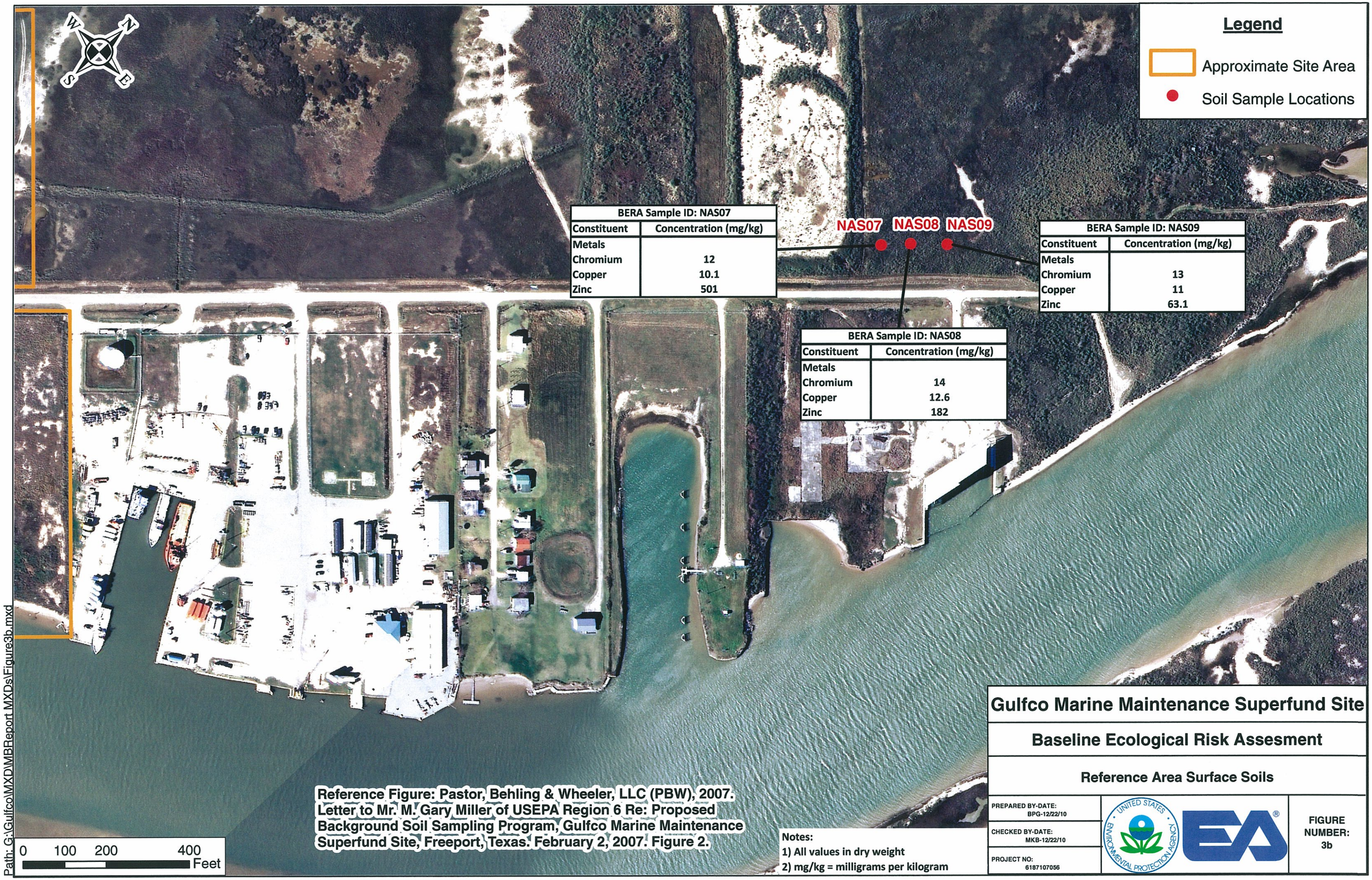
PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 3a

Path: G:\Gulfco\MXD\MBReport MXDs\Figure3a.mxd



BERA Sample ID: NAS07	
Constituent	Concentration (mg/kg)
Metals	
Chromium	12
Copper	10.1
Zinc	501

BERA Sample ID: NAS08	
Constituent	Concentration (mg/kg)
Metals	
Chromium	14
Copper	12.6
Zinc	182

BERA Sample ID: NAS09	
Constituent	Concentration (mg/kg)
Metals	
Chromium	13
Copper	11
Zinc	63.1

Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2007. Letter to Mr. M. Gary Miller of USEPA Region 6 Re: Proposed Background Soil Sampling Program, Gulfco Marine Maintenance Superfund Site, Freeport, Texas. February 2, 2007. Figure 2.

Notes:
1) All values in dry weight
2) mg/kg = milligrams per kilogram

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Reference Area Surface Soils

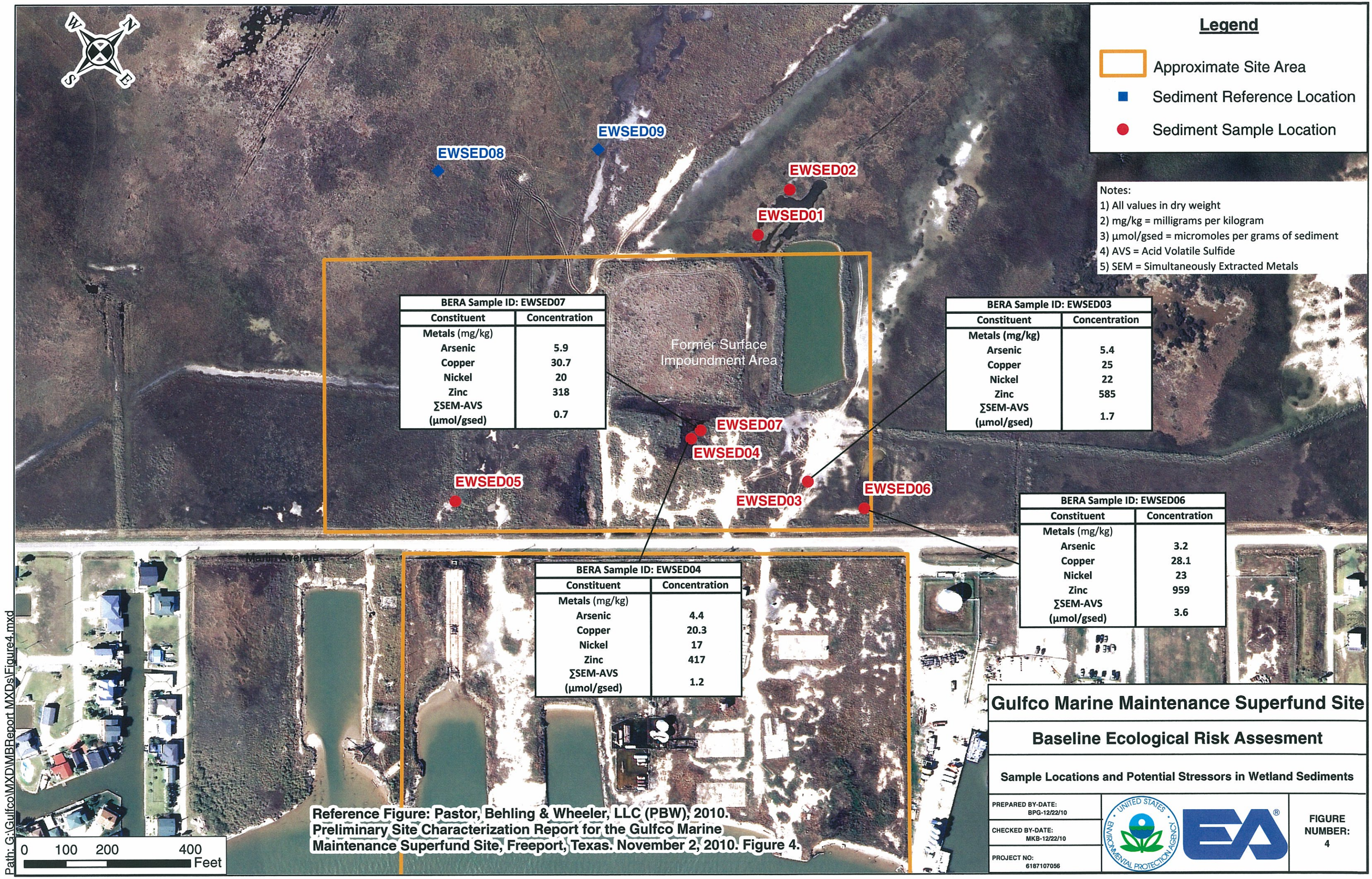
PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 3b

Path: G:\Gulfco\MXD\MBReport MXDs\Figure3b.mxd



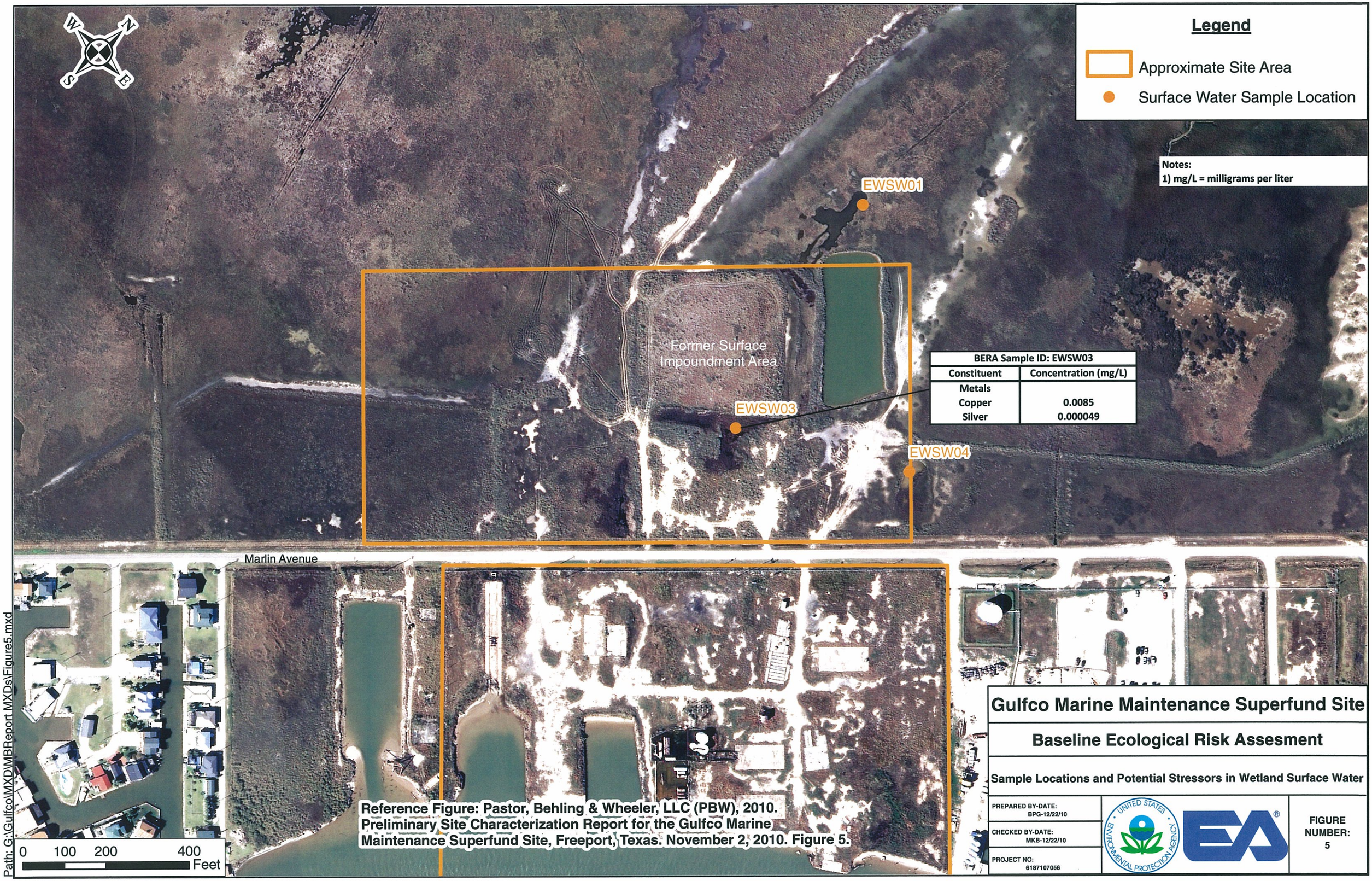
BERA Sample ID: EWSED07	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	5.9
Copper	30.7
Nickel	20
Zinc	318
∑SEM-AVS (µmol/gsed)	0.7

BERA Sample ID: EWSED03	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	5.4
Copper	25
Nickel	22
Zinc	585
∑SEM-AVS (µmol/gsed)	1.7

BERA Sample ID: EWSED06	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	3.2
Copper	28.1
Nickel	23
Zinc	959
∑SEM-AVS (µmol/gsed)	3.6

BERA Sample ID: EWSED04	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	4.4
Copper	20.3
Nickel	17
Zinc	417
∑SEM-AVS (µmol/gsed)	1.2

Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 4.



BERA Sample ID: EWSW03	
Constituent	Concentration (mg/L)
Metals	
Copper	0.0085
Silver	0.000049

Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 5.

Path: G:\Gulfco\MXD\MBReport MXDs\Figure5.mxd

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Sample Locations and Potential Stressors in Wetland Surface Water

PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 5

EA Engineering, Science,
and Technology, Inc.

South Central Region
405 S. Highway 121, Suite C-100
Lewisville, TX 75067
Telephone: 972-315-3922
Fax: 972-315-5181
www.eaest.com

28 December 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Revision 01)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the above-referenced Technical Memorandum (Revision 01) for the above-referenced Task Order. An electronic copy was submitted via email on 28 December 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 28 December 2010	TRANSMITTAL NO. 0007
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
3.0	Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Rev. 01) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

Technical Memorandum

Surface Impoundment Cap Evaluation for Erosion

Gulfco Marine Maintenance Superfund Site
906 Marlin Avenue
Freeport, Brazoria County, Texas
EPA Identification No. TXD0055144539

Non-Time Critical Removal Support
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
Building C, Suite 100
Lewisville, Texas 75067
(972) 315-3922

December 2010
Revision 01
EA Project No. 14342.67

1.0 INTRODUCTION

This technical memorandum documents the visual observations of the Surface Impoundment Cap performed by EA Engineering, Science, and Technology, Inc. (EA) for the former Gulfco Marine Site (Site) located in Freeport, Brazoria County, Texas. Inspection of the CAP was conducted on 15 December 2010. This work was completed for the U.S. Environmental Protection Agency (EPA) Region 6 as part of Task Order No. 0067-NSEE-06JZ under EPA Contract No. EP-W-06-004, in accordance with a Statement of Work (SOW) issued by EPA in October 2010.

The site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek to the east and the Old Brazos River Channel to the west. During the 1960's, the Site was used for occasional welding and was used as a barge cleaning facility 1971 through 1999. Occasional sandblasting and barge repair/refurbish also occurred onsite. The surface impoundments were closed under the Texas Water Commission's (Texas Commission on Environmental Quality (TCEQ) predecessor agency) direction in 1982 (PBW, 2010). Previous reports and observations have document erosion and or rutting in the cover.

2.0 SURFACE IMPOUNDMENT COVER EVALUATION

A visual Site reconnaissance was performed on 15 December 2010 by John Conquest, a State of Texas licensed Professional Engineer. The primary objective of the site visit was to visually observe the existing conditions.

2.1 EXISTING CONDITIONS

The elevation of the surface impoundment cap is approximately 2 feet higher than the surrounding existing natural surface grade. The existing cap is approximately 2.5 to 3.5 feet thick. The clay cap appeared to be in good condition with no surface cracking during the site investigation. The photo below shows the typical elevation differences between the cap, to the right, and the surrounding areas.

2.2 VEGETATION

The surface of the clay cap is covered with a layer of oyster shells and vegetation. Cap vegetation consists of mostly grasses with some brush. The majority of the brush is located along the perimeter of the cap with isolated patches within the interior portions of the cap. The photo below shows typical cap vegetation.

2.3 VEHICULAR TRAFFIC

Evidence of vehicular traffic along the perimeter of the cap was observed during the site investigation. Wheel tracks have formed ruts in portions of the vegetation along the western side of the cap. The rutting was generally no more than 3 inches deep with one location found to be approximately 6 inches deep. The photo below is an example of typical vehicle paths through the ground cover.

The photo below details the area of deepest rutting (approximately 6-inches).

2.4 SURROUNDING AREA

The perimeter of the cap was inspected during site reconnaissance. It was found to be in good condition with no visible rill erosion.

3.0 CONCLUSIONS

There is no obvious maintenance of the cap as evidenced by the presence of woody vegetation around the perimeter of the cap and on a few areas on top of the cap. The roots of woody vegetation could compromise the clay layer of the cap and allow infiltration and contribute to migration of contaminants away from the confines of the former impoundment.

Even though there is no evidence of erosion, the obvious rutting of the cap on the western edge has not been repaired and could also lead to compromise of the clay layer.

Based on the field inspection and cores collected during the 3 August 2006 field effort, the clay layer of the cap is estimated to be 2.5 to 3.5 feet thick (PBW 2009). The estimated hydraulic conductivity of the current clay layer was determined to be 1 x 10^{-7}cm/sec (PBW 2009). The surface of the current cap is approximately 6 inches thick and composed of crushed shells.

The February 2002 HRS Documentation Record recounted the Texas Department of Water Resources to deny the PRP request to classify the waste material in the impoundments as Class II. They did classify the material as Class I waste pursuant to Texas Administrative Code, Title

30, Chapter 335, Subchapter R, Rule §§ 335.505-335.507. The TNRCC guidelines for a Class I cap calls for a minimum compacted clay layer four feet thick and a conductivity of 1 x 10^{-7} cm/sec or less (TNRCC 2004). The guidelines also indicate the clay should be covered with 18 inches of topsoil or other acceptable material to minimize erosion. They recommend that the cap be vegetated with shallow rooting species to minimize disruption of the cover and established to aid in evapotranspiration.

Therefore, the current impoundment cap clay layer does not meet the requirements for a Class 1 impoundment, nor does the current surface layer. The cap is vegetated but woody growth needs to be cut or removed.

REFERENCES

Pastor, Behling & Wheeler, LLC (PBW). 2009. Nature and Extent Report for the Gulfco Marine Maintenance Site, Freeport, Texas. 20 May.

PBW. 2010. Final Screening-Level Ecological Risk Assessment, Gulfco Marine Maintenance Superfund Site, Freeport, Brazoria County, Texas, EPA Facility ID: TXD0055144539, May.

Texas Natural Resounce Conservation Comission (TNRCC). 2004. Industrial Solid Waste Management. Technical Guideline No. 3. Revised 13 October.

Texas Secretary of State. Texas Administrative Code, Title 30, Part 1, Chapter 335, Subchapter R, Rule §§335.503 - 335.507.

U.S. Environmental Protection Agency (EPA). 2010. RAC II Statement of Work for Non-Time Removal Support, Gulfco Marine Maintenance, Freeport, Texas. Contract No. EP-W-06-004. 6 October.

EA Engineering, Science,
and Technology, Inc.

South Central Region
405 S. Highway 121, Suite C-100
Lewisville, TX 75067
Telephone: 972-315-3922
Fax: 972-315-5181
www.eaest.com

26 May 2011

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency (EPA)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Task Order Closeout Report**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one hard copy of the Task Order Closeout Report (TOCR) for the Gulfco Marine Maintenance Site. EA will transmit an electronic version of the TOCR to EPA via e-mail.

EA is also providing one electronic copy on compact disc (CD) of the closeout files including the project index, final deliverables, and relevant correspondence. The data contained on the CD is for the designated recipient only and contains privileged and EA Confidential Business Information (CBI).

The period-of-performance expires on 31 May 2011. The Task Order was finished within the initial approved budget. The total cumulative cost for the Task Order is (b) (4) [redacted].

If you have any questions regarding this submittal, please call me at (972) 315-3922.

Sincerely,

Al Sloane
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: **26 May 2011**	TRANSMITTAL NO.: **012**
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		
TASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
13	Task Order Closeout Report/Closeout Files Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support Task Order 0067-NSEE-06JZ		One hard copy, one electronic copy via e-mail, one electronic copy of closeout files on compact disc	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

1. Gulfco Marine Maintenance Non-Time Critical Removal	2. 0067-NSEE-06JZ	3. State: Texas

EPA Region 6 RAC Task Order Closeout Report (TOCR)

Prepared By: **EA Engineering, Science, and Technology, Inc. (EA)**		
Contractor: **EA**	Contract Number: **EP-W-06-004**	
Contractor Program Manager: **Tim Startz**		Phone: **(972) 315-3922**
Contractor Project Manager: **Alpheus Sloan III**		Phone: **(972) 459-5033**
Project Officer (PO): **Rena McClurg**		Phone: **(214) 665-8314**
Contracting Officer (CO): **Michael Pheeny**		Phone: **(214) 665-2798**
Task Order Monitor (TOM): **Gary Miller**		Phone: **(214) 665-8318**
Performance Period From: **19 November 2010** To: **31 May 2011**		

Description of Activities: **EA completed the following tasks:**

Task 1—Project Planning and Support

On 27 October 2010, EA submitted Work Plan and Cost Estimate Revision 00 to the U.S. Environmental Protection Agency (EPA). The Work Plan and Cost Estimate was based on the Statement of Work (SOW) dated 6 October 2010 and the EPA responses provided on 15 October 2010 to questions EA submitted for the SOW. In the Work Plan and Cost Estimate, EA estimated $(b) (4) in total funding to perform the Task Order outlined in the EPA SOW.

On 29 October 2010, EA submitted Work Plan and Cost Estimate Revision 01 to EPA. The revised Work Plan was to incorporate EPA comments on the Work Plan schedule received on 29 October 2010. There was no change in the estimated cost of $(b) (4) from the initial Work Plan.

On 19 November 2010, EA received the initial contract modification for Task Order 0067-NSEE-06JZ from EPA. This modification approved the Work Plan and Cost Estimate dated 29 October 2010, and established the expenditure limit at (b) (4) .

On 22 November 2010, EA submitted a letter notifying EPA that an EA Project Manager change, from Mr. Mark Paddack to Mr. Al Sloan, was effective immediately.

On 24 November 2010, EA submitted the Health and Safety Plan.

On 29 November 2010, EA submitted the Sampling and Analysis Plan for the chemical and physical analysis of soil samples and physical analysis of soil cores.

On 15 December 2010, EA submitted Field Change Form No. 1 to request extending the delivery date of the Data Evaluation Summary Report from 19 December 2010 to 27 December 2010. On 20 December 2010, EA received Task Order Modification 001 approving Field Change Form No. 1.

On 23 February 2011, EA submitted a letter notifying EPA that EA would reach 75 percent of the expenditure limit by the end of February 2011.

Throughout the Task Order's period-of-performance, the EA Project Manager (1) communicated project status to the EPA TOM; (2) conducted routine budgeting and cost control activities; (3) coordinated staffing and subcontracting of technical support, Task Order deliverables, and field activities; and (4) prepared the monthly status reports.

This Task Order was completed 27.6 percent under budget. During the period-of-performance of the project collection of samples for chemical analysis was not required. Also, community involvement support and post Engineering Evaluation/Cost Analysis (EE/CA) support was not required. This resulted in lower labor, analytical, and reporting costs than were initially assumed.

Task 2—Community Involvement

Activities under this task were not required.

Task 3—Field Investigation/Data Acquisition

On 15 December 2010, EA conducted an engineering field reconnaissance of the cap over the former impoundments and an ecological reconnaissance of the area surrounding the former impoundments.

On 21 December 2010, EA submitted the Technical Memorandum Ecological and Habitat Health Assessment Wetlands A, B, and C (Revision 00) and Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Revision 00). The first discussed the visual status of the environment of the area surrounding the former impoundments from an ecological perspective, and the second described the visual status of the cap from an engineering perspective. Revision 01 of the visual status of the cap was submitted on 28 December 2010.

Task 4—Sample Analysis

On 17 December 2010, soil cores of cap and clay borrow samples that were collected on the 15 December 2010 field reconnaissance were sent to the private laboratory Apex Geoscience, Inc. for physical analysis. On 28 December 2010, EA received the analytical results.

Task 5—Analytical Support and Data Validation

Activities under this task were not required.

Task 6—Data Evaluation

On 27 December 2010, EA submitted the Data Evaluation Summary Report Revision 00 to EPA. On 28 January 2011, EPA requested EA add language to clarify the results of the potentially responsible parties (PRP) toxicity studies. On 11 February 2011, EA submitted the Data Evaluation Summary Report Revision 01 to EPA.

Task 7—Risk Assessment

The draft Streamlined Ecological Risk Evaluation (SERE) was prepared as Appendix A to the EE/CA report and submitted to EPA on 30 December 2010. EA received verbal comments on the draft SERE from EPA on 12 January 2011. EA incorporated EPA comments and submitted the SERE Revision 01 to the EPA on 21 January 2011. On 28 January 2011, EPA requested EA add language to clarify the results of the PRP toxicity studies. On 11 February 2011, EA submitted the SERE Revision 02 to EPA incorporating the requested information.

Task 8—Identification and Screening of Removal Alternatives

EA identified and screened removal alternatives to be included in the EE/CA.

Task 9—Analysis of Removal Alternatives

EA analyzed removal alternatives to be included in the EE/CA.

Task 10—Engineering Evaluation/Cost Analysis Report

EA prepared the draft EE/CA and submitted it for EPA review on 30 December 2010. EA received verbal comments on the draft EE/CA from EPA on 12 January 2011. EA incorporated EPA comments, revised the EE/CA and submitted the EE/CA Revision 01 to the EPA on 21 January 2011. On 28 January 2011, EPA requested EA add language to clarify the results of the PRP toxicity studies and include additional discussion as to the protectiveness of the clay layer cover. On 11 February 2011, EA submitted the EE/CA Revision 02 to EPA incorporating the requested clarification.

Task 11—Post EE/CA Support

Activities under this task were not required.

Task 12—Administrative Record

This task was inactive.

Task 13—Task Order Closeout

On 2 March 2011, EA received authorization from EPA to commence closeout activities.

1. Gulfco Marine Maintenance Non-Time Critical Removal	2. 0067-NSEE-06JZ	3. State: Texas

EPA Region 6 RAC Task Order Closeout Report (TOCR)

EA conducted project file closeout activities. EA conducted file duplication, distribution, and storage to meet Federal Records Center requirements and prepared a Task Order Closeout Report (TOCR) in accordance with regional guidance and other procedures as specified in the Task Order.

On 26 May 2011, EA submitted the TOCR to EPA.

Unusual Problems/Occurrences Affecting Contractor's Performance: None					
Approved Work Plan Budget:	(b) (4)	Total Amount Billed:	(b) (4)	Percent Remaining:	**27.6%**
Approved Expenditure Limits:	(b) (4)	Subcontract Charges:	(b) (4)	Fee on Subcontract Charges:	(b)

Task Order Closeout Checklist

Yes	Deliverables submitted
NA	Outstanding suspensions are resolved/addressed (if applicable, otherwise indicate NA)
Yes	Contractor release of claims (if applicable, otherwise indicate NA)
NA	Property disposition (if applicable, otherwise indicate NA)
Yes	Invoices are paid
Yes	All labor, subcontractor, and other direct costs booked
Yes	Initiated archiving of project documentation and filing for 10-year retention
Yes	Was the final budget of the Task Order greater than 10 percent over or under the original approved work plan? (If so, describe the circumstances and describe why this occurred.) *Certain work activities originally scoped as part of the project were not conducted following EPA's direction. During the period-of-performance of the project, collection of samples for chemical analysis was not required. In addition, community involvement support and post EE/CA support was not required. This resulted in lower labor, analytical, and reporting costs than were initially assumed.*
Yes	Task Order activities are complete
Yes	Compact disc includes all deliverables and relevant correspondence
Yes	Release of claims for Task Order

Project Manager Signature:	Date: 26 May 2011

CONTRACT FIELD CHANGE FORM

Project Name	Document Name	Task Order No.
Gulfco Marine Maintenance Site NTCRS	**Field Change Form No. 1**	**0067-NSEE-06JZ**
Contract No.		**Date**
EP-W-06-004		**15 December 2010**

Scope of Work for Field Change Form:

EA is requesting a deadline extension of the delivery of the DESR from 19 December 2010 to 27 December 2010 to allow for manipulation of the hard copy data and preparation of the report.

The work plan dated 29 October 2010 was approved on 19 November 2010. The schedule for the Task Order called for the delivery of Data Evaluation Summary Report by 19 December 2010. Since it was determined that no new data will be collected at this time, EA and our team subcontractor has all of the PRP data that will be included in the Data Evaluation Summary Report (DESR). Because of the late start of the Task Order and the amount of data that is available only in hard copy format, the delivery date and amount of time to prepare the DESR was underestimated.

This Field Change Form requires no additional Task Order funding. The Task Order remains unchanged at (b) (4) [redacted] **and there is no impact to the Task Order's period of performance, which remains at 31 May 2011.**

Reason for Action:

The deadline extension request would allow time to manipulate the hard copy data and senior review of the report.

COST DATA

Item Description (attach specifications if necessary)	Estimated Quantity	Unit	Unit Rate	Line Item Total
			Original Reserve Funding	**Not applicable**
			Subtotal for this field change form	**$0**
			Plus total for all previously submitted field change forms	**$0**
			Balance of Original Reserve Funding (upon approval of field change form)	**Not applicable**
			G&A (11.43% of Non-Labor Subtotal for this field change form)	**$0**

Schedule Impact (Calendar Days): 0 days

SIGNATURES

Not Applicable			
Resident Engineer	Financial Manager	Project Manager	EPA Approval
	15 December 2010	15 December 2010	
Date	Date	Date	Date

EPA REGION 6 REMEDIAL ACTION CONTRACT 2
CONTRACT: EP-W-06-004
MONTHLY STATUS REPORT
VOUCHER NO. 60

Task Order:	0067-NSEE-06JZ	**Report Period:**	December 2010
Task Order Name:	Gulfco Marine Maintenance NTCRS	**Firm:**	EA
EPA Task Order Monitor:	Gary Miller	**Tasks:**	1, 3, 6, 7, 8, 9, and 10
EPA Contracting Officer:	Michael Pheeny	**Percent Complete:**	38.4%
EPA Project Officer:	Rena McClurg	**Period-of-Performance:**	31 May 2011
EA Program Manager:	Tim Startz		
EA Financial Manager:	Jeff Hills		
EA Project Manager:	Al Sloan		

1. INTRODUCTION

This report covers the period 21 November – 31 December 2010.

During this report period, EA Engineering, Science, and Technology, Inc. (EA) conducted activities under Tasks 1, 3, 6, 7, 8, 9, and 10 of this Task Order. The specific activities conducted under these tasks are summarized below. The percent complete estimate is based on cumulative costs incurred versus authorized funding of the Task Order.

2. PROGRESS MADE DURING THIS REPORT PERIOD

2.1 TASK 1 – PROJECT PLANNING AND SUPPORT

The EA Project Manager (1) communicated project status to the U.S. Environmental Protection Agency (EPA) Task Order Monitor, (2) conducted routine budgeting and cost control activities, (3) coordinated staffing of technical support and Task Order deliverables. and (4) prepared the monthly status report.

On 24 November 2010 EA submitted the Health and Safety Plan (HSP) in preparation of conducting field work planned for the week of 13 December 2010. On 29 November 2010, EA submitted the Sampling and Analysis Plan (SAP) for EPA review and approval to guide field sampling efforts the week of 13 December 2010.

EA submitted Field Change Form(FCF) No. 1 on 15 December 2010 requesting an extension to the delivery date of the Data Evaluation Summary Report (DESR) from 19 December 2010 to 27 December 2010. On 20 December 2010, EPA Modification 001 was received approving FCF No. 1.

On 21 December 2010, EA submitted the monthly status report and invoice for this Task Order to EPA.

2.2 TASK 2 – COMMUNITY INVOLVEMENT

This task had no activity during this report period.

2.3 TASK 3 – REMEDIAL INVESTIGATION/DATA ACQUISITION

EA procured a subcontractor to conduct the physical analysis of soil cores collected from the cap and clay borrow area.

On 15 December 2010, EA conducted an engineering field reconnaissance of the cap and an ecological reconnaissance of the area surrounding the cap. EA collected cores from the cap and clay borrow samples for physical analysis.

On 22 December 2010, EA submitted one field Technical Memorandum on the visual status of the cap and a second field Technical Memorandum on the visual status of the environment in the area surrounding the former impoundment.

2.4 TASK 4 – SAMPLE ANALYSIS

The cores from the cap and clay borrow samples collected on 15 December 2010 were analyzed for physical parameters by Apex Geosciences, Inc.

2.5 TASK 5 – ANALYTICAL SUPPORT AND DATA VALIDATION

This task had no activity during this report period.

2.6 TASK 6 – DATA EVALUATION

The data collected during the last potentially responsible party's field effort was reviewed and the DESR was prepared.

On 27 December 2010, EA submitted the DESR to EPA.

2.7 TASK 7 – RISK ASSESSMENT

The draft Streamlined Ecological Risk Evaluation was prepared as an appendix to the Engineering Evaluation/Cost Analysis (EE/CA).

2.8 TASK 8 – IDENTIFICATION AND SCREENING OF REMOVAL ALTERNATIVES

EA identified and screened removal alternatives.

2.9 TASK 9 – ANALYSIS OF REMOVAL ALTERNATIVES

EA analyzed removal alternatives.

2.10 TASK 10 – ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)

The draft EE/CA was prepared during this report period. On 30 December 2010, EA submitted the draft EE/CA report to the EPA for review.

2.11 TASK 11 – POST EE/CA SUPPORT

This task had no activity during this report period.

2.12 TASK 12 – ADMINISTRATIVE RECORD

This task is currently inactive.

2.13 TASK 13 – TASK ORDER CLOSEOUT

This task had no activity during this report period.

3. DELIVERABLES

Description of Deliverable	Due Date	Submittal Date
Monthly Status Report and Invoice	20 December 2010	21 December 2010
Scoping Meeting	N/A	---
Site Visit	N/A	---
Work Plan Revision 00	27 October 2010	27 October 2010
Work Plan Revision 01	29 October 2010	29 October 2010
Conflict of Interest Disclosure	---	7 October 2010
Health and Safety Plan	24 November 2010	24 November 2010
Sampling and Analysis Plan, Revision 00	29 November 2010	29 November 2010
Quality Assurance Project Plan (QAPP)	29 November 2010	29 November 2010 (Included in SAP)
Fact Sheets	Five days after notification from EPA	---
Public Meeting Support Materials	One week prior to scheduling meeting	---
Field Reports	Friday of every week of field activities cover activities through noon on Thursday	---
Data Validation Report	Seven days after receipt of all analytical results from the laboratory	---
Data Evaluation Summary Report	27 December 2010	27 December 2010
Draft EE/CA Report	30 December 2010	30 December 2010
Final EE/CA Report	16 January 2011 (8 days after receipt of EPA comments on draft EE/CA Registry)	---
Preliminary Draft Action Memorandum	30 January 2011 (14 days after final EE/CA report submitted)	---
Task Order Closeout Report	1 March 2011 (30 days after Preliminary Draft Action Memorandum submitted)	---
Final Costs	30 May 2011 (90 days after Task Order Closeout notification is received.	---

4. OUTSTANDING ISSUES/RESOLUTION

None.

5. PROJECTED ACTIVITY DURING NEXT PERIOD

During the next report period, EA anticipates performing the following activities:

Task 1

- Conduct project management activities.

Task 3

- May visit site to collect clay borrow samples for chemical analysis.

Task 10

- Address comments received from the EPA on the draft EE/CA and finalize the report.

6. SUBCONTRACTING

Subcontractor, Apex Geosciences, Inc., conducted physical analysis of the cores and borrow clay samples.

7. SUSTAINABILITY/GREEN REMEDIATION

Reports are delivered via e-mail. Hard copies of deliverables submitted to EPA are double-sided and printed on recycled paper.

8. TOTAL EXPENDITURES

Please see the attached financial report. The December 2010 financial status report shows costs incurred during the period 21 November – 30 December 2010 to be (b) (4) hours and (b) (4) in direct labor, (b) (4) in other direct costs, and (b) (4) in subcontracting. The total Task Order cost for the report period is (b) (4).

EA has expended 38.4 percent of the approved funding for this Task Order.

TARGET SHEET

SITE NAME: GULFCO MARINE MAINTENANCE

CERCLIS I.D.: TXD055144539

TITLE OF DOC.: TASK ORDER CLOSEOUT FILES GULFCO MARINE MAINTENANCE SITE

DATE OF DOC.: 02/23/2011

NO. OF PGS. THIS TARGET SHEET REPLACES: 87

SDMS #: 9191440 **KEYWORD:** 14.99

SENSITIVE ?	X	MISSING PAGES ?	
ALTERN. MEDIA ?		CROSS REFERENCE ?	

LAB DOCUMENT ?		LAB NAME:	
ASC./BOX #:			
CASE #:		SDG #:	

COMMENTS : THIS TARGET SHEET REPLACES PAGES 328 THROUGH 414 THAT HAVE BEEN REDACTED DUE TO FOIA EXEMPTION (b) (4) - CONFIDENTIAL BUSINESS INFORMATION - THE NON-REDACTED DOCUMENT IS LOCATED IN THE U.S. EPA REGION 6 SUPERFUND RECORDS CENTER.

RAC II NATIONAL MODEL STATEMENT OF WORK FOR NON-TIME CRITICAL REMOVAL SUPPORT (NS)

Revision 0

Gulfco Marine Maintenance Superfund Site
Brazoria County, Texas
October 6, 2010

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RAC II NATIONAL MODEL STATEMENT OF WORK
FOR NON-TIME-CRITICAL REMOVAL SUPPORT (NS)
Revision 0

Gulfco Marine Maintenance Superfund Site
Brazoria County, Texas
October 6, 2010

Contract No: EP-W-06-004
Task Order No:

Introduction

PURPOSE

The purpose of this task order is to implement the non-time-critical removal support (NTCRS) at the Gulfco Marine Maintenance Superfund Site (Site) to select a removal action to eliminate, reduce, or control risks to human health and the environment. This statement of work (SOW) sets forth the framework and requirements for the NTCRS. The NTCRS shall consist of preparation of an Engineering Evaluation and Cost Analysis (EE/CA) report and a PRELIMINARY DRAFT Action Memorandum for the repair of an existing cap over the former impoundments and for a wetland sediment hot-spot removal. However, EPA shall determine the selected removal alternative. Current sampling being performed at the Site will determine whether the wetland sediment hot-spot removal will be necessary. For planning purposes, the sediment removal is to be included in the scope of this EE/CA, and will remain a part of this SOW until or unless the current sampling results indicate that the sediment hot-spot removal is not necessary to protect human health and the environment. The sampling results are expected to be available sometime in the October 2010 timeframe. The goal for completion of this task order is May 31, 2011.

SITE DESCRIPTION

The Site is located in Freeport, Texas at 906 Marlin Avenue (also referred to as County Road 756). The Site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek approximately one mile to the east and the Texas Highway 332 bridge approximately one mile to the west. The Site includes approximately 1,200 feet (ft.) of shoreline on the Intracoastal Waterway, a coastal shipping canal that extends from Port Isabel to West Orange on the Texas Gulf Coast.

Marlin Avenue divides the Site into two areas. The property to the north of Marlin Avenue consists of wetlands and the closed surface impoundments. The property south of Marlin Avenue was developed for industrial uses with a dry dock, sand blasting areas, an aboveground storage tank (AST) tank farm, and two barge slips connected to the Intracoastal Waterway. The Site was operated as a barge cleaning and repair facility from 1971 until 1999.

The former surface impoundments were three earthen pits with natural clay liners located in Lot 56 on the north side of Marlin Avenue. These former impoundments were used for storage of waste oils, caustics, various organic chemicals, and wash waters generated during barge cleaning activities. The former impoundments were closed in 1982 when the liquids and majority of sludges were removed and the remaining sludge was solidified with soil and left in place. The former impoundments were then capped with 3-feet of clay cover and a hard wearing (shell) surface. During recent investigations

at the Site, the cap was found to be between 2.5-feet and 3.6-feet thick, and was rutted on the western end.

Recent investigations at the Site found that the sediment north of Marlin Avenue contained several chemicals of potential ecological concern at concentrations exceeding the screening levels. These chemicals include polynuclear aromatic hydrocarbons and several metals. At this time sediment samples are being collected by the Respondents for the Site, and the Respondents will conduct bioassays to determine the toxicity of this material.

GENERAL REQUIREMENTS

This is a fixed rate task order that requires the contractor to provide a completed Engineering Evaluation and Cost Analysis (EE/CA) report that, when implemented through a removal action, will eliminate, reduce or control risks to human health and the environment. Furnish all necessary and appropriate personnel, materials, and services needed for, or incidental to, performing and completing the NTCRS. The NTCRS and associated deliverables required under this task order shall be consistent with the EE/CA, the *Remedial Design/Remedial Action (RD/RA) Handbook* (U.S. EPA Office of Solid Waste and Emergency Response (OSWER) 9355.0-04B, EPA 540/R-95/059, June 1995), all other guidance used by EPA in conducting an NTCRS (Attachment 3), and the requirements of this SOW. The NTRS involves the procurement of an analytical subcontractor(s).

In conducting the task order, EPA expects the contractor to propose the most appropriate and cost-effective procedures and methodologies using accepted engineering practices and controls. Throughout the performance of this task order, EPA expects the contractor to be responsible for performing services and providing products at the lowest reasonable cost. If there are changes to the SOW by the government, the government will issue a formal amendment to the task order and request an revised work plan and cost estimate from the contractor.

A summary of the potential major deliverables and proposed schedule for submittals is in Attachment 1. This summary and schedule can be used as the basis for the contractor's proposed deliverables and schedules included in the work plan. Submit the major deliverables using the Transmittal of Documents for Acceptance by EPA Form (Attachment 4). The EPA Task Order Monitor (TOM) will track deliverables submitted by the contractor using the Transmittal Register (Attachment 5).

A list of primary guidance and reference material is attached (Attachment 3). In all cases, the contractor shall use the most recently issued guidance.

Communicate at least weekly with the EPA TOM, either in face-to-face meetings or through conference calls. Document all decisions that are made in meetings and conversations with EPA via the monthly progress reports. EPA will provide oversight of contractor activities throughout the NTCRS. EPA review and approval of deliverables is a tool to assist this process and to satisfy, in part, EPA's responsibility to provide effective protection of public health, welfare, and the environment. EPA will review deliverables to assess the likelihood that the NTCRS will achieve its goals and that its performance and operations requirements have been met. Acceptance of deliverables by EPA does not relieve the NTCRS contractor for the adequacy of the deliverables or from their professional responsibilities.

RECORD KEEPING REQUIREMENTS

Maintain all technical and financial records for the NTCRS in accordance with the contract. At the completion of the task order, submit an official record of the NTCRS in both compact disk and a hardcopy to the TOM. Provide the deliverables using electronic media.

US EPA PRIMARY CONTACTS

The primary contact for this task order is Gary Miller. He can be reached at (214) 665-8318, via facsimile at (214) 665-6660, or via e-mail at miller.garyg@epa.gov. His mailing address is US EPA Region 6, 1445 Ross Avenue, Dallas, Texas 75202-2733.

TASK ORDER COMPLETION DATE AND PROJECT CLOSEOUT

The completion of the task order, perform all necessary project closeout activities as specified in the contract. These activities include closing out any subcontracts, indexing and consolidating project records and files as required above, and providing a technical and financial closeout report to EPA. The goal is to complete task order technical activities and closeout activities by May 31, 2011.

NTCRS Work Planning

WORK PLAN WBS: 1.1

Prepare and submit a NTCRS work plan that includes a detailed description of implementation activities, performance monitoring, and overall management strategy, including optimization, for the NTCRS. Typical activities involved in preparing the work plan include, but are not limited to, the following:

- Contact the TOM (COR) within five calendar days after receipt of the Statement of Work from EPA to schedule the scoping meeting or work plan development conference call to be conducted between EPA and the contractor. Regional personnel will be available to meet with the contractor after the initial scoping meeting to discuss and clarify any issues the contractor may have regarding this project. Contact the TOM to schedule this meeting at least five working days before the proposed meeting date.

- Conduct a site visit with the TOM during the NTCRS planning phase to assist in developing an understanding of the Site and any logistics if required or determine necessary between EPA and the contractor.
-
- Preparing and submitting a final NTCRS work plan within 30 calendar days after issuance of this SOW. The work plan shall include a detailed description of the technical approach for the NTCRS activities. Specify the necessary procedures, inspections, deliverables, and schedules. Include a comprehensive implementation management schedule for completion of each major activity and submittal.

- Preparing the estimated cost to complete the task order, including subcontractor costs, for each element of the SOW; providing a breakdown of the cost by task and subtask levels, in accordance with the contract work breakdown structure (WBS).

- Providing conflict of interest disclosure.

SITE-SPECIFIC PLANS WBS: 1.2

Review all existing site-specific plans and prepare, update, and/or maintain plans, as necessary, for NTCRS implementation. Incorporate the plans and procedures received from any subcontractor(s) into the overall site plans. Should the contractor fail to meet the required standards in accordance with the appropriate legal, regulatory, and EPA guidance, prepare revised site-specific plans. (NOTE: In that event, contractor costs associated with the preparation of the revised site-specific plans shall be paid by EPA but shall not bear fee.) Typical plans include, but are not limited to, the following:

- Sampling and Analysis Plan (SAP) in accordance with 40 CFR 300.415(b)(4)(ii).

- Site-specific Health and Safety Plan (HSP) that specifies employee training, protective equipment, medical surveillance requirements, standard operating procedures, and a contingency plan in accordance with 29 CFR 1910.120(l)(1) and (l)(2). NOTE: The RI/FS HSP may be modified for use if appropriate.

POLLUTION LIABILITY INSURANCE **Not Required** WBS 1.3

Prepare and submit costs to the Contracting Officer for approval for task order-specific Pollution Liability Insurance, if the contractor plans to bill insurance premiums as a direct charge to the task order and there is no contract-wide Pollution Liability Insurance. (NOTE: Track and report all costs associated with this subtask separately and in accordance with the Reports of Work, Attachment B, of this contract.)

Project Management and Reporting

PROJECT MANAGEMENT WBS: 1.4

Perform activities required to effectively manage the task order. These activities typically include, but are not limited to, the following:

- Monitoring costs and progress.

- Preparing and submitting monthly progress reports that document monthly and cumulative cost, performance status, and technical progress.

- Preparing and submitting monthly invoices in accordance with the level of detail as specified in the contract.

- Manage, track, and report status of site-specific equipment.

- Participating in meetings and preparing and submitting meeting summaries.

- Accommodating any external audit or review mechanism that EPA requires.

- Evaluating existing data, including usability, when directed by EPA.

- Coordinating with local and emergency response teams. **If Required**

- Reviewing background documents as directed by EPA.

- Attending EPA-held training. **Not Required**

COMMUNITY INVOLVEMENT (CR) WBS: 2

Prepare and implement the Community Involvement Plan (CIP) for the site. Perform community involvement activities in support of EPA throughout the NTCRS in accordance with the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP, 40 CFR Part 300) and the *Community Relations in Superfund - A Handbook*, (U.S. EPA, Office of Emergency and Remedial Response, OSWER Directive No. 9230.0-3C, January 1992). These tasks include, but are not limited to, the following:

- Conducting community interviews. **(NOT REQUIRED)**

- Developing Community Involvement Plan (CIP). **(NOT REQUIRED)**

- Providing public meeting and/or open house support: budget for (1) open house.

- Preparing fact sheets, notices and other informational documents: budget for (2) fact sheets.

- Providing support for proposed plan. **(NOT REQUIRED)**

- Providing public hearing support. **(NOT REQUIRED)**

- Publishing public notices in local newspapers serving the site community: budget for (1) newspaper notice.

- Maintaining public information repository.

- Developing and updating site mailing lists. **(NOT REQUIRED)**

- Providing administrative and technical support for Responsiveness Summary. **(NOT REQUIRED)**

- Preparing presentation materials.

- Implementing other community involvement activities as identified by the site-specific CIP or EPA.

- Providing technical support to review Community Involvement deliverables and participate in public meetings.

Risk Identification

PROJECT INITIATION WBS: 1.5

Perform project initiation and support that will lead to the selection of a removal action that eliminates, reduces, or controls risks to human health and the environment. Typical activities include, but are not limited to, the following:

- Developing data summaries.

- Compiling existing site data and reports.

- Identifying significant data gaps that limit ability to identify and evaluating removal alternatives.

- Developing a conceptual understanding of the site based on existing data.

- Identifying likely response scenarios and potentially applicable technologies that address site problems.

- Preparing conceptual exposure pathway analysis in accordance with Regional guidelines and OSWER Directives 9285.7-02B, 12/89, *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A, Baseline Risk Assessment)*, Interim Final; 9285.7-01B, 12/91, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*; 9285.7-01C, 12/91 *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part C, Risk Evaluation of Remedial Alternatives)*; 9285.7-47, 12/01 *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part D, Standardization Planning, Reporting and Review of Superfund Risk Assessments)* Final; and 9285.7-25, 2/97 *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conduction Ecological Risk Assessment*.

- Initiating identification of Applicable or Relevant and Appropriate Requirements (ARARs) that affect selection of the removal action

FIELD INVESTIGATION/DATA ACQUSITION (FI) WBS: 3

Collect environmental data required to support the NTCRS. Data acquisition begins with EPA's approval of the Field Sampling Plan (FSP). Typical activities include, but are not limited to, the following:

- Mobilization/demobilization.

- Hydrogeological assessment. **(NOT REQUIRED)**
  - Test boring and monitoring well installation and development
  - Downhole geophysics
  - Groundwater elevation measurements
  - Surface water elevation measurements

- Soil boring, drilling, and testing: budget for (3) test borings in cap.

- Environmental sampling.
  - Field screening **(NOT REQUIRED)**
  - Groundwater sampling **(NOT REQUIRED)**
  - Surface soil sampling: budget for (8) soil/sediment samples
  - Soil boring/permeability sampling: budget for (3) permeability analysis
  - Surface water and sediment sampling **(NOT REQUIRED)**
  - Air monitoring **(NOT REQUIRED)**
  - Indoor sampling **(NOT REQUIRED)**

- Reuse assessment. **(NOT REQUIRED)**

- Geotechnical survey. **(NOT REQUIRED)**

- Field-generated waste characterization and disposal in accordance with local, State and Federal regulations.

- Site reconnaissance.
  - Ecological resources reconnaissance
  - Well inventory **(NOT REQUIRED)**
  - Existing well development and establishment of sampling points **(NOT REQUIRED)**
  - Landfill gas emission sampling **(NOT REQUIRED)**
  - Surface geophysical survey **(NOT REQUIRED)**
  - On-site and residential well sampling **(NOT REQUIRED)**
  - Surface water sampling **(NOT REQUIRED)**
  - Soil sampling
  - Sediment sampling
  - Leachate sampling **(NOT REQUIRED)**
  - Field screening **(NOT REQUIRED)**
  - Tank and drum sampling **(NOT REQUIRED)**

- Ecological Characterization. **(NOT REQUIRED)**
  - Wetland and habitat delineation/function and value assessment
  - Wildlife observations
  - Benthic reconnaissance/community characterization
  - Identification of endangered species and others of special concern
  - Bioassays
  - Bioaccumulation studies
  - Biota sampling/population studies

SAMPLE ANALYSIS (SN) WBS: 4

Analyze split samples taken to document and confirm sampling results and performance. A variety of mechanisms may be used to implement this task including: the Contract Laboratory Program (CLP), laboratories procured under subpool or team subcontracts, the Environmental Response Team (ERT) laboratory, or regionally procured laboratories. [NOTE: This task consists exclusively of performing sample analyses and producing analytical data. For cost estimating purposes, there should be no direct labor costs under this task - no hours should be reflected under this task, only dollars.]

ANALYTICAL SUPPORT AND DATA VALIDATION (AN) WBS: 5

Schedule, coordinate, track, and oversee sample analyses and validate analytical data. Typical activities include, but are not limited to, the following:

- Collecting, preparing, and shipping environmental samples in accordance with the Field Sampling Plan (FSP). The following types of sampling shall be required:

  - Field screening **(NOT REQUIRED)**
  - Ground water sampling **(NOT REQUIRED)**
  - Surface and subsurface soil sampling
  - Surface water and sediment sampling

- Air monitoring and sampling **(NOT REQUIRED)**
- Biota sampling **(NOT REQUIRED)**
- Other types of media sampling and screening **(NOT REQUIRED)**

- Developing data quality objectives (DQO) for each sampling event; these DQOs shall be the determinative factor for assessing the success or failure of the sampling.

- Requesting, obtaining, and performing oversight of analytical services in compliance with EPA requirements.

- Coordinating with the EPA Sample Management Office (SMO), the Regional Sample Control Coordinator (RSCC), and/or the Region 6 Houston Laboratory regarding analytical support, data validation, and quality assurance issues.

- Implementing the EPA-approved laboratory quality assurance program that provides oversight of in-house and subcontracted laboratories through periodic performance evaluation sample analyses and/or on-site audits of operations and has a system of corrective actions.

- Providing sample management including chain of custody procedures, information management, sample retention, and 10-year data storage.

- Performing data validation, the process by which the quality of the data, the defensibility of the data, and the chain of custody are verified. Performing data validation in accordance with Regional guidelines.

- Reviewing data for usability for its intended purpose.

- Providing reports on data validation and usability.

DATA EVALUATION (DE) WBS: 6

Compile analytical and field data. Provide data in format that is compatible with Regional or National electronic data management network. Typical activities include, but are not limited to, the following:

- Data usability evaluation and field quality assurance/quality control (QA/QC).

- Data Reduction and Tabulation.

- Data trend evaluation and/or modeling and submission of Technical Memorandum. **(NOT REQUIRED)**

- Data reduction and tabulation.

  - Soil boring and monitoring well logs.
  - Field sampling data.
  - Hydrogeological testing data. **(NOT REQUIRED)**
  - Geophysical data (downhole geophysics, survey). **(NOT REQUIRED)**
  - Analytical results.

- Environmental Fate and Transport Modeling/Evaluation. **(NOT REQUIRED)**

Risk Assessment

RISK ASSESSMENT - EVALUATION (RA) WBS: 7

Conduct a streamlined ecological risk evaluation. The objective of these assessments is to characterize and quantify, where appropriate, the current and potential environmental risks that would prevail if no further remedial action is taken.

Risk Assessment must be done in accordance with applicable Agency guidance, directives and procedures.

IDENTIFICATION AND SCREENING OF REMOVAL ALTERNATIVES (IS) WBS: 8

Identify and screen removal alternatives appropriate to the purpose and scope of the Non-Time Critical Removal Action that comply with ARARs to the maximum extent practicable.

ANALYSIS OF REMOVAL ALTERNATIVES (AL) WBS: 9

Assess individual removal alternatives against the criteria of effectiveness, implementability and cost, in addition to comparative analysis of options. Recommend and conduct treatability studies at direction of EPA. EPA shall determine the selected removal alternative.

Engineering Evaluation and Cost Analysis

ENGINEERING EVALUATION/COST ANALYSIS (EE/CA) REPORT (EE) WBS: 10

Prepare findings after data have been evaluated. The task includes all draft and final reports. Also includes providing technical assistance in the preparation of the PRELIMINARY DRAFT Action Memo, however, EPA shall determine the selected removal alternative. The EE/CA Report shall include a discussion of the following:

- Site Characterization.
  - Site description
  - Site background
  - Analytical data
  - Site conditions that justify a removal action
  - Reuse Assessment and Reasonably Anticipated Future Land Uses
- Risk Evaluation.
  - Human health risks **(NOT REQUIRED)**
  - Ecological risks
  - Proposed cleanup levels
- Identification of Removal Action Objectives.
  - Statutory limits on removal actions
  - Removal action scope
  - Removal action schedule
  - Applicable or Relevant and Appropriate Requirements

- Identification of Removal Action Alternatives.

- Analysis of Removal Alternatives.

  - Effectiveness
  - Implementability
  - Cost

- Comparative Analysis.

- Identification of ARARs.

- Provide technical assistance in the preparation of the Action Memorandum.

- Evaluation of Post-Removal Site control activities necessary to sustain the integrity of the Removal Action.

POST EE/CA SUPPORT (PE) WBS: 11

Perform activities subsequent to the Engineering Evaluation/Cost Analysis (EE/CA). Typical activities include, but are not limited to, the following:

- Attending public meetings, briefings, public hearings, technical meetings with PRPs: budget for (1) meeting.

- Providing technical assistance in the preparation of the Responsiveness Summary.

- Providing technical assistance in the preparation of the Action Memorandum.

ADMINISTRATIVE RECORD (AR) **(NOT REQUIRED)** WBS: 12

Produce the Administrative Record. Typical activities include, but are not limited to, the following:

- Attending meetings with EPA TOM, Site Attorney, and Administrative Record Coordinator.

- Providing assistance in compiling documents comprising of the Administrative Record File in accordance with EPA Regional guidance or other procedures as specified.

- Preparing Draft Administrative Record Index in accordance with EPA Regional guidance or other procedures as specified.

- Preparing Administrative Record Index.

- Coordinating duplication of Administrative Record.

- Assembling Administrative Record and Index.

Perform the necessary activities to close out the task order in accordance with contract requirements. Typical activities include but are not limited to, the following:

- Packaging and returning documents to the government.
- Duplicating/distribution/storage of files.
- Archiving files in accordance with Federal Record Center requirements.
- Preparing microfiche/microfilm/optical disk or other EPA-approved data storage technology.
- Preparing the closeout report in accordance with Regional guidance or other procedures as specified in the task order. If the final hours/budget is greater than +/- 10% of the original approved work plan/task order hours/budget, the TOCR shall describe the circumstances that explain why this occurred.

Attachment 1 - Summary of Major Submittals for Non-Time-Critical Removal Support - Gulfco Marine Maintenance Site

DELIVERABLE	NO. OF COPIES	DUE DATE (calendar days)	EPA REVIEW PERIOD
Non-Time Critical Removal Support Work Plan	1HC & 1EC	Within 30 days after receipt of the Statement of Work from EPA	10 days after receipt of work plan
Monthly Progress Reports	1HC & 1EC	Monthly and as required in the contract	NA
Site Management Plan (SMP)	1HC & 1EC	7 days after approval of NTCRS work plan	3 days after receipt of plan
Health and Safety Plan (HASP)	1HC & 1EC	7 days after approval of NTCRS work plan	3 days after receipt of plan
Sampling and Analysis Plan (SAP)	1HC & 1EC	7 days after approval of NTCRS work plan	3 days after receipt of plan
Quality Assurance Project Plan (QAPP)	1HC & 1EC	7 days after approval of NTCRS work plan	3 days after receipt of plan
Fact Sheets	1EC	5 days after notification from EPA	3 days after receipt of fact sheet
Public Meeting Support Materials	TBD	One week prior to scheduled meeting	NA
Field Reports	1EC	Friday of every week of field activities (covering activities through noon on Thursday)	3 days after receipt
Data Validation Report	1HC & 1EC	7 days after receipt of all analytical results from laboratory	3 days after receipt
Data Evaluation Summary Report	1HC & 1EC	7 days after receipt of all analytical results from laboratory	3 days after receipt
Draft EE/CA Report	3HC & 1EC	50 days after approval of NTCRS work plan	9 days after receipt
Final EE/CA Report	3HC & 1EC	8 days after receipt of EPA comments on draft EE/CA Report	4 days after receipt
Preliminary Draft Action Memo	1HC & 1EC	14 days after final EE/CA report submitted	10 days after receipt of memo
Closeout Report	1HC & 1EC	30 days after Preliminary Draft Action Memo submitted	21 days after receipt of report
Final Costs	1HC & 1EC	90 days after task order closeout	NA

Attachment 2 - Work Breakdown Structure (WBS) for Non-Time-Critical Removal Support (NTCRS)

Task 1 Project Planning and Support (PP)

1.1 Project planning.
- 1.1.1 Attend scoping meeting.
- 1.1.2 Conduct site visit.
- 1.1.3 Develop Work Plan and cost estimate
- 1.1.4 Provide conflict of interest disclosure.

1.2 Site-specific plans.
- 1.2.1 Sampling and Analysis Plan (SAP).
- 1.2.2 Health and Safety Plan (HSP)

1.3 Pollution liability insurance **Not Required**

1.4 Project management.
- 1.4.1 Monitor costs and prepare periodic status reports.
- 1.4.2 Participate in meetings/communicate routinely
- 1.4.3 Manage, track, and report status of site-specific equipment.
- 1.4.4 Accommodate any external audit or review mechanism that EPA shall require.
- 1.4.5 Evaluate existing data, including usability, when directed by EPA.
- 1.4.6 Coordinate with local and emergency response teams. **If Required**
- 1.4.7 Review background documents as directed by EPA.
- 1.4.8 Attend EPA-held training. **Not Required**

1.5 Project initiation and support.
- 1.5.1 Develop data summaries.
- 1.5.2 Compile existing site data and reports.
- 1.5.3 Identify significant data gaps that limit ability to identify and evaluate removal alternatives.
- 1.5.4 Develop a conceptual understanding of the site based on existing data.
- 1.5.5 Identify likely response scenarios and potentially applicable technologies and operable units that address site problems.
- 1.5.6 Prepare conceptual exposure pathway analysis.
- 1.5.7 Initiate identification of Applicable or Relevant and Appropriate Requirements (ARARs) that affect selection of removal action.

Task 2 Community Involvement (CR)

2.1 Conduct community interviews. **(NOT REQUIRED)**
2.2 Prepare Community Involvement Plan (CIP). **(NOT REQUIRED)**
2.3 Provide public meeting and/or open house support.
2.4 Prepare fact sheets, notices and other informational documents.
2.5 Provide support for proposed plan. **(NOT REQUIRED)**
2.6 Provide public hearing support. **(NOT REQUIRED)**
2.7 Publish public notices in local newspapers serving the site community.
2.8 Maintain public information repositories.
2.9 Develop and update site mailing list. **(NOT REQUIRED)**
2.10 Provide administrative and technical support for Responsiveness Summary. **(NOT REQUIRED)**
2.11 Prepare presentation materials.
2.12 Implementation of other Community Involvement activities as identified by the site-specific Community Involvement Plan or EPA.
2.13 Provide technical support to review Community Involvement deliverables and participate in public meetings.

Task 3 Field Investigation/Data Acquisition (FI)

3.1 Mobilization/demobilization.
3.2 Hydrogeological assessment. **(NOT REQUIRED)**
3.3 Soil boring, drilling, and testing.
3.4 Environmental sampling.
3.5 Reuse assessment. **(NOT REQUIRED)**

3.6 Geotechnical survey. **(NOT REQUIRED)**
3.7 Field-generated waste characterization and disposal in accordance with local, state and federal regulations.
3.8 Site reconnaissance.
3.9 Ecological characterization. **(NOT REQUIRED)**

Task 4 Sample Analysis (SN)

4.1 Sample analyses and production of analytical data. [NOTE: For cost estimating purposes there should be no direct labor costs under this task - no hours should be reflected under this task, only dollars.]

Task 5 Analytical Support and Data Validation (AN)

5.1 Collect, prepare, and ship environmental samples in accordance with the Field Sampling Plan (FSP).
- 5.1.1 Field screening. **(NOT REQUIRED)**
- 5.1.2 Ground water sampling. **(NOT REQUIRED)**
- 5.1.3 Surface and subsurface soil sampling.
- 5.1.4 Surface water and sediment sampling.
- 5.1.5 Air monitoring and sampling. **(NOT REQUIRED)**
- 5.1.6 Biota sampling. **(NOT REQUIRED)**
- 5.1.7 Other types of media sampling and screening. **(NOT REQUIRED)**

5.2 Develop performance or acceptance criteria (such as data quality objectives (DQO)) for each sampling event; these criteria shall be the determinative factor for assessing the success or failure of the sampling.
5.3 Request, obtain, and perform oversight of analytical services in compliance with EPA requirements.
5.4 Coordinate with the EPA Sample Management Office (SMO), the Regional Sample Control Coordinator (RSCC), and/or the Environmental Services Division (ESD) regarding analytical support, data validation, and quality assurance issues.
5.5 Implement the EPA-approved laboratory quality assurance program that provides oversight of in-house and subcontracted laboratories through periodic performance evaluation sample analyses and/or on-site audits of operations and has a system of corrective actions.
5.6 Provide sample management including chain of custody procedures, information management, sample retention, and 10-year data storage.
5.7 Perform data validation, the process by which the quality of the data, the defensibility of the data, and the chain of custody are verified. Perform data validation in accordance with Regional guidelines.
5.8 Review data for usability for its intended purpose.
5.9 Provide reports on data validation and usability.

Task 6 Data Evaluation (DE)

6.1 Combine analytical and field data, providing data in a format that is compatible with Regional or national electronic data management network.
- 6.1.1 Data usability evaluation and field quality assurance/quality control (QA/QC).
- 6.1.2 Data reduction and tabulation.
- 6.1.3 Data trend evaluation and/or modeling and submission of Technical Memorandum. **(NOT REQUIRED)**

6.2 Data reduction, tabulation, and evaluation.
6.4 Environmental fate and transport modeling/evaluation. **(NOT REQUIRED)**

Task 7 Risk Assessment (RA)

7.1 Conduct a baseline human health risk assessment. **(NOT REQUIRED)**
7.2 Conduct an ecological risk evaluation baseline ecological risk assessment.
7.3 Prepare draft risk evaluation assessment reports. **(include with draft EE/CA Report)**
7.4 Prepare final risk evaluation assessment reports. **(include with final EE/CA Report)**

Task 8 Identification and Screening of Removal Alternatives (IS)

8.1 Identify and screen appropriate removal alternatives.

Task 9 Analysis of Removal Alternatives (AL)

9.1 Assess individual removal alternatives.
9.2 Perform a comparative analysis of options.

9.3 Recommend treatability studies.
9.4 Conduct treatability studies at direction of EPA.

Task 10 Engineering Evaluation/Cost Analysis (EE/CA) Report (EE)

10.1 Prepare draft EE/CA Report(s).
10.2 Prepare final EE/CA Report.

Task 11 Post EE/CA Support (PE)

11.1 Attend public meetings, briefings, public hearings, technical meetings with PRPs.
11.2 Provide technical assistance in the preparation of the Responsiveness Summary.
11.3 Provide technical assistance in the preparation of the Action Memorandum.

Task 12 Administrative Record (NOT REQUIRED) (AR)

12.1 Attend meeting with EPA TOM, Site Attorney, and Administrative Record Coordinator.
12.2 Provide assistance in compiling documents comprising of the Administrative Record File in accordance with EPA Regional guidance or other procedures as specified.
12.3 Prepare Draft Administrative Record Index in accordance with EPA regional guidance or other procedures as specified.
12.4 Prepare Administrative Record Index.
12.5 Coordinate duplication of Administrative Record.
12.6 Assemble Administrative Record and Index.

Task 13 Task order Closeout (CO)

13.1 Package and return documents to the government.
13.2 Duplicate, distribute, and store files.
13.3 Archive files in accordance with Federal Record Center requirements.
13.4 Produce microfiche/microfilm/optical disk or other EPA-approved storage format.
13.5 Prepare the Task order Closeout Report (TOCR).

Attachment 3 - Regulations and Guidance Documents

The following list, although not comprehensive, consists of many of the regulations and guidance documents that apply to the NTCRS process:

1. American National Standards Practices for Respiratory Protection. American National Standards Institute Z88.2-1980, March 11, 1981.
2. ARCS Construction Contract Modification Procedures September 89, OERR Directive 9355.5-01/FS.
3. CERCLA Compliance with Other Laws Manual, Two Volumes, U.S. EPA, Office of Emergency and Remedial Response, August 1988 (DRAFT), OSWER Directive No. 9234.1-01 and -02.
4. Community Relations in Superfund C A Handbook, U.S. EPA, Office of Emergency and Remedial Response, January 1992, OSWER Directive No. 9230.0-3C.
5. A Compendium of Superfund Field Operations Methods, Two Volumes, U.S. EPA, Office of Emergency and Remedial Response, EPA/540/P-87/001a, August 1987, OSWER Directive No. 9355.0-14.
6. Construction Quality Assurance for Hazardous Waste Land Disposal Facilities, U.S. EPA, Office of Solid Waste and Emergency Response, October 1986, OSWER Directive No. 9472.003.
7. Contractor Requirements for the Control and Security of RCRA Confidential Business Information, March 1984.
8. Data Quality Objectives for Remedial Response Activities, U.S. EPA, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, EPA/540/G-87/003, March 1987, OSWER Directive No. 9335.0-7B.
9. Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, U.S. EPA Region IV, Environmental Services Division, April 1, 1986 (revised periodically).
10. EPA NEIC Policies and Procedures Manual, EPA-330/9-78-001-R, May 1978, revised November 1984.
11. Federal Acquisition Regulation, Washington, DC: U.S. Government Printing Office (revised periodically).
12. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final, U.S. EPA, Office of Emergency and Remedial Response, October 1988, OSWER Directive NO. 9355.3-01.
13. Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potential Responsible Parties, U.S. EPA Office of Emergency and Remedial Response, EPA/540/G-90/001, April 1990.
14. Guidance on Expediting Remedial Design and Remedial Actions, EPA/540/G-90/006, August 1990.
15. Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, U.S. EPA Office of Emergency and Remedial Response (DRAFT), OSWER Directive No. 9283.1-2.
16. Guide for Conducting Treatability Studies Under CERCLA, U.S. EPA, Office of Emergency and Remedial Response, Prepublication version.
17. Guide to Management of Investigation-Derived Wastes, U.S. EPA, Office of Solid Waste and Emergency Response, Publication 9345.3-03FS, January 1992.
18. Guidelines and Specifications for Preparing Quality Assurance Project Plans, U.S. EPA, Office of Research and Development, Cincinnati, OH, QAMS-004/80, December 29, 1980.
19. Health and Safety Requirements of Employees Employed in Field Activities, U.S. EPA, Office of Emergency and Remedial Response, July 12, 1982, EPA Order No. 1440.2.
20. Interim Guidance on Compliance with Applicable of Relevant and Appropriate Requirements, U.S. EPA, Office of Emergency and Remedial Response, July 9, 1987, OSWER Directive No. 9234.0-05.
21. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, U.S. EPA, Office of Emergency and Remedial Response, QAMS-005/80, December 1980.
22. Methods for Evaluating the Attainment of Cleanup Standards: Vol. 1, Soils and Solid Media, February 1989, EPA 23/02-89-042; vol. 2, Ground water (Jul 1992).
23. National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule, Federal Register 40 CFR Part 300, March 8, 1990.
24. NIOSH Manual of Analytical Methods, 2nd edition. Volumes I-VII for the 3rd edition, Volumes I and II, National Institute of Occupational Safety and Health.
25. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, National Institute of Occupational Safety and Health/Occupational Health and Safety Administration/United States Coast Guard/Environmental Protection Agency, October 1985.
26. Permits and Permit Equivalency Processes for CERCLA On-Site Response Actions, February 19, 1992, OSWER Directive 9355.7-03.
27. Procedure for Planning and Implementing Off-Site Response Actions, Federal Register, Volume 50, Number 214, November 1985, pages 45933-45937.

28. Procedures for Completion and Deletion of NPL Sites, U.S. EPA, Office of Emergency and Remedial Response, April 1989, OSWER Directive No. 9320.2-3A.
29. Quality in the Constructed Project: A Guideline for Owners, Designers and Constructors, Volume 1, Preliminary Edition for Trial Use and Comment, American Society of Civil Engineers, May 1988.
30. Remedial Design and Remedial Action Handbook, U.S. EPA, Office of Emergency and Remedial Response, June 1995, OSWER Directive No. 9355.5-22.
31. Revision of Policy Regarding Superfund Project Assignments, OSWER Directive No. 9242.3-08, December 10, 1991. [Guidance, p. 2-2]
32. Scoping the Remedial Design (Fact Sheet), February 1995, OSWER Publ. 9355-5-21 FS.
33. Standard Operating Safety Guides, U.S. EPA, Office of Emergency and Remedial Response, November 1984.
34. Standards for the Construction Industry, Code of Federal Regulations, Title 29, Part 1926, Occupational Health and Safety Administration.
35. Standards for General Industry, Code of Federal Regulations, Title 29, Part 1910, Occupational Health and Safety Administration.
36. Structure and Components of 5-Year Reviews, OSWER Directive No. 9355.7-02, May 23, 1991. [Guidance, p. 3-5]
37. Superfund Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties, April 1990, EPA/540/G-90/001.
38. Superfund Remedial Design and Remedial Action Guidance, U.S. EPA, Office of Emergency and Remedial Response, June 1986, OSWER Directive No. 9355.0-4A.
39. Superfund Response Action Contracts (Fact Sheet), May 1993, OSWER Publ. 9242.2-08FS.
40. TLVs-Threshold Limit Values and Biological Exposure Indices for 1987-88, American Conference of Governmental Industrial Hygienists.
41. Treatability Studies Under CERCLA, Final. U.S. EPA, Office of Solid Waste and Emergency Response, EPA/540/R-92/071a, October 1992.
42. USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, U.S. EPA, Office of Emergency and Remedial Response, July 1988.
43. USEPA Contract Laboratory Program Statement of Work for Organic Analysis, U.S. EPA, Office of Emergency and Remedial Response, February 1988.
44. User=s Guide to the EPA Contract Laboratory Program, U.S. EPA, Sample Management Office, August 1982.
45. Value Engineering (Fact Sheet), U.S. EPA, Office of Solid Waste and Emergency Response, Publication 9355.5-03FS, May 1990.
46. Guide to Documenting Cost and Performance for Remediation Projects, Publication EPA-542-B-95-002, March 1995.
47. Presumptive Remedies: Policy and Procedures, U.S. EPA, Office of Solid Waste and Emergency Response, Directive 9355.0-47FS, EPA 540-F-93-047, PB 93-963345, September, 1993.
48. Presumptive Remedies for Soils, Sediments, and Sludges at Wood Treater Sites, U.S. EPA, Office of Solid Waste and Emergency Response, Directive 9200.5-162, EPA/540/R-95/128, PB 95-963410, November, 1995.
49. Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites, U.S. EPA, Office of Solid Waste and Emergency Response, Directive 9283.1-12, EPA 5401R/023, June, 1996.

See the following guidance documents for more information on performance-based contracting:

50 A Guide to Best Practices for Performance-Based Service Contracting, Office of Federal Procurement Policy, April 1996.
51. A Guide to Best Practices for Performance-Based Service Contracting, Final Edition, Office of Federal Procurement Policy, October 1998.
52. Performance-Based Contracting (Fact Sheet), U.S. EPA, Office of Emergency and Remedial Response, Draft February 1999.
53. Policy Letter 91-2, To The Heads of Executive Agencies and Departments, April 9, 1991.

Attachment 4 - Transmittal Of Documents For Acceptance By EPA

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA		DATE:	TRANSMITTAL NO.
TO:	FROM:		G New Transmittal G Re-submittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE	NO. OF COPIES	REMARKS
ACCEPTANCE ACTION			
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)	NAME/TITLE/SIGNATURE OF REVIEWER DATE		

Attachment 5 - Transmittal Register

TRANSMITTAL REGISTER								
PROJECT TITLE AND LOCATION				CONTRACT NO.			WORK ASSIGNMENT NO.	
Subtask No.	DELIVERABLE	No. of Copies	Due Date	Transmittal No.	Date Received	Date Comments Sent to Contractor	EPA Acceptance Date	REMARKS

Gulfco Marine Maintenance Superfund Site
Non-Time Critical Removal Support
EPA Region 6 Remedial Action Contract 2
Contract: EP-W-06-004
Task Order 0067-NSEE-06JZ

PROJECT INDEX

File Initials	Document Type	Author	Addressee	Date	Title
TO	TO	M. Pheeny	F. Meyer	06-Oct-10	RAC II Statement of Work for Gulfco Marine Non-Time Critical Removal Support
WP	LET	F. Meyer	M. Pheeny	27-Oct-10	Transmittal Letter - Work Plan and Cost Estimate
WP	COS	F. Meyer	M. Pheeny	27-Oct-10	Work Plan and Cost Estimate
WP	LET	F. Meyer	M. Pheeny	29-Oct-10	Transmittal Letter - Work Plan and Cost Estimate, Revision No. 1
WP	COS	F. Meyer	M. Pheeny	29-Oct-10	Work Plan and Cost Estimate, Revision No. 1
TO	TO	M. Pheeny	T. Startz	19-Nov-10	Task Order 0067-NSEE-06JZ Gulfco Marine Maintenance EE/CA
LET	LET	T. Startz	M. Pheeny	22-Nov-10	Project Manager Change Letter
DEL	LET	A. Sloane	G. Miller	24-Nov-10	Transmittal Letter - Health and Safety Plan Revision No. 00
DEL	DEL	A. Sloane	G. Miller	24-Nov-10	Health and Safety Plan Revision No. 00
DEL	LET	A. Sloane	G. Miller	29-Nov-10	Transmittal Letter - Sampling and Analysis Plan Revision No. 00
DEL	DEL	A. Sloane	G. Miller	29-Nov-10	Sampling and Analysis Plan Revision No. 00
FCF	FCF	A. Sloane	M. Pheeny	15-Dec-10	Field Change Form No. 1
TO	TO	M. Pheeny	T. Startz	20-Dec-10	Task Order 0067-NSEE-06JZ Gulfco Marine Maintenance EE/CA, Modification 1
DEL	MSR	T. Startz	M. Pheeny	21-Dec-10	Monthly Status Report, Voucher No. 59, November 2010
DEL	LET	A. Sloane	G. Miller	21-Dec-10	Transmittal Letter - Technical Memorandum Ecological and Habitat Health Assessment Wetlands A, B, and C, Revision No. 00 and Technical Memorandum Surface Impoundment Cap Evaluation for Erosion, Revision No. 00
DEL	RPT	A. Sloane	G. Miller	21-Dec-10	Technical Memorandum Ecological and Habitat Health Assessment Wetlands A, B, and C, Revision No. 00 and Technical Memorandum Surface Impoundment Cap Evaluation for Erosion, Revision No. 00
DEL	LET	A. Sloane	G. Miller	27-Dec-10	Transmittal Letter - Data Evaluation Summary Report
DEL	RPT	A. Sloane	G. Miller	27-Dec-10	Data Evaluation Summary Report
DEL	LET	A. Sloane	G. Miller	28-Dec-10	Transmittal Letter - Technical Memorandum Surface Impoundment Cap Evaluation for Erosion, Revision No. 01
DEL	RPT	A. Sloane	G. Miller	28-Dec-10	Technical Memorandum Surface Impoundment Cap Evaluation for Erosion, Revision No. 01
DEL	LET	A. Sloane	G. Miller	30-Dec-10	Transmittal Letter - Engineering Evaluation/Cost Analysis, Revision No. 00
DEL	RPT	A. Sloane	G. Miller	30-Dec-10	Engineering Evaluation/Cost Analysis, Revision No. 00
DEL	MSR	T. Startz	M. Pheeny	19-Jan-11	Monthly Status Report, Voucher No. 60, December 2010
DEL	LET	A. Sloane	G. Miller	21-Jan-11	Transmittal Letter - Engineering Evaluation/Cost Analysis, Revision No. 01
DEL	RPT	A. Sloane	G. Miller	21-Jan-11	Engineering Evaluation/Cost Analysis, Revision No. 01
DEL	LET	A. Sloane	G. Miller	11-Feb-11	Transmittal Letter - Engineering Evaluation/Cost Analysis, Revision No. 02
DEL	RPT	A. Sloane	G. Miller	11-Feb-11	Engineering Evaluation/Cost Analysis, Revision No. 02
DEL	LET	A. Sloane	G. Miller	11-Feb-11	Transmittal Letter - Data Evaluation Summary Report, Revision No. 01
DEL	RPT	A. Sloane	G. Miller	11-Feb-11	Data Evaluation Summary Report, Revision No. 01
DEL	MSR	T. Startz	M. Pheeny	18-Feb-11	Monthly Status Report, Voucher No. 61, January 2011
ROC	LET	F. Meyer	M. Pheeny	23-Feb-11	75% Notification Letter
ROC	LET	G. Miller	A. Sloane	02-Mar-11	Notification to Closeout Task Order 0067-NSEE-06JZ
DEL	MSR	T. Startz	M. Pheeny	18-Mar-11	Monthly Status Report, Voucher No. 62, February 2011
DEL	MSR	T. Startz	M. Pheeny	15-Apr-11	Monthly Status Report, Voucher No. 63, March 2011
DEL	MSR	T. Startz	M. Pheeny	20-May-11	Monthly Status Report, Voucher No. 64, April 2011
DEL	LET	A. Sloan	G. Miller	26-May-11	Transmittal Letter - Task Order Closeout Report
DEL	RPT	A. Sloan	G. Miller	26-May-11	Task Order Closeout Report

Notes:

COS - Cost Estimate
DEL - Deliverable
EPA - U.S. Environmental Protection Agency
FCF - Field Change Form
LET - Letter
MSR - Monthly Status Report
RAC - Remedial Action Contract
ROC - Record of Communication
RPT - Report
TO - Task Order
WP - Work Plan

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE

PAGE 1 OF PAGES 3

2. AMENDMENT/MODIFICATION NO. 001

3. EFFECTIVE DATE See Block 16C

4. REQUISITION/PURCHASE REQ. NO.

5. PROJECT NO. *(If applicable)*

6. ISSUED BY CODE R6

REGION 6
US ENVIRONMENTAL PROTECTION AGENCY
1445 ROSS AVENUE
SUITE 1200
DALLAS TX 75202-2733

7. ADMINISTERED BY *(If other than Item 6)* CODE R6

REGION 6
US ENVIRONMENTAL PROTECTION AGENCY
1445 ROSS AVENUE
SUITE 1200
DALLAS TX 75202-2733

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*

EA ENGINEERING SCIENCE AND TECHNOLOGY INC
ATTN NA
11019 MCCORMICK ROAD
HUNT VALLEY MD 21031

CODE 069381812 FACILITY CODE

(x) 9A. AMENDMENT OF SOLICITATION NO.

9B. DATED *(SEE ITEM 11)*

x 10A. MODIFICATION OF CONTRACT/ORDER NO. EP-W-06-004
EP-G116-00067

10B. DATED *(SEE ITEM 13)* 11/19/2010

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*
NA

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
X	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☒ is not, ☐ is required to sign this document and return 0 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

DUNS Number: 069381812
TOPO: Rena McClurg Max Expire Date: 05/31/2011
LIST OF CHANGES:
Reason for Modification : Other Administrative Action
Total Amount for this Modification: $0.00
New Total Amount for this Version: $0.00
New Total Amount for this Award: (b) (4) [redacted]

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*

16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*
Michael J. Pheeny

15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*

15C. DATE SIGNED

16B. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*

16C. DATE SIGNED 12-20-10

NAME OF OFFEROR OR CONTRACTOR
EA ENGINEERING SCIENCE AND TECHNOLOGY INC

ITEM NO. (A)	SUPPLIES/SERVICES (B)	QUANTITY (C)	UNIT (D)	UNIT PRICE (E)	AMOUNT (F)
	Payment: RTP FINANCE CENTER US ENVIRONMENTAL PROTECTION AGENCY RTP-FINANCE CENTER MAIL DROP D143-02 109 TW ALEXANDER DRIVE DURHAM NC 27711 Period of Performance: 11/19/2010 to 05/31/2011				

This purpose of this task order modification is to approve Field Change Form No. 01, dated 15 December 2010 at no cost increase to the approved Work Plan and Cost Estimate, Revision No. 01, dated 29 October 2010 for $(b) (4). The period of performance for this task order is through May 31, 2011.

The purpose of FCF No. 01 is to extend the delivery schedule for the Data Evaluation Summary report from 19 December 2010 to 27 December 2010 at no increase in cost to the approved work plan.

Total Funding $	Approved Work Plan Budget ($s)	Expenditure Limits Not To Be Exceeded ($s)
Previous Total: (b) (4)	(b) (4)	(b) (4)
This Action: $ 0	$ 0	$ 0
New Total: (b) (4)	(b) (4)	(b) (4)

The contractor shall not incur costs exceeding the amount of funding and/or expenditure limits as set forth by this Task Order.

To the best of my knowledge, the work specified in this procurement action does not unnecessarily duplicate any other work previously performed, or being performed, under my authority.

ORDER FOR SUPPLIES OR SERVICES

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

1. DATE OF ORDER: 11/19/2010

2. CONTRACT NO. (If any): EP-W-06-004

3. ORDER NO.: EP-G116-00067

4. REQUISITION/REFERENCE NO.: PR-R6-11-00054

5. ISSUING OFFICE (Address correspondence to):
REGION 6
US ENVIRONMENTAL PROTECTION AGENCY
1445 ROSS AVENUE
SUITE 1200
DALLAS TX 75202-2733

6. SHIP TO:
a. NAME OF CONSIGNEE: REGION 6
b. STREET ADDRESS: US ENVIRONMENTAL PROTECTION AGENCY
1445 ROSS AVENUE
SUITE 1200
c. CITY: DALLAS
d. STATE: TX
e. ZIP CODE: 75202-2733

7. TO: NA
a. NAME OF CONTRACTOR: EA ENGINEERING SCIENCE AND TECHNOLOGY INC
b. COMPANY NAME:
c. STREET ADDRESS: 11019 MCCORMICK ROAD
d. CITY: HUNT VALLEY
e. STATE: MD
f. ZIP CODE: 21031

f. SHIP VIA:

8. TYPE OF ORDER
☐ a. PURCHASE
REFERENCE YOUR:
Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated.
☒ b. DELIVERY
Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.

9. ACCOUNTING AND APPROPRIATION DATA: See Schedule

10. REQUISITIONING OFFICE: RECONSTRUCT ORIGINATING OFFICE

11. BUSINESS CLASSIFICATION (Check appropriate box(es))
☐ a. SMALL ☐ b. OTHER THAN SMALL ☐ c. DISADVANTAGED ☐ g. SERVICE-DISABLED VETERAN-OWNED
☐ d. WOMEN-OWNED ☐ e. HUBZone ☐ f. EMERGING SMALL BUSINESS

12. F.O.B. POINT: Destination

13. PLACE OF
a. INSPECTION: Destination
b. ACCEPTANCE: Destination

14. GOVERNMENT B/L NO.:

15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date): 11/22/2010

16. DISCOUNT TERMS:

17. SCHEDULE (See reverse for Rejections)

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	DUNS Number: 069381812 TOPO: Rena McClurg Max Expire Date: 05/31/2011 Continued ...					

18. SHIPPING POINT:
19. GROSS SHIPPING WEIGHT:
20. INVOICE NO.:

17(h) TOTAL (Cont. pages): (b) (4)

21. MAIL INVOICE TO:
a. NAME: RTP FINANCE CENTER
b. STREET ADDRESS (or P.O. Box): US ENVIRONMENTAL PROTECTION AGENCY
RTP-FINANCE CENTER D143-02
109 TW ALEXANDER DRIVE
c. CITY: RESEARCH TRIANGLE PARK
d. STATE: NC
e. ZIP CODE: 27711

SEE BILLING INSTRUCTIONS ON REVERSE

17(i) GRAND TOTAL: (b) (4)

22. UNITED STATES OF AMERICA BY (Signature):

23. NAME (Typed): Michael J. Pheeny
TITLE: CONTRACTING/ORDERING OFFICER

ORDER FOR SUPPLIES OR SERVICES
SCHEDULE - CONTINUATION

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

DATE OF ORDER	CONTRACT NO.	ORDER NO.
11/19/2010	EP-W-06-004	EP-G116-00067

ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Admin Office: REGION 6 US ENVIRONMENTAL PROTECTION AGENCY 1445 ROSS AVENUE SUITE 1200 DALLAS TX 75202-2733 Accounting Info: 11-T-6A00P-302DD2C-2505-C001-116APLC001-001 BFY: 11 Fund: T Budget Org: 6A00P Program (PRC): 302DD2C Budget (BOC): 2505 Job #: 06JZEE00 Cost: C001 DCN - Line ID: 116APLC001-001 Period of Performance: 11/19/2010 to 05/31/2011 Gulfco Marine Maintenance EE/CA New Task Order Funding contract EP-W-06-004					
0001	Gulfco Marine Maintenance EE/CA New Task Order Funding-Contract No. EP-W-06-004 The obligated amount of award: $(b) (4) [redacted]. The total for this award is shown in box 17(i).				(b) (4) [redacted]	

TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H)) ▷ (b) (4) [redacted]

This is a Fixed Rate Task Order for the Gulfco Marine Non-Time Critical Removal **shall be performed in accordance with the attached Statement of Work dated October 6, 2010 and per the Work Plan and Cost Estimate Revision 1 dated October 29, 2010.**

The period of performance for this task order is through may 31, 2011.

Total Funding $	Approved Work Plan Budget ($s)	Expenditure Limits Not To Be Exceeded ($s)
Previous Total: $ 0	$ 0	$ 0
This Action: (b) (4)	(b) (4)	(b) (4)
New Total: (b) (4)	(b) (4)	(b) (4)

The contractor shall not incur costs exceeding the amount of funding and/or expenditure limits as set forth by this Task Order.

This task order (and its approved work plan) is divided into two phases. Phase I covers work performed during the contract's base period of performance. Phase II covers work to

be performed during the contract's option period. If the contract option period is exercised, Phase II is automatically activated. If the contract option period is not exercised, this task order/work assignment is limited to Phase I only.

To the best of my knowledge, the work specified in this procurement action does not unnecessarily duplicate any other work previously performed, or being performed, under my authority.

SITE SUMMARY
Site Name: Gulfco Marine Maintenance Non-Time Critical Removal, Brazoria Co., TX
Site ID: 06JZ
CERCLIS No. TXD055144539
TOM: Gary Miller

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 27 October 2010	TRANSMITTAL NO. 0001
TO: **Mr. Michael Pheeny** **U.S. Environmental Protection Agency Region 6**		FROM: **Fritz Meyer** **EA Engineering, Science, and Technology, Inc.**		**X** New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
1.1.3	Work Plan/Cost Estimate (Rev. 0) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 29 October 2010	TRANSMITTAL NO. 0002
TO: **Mr. Michael Pheeny** **U.S. Environmental Protection Agency Region 6**		FROM: **Fritz Meyer** **EA Engineering, Science, and Technology, Inc.**		**X** New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
1.1.3	Work Plan/Cost Estimate (Rev. 01) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 24 November 2010	TRANSMITTAL NO. 0003
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
1.2.1	Health and Safety Plan (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 29 November 2010	TRANSMITTAL NO. 0004
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
1.2.2	Sampling and Analysis Plan (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 21 December 2010	TRANSMITTAL NO. 0005
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
3.0	Technical Memorandum Ecological and Habitat Health Assessment Wetlands A, B, and C (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
3.0	Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Rev. 00) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 27 December 2010	TRANSMITTAL NO. 0006
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
6.1	Data Evaluation Summary Report Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 28 December 2010	TRANSMITTAL NO. 0007
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
3.0	Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Rev. 01) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 30 December 2010	TRANSMITTAL NO. 0008
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
10.1	Engineering Evaluation/Cost Analysis, Revision 00 Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		3 Hard Copies 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 21 January 2011	TRANSMITTAL NO. 0009
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
10.1	Engineering Evaluation/Cost Analysis, Revision 01 Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		3 Hard Copies 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 11 February 2011	TRANSMITTAL NO. 00010
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
10.2	Engineering Evaluation/Cost Analysis, Revision 02 Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		3 Hard Copies 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 11 February 2011	TRANSMITTAL NO. 0011
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
6.1	Data Evaluation Summary Report, Revision 01 Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: **26 May 2011**	TRANSMITTAL NO.: **012**
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		
TASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
13	Task Order Closeout Report/Closeout Files Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support Task Order 0067-NSEE-06JZ		One hard copy, one electronic copy via e-mail, one electronic copy of closeout files on compact disc	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

EA Engineering, Science,
and Technology, Inc.

South Central Region
405 S. Highway 121, Suite C-100
Lewisville, TX 75067
Telephone: 972-315-3922
Fax: 972-315-5181
www.eaest.com

27 December 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Data Evaluation Summary Report (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Data Evaluation Summary Report (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 27 December 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

EA Engineering, Science,
and Technology, Inc.

South Central Region
405 S. Highway 121, Suite C-100
Lewisville, TX 75067
Telephone: 972-315-3922
Fax: 972-315-5181
www.eaest.com

11 February 2011

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Data Evaluation Summary Report (Revision 01)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Data Evaluation Summary Report (Revision 01) for the above-referenced Task Order. An electronic copy was submitted via email on 11 February 2011.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 11 February 2011	TRANSMITTAL NO. 0011
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
6.1	Data Evaluation Summary Report, Revision 01 Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

Data Evaluation Summary Report for the Baseline Ecological Risk Assessment Gulfco Marine Maintenance Superfund Site Freeport, Brazoria County, Texas EPA Identification No. TXD055144539

Non-Time Critical Removal Support

Remedial Action Contract 2 Full Service Contract: EP-W-06-004 Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
Building C, Suite 100
Lewisville, Texas 75067
(972) 315-3922

February 2011
Revision: 01
EA Project No. 14342.67

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LIST OF ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
AVS	acid volatile sulfide
BERA	Baseline Ecological Risk Assessment
CAS	Columbia Analytical Services
CLP	Contract Laboratory Program
DESR	Data Evaluation Summary Report
DQO	data quality objective
DW	dry weight
EA	EA Engineering, Science, and Technology, Inc.
EC20	Effects concentration 20 percent
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
Gulfco	Gulfco Marine Maintenance
LC50	Lethal Concentration for 50 percent of test animals
LCS	laboratory control spike
MCAWW	Methods for the Chemical Analysis of Water and Wastes
µg/L	microgram per liter
µmol/gOC	micromole per gram organic carbon
mg/kg	milligram per kilogram
mg/L	milligram per liter
MS/MSD	matrix spike/matrix spike duplicate
NFG	National Functional Guidelines
OC	organic carbon content
PAH	polynuclear aromatic hydrocarbon
PCA	Principal Components Analysis
PCB	polychlorinated biphenyl
PRP	Potentially Responsible Party
PSCR	Preliminary Site Characterization Report
QC	quality control
RL	reporting limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SEM	simultaneously extracted metals
SOW	Statement of Work
SVOC	Semi-volatile organic compounds
TOC	Total Organic Carbon
URS	URS Corporation
VOC	volatile organic compound

1. INTRODUCTION

This Data Evaluation Summary Report (DESR) summarizes the supplemental surface soil, sediment, pore water, and surface water data collected by URS Corporation (URS) in August and September 2010 for the Gulfco Marine Maintenance Superfund (Gulfco) Site, which presented the samples associated with the toxicity testing performed to develop an Engineering Evaluation/Cost Analysis (EE/CA) and perform a Streamlined Ecological Risk Evaluation (SERE) at the Gulfco Site (Figure 1). URS documented the sampling activities associated with these samples and the evaluation of these data in the Final Preliminary Site Characterization Report (PSCR) (URS 2010b). EA Engineering, Science, and Technology, Inc. (EA) prepared this DESR for the U.S. Environmental Protection Agency (EPA) Region 6 as part of Task Order No. 0067-NSEE-06JZ under EPA Contract No. EP-W-06-004, in accordance with the Statement of Work (SOW) issued by EPA (EPA 2010).

The purpose of this Task Order is to develop an EE/CA and perform a SERE at the Gulfco Site. This is in support of a Non-Time Critical Removal Action that eliminates, reduces, or controls risks to human health and the environment. Specifically, the SERE involves the evaluation of surface soil, sediment, sediment pore water, and surface water and the potential for adverse ecological effects to soil- and sediment-dwelling invertebrates. According to the PSCR the August and September 2010 supplemental data collection activities were conducted in accordance with the EPA-approved PRP Baseline Ecological Risk Assessment (BERA) Work Plan and Sampling and Analysis Plan (SAP) (URS 2010a).

The purpose of this document is to summarize analytical data quality and usability in relation to the project-specific data quality objectives (DQOs) presented in the site-specific PRP BERA Work Plan and SAP (URS 2010a). No additional data was collected or usability evaluations performed beyond those presented in the URS reports. A summary of the data collection events and types of data collected for the PRP BERA is provided in Section 2.0. Data validation guidelines, responsibilities, and results are addressed in Section 3.0. Data quality is discussed in Section 4.0. A data evaluation is presented in Section 5.0, and the analytical data summary is presented in Section 6.0. EA performed further analysis or evaluation of the toxicity study and associated data presented in the Preliminary Site Characterization Report (PSCR) (URS, 2010b) and this analysis is included in Section 7.0 of this document. References and supporting tables, and figures are also included. The DESR information will be used to further support the alternative selection in the EE/CA.

2. DATA SUMMARY

This section summarizes the supplemental surface soil, surface water, pore water, sediment, and soil sampling data collected by URS for the PRP BERA.

2.1 NORTH AREA SOIL

In order to evaluate the North Area surface soil, six samples were collected from the Site (NAS01 through NAS06) (Figure 2) and three samples were collected from a

reference/background area (NAS07 through NAS09). The soil analytical results generated from implementation of the PRP BERA sampling as presented in the PSCR are summarized in Table 1.

The surface soil samples were analyzed for metals using Methods for the Chemical Analysis of Water and Wastes (MCAWW) 200.8, for organochlorine pesticides by SW-846 8081A, and for polychlorinated biphenyls (PCBs) by SW-846 8082. The surface soil samples were also analyzed for total organic carbon (TOC) using American Society for Testing and Materials (ASTM) D4129-82M. The laboratory reports for these samples are provided in Appendix A of the URS PSCR (URS 2010b).

2.2 WETLAND SEDIMENT AND SURFACE WATER

In order to evaluate the wetland sediment, seven samples were collected from the Site (EWSED01 through EWSED07) and two samples were collected from a reference/background area (EWSED08 and EWSED09). The locations of these samples are shown in Figure 3. The sediment and sediment pore water analytical results generated from implementation of the PRP BERA sampling as presented in the PSCR are summarized in Table 2 and Table 3, respectively.

The sediment samples and sediment pore water were analyzed for metals using MCAWW 200.8, for organochlorine pesticides by SW-846 8081A, and for semi-volatile organic compounds (SVOCs) by SW-846 8270C. The sediment samples were also analyzed for acid volatile sulfide (AVS) using 821/R-91-100, for simultaneously extracted metals (SEM) using SW-864 6010B, for total organic carbon using ASTM D4129-82M, and for grain size using ASTM D422 Modified. The laboratory reports for these samples are provided in Appendix A of the URS PSCR (URS 2010b).

A ratio of AVS versus SEM is typically performed to determine the potential for bioavailability of metals from sediments. An AVS/SEM ratio above one indicates that metal availability might be reduced due to sulfides and an AVS/SEM ratio less than one indicates that metals are potentially bioavailable because there is not enough sulfide present to bind the metals into sulfide complexes. Further evaluation of the AVS/SEM ratio and its correlation with metals concentrations or toxicity to organisms is provided in Section 7.0. In order to evaluate the wetland surface water, three samples were collected from the Site (EWSW01, EWSW03, and EWSW04). The locations of these samples are shown in Figure 4. The surface water analytical results generated from implementation of the PRP BERA sampling as presented in the PSCR are summarized in Table 4.

The surface water samples were analyzed for metals using MCAWW 200.8, for organochlorine pesticides by SW-846 8081A and for volatile organic compounds (VOCs) by SW-846 8260B. The laboratory reports for these samples are provided in Appendix A of the URS PSCR (URS 2010b).

2.3 INTRACOASTAL WATERWAY SEDIMENT

In order to evaluate the intracoastal waterway sediment, five samples were collected from the Site (EIWSED01 through EIWSED05) and two samples were collected from a reference/background area (EIWSED06 and EIWSED07). The locations of these samples are shown in Figure 5 and Figure 6, respectively. The sediment and sediment pore water analytical results generated from implementation of the PRP BERA sampling as presented in the PSCR are summarized in Table 5 and Table 6, respectively.

The sediment samples and sediment pore water were analyzed for organochlorine pesticides by SW-846 8081A and for SVOCs by SW-846 8270C. The sediment samples were also analyzed for TOC using ASTM D4129-82M. The laboratory reports for these samples are provided in Appendix A of the URS PSCR (URS 2010b).

3. DATA VALIDATION

This section summarizes the data validation for analytical data provided by URS and the supporting laboratory. Surface soil, sediment, sediment pore water, and surface water samples collected in 2010 were analyzed by Columbia Analytical Services (Kelso, Washington) (CAS); which holds Texas laboratory accreditation T104704427-09-1. URS reviewed the data packages from CAS using the guidance in the Contract Laboratory Program (CLP) National Functional Guidelines (NFG) for Inorganic Superfund Data Review (January 2010), the CLP NFG Guidelines for Superfund Organic Methods Data Review (June 2008), and the acceptance criteria in the Final BERA Work Plan and SAP (URS 2010a). The data validation by URS is documented in Appendix A of the URS PSCR (URS 2010b) and summarized below.

URS performed validation of project data on 10 percent of the samples, checking the reported data against the raw data for these samples. Data for selected analytes were recalculated from instrument reports in the CAS data packages. Reported data agreed with raw data from quantitation reports within the expected limits of error. Data were recalculated for several constituents as documented in Appendix A of the URS PSCR (URS 2010b). Calibrations and adjustments were verified and were found to be acceptable for SVOCs and VOCs. Calibration data were recalculated for several constituents as documented in Appendix A of the URS PSCR (URS 2010b).

4. DATA QUALITY

Surface soil, sediment, sediment pore water, and surface water samples collected in 2010 were analyzed by CAS. According to the CAS Final Analytical Reports for samples collected in August and September 2010 (as included in Appendix A of the URS PSCR [URS 2010b]), standard procedures for quality assurance and quality control (QC) were followed in the analysis and reporting. Reporting limits (RLs) were adjusted for sample size and matrix interference.

The data qualifiers listed on the data tables are defined below. Although some qualifiers indicate uncertainty regarding the identification and/or the quantity of the sample analyte, as a whole, the data are useable for the purposes of site characterization, risk assessment, and remedy selection.

J	The analyte was analyzed for, but the associated numerical value may not be consistent with the amount actually present; the value is an estimated quantity.
JH	Matrix spike (MS) recovery greater than acceptance criteria; bias high.
JL	Surrogate recovery less than control limits; bias low.
U	The chemical was analyzed, but was not detected at the quantitation limit.
<	Less than the reporting limit.

5. DATA EVALUATION

Analytical results associated with the 2010 sampling activities were evaluated by URS to determine if the data were of adequate quality and quantity to accurately address the ecological risk assessment questions described in the Final BERA Work Plan and SAP (URS 2010a). The URS data evaluation is presented in the URS PSCR (URS 2010b) and is summarized below.

5.1 PRECISION

Precision is the measure of the variability associated with an entire sampling and analysis process. It is the comparison among independent measurements as the result of repeated application of the same process under similar conditions. It is determined by analyzing field duplicate pairs and matrix spike/matrix spike duplicate (MS/MSD) pairs. Precision is expressed as the relative percent difference (RPD) of a pair of values (or results). Acceptance criteria for analytical methodologies are presented in the BERA Work Plan and SAP (URS 2010a). During the data validation process, field duplicate and MS/MSD results were evaluated for compliance with acceptance criteria for precision for each analytical methodology.

Field duplicate pairs were collected, analyzed, and evaluated for each analysis performed on aqueous and sediment samples. The aqueous field duplicates precision was acceptable using the selected criteria of 30 RPD. The sediment field duplicates precision was acceptable using the selected criteria of 50 RPD. The field duplicate precision is summarized in Table 5 of Appendix A of the URS PSCR (URS 2010b).

MS/MSD samples were collected, analyzed, and evaluated. Surrogate recoveries outside the SAP acceptance criterion are listed in Table 4 of Appendix A of the URS PSCR (URS 2010b).

5.2 ACCURACY

Accuracy is the degree to which a measurement agrees with its true value and is expressed as percent recovery; acceptance criteria for each analytical methodology are stated in the BERA Work Plan and SAP (URS 2010a). By comparing MS/MSD, laboratory control spikes (LCSs), and surrogate recoveries to associated QC limits, accuracy is assessed. Through the process of data validation, MS/MSD, LCS, and surrogate recoveries were evaluated for compliance with acceptance criteria for accuracy for each applicable analytical methodology. Evaluations of

percent recovery are documented in Appendix A of the URS PSCR (URS 2010b). Accuracy data were found to be within acceptance criteria.

5.3 REPRESENTATIVENESS

Representativeness is a qualitative parameter and is defined by the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or a process or environmental condition. Sample results were evaluated for representativeness by examining items related to sample collection, including chain-of-custody documentation, sample labeling, collection dates, and condition of the samples upon receipt at the laboratory. Laboratory procedures were also examined, including anomalies reported by the laboratory, either upon receipt of the samples at the laboratory or during analytical processes; adherence to recommended holding times of samples prior to analysis; calibration of laboratory instruments; adherence to analytical methods; and completeness of data package documentation.

Equipment rinsate and laboratory method blank results were evaluated during the data validation process to determine whether equipment decontamination procedures (equipment rinsate blank) or laboratory conditions (method blanks) affected sample results. Analytes detected in field and laboratory blanks are listed in Table 3 Appendix A of the URS PSCR (URS 2010b) and additional details pertaining to the representativeness of the sample results are documented in Appendix A of the URS PSCR (URS 2010b).

5.4 COMPLETENESS

Completeness is defined as the percentage of measurements judged to be valid. The validity of sample results is determined through the data validation process. All rejected (R-flagged) sample results are considered to be incomplete. Data that are qualified as estimated (J-flagged) or estimated non-detect (UJ-flagged) are considered to be valid and usable.

The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. The completeness of surface soil, sediment, surface water, and sediment pore water was 100 percent since no analytical data were rejected. The results are useable as reported.

The number of data points obtained divided by the number of planned data points is also used to evaluate completeness. This completeness was 100 percent for surface soils and sediments and 90 percent for water as one sediment pore water and one background surface water sample were not collected due to dry conditions at the sample locations. Additional details pertaining to the completeness of the sample results are documented in Appendix A of the URS PSCR (URS 2010b).

5.5 COMPARABILITY

Comparability of the data is a qualitative parameter that expresses the confidence with which one data set may be compared to another. Comparability of the data is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standardized reporting formats and data validation procedures.

No method substitutions were observed that reduced the quality of the data for comparison purposes. Per the BERA Work Plan and SAP (URS 2010a), the newly collected data are fully comparable with similar data collected during previous investigations.

5.6 SENSITIVITY

Sensitivity is the measure of the signal from an instrument that represents an actual deflection or response above instrument noise. Analytical sensitivity is measured by the method detection limit or instrument detection limit and reported with the necessary dilution factors, preparation factors, and dry weight factors of an individual sample as the sample quantitation limit.

For this project, aqueous and solid media were sampled and analyzed using CLP methods. According to the report the contract-required detection limits for the analytes were sensitive enough for comparison to regulatory action levels.

6. DATA SUMMARY

No significant data quality issues were identified by URS (URS 2010b) for the August and September 2010 surface soil, sediment, sediment pore water, and surface water. According to the report these data are useable for the PRP BERA.

7. EVALUATION OF TOXICITY DATA

7.1 SUMMARY OF HYPOTHESIS TESTS FOR WETLAND SEDIMENTS, INTRACOASTAL WATERWAY SEDIMENTS, AND NORTH AREA SOILS

The toxicity test results data have been evaluated using alternate logical sequences and statistical test procedures than presented in the toxicity test reports (URS, 2010b). That analysis and findings are summarized here and the output files from the statistical analyses (run on CETIS: Comprehensive Environmental Toxicity Information System) for toxicity are included in Appendix A.

This analysis begins with the conceptual model that Wetland Sediments and Intracoastal Waterway Sediments are distinct exposure areas, with differing water quality and habitats. In this analysis, these areas, as well as the North Area soils, are evaluated independently.

Reference samples for each of these exposure areas may be pooled, to improve reliability in the characterization of reference conditions. Reference samples were pooled, in the following analyses, where it can be shown that the toxicological response to the individual reference sediments is not different.

There are certainly situations in which reference samples may not be pooled; for example, when different reference samples apply to different streams, or there is some important feature of the reference location that applies to only a subset of the site related samples.

This is not the case at this site (once the two distinct exposure areas are kept separate), where each reference location appears to be equally representative of site conditions, except for the lack of site-related contaminant impacts. In this case, reference samples should be pooled if they exhibit similar toxic responses, since the pooled statistics will increase power of subsequent hypothesis tests.

Hypothesis tests were performed in accordance with method guidance (EPA 1991, 1994, and EPA/USACE 2008). Replicate results were tested for normality using the Shapiro-Wilk test and homogeneity of variance using the variance ratio F test. Survival data were transformed using the arcsine-square root transformation prior to testing for normality and homogeneity of variance. If the data distributions passed these tests, parametric two sample t tests (equal variance) were used to compare reference samples (pooled if appropriate) with site samples. If the data did not pass the normality test, the nonparametric Wilcoxon rank sum two sample test was applied. If the data passed the normality test, but failed the homogeneity of variance test, then the parametric two sample t test was used assuming unequal variances. The output files from the statistical analyses (run on CETIS: Comprehensive Environmental Toxicity Information System) for toxicity are included in Appendix A.

7.1.1 Wetland Sediments

Reference sediments for this exposure area are EWSED08 and 09. Testing was performed using *Leptocheirus plumulosus* and *Neanthes arenaceodentata*. Survival and growth responses for these two samples were compared, and they were not significantly different, for either test organism. Therefore the replicates were pooled, i.e., the EWSED REF data set included all replicates from the two samples, evaluated as a single reference condition. Pooling the similar references improves the power of subsequent tests, reducing the probability of a false negative conclusion in which the statistical test does not detect an actual adverse effect. The output files from the statistical analyses (run on CETIS: Comprehensive Environmental Toxicity Information System) for toxicity are included in Appendix A.

7.1.1.1 Response of *Leptocheirus*

Survival was evaluated following the arcsine-square root transformation using the two sample t test. Site samples did not exhibit significantly reduced survival when compared with the pooled reference data set.

Growth was significantly lower in sample EWSED06 when compared with the pooled reference data set. The magnitude of the reduced growth appears to be ecologically significant with growth reduced by 74 percent in EWSED06 when compared to the reference sites.

7.1.1.2 Response of *Neanthes*

In the wetland sediments exposure area, site samples did not exhibit statistically significant reduction in either survival or growth when compared with the pooled reference data set, based on the two sample t test.

7.1.2 Intracoastal Waterway Sediments

Reference sediments for this exposure area are EIWSED06 and 07. Testing was performed using *Leptocheirus plumulosus* and *Neanthes arenaceodentata*. Survival and growth responses for these two samples were compared, and the responses were not significantly different from each other, for either test organism. Therefore the replicates were pooled, i.e., the EIWSED REF data set included all replicates from the two samples, evaluated as a single reference condition. The output files from the statistical analyses (run on CETIS: Comprehensive Environmental Toxicity Information System) for toxicity are included in Appendix A.

7.1.2.1 Response of *Leptocheirus*

In the Intracoastal Waterway sediments exposure area, site samples did not exhibit statistically significant reduction in either survival or growth compared with the pooled reference data set, based on the two sample t test.

7.1.2.2 Response of *Neanthes*

In the Intracoastal Waterways sediments exposure area, site samples did not exhibit statistically significant reduction in either survival or growth when compared with the pooled reference data set. Survival data were not normally distributed so hypothesis tests were conducted using the Wilcoxon Rank Sum 2 sample test. Growth data passed both the normality and homogeneity of variance tests, so the 2 sample t test was used for the *Neanthes* growth data.

7.1.3 North Area Soils

Reference soils for this exposure area are NAS07, 08, and 09. Testing was performed using *Neanthes arenaceodentata.* Survival and growth responses for these three samples were compared. For both the survival and growth endpoints, NAS08 and 09 exhibited similar responses. Both of these reference samples, however, exhibited greater toxicity than NAS07, for both endpoints. Consequently, NAS08 and 09 were pooled prior to comparison to site samples. NAS07 was compared independently with site samples. The output files from the statistical analyses (run on CETIS: Comprehensive Environmental Toxicity Information System) for toxicity are included in Appendix A.

7.1.3.1 Response of *Neanthes*

No site sample exhibited reduced survival when compared with either NAS07, or the pooled references consisting of NAS08 and 09. Hypothesis tests were performed using the 2 sample t test. No site samples exhibited reduced growth when compared with the pooled references consisting of NAS08 and 09. Growth in site sample NAS01 was 57 percent lower than growth in reference NAS07, and this effect was statistically significant. No other site sample exhibited reduced growth when compared with NAS07.

7.1.4 Summary

Growth was significantly lower in sample EWSED06 when compared with the pooled reference data set. The magnitude of the reduced growth appears to be ecologically significant with growth reduced 74 percent in EWSED06 when compared to reference sites. No other wetland sediment samples exhibited toxicity to *Leptocheirus* when compared with reference sites.

Site sample NAS01 exhibited reduced growth of *Neanthes* when compared with reference sample NAS07. No North Area Soils exhibited toxicity when compared to the other reference data set consisting of NAS08 and 09.

No other site soils or sediments exhibited toxicity when compared with appropriate reference samples. Specifically no significant toxicity was observed in the Intracoastal Waterway sediment exposure area. Wetland sediments did not exhibit toxicity to *Neanthes.*

7.2 SURFACE WATERS

Acute toxicity of three surface water samples to brine shrimp were tested. The results for Run 3 for all samples, which exhibited acceptable control survival for 72 hours, were independently checked. By relevant test method guidance (EPA 2002; EPA-821-R-02-012), the Probit Method is the preferred procedure for determining the Lethal Concentration for 50 percent of the test animals (LC50) if the data passes the chi-square test. The Probit Method was appropriate for the data from these tests, and was used. The results were generally consistent with those presented in the toxicity test reports (URS, 2010b):

- Samples EWSW01 and 04 did not exhibit acute toxicity (LC50 > 100 percent)
- Sample EWSW03 had an LC50 at 6 percent dilution.

URS used the trimmed Spearman-Karber procedure and found that EWSW01 and 04 were not toxic, while EWSW03 had an LC50 at 5 percent dilution.

7.3 IDENTIFICATION OF POTENTIAL STRESSORS

For exposure areas and toxicological endpoints that exhibited statistically significant toxicity, chemical and physical characteristics of the sediment were examined to determine if one or more potential stressors were significantly associated with the observed toxicity.

Initial steps in the Dose-Response Evaluation used techniques that are occasionally referred to as "data mining" techniques intended to identify relationships between parameters. Procedures used included development of correlation matrices and Principal Components Analysis (PCA). Upon review of findings of these statistical procedures, the concentrations of a selected number of indicator chemicals that are significantly associated with a 20 percent reduction in measurement endpoints (effects concentration 20 percent, or EC20) were estimated. EC20s were estimated by the smoothed linear interpolation procedure recommended by relevant EPA test methods (see for example, EPA 2000, Section 16.2.5.7).

It is generally true that statistical associations are not conclusive regarding cause and effect. Because many of the chemicals are significantly correlated with other chemicals in the samples, the ability to conclude cause and effect from the statistical analyses is difficult. A subset of chemicals with the strongest statistical association with adverse effects was selected as indicator chemicals for estimation of EC20s. It is possible that these chemicals are not the cause of the adverse effect; adverse effects may actually be caused by one or more other chemicals that are correlated with the indicator chemicals. Nonetheless, the indicator chemicals selected have the

strongest association with the adverse effects, and may be used to identify sediments that are likely to impair the benthic macroinvertebrate community.

Parameters evaluated included concentration of chemicals in bulk sediment, concentrations of organic chemicals normalized by the organic carbon content of the sediments/soils, concentrations of chemicals in pore water, ΣSEM/AVS, (ΣSEM-AVS)/OC, organic carbon content (OC), and grain size (indicated by percent grave, sand, silt, and clay).

The PCA procedure was implemented using SYSTAT 11 (SYSTAT Software, Inc. 2004). Two factors were sought. The first factor is a linear combination of the chemical concentrations that explains the largest portion of the variance in the concentration data. The second factor is orthogonal (not correlated) to the first and explains as much of the remaining variance in the data as possible.

7.3.1 Wetland Sediments

Exploratory correlation and PCA revealed that, although polynuclear aromatic hydrocarbon (PAH) compounds were strongly correlated with each other (co-located) they were not closely associated with the toxic endpoint (*Leptocheirus plumulosus* growth) (Appendix A). To reduce the number of variables considered in the analysis, Total PAHs and Σ(PAHs/OC) were determined, and individual PAH compounds were eliminated from the data set.

Correlation analysis showed that sediment grain size was not significantly associated with *Leptocheirus* growth, while zinc in bulk sediment, (ΣSEM-AVS)/OC, and copper in pore water were significantly negatively associated with *Leptocheirus* growth (Appendix A). Significant association is indicated at the 0.05 level of significance.

In this investigation, PCA was used primarily to examine and illustrate the relationships. Figure 7 illustrates the association of a reduced set of potential stressors with the two PCA Factors. This figure illustrates that PAHs (whether normalized for organic carbon or not) are not correlated with the toxic endpoints (they are orthogonal on Factor 2); while arsenic, copper, nickel, zinc, and (ΣSEM-AVS)/OC are negatively associated with both endpoints.

Pore water was not analyzed in all the samples that were analyzed for bulk sediment chemistry and SEM/AVS. Therefore the correlation analysis was performed separately (Appendix A). Copper was the only pore water analyte that was significantly negatively associated with *Leptocheirus plumulosus* growth at the 0.05 level of significance.

As a result of these analyses, the following analytes appear to be associated with the observed toxicity to *Leptocheirus plumulosus* in wetland sediments:

- Copper (pore water)
- Zinc (bulk sediment)
- (ΣSEM-AVS)/OC

Correlation matrices for *Leptocheirus* growth versus bulk sediment chemistry and pore water chemistry are included in Appendix A.

7.3.2 North Area Soils

A limited number of potential stressors were quantified in the North Area Soils exposure area. These were barium, chromium, copper, and zinc. Chromium, copper, and zinc were significantly correlated with each other (co-located), while barium was not associated with the other metals analyzed. Chromium, copper, and zinc also appeared to be negatively associated with *Neanthes* growth, however the apparent relationships were not significant at the 0.10 level of significance, and are not investigated further here.

7.3.4 Surface Waters

Acute toxicity to *Artemia salina* was indicated in 1 of 3 samples. These samples were analyzed for copper, nickel, silver, and zinc. The data set is too small for quantitative statistical evaluation, however copper, at 8.54 μg/L, and silver are higher in the sample that exhibited acute toxicity to brine shrimp. If toxicity is attributable to copper, it appears that concentrations less than 3.4 μg /L would not cause toxicity to *Artemia salina.*

7.4 DOSE/RESPONSE EVALUATION

Concentrations that are significantly associated with 20 percent reduction in measurement endpoints were estimated using the smoothed linear interpolation method presented in several relevant EPA guidance manuals (see, for example, EPA 2000). The smoothed linear interpolation method synthetically creates a monotonically decreasing dose-response relationship, by averaging concentrations associated with similar measurement endpoint results in a systematic way. To illustrate the method, the following chart shows all dose-response data for *C. dilutus* survival as a function of benzo(a)anthracene concentrations in an example data set (not site-specific) and the smoothed function used to estimate EC20 by linear interpolation.

EC20s were estimated for *Leptocheirus plumulosus* growth for copper and zinc in bulk sediment and pore water, and (ΣSEM – AVS)/OC. The calculated EC20s are shown in Table 7. In addition, Table 7 summarizes whether the wetland sediment samples (i.e., 1 implies EWSED-01, and so on) exceed the EC20s and whether they exhibited toxicity to the growth endpoint.

Generally Table 7 demonstrates a correspondence between the observed toxicity and exceedances of the EC20s. Site 6, which exhibited toxicity exceeded the EC20s. Sites 1 and 2, which did not exhibit toxicity, do not exceed any of the EC20s.

Dose-response relationships are illustrated in Figures 9 and, 10. Figure 9 illustrates the relationship between zinc in sediment and *Leptocheirus plumulosus* growth. Figure 10 illustrates the relationship between (ΣSEM – AVS)/OC and *Leptocheirus plumulosus* growth. In each case a clear dose-response relationship is apparent. In most cases at least one site-related location exhibited less toxicity than the pooled reference locations. The 20 percent reduction growth, however, is calculated as the reduction from the pooled reference data.

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Tables

TABLE 1

DATA SUMMARY FOR NORTH AREA SOILS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Location	Comments	4,4'-DDT	Aroclor-1254	Barium	Chromium	Copper	Zinc
NAS01	North Area Soil				272	97.3	221	5770
NAS02	North Area Soil		0.0075 J	0.093 J	163	27.2	26	296 JH
NAS02DUP	North Area Soil		0.015 J	0.16 J	261	23.1	24.9	307 J
NAS03	North Area Soil		0.0078	--	190	15.4	22.9	307 J
NAS04	North Area Soil		--	0.01	502	7.86	10.8	321 J
NAS05	North Area Soil		0.008	--	198	30.9	27.4	309 J
NAS06	North Area Soil		--	--	52.2	13.4	10.8	62.3 J
NAS07	North Area Soil	Background location BSS-01	--	--	340	12.4	10.1	501
NAS08	North Area Soil	Background location BSS-02	--	--	182	13.6	12.6	182
NAS09	North Area Soil	Background location BSS-03	--	--	172	13.3	11	63.1

Notes:
Values in mg/kg, dry weight
J = Estimated Concentration
H = Concentratin Biased High
mg/kg = milligrams per kilograms
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Location	Date	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene
EWSED01	Wetland	8/12/2010	0.0038 J	0.0046 J	0.057	0.043
EWSED02	Wetland	8/12/2010	0.002 J	0.0018 J	0.041	0.032
EWSED02DUP	Wetland	8/12/2010	0.0026 J	0.0013 J	0.03	0.024
EWSED03	Wetland	8/13/2010	0.0068	0.0043 J	0.0032 J	0.005
EWSED04	Wetland	8/13/2010	0.0037 J	0.0026 J	0.0069	0.006
EWSED05	Wetland	8/12/2010	0.02	0.075	0.018	0.078
EWSED06	Wetland	8/12/2010	0.0016 J	0.0013 J	0.0008 J	0.0011 J
EWSED07	Wetland	8/13/2010	0.0053	0.009	0.0091	0.027
EWSED08	Wetland	8/13/2010	0.001 J	< 0.00088	< 0.00069	0.001 J
EWSED09	Wetland	8/13/2010	0.00061 J	< 0.00076	< 0.00059	< 0.00058

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Arsenic	AVS/SEM	Benzo(a)pyrene	Benzo(g,h,i)perylene	Copper	Indeno(1,2,3-cd)pyrene
EWSED01	2.97	0.089	0.24	0.63	20.6	0.22
EWSED02	2.4	0.014	0.12	0.46	13.3	0.18
EWSED02DUP	2.51	--	0.097	0.35	14.6	0.16
EWSED03	5.36	0.002	0.028	0.058	25	0.034
EWSED04	4.35	0.039	0.04	0.076	20.3	0.064
EWSED05	3.06	0.002	0.79	0.68	28.9	0.79
EWSED06	3.23	0.084	0.01	0.019	28.1	0.019
EWSED07	5.94	0.005	0.087	0.1	30.7	0.1
EWSED08	2.92	6.4	0.014	0.017	15.8	0.019
EWSED09	2.58	0.062	0.0027 J	0.0032 J	11.7	0.0032 J

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Lead	Nickel	4,4'-DDT	Endrin Aldehyde	Benzo(a)anthracene	Endrin ketone
EWSED01	17.2	18.9	< 0.001 J	0.0007 J	< 0.066 J	< 0.000093
EWSED02	12	15.6	< 0.00017	< 0.00012	< 0.043 J	< 0.000093
EWSED02DUP	14.7	17.3	< 0.00017	< 0.001 J	< 0.00072 J	< 0.0011 J
EWSED03	48.4	21.7	0.0028	0.00027 J	0.024	< 0.00011 J
EWSED04	37.4	16.9	--	--	0.031	--
EWSED05	76.1	14.4	< 0.019 J	0.0014 J	0.55	< 0.001 J
EWSED06	32.9	22.5	0.0012	< 0.00012	0.0069	< 0.000093
EWSED07	32.7	20.1	--	--	0.09	--
EWSED08	19.8	16.3	0.0014	0.00052 J	0.011	< 0.00012
EWSED09	17.4	16.5	0.0016	< 0.00012	0.0024 J	< 0.000093

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Chrysene	gamma-chlordane	Dibenz(a,h)anthracene	Flourene	Flouranthene
EWSED01	0.39	< 0.00009	0.17	0.019	0.038
EWSED02	0.62	< 0.00009	0.11	0.013	0.023
EWSED02DUP	0.49	< 0.00009	0.094	0.011	0.019
EWSED03	0.064	< 0.00009	0.0074	0.0048	0.052
EWSED04	0.05	--	0.01	0.0032 J	0.076
EWSED05	0.77	< 0.00009	0.14	0.065	1.3
EWSED06	0.014	0.00025 J	0.0026 J	0.001 J	0.02
EWSED07	0.14	--	0.019	0.016	0.26
EWSED08	0.017	< 0.00012 J	0.003 J	0.00092 J	0.031
EWSED09	0.004	< 0.00023 J	< 0.0008	< 0.00061	0.0055

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Phenanthrene	Pyrene	Total Organic Carbon	Zinc	GRAVEL, MEDIUM,%	GRAVEL, FINE,%
EWSED01	0.032	0.091	59400	115	2.52	3.49
EWSED02	0.016	0.14	24100	70.1	53.7	5.66
EWSED02DUP	0.014	0.11	30500	86.1	--	--
EWSED03	0.049	0.069	18200	585	47.9	7.73
EWSED04	0.041	0.075	16700	417	0.57	2.19
EWSED05	0.78	1.1	18100	595	0.34	2.64
EWSED06	0.013	0.021	21500	959	18.7	0.87
EWSED07	0.15	0.19	23900	318	--	--
EWSED08	0.015	0.027	46800	94.3	12.7	12.1
EWSED09	0.0024 J	0.0044 J	11200	88.3	1.97	2.31

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	SAND, VERY COARSE,%	SAND, COURSE,%	SAND, MEDIUM,%	SAND, FINE,%	SAND, VERY FINE,%	SILT,%	CLAY,%	Acid-volatile sulfide, µmol/gsed
EWSED01	5.58	2.82	1.8	2.12	2.42	61.6	21.2	0.018 J
EWSED02	2.91	1.77	1.15	2.29	1.64	13.7	10.8	< 0.005
EWSED02DUP	--	--	--	--	--	--	--	--
EWSED03	4.83	3.01	1.75	1.93	0.93	29.2	1.7	< 0.004
EWSED04	2.88	3.18	2.98	7.02	4.59	81.4	0.6	0.05
EWSED05	2.83	4.49	4.93	8.91	6.96	38.7	27.5	< 0.004
EWSED06	0.67	0.41	0.27	2.06	1.24	21.6	61.7	0.33
EWSED07	--	--	--	--	--	--	--	--
EWSED08	8.04	3.92	1.93	2.62	2.51	44.3	14.6	2.04
EWSED09	1.35	0.54	0.4	1.87	5.24	40.4	48.5	0.004

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Cadmium, SEM, µmol/gsed	Copper, SEM, µmol/gsed	Lead, SEM, µmol/gsed	Nickel, SEM, µmol/gsed	Zinc, SEM, µmol/gsed	∑SEM, µmol/gsed	∑SEM/AVS
EWSED01	< 0.0006	0.024	0.015	0.015	0.148	0.2	11.3
EWSED02	0.0007	0.03	0.029	0.03	0.259	0.3	69.7
EWSED02DUP	--	--	--	--	--	--	--
EWSED03	0.0011	0.057	0.038	0.012	1.55	1.7	415
EWSED04	0.0012	0.16	0.088	0.016	1.02	1.3	25.7
EWSED05	< 0.0005	0.082	0.055	0.011	1.74	1.9	472
EWSED06	0.0019	0.092	0.04	0.019	3.79	3.9	11.9
EWSED07	--	--	--	--	--	0.7	184
EWSED08	< 0.0008	0.016	0.021	0.028	0.255	0.3	0.157
EWSED09	< 0.0005	0.011	0.009	0.005	0.039	0.1	16.1

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 2

DATA SUMMARY FOR WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	foc,goc/gsed	∑SEM-AVS, µmol/gsed	(∑SEM-AVS)/foc, µmol/goc
EWSED01	0.0594	0.185	3.1
EWSED02	0.0273	0.344	12.6
EWSED02DUP	--	--	--
EWSED03	0.0182	1.654	90.9
EWSED04	0.0167	1.235	74
EWSED05	0.0181	1.885	104.1
EWSED06	0.0215	3.613	168
EWSED07	0.0239	0.731	30.6
EWSED08	0.0468	--	--
EWSED09	0.0112	0.061	5.4

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

TABLE 3

DATA SUMMARY TABLE FOR WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	2-Methylnaphthalene	4,4'-DDT	Acenaphthene	Acenaphthylene
EWSED01	0.000018 U	< 0.000012 J	< 0.0000052	0.000024
EWSED02	0.000026 U	< 0.0000047 J	< 0.0000044	< 0.0000034
EWSED03	0.000022 U	< 0.000016 J	< 0.0000047	< 0.0000036
EWSED04	0.000046	--	< 0.0000085 J	0.000014 J
EWSED04DUP	--	--	--	--
EWSED06	0.000019 U	< 0.00000058	0.0000091 J	< 0.0000035
EWSED07	0.000013 U	--	< 0.000012	0.000032 J
EWSED08	0.0000083 U	0.000003 J	< 0.000005	< 0.0000039
EWSED09	0.000018 U	< 0.0000014 J	< 0.0000044	< 0.0000034

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below
indicated detection limit.
J = Estimated Concentration
-- Not Analyzed

TABLE 3

DATA SUMMARY TABLE FOR WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Anthracene	Arsenic	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene
EWSED01	0.000067	0.0037 J	< 0.0000031	< 0.0000051	0.000012 J
EWSED02	< 0.0000036	0.0041 J	< 0.0000026	< 0.0000043	0.000012 J
EWSED03	0.000013 J	0.0019 J	< 0.0000028	< 0.0000046	< 0.0000031
EWSED04	0.000047	0.00072 J	< 0.0000026	< 0.0000043	< 0.0000029
EWSED04DUP	--	0.00325	--	--	--
EWSED06	< 0.0000037	0.00177 J	0.0000095 U	0.0000097 U	0.000023 U
EWSED07	0.000066	0.00063 J	< 0.0000067	< 0.000012	< 0.0000075
EWSED08	< 0.0000041	0.00576 J	< 0.000003	< 0.0000049	< 0.0000033
EWSED09	< 0.0000036	0.00171 J	< 0.0000026	< 0.0000043	< 0.0000029

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below
indicated detection limit.
J = Estimated Concentration
-- Not Analyzed

TABLE 3

DATA SUMMARY TABLE FOR WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Chrysene	Copper	Dibenz(a,h)anthracene	Endrin Aldehyde
EWSED01	< 0.000004	0.000922	< 0.000003	0.000013
EWSED02	0.000049	0.000342 U	0.0000034 J	0.0000067 J
EWSED03	< 0.0000036	0.00456	< 0.0000027	0.000015 J
EWSED04	< 0.0000034	0.00426	< 0.0000025	--
EWSED04DUP	--	0.00531 U	--	--
EWSED06	0.0000096 U	0.00702	0.000015 U	< 4.6E-07
EWSED07	< 0.0000088	0.00303	< 0.0000065	--
EWSED08	< 0.0000039	0.00137	< 0.0000029	0.0000026 J
EWSED09	< 0.0000034	0.000761 U	< 0.0000025	< 0.0000033 J

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below
indicated detection limit.
J = Estimated Concentration
-- Not Analyzed

TABLE 3

DATA SUMMARY TABLE FOR WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Endrin ketone	Flourene	Fluoranthene	gamma-Chlordane
EWSED01	< 0.00000078	0.000013 J	< 0.0000052	< 0.00000038
EWSED02	< 0.0000013 J	< 0.0000038	< 0.0000044	< 0.0000013 J
EWSED03	0.000007 J	< 0.000004	< 0.0000047	< 0.000016 J
EWSED04	--	0.0000047 J	< 0.0000044	--
EWSED04DUP	--	--	--	--
EWSED06	< 0.00000066	0.0000091 J	< 0.0000045	< 0.00000032
EWSED07	--	< 0.0000098	< 0.000012	--
EWSED08	< 0.0000007	< 0.0000044	< 0.000005	0.0000033 J
EWSED09	< 0.0000011	< 0.0000038	< 0.0000044	< 0.000016 J

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below
indicated detection limit.
J = Estimated Concentration
-- Not Analyzed

TABLE 3

DATA SUMMARY TABLE FOR WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Indeno(1,2,3-cd)pyrene	Lead	Nickel	Phenanthrene	Pyrene	Zinc
EWSED01	0.0000051 J	0.000115 U	0.00944	0.000012 J	< 0.0000042	0.0101
EWSED02	0.0000062 J	0.000113 U	0.00486	< 0.000005	< 0.0000035	0.00135 U
EWSED03	< 0.0000028	0.000425 U	0.00749 U	0.0000053 U	< 0.0000037	0.0413
EWSED04	< 0.0000026	0.00015 U	0.0114	< 0.000005	< 0.0000035	0.101
EWSED04DUP	--	0.000239 U	--	--	--	0.083
EWSED06	0.000014 U	0.000443 U	0.00915	0.0000068 J	< 0.0000036	0.626
EWSED07	< 0.0000067	0.000184	0.00917	< 0.000013	< 0.000009	0.0599
EWSED08	< 0.000003	0.00128 U	0.0142	< 0.0000057	< 0.000004	0.039
EWSED09	< 0.0000026	0.000236 U	0.00669	< 0.000005	< 0.0000035	0.00124 U

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below
indicated detection limit.
J = Estimated Concentration
-- Not Analyzed

TABLE 4

DATA SUMMARY FOR WETLAND SURFACE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Acrolein	Copper	Nickel	Silver	Zinc
EWSW01	<0.00096	0.00338 J	0.00616	0.00002 J	0.029
EWSW01DUP	<0.00096	0.00331	0.00601	0.000021 J	0.0279
EWSW03	--	0.00854	0.00474	0.000049	0.0242
EWSW04	--	0.00154	0.00396	0.000011 J	0.122

Notes:
Values in mg/L
mg/L = milligrams/liter
< indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed

TABLE 5

DATA SUMMARY FOR INTERCOASTAL WATERWAY SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Location	4,4'-DDT	Acenaphthene	Benzo(a)anthracene	Chrysene	Dibenz(a,h)anthracene
EIWSED01	IW	0.00023 J	0.0071	0.03	0.046	0.0046
EIWSED02	IW	0.0019	0.023	0.24	0.31	0.063
EIWSED03	IW	0.00032 J	0.0052	0.052	0.07	0.015
EIWSED03DUP	IW	0.00089 J	0.0022 J	0.048	0.067	0.014
EIWSED04	IW	--	0.0029 J	0.032	0.054	0.0087 J
EIWSED05	IW	0.00029 J	0.0046 J	0.042	0.059	0.01
EIWSED06	IW	< 0.00017	< 0.0014 JL	< 0.0017 JL	0.0019	< 0.0015 JL
EIWSED07	IW	< 0.00017	< 0.0014 JL	< 0.0017 JL	< 0.0015	< 0.0015 JL

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below
indicated detection limit.
mg/kg = milligrams per kilograms
-- Not Analyzed

TABLE 5

DATA SUMMARY FOR INTERCOASTAL WATERWAY SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Fluoranthene	Fluorene	Hexachlorobenzene	Phenanthrene	Pyrene	Total Organic Carbon
EIWSED01	0.12	0.019	--	0.15	0.081	4130
EIWSED02	0.52	0.02	--	0.24	0.47	7200
EIWSED03	0.12	0.0067	--	0.071	0.1	6320
EIWSED03DUP	0.094	0.0032 J	--	0.043	0.11	6680
EIWSED04	0.074	0.0031 J	< 0.0012	0.028	0.073	5480
EIWSED05	0.1	0.0045 J	--	0.051	0.054	6820
EIWSED06	0.0019 JL	< 0.0011 JL	< 0.0012 JL	< 0.0014 JL	0.0025 JL	6060
EIWSED07	0.0018 JL	< 0.0011 JL	< 0.0012 JL	< 0.0014 JL	0.0018 JL	5090

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below
indicated detection limit.
mg/kg = milligrams per kilograms
-- Not Analyzed

TABLE 6

DATA SUMMARY FOR INTERCOASTAL WATERWAY SEDIMENTS PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	4,4'-DDT		Acenaphthene	Benzo(a)anthracene	Chrysene	Dibenz(a,h)anthracene
EIWSED01	< 0.0000035	J	0.000052	< 0.0000035	< 0.0000046	< 0.0000034
EIWSED02	< 0.00000098	J	0.000037	< 0.0000028	< 0.0000037	< 0.0000027
EIWSED03	< 0.0000013	J	0.000024	< 0.0000026	< 0.0000034	< 0.0000025
EIWSED04	< 0.00000076	J	< 0.0000088	< 0.0000052	< 0.0000068	< 0.000005
EIWSED05	< 0.0000013	J	0.000027	< 0.0000034	< 0.0000044	< 0.0000033
EIWSED05DUP	< 0.0000016	J	0.000031	< 0.0000028	< 0.0000036	< 0.0000027
EIWSED06	< 0.000001	J	< 0.0000088	< 0.0000052	< 0.0000068	< 0.000005
EIWSED07	< 0.00000058		< 0.000026	< 0.000018	< 0.000028	< 0.000017

Notes:
Values in mg/l
mg/l = milligrams/liter
< indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed

TABLE 6

DATA SUMMARY FOR INTERCOASTAL WATERWAY SEDIMENTS PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Fluoranthene	Fluorene	Hexachlorobenzene	Phenanthrene	Pyrene
EIWSED01	< 0.0000059	0.000043	< 0.00000035	0.000031	< 0.0000047
EIWSED02	< 0.0000048	0.000029	< 0.00000031	0.000022 J	< 0.0000038
EIWSED03	< 0.0000044	0.00002 J	< 0.00000039	0.000012 J	< 0.0000035
EIWSED04	< 0.0000088	< 0.0000076	< 0.00000037	< 0.00001	< 0.000007
EIWSED05	< 0.0000057	0.000023 J	< 0.00000037	0.000015 J	< 0.0000045
EIWSED05DUP	< 0.0000047	0.000026	< 0.00000044	0.000015 J	< 0.0000037
EIWSED06	< 0.0000088	< 0.0000076	< 0.00000039	< 0.00001	< 0.000007
EIWSED07	< 0.00002	< 0.000027	< 0.000022	< 0.000022	< 0.000019

Notes:
Values in mg/l
mg/l = milligrams/liter
< indicates samples was below
J = Estimated Concentration
-- Not Analyzed

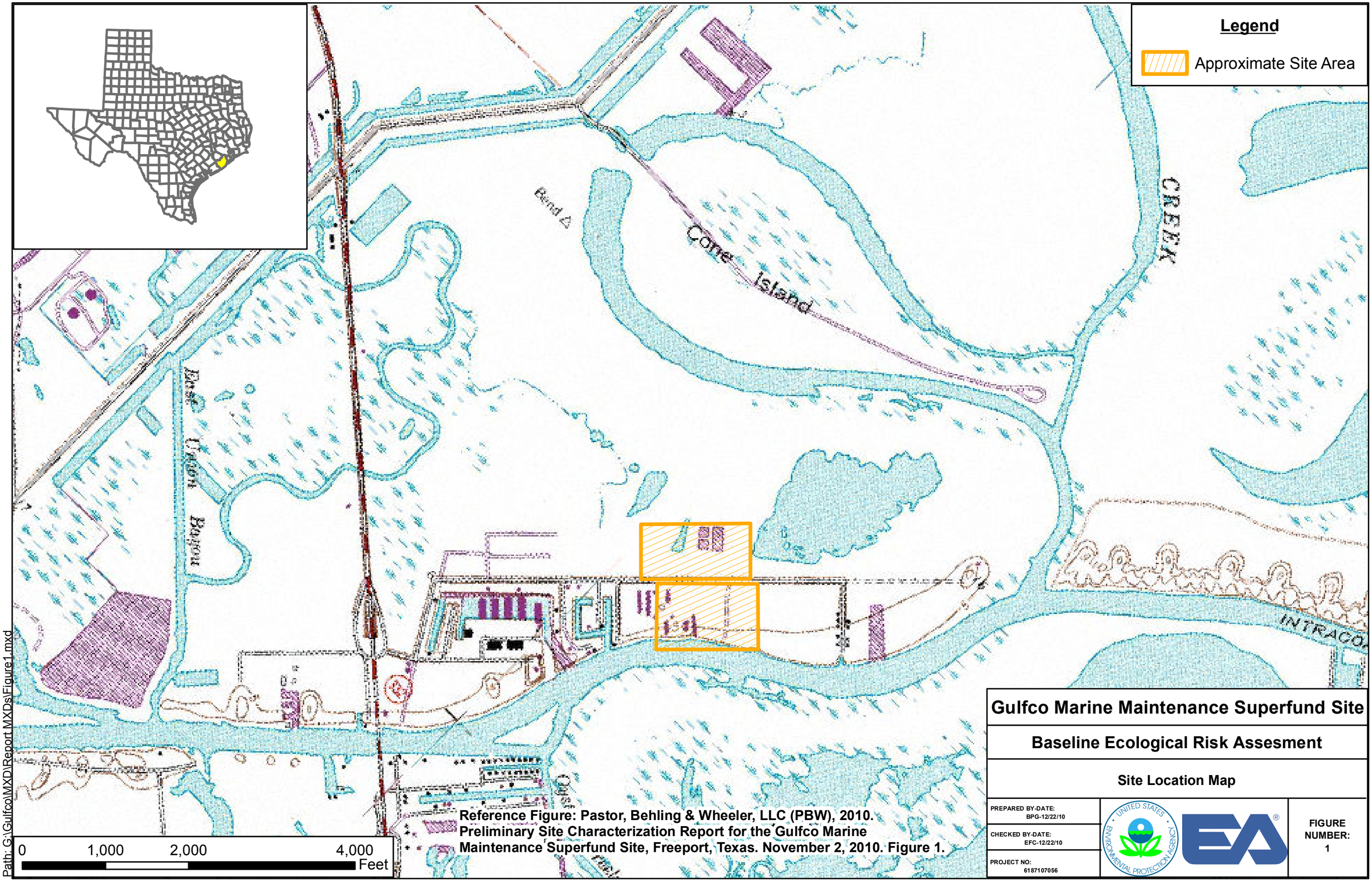
TABLE 7

SUMMARY EC20s AND TOXICITY

GULFCO MARINE MAINTENANCE SUPERFUND SITE

***Leptocheirus plumulosus* Survival**								
		Locations Exceeding EC20						
Stressor	**EC20**	**EWSED01**	**EWSED02**	**EWSED03**	**EWSED04**	**EWSED05**	**EWSED06**	**EWSED07**
Copper (mg/kg DW)	>28.2							
Copper (mg/L)	0.0045			X			X	
Zinc (mg/kg DW)	734						X	
Zinc (mg/L)	0.245						X	
(SSEM-AVS)/OC (mmol/gOC)	126						X	
	Toxicity Observed?			**X**	**X**		**X**	**X**
***Leptocheirus plumulosus* Growth**								
Copper (mg/kg DW)	24.8			X		X	X	X
Copper (mg/L)	0.00271			X	X		X	X
Zinc (mg/kg DW)	284			X	X	X	X	X
Zinc (mg/L)	0.0495				X		X	X
(SSEM-AVS)/OC (mmol/gOC)	25.4			X	X	X	X	X
	Toxicity Observed?			**X**			**X**	

Figures



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 1.

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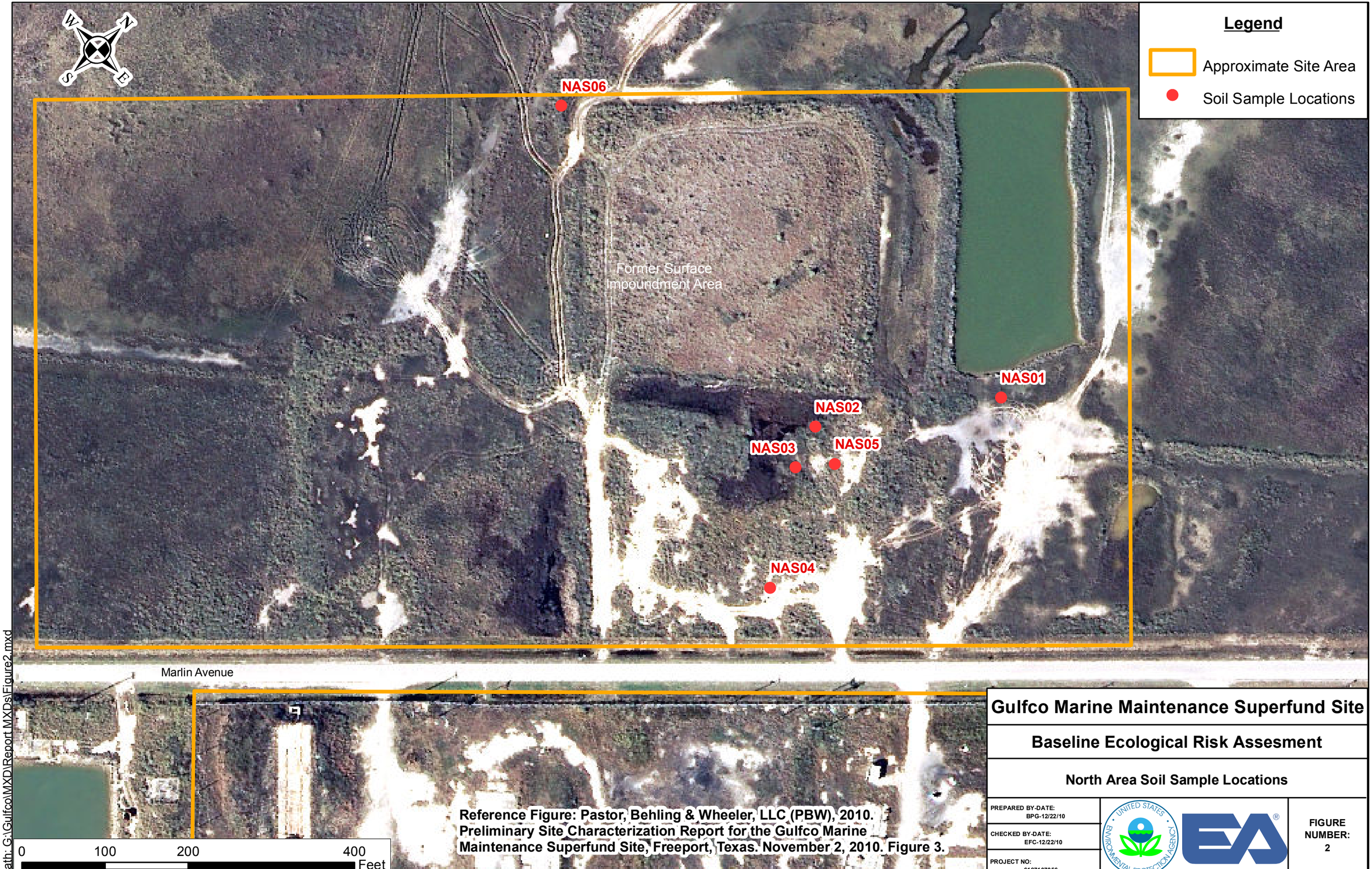
Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Site Location Map

PREPARED BY-DATE:	BPG-12/22/10
CHECKED BY-DATE:	EFC-12/22/10
PROJECT NO:	6187107056

FIGURE NUMBER: 1



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 3.

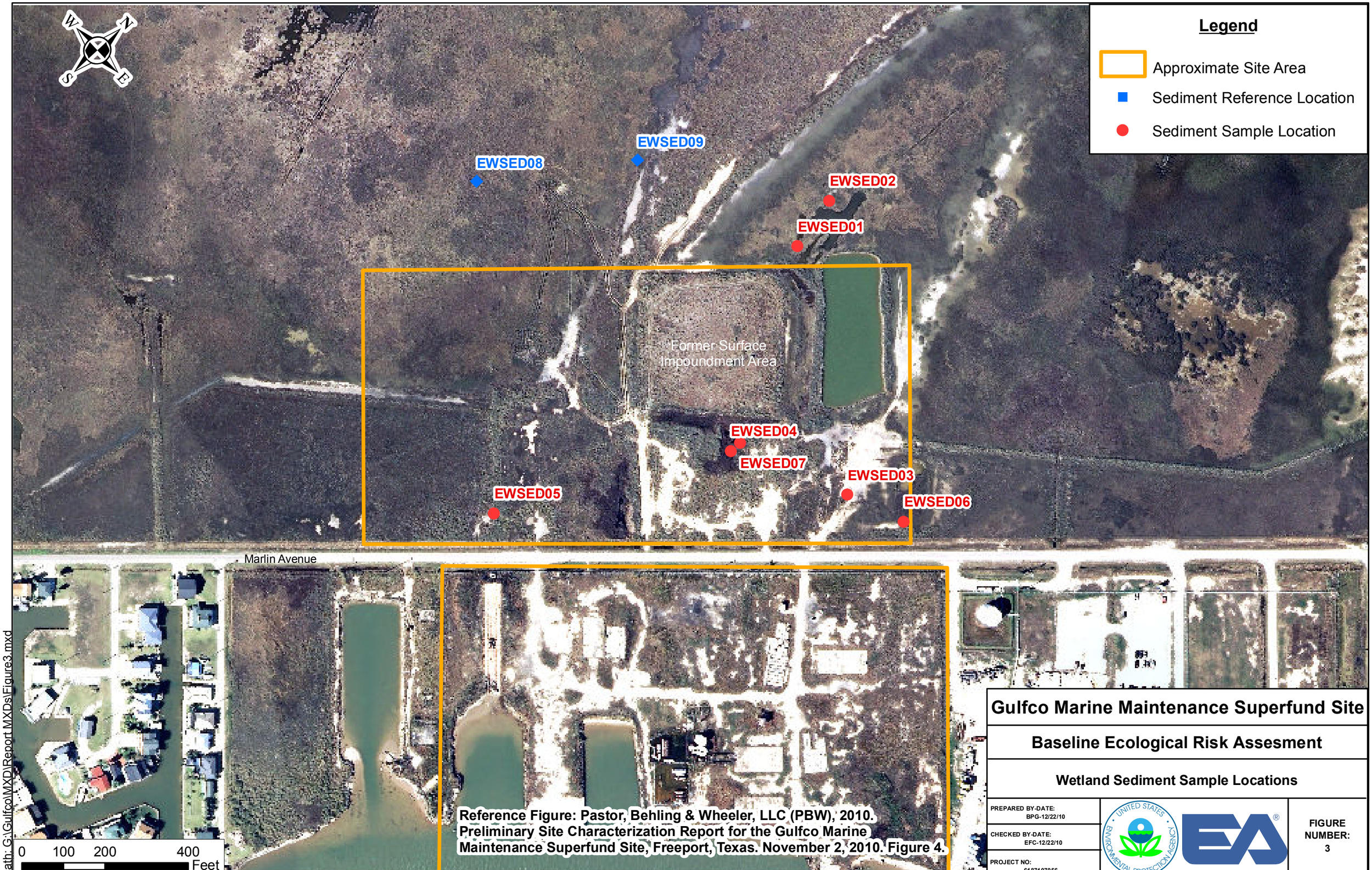
Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

North Area Soil Sample Locations

PREPARED BY-DATE: BPG-12/22/10	FIGURE NUMBER: 2
CHECKED BY-DATE: EFC-12/22/10	
PROJECT NO: 6187107056	

Path: G:\Gulfco\MXD\Report MXDs\Figure2.mxd



Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

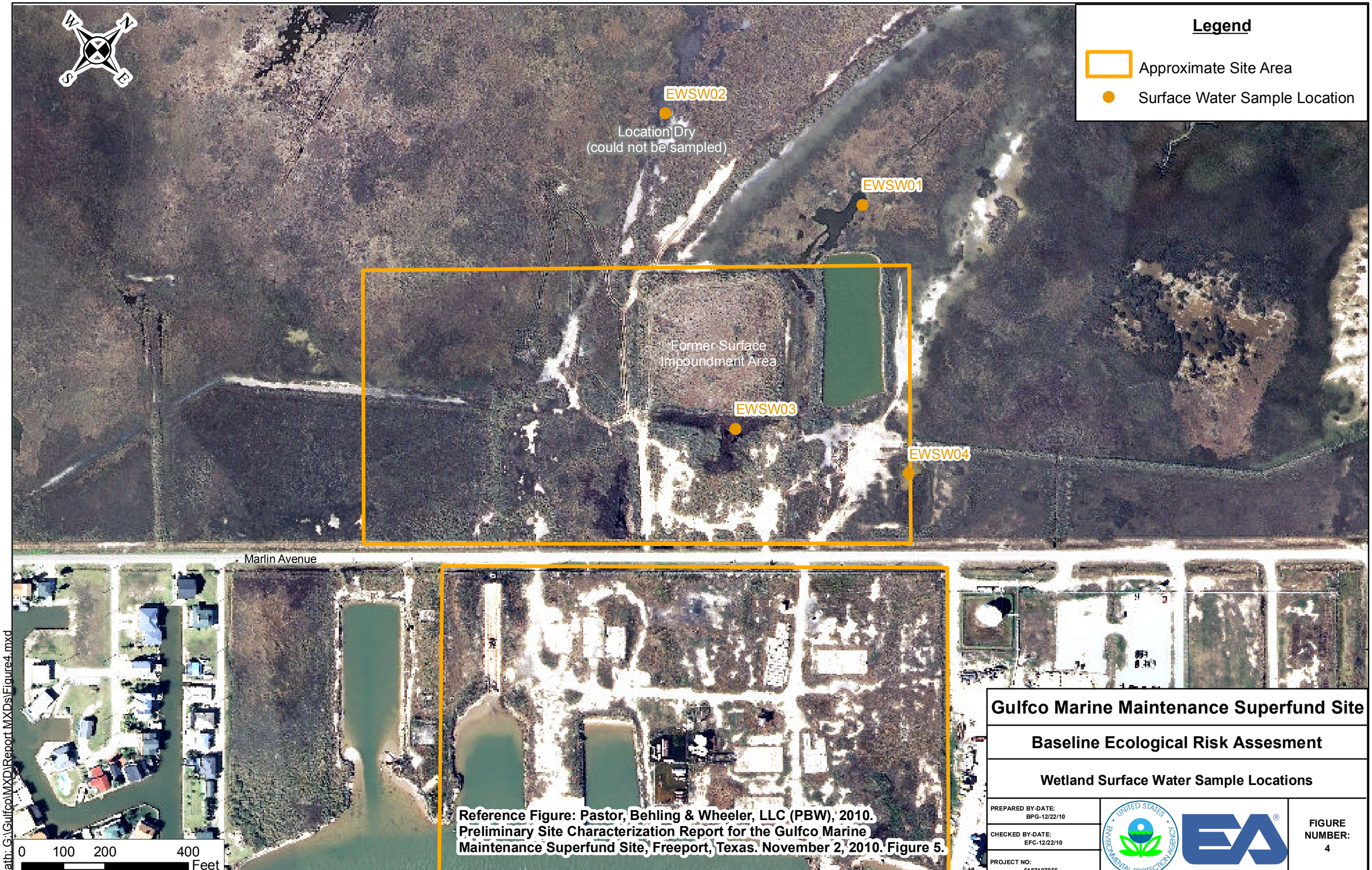
Wetland Sediment Sample Locations

PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: EFC-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 3



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 5.

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Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Wetland Surface Water Sample Locations

PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: EFC-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 4

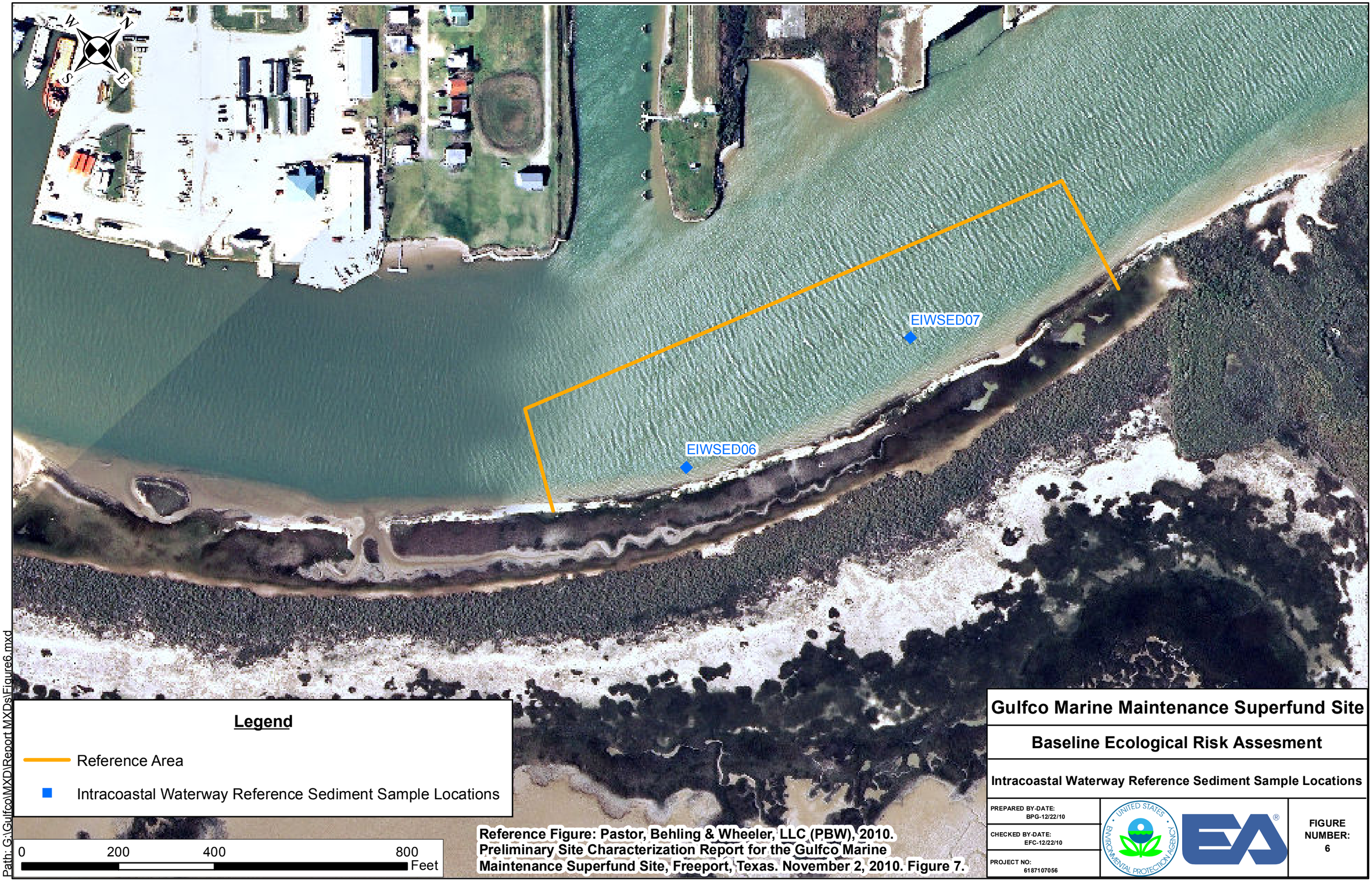
Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 6.

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Intracoastal Waterway Sediment Sample Locations

PREPARED BY-DATE: BPG-12/22/10	FIGURE NUMBER: 5
CHECKED BY-DATE: EFC-12/22/10	
PROJECT NO: 6187107056	



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 7.

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Gulfco Marine Maintenance Superfund Site

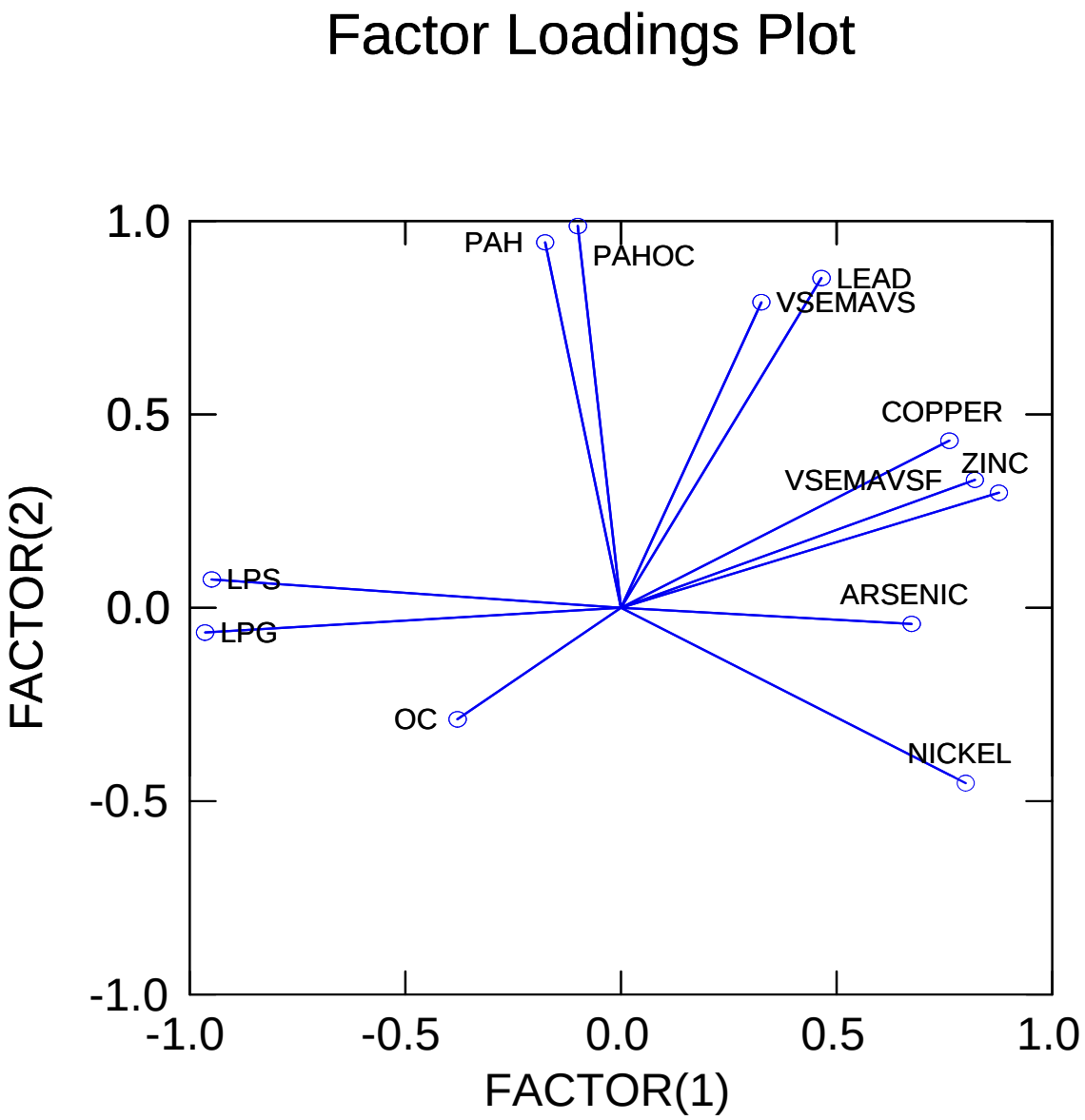
Baseline Ecological Risk Assesment

Intracoastal Waterway Reference Sediment Sample Locations

PREPARED BY-DATE: BPG-12/22/10	FIGURE NUMBER: 6
CHECKED BY-DATE: EFC-12/22/10	
PROJECT NO: 6187107056	

FIGURE 7

BULK SEDIMENT CHEMISTRY AND SEM/AVS ASSOCIATIONS WITH *LEPTOCHEIRUS PLUMULOSUS* SURVIVAL AND GROWTH

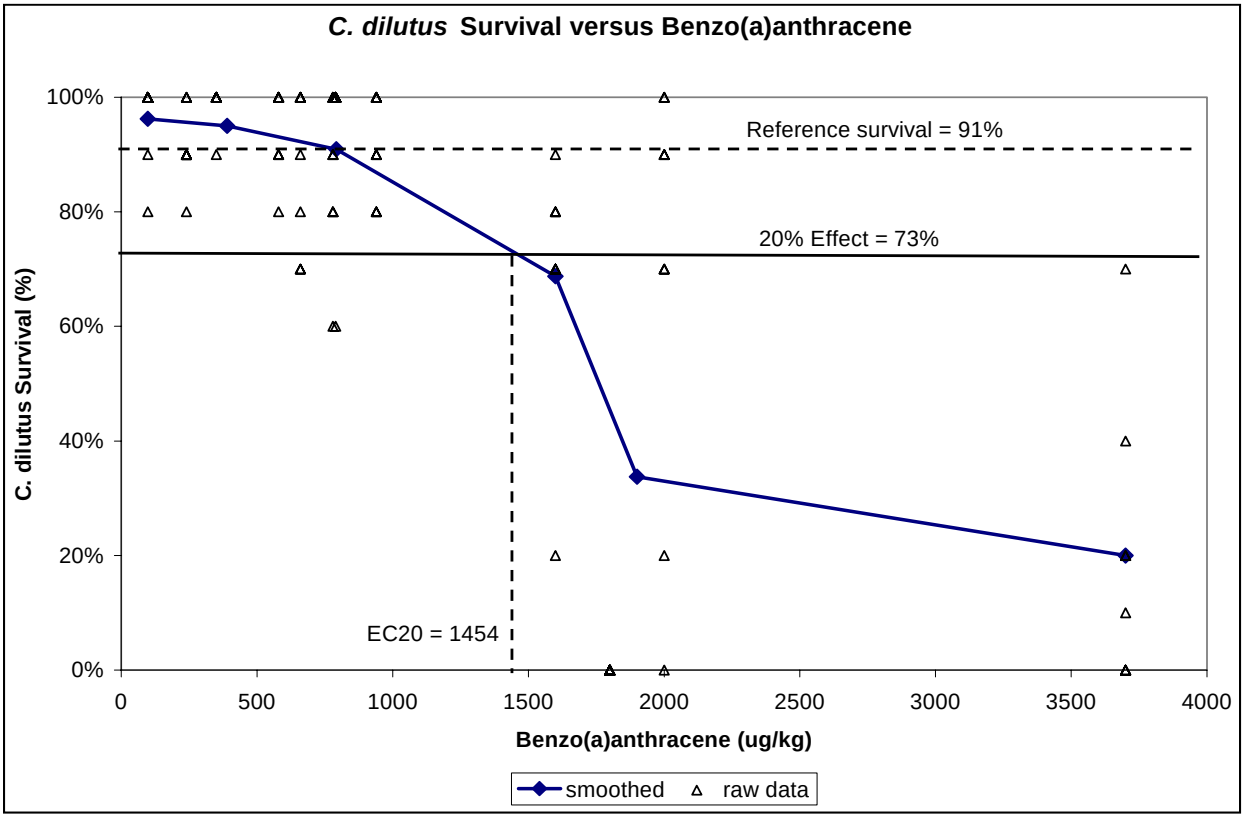


Notes:

LPS = *Leptocheirus plumulosus* survival; LPG = *Leptocheirus plumulosus* growth; VSEMAVS = ΣSEM/AVS; VSEMAVSF = (ΣSEM – AVS)/OC

FIGURE 8

ILLUSTRATION OF EC20 CALCULATION BY SMOOTHED LINEAR INTERPOLATION METHOD



Created by: JAT
Checked by: WAT
Source: MACTEC 2003

FIGURE 9

***LEPTOCHEIRUS PLUMULOSUS* GROWTH VERSUS ZINC IN SEDIMENT**

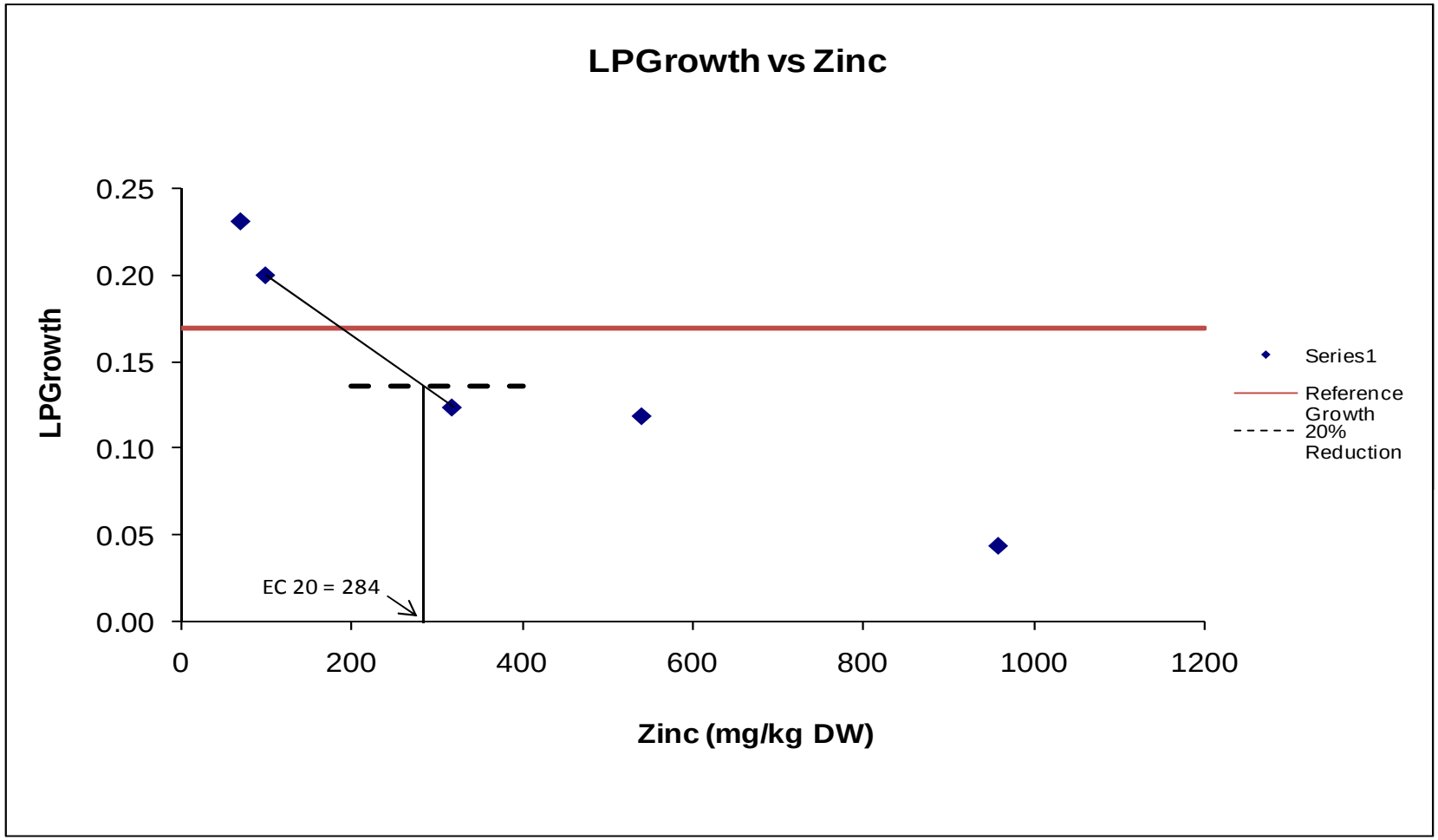
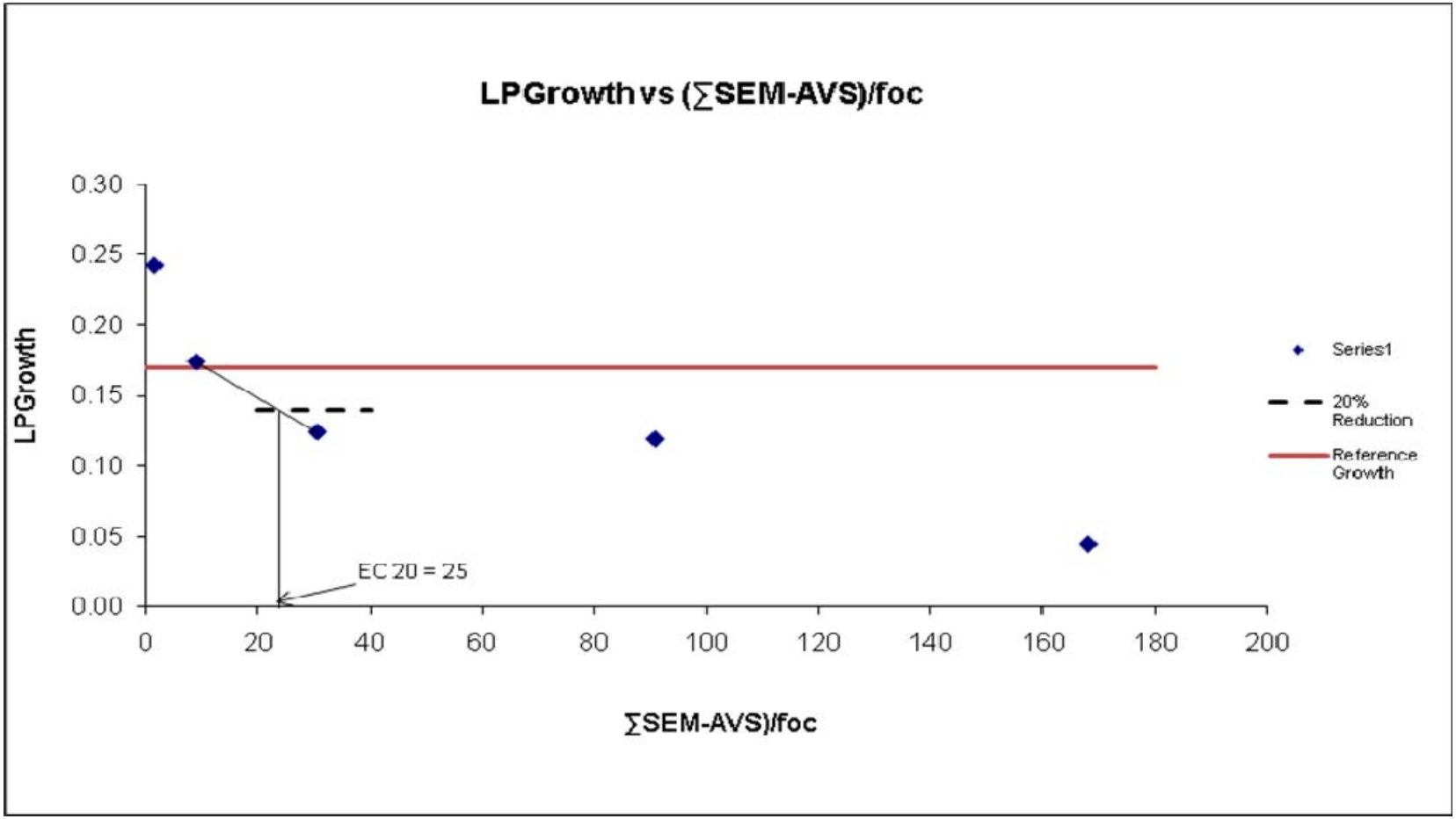


FIGURE 10

***LEPTOCHEIRUS PLUMULOSIS* GROWTH VERSUS (ΣSEM – AVS)/OC**



Appendix A

Correlation Matrices Relating Potential Stressors to *Leptocheirus plumulosus* Toxicity Endpoints in Wetland Sediments and CETIS Analytical Reports

Correlation Matrix - Reduced Set of Bulk Sediment Analytes versus *Leptocheirus* Survival and Growth

	PAH	*PAHOC*	*Arsenic*	*Copper*	*Lead*	*Nickel*	*TOTAL ORGANIC CARBON*	*Zinc*	*SEM/AVS*	*(SEM-AVS) /foc*	*LPG*
PAH	1.000										
PAHOC	0.979	1.000									
Arsenic	-0.183	-0.143	1.000								
Copper	0.369	0.389	0.626	1.000							
Lead	0.690	0.775	0.327	0.692	1.000						
Nickel	-0.507	-0.517	0.551	0.503	-0.048	1.000					
TOTAL ORGANIC CARBON	-0.034	-0.196	-0.235	-0.127	-0.406	0.017	1.000				
Zinc	0.138	0.226	0.305	0.741	0.637	0.554	-0.408	1.000			
SEM/AVS	0.643	0.698	0.404	0.562	0.853	-0.013	-0.360	0.390	1.000		
(SEM-AVS)/foc	0.170	0.264	0.208	0.665	0.634	0.465	-0.454	0.989	0.369	1.000	
LPG	0.271	0.129	-0.481	-0.461	-0.390	-0.574	**0.738**	**-0.761**	-0.227	**-0.738**	1.000

r is significant at 0.05 if absolute value >0.666

LPG = *Leptocheirus* growth

PAHOC = Total PAHs/OC

Correlation Matrix

Pore Water Concentrations v Leptocheirus Survival and Growth

	2mnapPW	*acenapPW*	*acenapyPW*	*AnthracenePW*	*ArsenicPW*	*BghiPPW*	*CopperPW*	*indeno123PPW*	*LeadPW*
2mnapPW	1.000								
acenapPW	0.077	1.000							
acenapyPW	-0.055	0.625	1.000						
AnthracenePW	0.151	0.521	0.957	1.000					
ArsenicPW	-0.443	-0.635	-0.339	-0.351	1.000				
BghiPPW	-0.135	0.272	-0.015	-0.074	0.020	1.000			
CopperPW	0.244	0.554	-0.083	-0.046	-0.551	0.400	1.000		
indeno123PPW	-0.184	0.478	0.006	-0.102	-0.140	0.950	0.559	1.000	
LeadPW	-0.509	-0.203	-0.398	-0.455	0.610	-0.185	0.019	-0.102	1.000
NickelPW	-0.107	0.244	0.170	0.210	0.244	-0.212	0.172	-0.138	0.682
chrysenePW	0.119	-0.196	-0.222	-0.293	0.295	0.323	-0.329	0.227	-0.277
DibenzahAPW	-0.187	0.557	-0.041	-0.148	-0.257	0.845	0.710	0.960	0.018
FluorenePW	-0.275	0.448	0.723	0.697	-0.103	0.551	0.131	0.486	-0.276
fluoranPW	-0.354	0.730	0.788	0.599	-0.360	-0.050	0.012	0.120	-0.144
PhenanPW	-0.389	0.530	0.908	0.813	-0.153	0.243	-0.071	0.242	-0.270
PyrenePW	-0.364	0.727	0.796	0.609	-0.347	-0.044	0.004	0.123	-0.139
ZincPW	0.004	0.443	-0.214	-0.245	-0.249	0.780	0.807	0.874	0.084
LPG	-0.210	-0.458	0.193	0.208	0.766	-0.116	**-0.825**	-0.335	0.110

r is significant at 0.05 if absolute value >0.707

LPG = *Leptocheirus* growth

Correlation Matrix

Pore Water Concentrations v Leptocheirus Survival and Growth

NickelPW	*chrysenePW*	*DibenzahAPW*	*FluorenePW*	*fluoranPW*	*PhenanPW*	*PyrenePW*	*ZincPW*	*LPG*
1.000								
-0.594	1.000							
-0.001	0.011	1.000						
0.136	-0.234	0.408	1.000					
0.073	-0.091	0.134	0.428	1.000				
0.105	-0.195	0.171	0.884	0.760	1.000			
0.084	-0.097	0.134	0.445	1.000	0.773	1.000		
0.103	-0.092	0.949	0.276	-0.122	-0.049	-0.123	1.000	
0.109	0.352	-0.533	0.160	-0.062	0.229	-0.047	-0.598	1.000

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	01-0319-6428	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:37	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control1	05-2411-1861	24 Aug-10	24 Aug-10	24h		
Control2	04-7180-6200	24 Aug-10	24 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control1	Sediment	Control 1			
Control2	Sediment	Control2			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					27.8%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Control1		Control2	0.6393	1.86	0.1833	0.2703	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.56	2.29	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.009922496	0.009922496	1	0.4086	0.5405	Non-Significant Effect
Error	0.1942536	0.0242817	8			
Total	0.2041761	0.0342042	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	2.814	23.15	0.3403	Equal Variances
Distribution	Shapiro-Wilk Normality	0.8927		0.1820	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Control1	5	0.6593	0.5873	0.7313	0.4535	0.8885	0.03515	0.1893	28.71%	0.0%
Control2	5	0.5963	0.5534	0.6392	0.4095	0.6955	0.02095	0.1128	18.92%	9.56%

Analysis ID:	01-0319-6428	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:37	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code
Control1
Control2

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	08-6067-7144	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:37	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control1	05-2411-1861	24 Aug-10	24 Aug-10	24h		
Control2	04-7180-6200	24 Aug-10	24 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control1	Sediment	Control 1			
Control2	Sediment	Control2			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	C > T	Not Run					18.82%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Control1		Control2	0.2839	1.86	0.1976	0.3918	Non-Significant Effect

Test Acceptability

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.83	0.8 - NL	Yes	Result Within Limits

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.074	2.29	0.1685	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.002275846	0.002275846	1	0.08062	0.7837	Non-Significant Effect
Error	0.2258348	0.02822935	8			
Total	0.2281106	0.0305052	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	1.681	23.15	0.6272	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9228		0.3807	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Control1	5	0.83	0.7883	0.8717	0.65	0.95	0.02034	0.1095	13.2%	0.0%
Control2	5	0.8	0.7554	0.8446	0.7	1	0.02177	0.1173	14.66%	3.61%

Analysis ID:	08-6067-7144	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:37	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Survival Rate Detail

Sample Code
Control1
Control2

CETIS Analytical Report

Test Code: 16-0932-1424/LP Intercoastal

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	14-2698-4028	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	14 Dec-10 15:25	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
EI-06	16-6046-5661	24 Aug-10	25 Aug-10	24h		
EI-07	00-4671-6706	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
EI-06	Marine Dredge Sample	EI-06	EI-06		
EI-07	Marine Dredge Sample	EI-07	EI-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	D<>0	Not Run					102.4%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
EI-06		EI-07	0.9644	3.264	0.1946	0.5147	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.009	2.29	0.2256	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.008265623	0.008265623	1	0.465	0.5145	Non-Significant Effect
Error	0.142203	0.01777537	8			
Total	0.1504686	0.02604099	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	2.425	23.15	0.4119	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9034		0.2385	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
EI-06	5	0.19	0.1297	0.2503	0.077	0.4425	0.02946	0.1587	83.5%	0.0%
EI-07	5	0.2475	0.2087	0.2863	0.116	0.3905	0.01892	0.1019	41.16%	-30.26%

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	14-2698-4028	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	14 Dec-10 15:25	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
EI-06	0.252	0.077	0.0865	0.4425	0.092
EI-07	0.116	0.3905	0.232	0.2075	0.2915

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	15-2852-5785	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	14 Dec-10 15:25	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
EI-06	16-6046-5661	24 Aug-10	25 Aug-10	24h		
EI-07	00-4671-6706	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
EI-06	Marine Dredge Sample	EI-06	EI-06		
EI-07	Marine Dredge Sample	EI-07	EI-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	D<>0	Not Run					73.66%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
EI-06		EI-07	2.237	3.264	0.3635	0.1525	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.677	2.29	0.7315	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.1551762	0.1551762	1	2.503	0.1523	Non-Significant Effect
Error	0.4960025	0.06200031	8			
Total	0.6511787	0.2171765	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	1.55	23.15	0.6816	Equal Variances
Distribution	Shapiro-Wilk Normality	0.8983		0.2101	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
EI-06	5	0.42	0.3398	0.5002	0.25	0.75	0.03917	0.211	50.23%	0.0%
EI-07	5	0.64	0.5514	0.7286	0.4	0.95	0.04325	0.2329	36.39%	-52.38%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
EI-06	5	0.7026	0.6187	0.7865	0.5236	1.047	0.04095	0.2205	31.39%	0.0%
EI-07	5	0.9517	0.8473	1.056	0.6847	1.345	0.05098	0.2745	28.85%	-35.46%

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test **MACTEC Biology-Toxicology LAB**

Analysis ID:	15-2852-5785	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	14 Dec-10 15:25	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
EI-06	0.5	0.25	0.35	0.75	0.25
EI-07	0.45	0.95	0.6	0.4	0.8

CETIS Analytical Report

Test Code: 01-4794-0881/EI-Ref-LP

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	01-4702-3413	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	14 Dec-10 15:27	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	00-2325-8351	24 Aug-10	24 Aug-10	24h	Gulfco	Gulfco
EI-01	16-0464-8606	24 Aug-10	24 Aug-10	24h		
EI-02	17-4690-1495	24 Aug-10	25 Aug-10	24h		
EI-03	10-0714-3044	24 Aug-10	25 Aug-10	24h		
EI-04	03-4097-7007	24 Aug-10	25 Aug-10	24h		
EI-05	04-5364-9674	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Intercoastal Reference			
EI-01	Marine Dredge Sample	EI-01	EI-01		
EI-02	Marine Dredge Sample	EI-02	EI-02		
EI-03	Marine Dredge Sample	EI-03	EI-03		
EI-04	Marine Dredge Sample	EI-04	EI-04		
EI-05	Marine Dredge Sample	EI-05	EI-05		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					56.68%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		EI-01	-0.06297	1.771	0.1167	0.5246	Non-Significant Effect
		EI-02	-1.729	1.771	0.1306	0.9463	Non-Significant Effect
		EI-03	-0.2153	1.771	0.1501	0.5836	Non-Significant Effect
		EI-04	0.1329	1.771	0.1273	0.4482	Non-Significant Effect
		EI-05	-0.3935	1.771	0.124	0.6498	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.568	2.978	0.2491	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.06719945	0.01343989	5	0.6839	0.6393	Non-Significant Effect
Error	0.5698947	0.01965154	29			
Total	0.6370941	0.03309143	34			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	2.221	15.09	0.8179	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9703		0.4513	Normal Distribution

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test **MACTEC Biology-Toxicology LAB**

Analysis ID: 01-4702-3413 **Endpoint:** Mean Dry Biomass-mg **CETIS Version:** CETISv1.7.0
Analyzed: 14 Dec-10 15:27 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	0.2187	0.1696	0.2679	0.077	0.4425	0.02401	0.1293	59.11%	0.0%
EI-01	5	0.2229	0.1859	0.2599	0.086	0.3115	0.01805	0.09718	43.6%	-1.9%
EI-02	5	0.3463	0.2907	0.4019	0.161	0.569	0.02712	0.1461	42.18%	-58.31%
EI-03	5	0.237	0.1607	0.3133	0.0345	0.5695	0.03725	0.2006	84.64%	-8.34%
EI-04	5	0.2092	0.1577	0.2607	0.078	0.3655	0.02515	0.1355	64.75%	4.37%
EI-05	5	0.2463	0.199	0.2936	0.044	0.3575	0.02311	0.1245	50.53%	-12.59%

Mean Dry Biomass-mg Detail

Sample Code
Reference
EI-01
EI-02
EI-03
EI-04
EI-05

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	12-3088-4049	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	14 Dec-10 15:27	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	00-2325-8351	24 Aug-10	24 Aug-10	24h	Gulfco	Gulfco
EI-01	16-0464-8606	24 Aug-10	24 Aug-10	24h		
EI-02	17-4690-1495	24 Aug-10	25 Aug-10	24h		
EI-03	10-0714-3044	24 Aug-10	25 Aug-10	24h		
EI-04	03-4097-7007	24 Aug-10	25 Aug-10	24h		
EI-05	04-5364-9674	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Intercoastal Reference			
EI-01	Marine Dredge Sample	EI-01	EI-01		
EI-02	Marine Dredge Sample	EI-02	EI-02		
EI-03	Marine Dredge Sample	EI-03	EI-03		
EI-04	Marine Dredge Sample	EI-04	EI-04		
EI-05	Marine Dredge Sample	EI-05	EI-05		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	C > T	Not Run					43.61%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		EI-01	1.042	1.771	0.2295	0.1582	Non-Significant Effect
		EI-02	-0.8441	1.771	0.254	0.7931	Non-Significant Effect
		EI-03	1.078	1.771	0.2669	0.1503	Non-Significant Effect
		EI-04	0.859	1.771	0.2505	0.2030	Non-Significant Effect
		EI-05	0.814	1.771	0.2487	0.2152	Non-Significant Effect

Test Acceptability

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.53	0.8 - NL	Yes	Result Below Limit

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.304	2.978	0.5958	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.3141387	0.06282774	5	1.059	0.4029	Non-Significant Effect
Error	1.720218	0.05931788	29			
Total	2.034357	0.1221456	34			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	2.138	15.09	0.8298	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9637		0.2938	Normal Distribution

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test **MACTEC Biology-Toxicology LAB**

Analysis ID: 12-3088-4049 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.7.0
Analyzed: 14 Dec-10 15:27 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	0.53	0.4389	0.6211	0.25	0.95	0.04446	0.2394	45.18%	0.0%
EI-01	5	0.41	0.359	0.461	0.25	0.55	0.02491	0.1342	32.72%	22.64%
EI-02	5	0.64	0.5635	0.7165	0.4	0.95	0.03737	0.2012	31.44%	-20.75%
EI-03	5	0.39	0.2908	0.4892	0.1	0.8	0.04842	0.2608	66.86%	26.42%
EI-04	5	0.42	0.3364	0.5036	0.25	0.8	0.04079	0.2197	52.3%	20.75%
EI-05	5	0.44	0.3646	0.5154	0.1	0.6	0.03679	0.1981	45.03%	16.98%

Survival Rate Detail

Sample Code
Reference
EI-01
EI-02
EI-03
EI-04
EI-05

CETIS Analytical Report

Test Code: 06-4346-2203/LP Wet Ref Comp

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	05-7169-1278	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:29	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
W-08	12-9420-1377	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco
W-09	16-0157-7098	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
W-08	Sediment	W-08	W-08		
W-09	Sediment	W-09	W-09		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	D<>0	Not Run					87.48%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
W-08		W-09	1.794	3.264	0.1958	0.2404	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.687	2.29	0.7097	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.02894441	0.02894441	1	1.609	0.2403	Non-Significant Effect
Error	0.1439121	0.01798901	8			
Total	0.1728565	0.04693342	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	1.683	23.15	0.6263	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9663		0.8541	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
W-08	5	0.2238	0.1667	0.2809	0.0105	0.4155	0.0279	0.1502	67.13%	0.0%
W-09	5	0.1162	0.07215	0.1602	0.018	0.266	0.0215	0.1158	99.65%	48.08%

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test **MACTEC Biology-Toxicology LAB**

Analysis ID:	05-7169-1278	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:29	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code
W-08
W-09

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	21-1363-0566	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:29	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	05-4826-7840	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	25 Aug-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	N/A	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
W-08	12-9420-1377	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco
W-09	16-0157-7098	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
W-08	Sediment	W-08	W-08		
W-09	Sediment	W-09	W-09		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	D<>0	Not Run					70.95%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
W-08		W-09	1.867	3.264	0.2773	0.2235	Non-Significant Effect

Test Acceptability

Attribute	Test Stat	TAC Limits	Overlap	Decision
Control Resp	0.33	0.8 - NL	Yes	Result Below Limit

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.047	2.29	0.1908	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.06287524	0.06287524	1	1.742	0.2234	Non-Significant Effect
Error	0.288734	0.03609175	8			
Total	0.3516093	0.09896699	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	1.761	23.15	0.5972	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9019		0.2297	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
W-08	5	0.33	0.2661	0.3939	0.05	0.45	0.03121	0.1681	50.93%	0.0%
W-09	5	0.19	0.1446	0.2354	0.05	0.35	0.02217	0.1194	62.83%	42.42%

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test **MACTEC Biology-Toxicology LAB**

Analysis ID:	21-1363-0566	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:29	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Survival Rate Detail

Sample Code
W-08
W-09

CETIS Analytical Report

Test Code: 09-0065-4155/W-REF-LP

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	18-8782-5239	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:28	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	08-9796-1970	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	02-3633-2190	24 Aug-10	24 Aug-09	24h	Gulfco	Gulfco
W-01	01-5466-3613	24 Aug-10	25 Aug-10	24h		
W-02	08-5451-7873	24 Aug-10	25 Aug-10	24h		
W-03	06-9110-7113	24 Aug-10	25 Aug-10	24h		
W-04	14-7060-6066	24 Aug-10	25 Aug-10	24h		
W-05	15-8235-8061	24 Aug-10	25 Aug-10	24h		
W-06	16-3918-5222	24 Aug-10	25 Aug-10	24h		
W-07	21-0527-6980	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Wetland Reference			
W-01	Sediment	W-01	W-01		
W-02	Sediment	W-02	W-02		
W-03	Sediment	W-03	W-03		
W-04	Sediment	W-04	W-04		
W-05	Sediment	W-05	W-05		
W-06	Sediment	W-06	W-06		
W-07	Sediment	W-07	W-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					74.17%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		W-01	-0.9082	1.771	0.1769	0.8099	Non-Significant Effect
		W-02	-0.9348	1.771	0.1161	0.8165	Non-Significant Effect
		W-03	1.229	1.771	0.1288	0.1205	Non-Significant Effect
		W-04	0.701	1.782	0.1427	0.2483	Non-Significant Effect
		W-05	0.1282	1.771	0.1188	0.4500	Non-Significant Effect
		W-06	1.937	1.771	0.115	0.0374	Significant Effect
		W-07	0.6461	1.771	0.1261	0.2647	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.961	3.076	0.0806	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.1875203	0.02678861	7	1.536	0.1867	Non-Significant Effect
Error	0.6279879	0.01744411	36			
Total	0.8155082	0.04423272	43			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	14.3	18.48	0.0461	Equal Variances
Distribution	Shapiro-Wilk Normality	0.963		0.1678	Normal Distribution

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID: 18-8782-5239 **Endpoint:** Mean Dry Biomass-mg **CETIS Version:** CETISv1.7.0
Analyzed: 15 Dec-10 10:28 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	0.17	0.1173	0.2227	0.0105	0.4155	0.02573	0.1386	81.52%	0.0%
W-01	5	0.2607	0.1639	0.3575	0.059	0.6185	0.04728	0.2546	97.66%	-53.35%
W-02	5	0.2313	0.2092	0.2534	0.147	0.278	0.01079	0.05809	25.12%	-36.06%
W-03	5	0.0806	0.03538	0.1258	0	0.264	0.02208	0.1189	147.5%	52.59%
W-04	4	0.1139	0.06632	0.1614	0	0.2905	0.02322	0.125	109.8%	33.01%
W-05	5	0.1614	0.1331	0.1897	0.097	0.2455	0.01382	0.0744	46.1%	5.06%
W-06	5	0.0442	0.02523	0.06317	0	0.128	0.009259	0.04986	112.8%	74.0%
W-07	5	0.124	0.08284	0.1652	0.0185	0.271	0.02009	0.1082	87.25%	27.06%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Reference	0.248	0.0105	0.1615	0.4155	0.2835	0.0565	0.0255	0.215	0.018	0.266
W-01	0.0985	0.059	0.0845	0.6185	0.443					
W-02	0.266	0.278	0.2715	0.194	0.147					
W-03	0	0.264	0.139	0	0					
W-04	0.102	0	0.063	0.2905						
W-05	0.108	0.097	0.117	0.2455	0.2395					
W-06	0	0.128	0.02	0.025	0.048					
W-07	0.271	0.205	0.0185	0.0595	0.066					

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	16-5041-0885	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:28	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	08-9796-1970	**Test Type:**	Leptocheirus (28-d)	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	EPA/600/R-01/020 (2001)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Leptocheirus plumulosus	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	02-3633-2190	24 Aug-10	24 Aug-09	24h	Gulfco	Gulfco
W-01	01-5466-3613	24 Aug-10	25 Aug-10	24h		
W-02	08-5451-7873	24 Aug-10	25 Aug-10	24h		
W-03	06-9110-7113	24 Aug-10	25 Aug-10	24h		
W-04	14-7060-6066	24 Aug-10	25 Aug-10	24h		
W-05	15-8235-8061	24 Aug-10	25 Aug-10	24h		
W-06	16-3918-5222	24 Aug-10	25 Aug-10	24h		
W-07	21-0527-6980	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Wetland Reference			
W-01	Sediment	W-01	W-01		
W-02	Sediment	W-02	W-02		
W-03	Sediment	W-03	W-03		
W-04	Sediment	W-04	W-04		
W-05	Sediment	W-05	W-05		
W-06	Sediment	W-06	W-06		
W-07	Sediment	W-07	W-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	C > T	Not Run					67.31%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		W-01	-0.986	1.771	0.1928	0.8289	Non-Significant Effect
		W-02	-2.809	1.771	0.2225	0.9926	Non-Significant Effect
		W-03	0.8738	1.771	0.2664	0.1991	Non-Significant Effect
		W-04	0.3727	1.782	0.2583	0.3579	Non-Significant Effect
		W-05	-1.538	1.771	0.1717	0.9260	Non-Significant Effect
		W-06	1.634	1.771	0.196	0.0631	Non-Significant Effect
		W-07	-0.3163	1.771	0.217	0.6216	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.593	3.076	0.3137	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	1.011995	0.1445707	7	2.189	0.0585	Non-Significant Effect
Error	2.37721	0.06603362	36			
Total	3.389205	0.2106044	43			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	7.058	18.48	0.4229	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9758		0.4748	Normal Distribution

Leptocheirus 28-d Survival, Growth and Reproduction Sediment Test — **MACTEC Biology-Toxicology LAB**

Analysis ID: 16-5041-0885 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.7.0
Analyzed: 15 Dec-10 10:28 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	0.26	0.2007	0.3193	0.05	0.45	0.02897	0.156	60.0%	0.0%
W-01	5	0.35	0.2828	0.4172	0.1	0.55	0.03283	0.1768	50.51%	-34.62%
W-02	5	0.58	0.4788	0.6812	0.15	0.8	0.04939	0.266	45.86%	-123.1%
W-03	5	0.2	0.08276	0.3172	0	0.7	0.05724	0.3082	154.1%	23.08%
W-04	4	0.2375	0.1284	0.3466	0	0.65	0.05327	0.2869	120.8%	8.65%
W-05	5	0.38	0.3362	0.4238	0.3	0.55	0.02138	0.1151	30.29%	-46.15%
W-06	5	0.13	0.07521	0.1848	0	0.35	0.02675	0.144	110.8%	50.0%
W-07	5	0.3	0.2108	0.3892	0.05	0.55	0.04355	0.2345	78.17%	-15.38%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	0.5128	0.4376	0.588	0.2255	0.7353	0.0367	0.1977	38.54%	0.0%
W-01	5	0.6202	0.5436	0.6968	0.3218	0.8355	0.03739	0.2013	32.47%	-20.94%
W-02	5	0.8657	0.7561	0.9754	0.3977	1.107	0.05353	0.2883	33.3%	-68.82%
W-03	5	0.3814	0.2306	0.5322	0.112	0.9912	0.07362	0.3965	104.0%	25.63%
W-04	4	0.4588	0.3255	0.5921	0.112	0.9377	0.06508	0.3504	76.38%	10.53%
W-05	5	0.6619	0.617	0.7069	0.5796	0.8355	0.02194	0.1181	17.85%	-29.08%
W-06	5	0.332	0.2515	0.4124	0.112	0.6331	0.03929	0.2116	63.73%	35.27%
W-07	5	0.5516	0.4476	0.6556	0.2255	0.8355	0.05076	0.2734	49.56%	-7.56%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Reference	0.3	0.05	0.4	0.45	0.45	0.2	0.1	0.25	0.05	0.35
W-01	0.4	0.1	0.25	0.55	0.45					
W-02	0.7	0.75	0.8	0.5	0.15					
W-03	0	0.7	0.3	0	0					
W-04	0.2	0	0.1	0.65						
W-05	0.3	0.3	0.3	0.45	0.55					
W-06	0	0.35	0.05	0.05	0.2					
W-07	0.55	0.55	0.05	0.15	0.2					

CETIS Analytical Report

Test Code: 18-9787-2318/NA Control1 vs

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	20-6253-3844	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:36	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control1	05-2411-1861	24 Aug-10	24 Aug-10	24h		
Control2	04-7180-6200	24 Aug-10	24 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control1	Sediment	Control 1			
Control2	Sediment	Control2			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	C > T	Not Run					10.75%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Control1		Control2	1.633	1.86	0.1085	0.0706	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.643	2.29	0.8052	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.02268316	0.02268316	1	2.667	0.1411	Non-Significant Effect
Error	0.06804948	0.008506184	8			
Total	0.09073263	0.03118934	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Mod Levene Equality of Variance	3	13.75	0.1340	Equal Variances
Distribution	Shapiro-Wilk Normality	0.8142		0.0215	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Control1	5	1	1	1	1	1	0	0	0.0%	0.0%
Control2	5	0.92	0.8783	0.9617	0.8	1	0.02034	0.1095	11.91%	8.0%

Analysis ID:	20-6253-3844	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:36	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Survival Rate Detail

Sample Code
Control1
Control2

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	03-3034-8010	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:35	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control1	05-2411-1861	24 Aug-10	24 Aug-10	24h		
Control2	04-7180-6200	24 Aug-10	24 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control1	Sediment	Control 1			
Control2	Sediment	Control2			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					21.76%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Control1		Control2	0.1589	1.86	0.8943	0.4389	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.493	2.29	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.01459245	0.01459245	1	0.02523	0.8777	Non-Significant Effect
Error	4.626101	0.5782627	8			
Total	4.640694	0.5928552	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	2.879	23.15	0.3302	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9317		0.4645	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Control1	5	4.111	3.903	4.318	3.614	5.04	0.1014	0.546	13.28%	0.0%
Control2	5	4.034	3.682	4.387	2.964	4.846	0.172	0.9265	22.97%	1.86%

Neanthes Survival and Growth Test **MACTEC Biology-Toxicology LAB**

Analysis ID:	03-3034-8010	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	08 Dec-10 16:35	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code
Control1
Control2

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	03-4786-6719	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:34	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
EI-06	16-6046-5661	24 Aug-10	25 Aug-10	24h		
EI-07	00-4671-6706	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
EI-06	Marine Dredge Sample	EI-06	EI-06		
EI-07	Marine Dredge Sample	EI-07	EI-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	D<>0	Not Run					12.42%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
EI-06		EI-07	2.309	3.264	0.1346	0.1413	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.643	2.29	0.8052	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.02268316	0.02268316	1	2.667	0.1411	Non-Significant Effect
Error	0.06804948	0.008506184	8			
Total	0.09073263	0.03118934	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Mod Levene Equality of Variance	3	13.75	0.1340	Equal Variances
Distribution	Shapiro-Wilk Normality	0.8142		0.0215	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
EI-06	5	1	1	1	1	1	0	0	0.0%	0.0%
EI-07	5	0.92	0.8783	0.9617	0.8	1	0.02034	0.1095	11.91%	8.0%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
EI-06	5	1.345	1.345	1.345	1.345	1.345	0	0	0.0%	0.0%
EI-07	5	1.25	1.2	1.3	1.107	1.345	0.02422	0.1304	10.43%	7.08%

Neanthes Survival and Growth Test | **MACTEC Biology-Toxicology LAB**

Analysis ID:	03-4786-6719	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:34	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
EI-06	1	1	1	1	1
EI-07	1	1	0.8	1	0.8

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	12-8532-8050	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:34	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
EI-06	16-6046-5661	24 Aug-10	25 Aug-10	24h		
EI-07	00-4671-6706	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
EI-06	Marine Dredge Sample	EI-06	EI-06		
EI-07	Marine Dredge Sample	EI-07	EI-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	D<>0	Not Run					34.17%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
EI-06		EI-07	0.115	3.264	1.635	0.9373	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.623	2.29	0.8514	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.00829442	0.00829442	1	0.006613	0.9372	Non-Significant Effect
Error	10.03469	1.254336	8			
Total	10.04298	1.262631	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	1.055	23.15	0.9599	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9338		0.4864	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
EI-06	5	4.784	4.352	5.216	3.43	6.498	0.2107	1.135	23.72%	0.0%
EI-07	5	4.842	4.421	5.262	3.474	6.384	0.2052	1.105	22.82%	-1.2%

Neanthes Survival and Growth Test | **MACTEC Biology-Toxicology LAB**

Analysis ID:	12-8532-8050	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:34	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
EI-06	5.03	4.742	4.22	3.43	6.498
EI-07	6.384	4.238	3.474	4.758	5.354

CETIS Analytical Report

Test Code: 19-6549-3148/EL-Ref-NA

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	10-5594-1862	**Endpoint:**	Mean Dry Weight-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:37	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	00-2325-8351	24 Aug-10	24 Aug-10	24h	Gulfco	Gulfco
EI-01	16-0464-8606	24 Aug-10	24 Aug-10	24h		
EI-02	17-4690-1495	24 Aug-10	25 Aug-10	24h		
EI-03	10-0714-3044	24 Aug-10	25 Aug-10	24h		
EI-04	03-4097-7007	24 Aug-10	25 Aug-10	24h		
EI-05	04-5364-9674	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Intercoastal Reference			
EI-01	Marine Dredge Sample	EI-01	EI-01		
EI-02	Marine Dredge Sample	EI-02	EI-02		
EI-03	Marine Dredge Sample	EI-03	EI-03		
EI-04	Marine Dredge Sample	EI-04	EI-04		
EI-05	Marine Dredge Sample	EI-05	EI-05		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					19.18%

Unequal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		EI-01	0.3037	1.86	1.08	0.3846	Non-Significant Effect
		EI-02	-1.19	2.132	2.831	0.8501	Non-Significant Effect
		EI-03	-0.9149	1.796	0.898	0.8101	Non-Significant Effect
		EI-04	-1.817	1.833	1.001	0.9487	Non-Significant Effect
		EI-05	1.717	1.812	0.9652	0.0584	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	3.855	2.978	0.0004	Outlier Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	20.10712	4.021423	5	2.032	0.1036	Non-Significant Effect
Error	57.39983	1.979304	29			
Total	77.50694	6.000728	34			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	11.49	15.09	0.0424	Equal Variances
Distribution	Shapiro-Wilk Normality	0.8747		0.0009	Non-normal Distribution

Neanthes Survival and Growth Test | **MACTEC Biology-Toxicology LAB**

Analysis ID: 10-5594-1862 **Endpoint:** Mean Dry Weight-mg **CETIS Version:** CETISv1.7.0
Analyzed: 15 Dec-10 10:37 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	5.033	4.609	5.458	3.43	6.693	0.2074	1.117	22.19%	0.0%
EI-01	5	4.857	4.465	5.249	3.908	6.553	0.1915	1.031	21.23%	3.51%
EI-02	5	6.614	5.525	7.702	4.582	11.62	0.5315	2.862	43.27%	-31.4%
EI-03	5	5.491	5.19	5.792	4.7	6.718	0.147	0.7916	14.42%	-9.09%
EI-04	5	6.026	5.672	6.38	4.472	6.778	0.173	0.9318	15.46%	-19.72%
EI-05	5	4.119	3.78	4.458	3.018	5.416	0.1655	0.8913	21.64%	18.16%

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Reference	5.03	4.742	4.22	3.43	6.498	6.384	4.238	4.343	4.758	6.693
EI-01	5.002	4.238	4.585	6.553	3.908					
EI-02	6.123	11.62	4.582	5.693	5.048					
EI-03	5.738	6.718	4.946	4.7	5.354					
EI-04	6.194	4.472	6.706	6.778	5.98					
EI-05	3.018	3.802	4.476	3.884	5.416					

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	11-1346-9279	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:37	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	00-2325-8351	24 Aug-10	24 Aug-10	24h	Gulfco	Gulfco
EI-01	16-0464-8606	24 Aug-10	24 Aug-10	24h		
EI-02	17-4690-1495	24 Aug-10	25 Aug-10	24h		
EI-03	10-0714-3044	24 Aug-10	25 Aug-10	24h		
EI-04	03-4097-7007	24 Aug-10	25 Aug-10	24h		
EI-05	04-5364-9674	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Intercoastal Reference			
EI-01	Marine Dredge Sample	EI-01	EI-01		
EI-02	Marine Dredge Sample	EI-02	EI-02		
EI-03	Marine Dredge Sample	EI-03	EI-03		
EI-04	Marine Dredge Sample	EI-04	EI-04		
EI-05	Marine Dredge Sample	EI-05	EI-05		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					20.32%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		EI-01	0.765	1.771	0.9287	0.2290	Non-Significant Effect
		EI-02	-0.2757	1.771	1.097	0.6064	Non-Significant Effect
		EI-03	-0.3645	1.771	0.8746	0.6393	Non-Significant Effect
		EI-04	-2.172	1.771	0.989	0.9755	Non-Significant Effect
		EI-05	1.256	1.771	0.9782	0.1157	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.29	2.978	0.6212	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	10.7201	2.14402	5	2.421	0.0596	Non-Significant Effect
Error	25.68631	0.8857348	29			
Total	36.40641	3.029755	34			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	5.63	15.09	0.3439	Equal Variances
Distribution	Shapiro-Wilk Normality	0.972		0.4997	Normal Distribution

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID: 11-1346-9279 **Endpoint:** Mean Dry Biomass-mg **CETIS Version:** CETISv1.7.0
Analyzed: 15 Dec-10 10:37 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	4.813	4.411	5.215	3.43	6.498	0.1962	1.056	21.95%	0.0%
EI-01	5	4.412	4.151	4.672	3.668	5.242	0.1271	0.6846	15.52%	8.34%
EI-02	5	4.984	4.495	5.472	3.416	6.974	0.2384	1.284	25.76%	-3.55%
EI-03	5	4.993	4.855	5.131	4.59	5.374	0.06734	0.3626	7.26%	-3.74%
EI-04	5	6.026	5.672	6.38	4.472	6.778	0.173	0.9318	15.46%	-25.21%
EI-05	5	4.119	3.78	4.458	3.018	5.416	0.1655	0.8913	21.64%	14.41%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Reference	5.03	4.742	4.22	3.43	6.498	6.384	4.238	3.474	4.758	5.354
EI-01	5.002	4.238	3.668	5.242	3.908					
EI-02	4.898	6.974	4.582	3.416	5.048					
EI-03	4.59	5.374	4.946	4.7	5.354					
EI-04	6.194	4.472	6.706	6.778	5.98					
EI-05	3.018	3.802	4.476	3.884	5.416					

CETIS Analytical Report

Test Code: 01-7105-4561/AN WET Ref Comp

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	02-7121-2327	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:43	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
W-08	12-9420-1377	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco
W-09	16-0157-7098	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
W-08	Sediment	W-08	W-08		
W-09	Sediment	W-09	W-09		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	D<>0	Not Run					54.98%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
W-08		W-09	0.6972	3.264	0.3955	0.6354	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.029	2.29	0.2069	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.01784467	0.01784467	1	0.2431	0.6352	Non-Significant Effect
Error	0.5873185	0.07341481	8			
Total	0.6051632	0.09125948	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	3.019	23.15	0.3098	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9565		0.7454	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
W-08	5	0.68	0.5646	0.7954	0.2	1	0.05632	0.3033	44.61%	0.0%
W-09	5	0.76	0.6964	0.8236	0.6	1	0.03107	0.1673	22.02%	-11.76%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
W-08	5	0.9819	0.8555	1.108	0.4636	1.345	0.06167	0.3321	33.82%	0.0%
W-09	5	1.066	0.9936	1.139	0.8861	1.345	0.03549	0.1911	17.92%	-8.61%

Neanthes Survival and Growth Test | **MACTEC Biology-Toxicology LAB**

Analysis ID:	02-7121-2327	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:43	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
W-08	0.8	0.2	0.6	0.8	1
W-09	0.8	0.8	0.6	0.6	1

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	11-0164-6686	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:43	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
W-08	12-9420-1377	24 Aug-10	25 Aug-10	24h	Gulfco	Gulfco
W-09	16-0157-7098	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
W-08	Sediment	W-08	W-08		
W-09	Sediment	W-09	W-09		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	D<>0	Not Run					43.92%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
W-08		W-09	2.645	3.264	0.6964	0.0985	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.543	2.29	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.7963688	0.7963688	1	3.499	0.0983	Non-Significant Effect
Error	1.820923	0.2276154	8			
Total	2.617292	1.023984	9			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Variance Ratio F	1.584	23.15	0.6666	Equal Variances
Distribution	Shapiro-Wilk Normality	0.899		0.2138	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
W-08	5	1.586	1.426	1.745	0.912	1.93	0.07794	0.4197	26.47%	0.0%
W-09	5	2.15	1.949	2.351	1.456	2.75	0.0981	0.5283	24.57%	-35.6%

Neanthes Survival and Growth Test | **MACTEC Biology-Toxicology LAB**

Analysis ID:	11-0164-6686	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:43	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
W-08	1.9	0.912	1.93	1.464	1.722
W-09	2.408	2.38	1.456	2.75	1.756

CETIS Analytical Report

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	03-6947-6366	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	02-3633-2190	24 Aug-10	24 Aug-09	24h	Gulfco	Gulfco
W-01	01-5466-3613	24 Aug-10	25 Aug-10	24h		
W-02	08-5451-7873	24 Aug-10	25 Aug-10	24h		
W-03	06-9110-7113	24 Aug-10	25 Aug-10	24h		
W-04	14-7060-6066	24 Aug-10	25 Aug-10	24h		
W-05	15-8235-8061	24 Aug-10	25 Aug-10	24h		
W-06	16-3918-5222	24 Aug-10	25 Aug-10	24h		
W-07	21-0527-6980	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Wetland Reference			
W-01	Sediment	W-01	W-01		
W-02	Sediment	W-02	W-02		
W-03	Sediment	W-03	W-03		
W-04	Sediment	W-04	W-04		
W-05	Sediment	W-05	W-05		
W-06	Sediment	W-06	W-06		
W-07	Sediment	W-07	W-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	C > T	Not Run					31.98%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		W-01	-2.233	1.771	0.217	0.9781	Non-Significant Effect
		W-02	-0.3367	1.771	0.2609	0.6291	Non-Significant Effect
		W-03	-0.977	1.771	0.2492	0.8268	Non-Significant Effect
		W-04	-1.066	1.771	0.217	0.8472	Non-Significant Effect
		W-05	0.01477	1.771	0.2364	0.4942	Non-Significant Effect
		W-06	-0.6549	1.771	0.243	0.7380	Non-Significant Effect
		W-07	-0.01402	1.771	0.2489	0.5055	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.688	3.085	0.2334	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.3489899	0.0498557	7	0.9641	0.4712	Non-Significant Effect
Error	1.91336	0.05171242	37			
Total	2.26235	0.1015681	44			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	6.47	18.48	0.4861	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9664		0.2133	Normal Distribution

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID: 03-6947-6366 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.7.0
Analyzed: 15 Dec-10 10:41 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	0.72	0.6307	0.8093	0.2	1	0.04359	0.2348	32.61%	0.0%
W-01	5	0.96	0.926	0.994	0.8	1	0.01661	0.08944	9.32%	-33.33%
W-02	5	0.76	0.6608	0.8592	0.4	1	0.04842	0.2608	34.31%	-5.56%
W-03	5	0.84	0.7567	0.9233	0.6	1	0.04068	0.2191	26.08%	-16.67%
W-04	5	0.84	0.806	0.874	0.8	1	0.01661	0.08944	10.65%	-16.67%
W-05	5	0.72	0.652	0.788	0.6	1	0.03322	0.1789	24.85%	0.0%
W-06	5	0.8	0.7239	0.8761	0.6	1	0.03714	0.2	25.0%	-11.11%
W-07	5	0.72	0.6333	0.8067	0.4	1	0.04235	0.228	31.67%	0.0%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	1.024	0.9255	1.123	0.4636	1.345	0.04815	0.2593	25.32%	0.0%
W-01	5	1.298	1.257	1.338	1.107	1.345	0.01978	0.1065	8.21%	-26.71%
W-02	5	1.074	0.9636	1.184	0.6847	1.345	0.05375	0.2895	26.96%	-4.84%
W-03	5	1.162	1.066	1.257	0.8861	1.345	0.04671	0.2515	21.65%	-13.43%
W-04	5	1.155	1.114	1.195	1.107	1.345	0.01978	0.1065	9.22%	-12.76%
W-05	5	1.022	0.9444	1.1	0.8861	1.345	0.03796	0.2044	20.0%	0.19%
W-06	5	1.114	1.027	1.201	0.8861	1.345	0.04264	0.2296	20.61%	-8.78%
W-07	5	1.026	0.9308	1.121	0.6847	1.345	0.04653	0.2506	24.42%	-0.19%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Reference	0.8	0.2	0.6	0.8	1	0.8	0.8	0.6	0.6	1
W-01	1	1	1	0.8	1					
W-02	1	1	0.6	0.4	0.8					
W-03	1	0.6	1	1	0.6					
W-04	0.8	0.8	0.8	0.8	1					
W-05	0.6	0.6	1	0.8	0.6					
W-06	1	0.6	0.8	0.6	1					
W-07	0.6	0.8	0.4	0.8	1					

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	12-5072-0846	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	15 Dec-10 10:41	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	06-2679-7824	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	25 Aug-10	**Protocol:**	ASTM E1611-00 (2000)	**Diluent:**	
Ending Date:	22 Sep-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	28d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Reference	02-3633-2190	24 Aug-10	24 Aug-09	24h	Gulfco	Gulfco
W-01	01-5466-3613	24 Aug-10	25 Aug-10	24h		
W-02	08-5451-7873	24 Aug-10	25 Aug-10	24h		
W-03	06-9110-7113	24 Aug-10	25 Aug-10	24h		
W-04	14-7060-6066	24 Aug-10	25 Aug-10	24h		
W-05	15-8235-8061	24 Aug-10	25 Aug-10	24h		
W-06	16-3918-5222	24 Aug-10	25 Aug-10	24h		
W-07	21-0527-6980	24 Aug-10	25 Aug-10	24h		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Reference	Reference sediment	Wetland Reference			
W-01	Sediment	W-01	W-01		
W-02	Sediment	W-02	W-02		
W-03	Sediment	W-03	W-03		
W-04	Sediment	W-04	W-04		
W-05	Sediment	W-05	W-05		
W-06	Sediment	W-06	W-06		
W-07	Sediment	W-07	W-07		

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					36.07%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
Reference		W-01	-4.244	1.771	0.503	0.9995	Non-Significant Effect
		W-02	-1.208	1.771	0.6115	0.8757	Non-Significant Effect
		W-03	-0.4514	1.771	0.5327	0.6704	Non-Significant Effect
		W-04	-1.996	1.771	0.5875	0.9664	Non-Significant Effect
		W-05	-1.122	1.771	0.5995	0.8589	Non-Significant Effect
		W-06	0.2789	1.771	0.5575	0.3924	Non-Significant Effect
		W-07	-1.534	1.771	0.6736	0.9255	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.012	3.085	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	6.846094	0.9780134	7	2.106	0.0672	Non-Significant Effect
Error	17.17902	0.4642978	37			
Total	24.02511	1.442311	44			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	3.244	18.48	0.8616	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9785		0.5596	Normal Distribution

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID: 12-5072-0846 **Endpoint:** Mean Dry Biomass-mg **CETIS Version:** CETISv1.7.0
Analyzed: 15 Dec-10 10:41 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
Reference	10	1.868	1.663	2.073	0.912	2.75	0.1001	0.5393	28.87%	0.0%
W-01	5	3.073	2.895	3.251	2.446	3.564	0.08703	0.4687	15.25%	-64.54%
W-02	5	2.285	1.981	2.588	1.402	3.498	0.1482	0.7982	34.94%	-22.33%
W-03	5	2.004	1.786	2.221	1.552	2.94	0.106	0.571	28.5%	-7.27%
W-04	5	2.53	2.251	2.809	1.828	3.494	0.1362	0.7334	28.99%	-35.45%
W-05	5	2.248	1.956	2.539	1.19	3.1	0.1423	0.7664	34.1%	-20.33%
W-06	5	1.78	1.534	2.026	0.852	2.622	0.1202	0.6475	36.38%	4.7%
W-07	5	2.451	2.088	2.815	1.194	3.638	0.1774	0.9556	38.98%	-31.23%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Reference	1.9	0.912	1.93	1.464	1.722	2.408	2.38	1.456	2.75	1.756
W-01	2.736	3.564	3.406	3.214	2.446					
W-02	2.274	3.498	1.774	2.476	1.402					
W-03	2.94	1.552	2.118	1.828	1.58					
W-04	1.984	3.114	2.23	1.828	3.494					
W-05	3.1	2.808	2.322	1.818	1.19					
W-06	2.622	1.636	1.722	2.068	0.852					
W-07	2.28	3.122	1.194	2.022	3.638					

CETIS Analytical Report

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	10-9764-2317	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	09 Dec-10 15:36	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	19-2467-8032	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	10 Sep-10 00:01	**Protocol:**		**Diluent:**	
Ending Date:	01 Oct-10 00:01	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	21d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
NAS07	13-2306-7028	10 Sep-10	01 Oct-10	1m		
NAS08	19-3755-2485	10 Sep-10	10 Sep-10	1m		
NAS09	16-4746-9613	10 Sep-10	10 Sep-10	1m		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
NAS07	Sediment	NAS07			
NAS08	Sediment	NAS08			
NAS09	Sediment	NAS09			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	D<>0	Not Run					22.36%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
NAS07		NAS08	4.004	3.084	0.2432	0.0153	Significant Effect
		NAS09	4.514	3.775	0.2977	0.0198	Significant Effect
NAS08		NAS09	0.5106	3.084	0.2432	0.7245	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	1.528	2.548	1.0000	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.3802196	0.1901098	2	6.112	0.0148	Significant Effect
Error	0.3732687	0.03110573	12			
Total	0.7534883	0.2212155	14			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	0.8075	9.21	0.6678	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9127		0.1490	Normal Distribution

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
NAS07	5	0.92	0.8783	0.9617	0.8	1	0.02034	0.1095	11.91%	0.0%
NAS08	5	0.64	0.5764	0.7036	0.4	0.8	0.03107	0.1673	26.15%	30.43%
NAS09	5	0.6	0.5239	0.6761	0.4	0.8	0.03714	0.2	33.33%	34.78%

Analysis ID:	10-9764-2317	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	09 Dec-10 15:36	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Survival Rate Detail

Sample Code
NAS07
NAS08
NAS09

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	11-2045-0920	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	09 Dec-10 15:36	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Batch ID:	19-2467-8032	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	10 Sep-10 00:01	**Protocol:**		**Diluent:**	
Ending Date:	01 Oct-10 00:01	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	21d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
NAS07	13-2306-7028	10 Sep-10	01 Oct-10	1m		
NAS08	19-3755-2485	10 Sep-10	10 Sep-10	1m		
NAS09	16-4746-9613	10 Sep-10	10 Sep-10	1m		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
NAS07	Sediment	NAS07			
NAS08	Sediment	NAS08			
NAS09	Sediment	NAS09			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	D<>0	Not Run					26.32%

Student-Newman-Keuls Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
NAS07		NAS08	6.458	3.084	0.4034	0.0008	Significant Effect
		NAS09	7.503	3.775	0.4938	0.0007	Significant Effect
NAS08		NAS09	1.046	3.084	0.4034	0.4741	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.137	2.548	0.3042	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	2.826567	1.413283	2	16.52	0.0004	Significant Effect
Error	1.026897	0.08557478	12			
Total	3.853464	1.498858	14			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	1.502	9.21	0.4719	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9588		0.6723	Normal Distribution

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
NAS07	5	1.533	1.385	1.681	0.954	1.96	0.07235	0.3896	25.42%	0.0%
NAS08	5	0.688	0.6058	0.7702	0.384	0.918	0.04014	0.2162	31.42%	55.11%
NAS09	5	0.5512	0.4594	0.643	0.18	0.828	0.0448	0.2413	43.77%	64.04%

Neanthes Survival and Growth Test | **MACTEC Biology-Toxicology LAB**

Analysis ID:	11-2045-0920	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	09 Dec-10 15:36	**Analysis:**	Parametric-All Pairwise	**Official Results:**	Yes

Mean Dry Biomass-mg Detail

Sample Code
NAS07
NAS08
NAS09

CETIS Analytical Report

Test Code: 04-5244-6949/REF NAS07 Comp

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	12-3541-2939	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.7.0
Analyzed:	13 Dec-10 15:38	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	11-9021-9355	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	10 Sep-10	**Protocol:**		**Diluent:**	
Ending Date:	01 Oct-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	21d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
NAS07 (REF)	03-3464-7421	10 Sep-10	10 Sep-10	N/A		
NAS01	11-1046-0661	10 Sep-10	10 Sep-10	N/A		
NAS02	04-1287-5100	10 Sep-10	10 Sep-10	N/A		
NAS03	10-0178-8311	10 Sep-10	10 Sep-10	N/A		
NAS04	17-1619-6284	10 Sep-10	10 Sep-10	N/A		
NAS05	06-1191-8123	10 Sep-10	10 Sep-10	N/A		
NAS06	07-7972-3735	10 Sep-10	10 Sep-10	N/A		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
NAS07 (REF)	Reference sediment	NAS REF (NAS 07)			
NAS01	Sediment	NAS01			
NAS02	Sediment	NAS02			
NAS03	Sediment	NAS03			
NAS04	Sediment	NAS04			
NAS05	Sediment	NAS05			
NAS06	Sediment	NAS06			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	0	C > T	Not Run					13.97%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
NAS07 (REF)		NAS01	1.242	1.86	0.264	0.1247	Non-Significant Effect
		NAS02	0.5774	1.86	0.1534	0.2898	Non-Significant Effect
		NAS03	-0.6325	1.86	0.14	0.7276	Non-Significant Effect
		NAS04	0.8811	1.86	0.1938	0.2020	Non-Significant Effect
		NAS05	1.242	1.86	0.264	0.1247	Non-Significant Effect
		NAS06	0.5774	1.86	0.1534	0.2898	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.194	2.978	0.8281	No Outliers Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	0.2141224	0.03568706	6	0.9347	0.4859	Non-Significant Effect
Error	1.069062	0.03818078	28			
Total	1.283184	0.07386784	34			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	7.633	16.81	0.2662	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9573		0.1893	Normal Distribution

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID: 12-3541-2939 **Endpoint:** Survival Rate **CETIS Version:** CETISv1.7.0
Analyzed: 13 Dec-10 15:38 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
NAS07 (REF)	5	0.92	0.8783	0.9617	0.8	1	0.02034	0.1095	11.91%	0.0%
NAS01	5	0.76	0.6608	0.8592	0.4	1	0.04842	0.2608	34.31%	17.39%
NAS02	5	0.88	0.8383	0.9217	0.8	1	0.02034	0.1095	12.45%	4.35%
NAS03	5	0.96	0.926	0.994	0.8	1	0.01661	0.08944	9.32%	-4.35%
NAS04	5	0.84	0.7764	0.9036	0.6	1	0.03107	0.1673	19.92%	8.7%
NAS05	5	0.76	0.6608	0.8592	0.4	1	0.04842	0.2608	34.31%	17.39%
NAS06	5	0.88	0.8383	0.9217	0.8	1	0.02034	0.1095	12.45%	4.35%

Angular (Corrected) Transformed Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
NAS07 (REF)	5	1.25	1.2	1.3	1.107	1.345	0.02422	0.1304	10.43%	0.0%
NAS01	5	1.074	0.9636	1.184	0.6847	1.345	0.05375	0.2895	26.96%	14.11%
NAS02	5	1.202	1.153	1.252	1.107	1.345	0.02422	0.1304	10.85%	3.81%
NAS03	5	1.298	1.257	1.338	1.107	1.345	0.01978	0.1065	8.21%	-3.81%
NAS04	5	1.158	1.085	1.232	0.8861	1.345	0.03587	0.1932	16.68%	7.35%
NAS05	5	1.074	0.9636	1.184	0.6847	1.345	0.05375	0.2895	26.96%	14.11%
NAS06	5	1.202	1.153	1.252	1.107	1.345	0.02422	0.1304	10.85%	3.81%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
NAS07 (REF)	1	1	0.8	1	0.8
NAS01	0.6	1	0.4	0.8	1
NAS02	1	0.8	1	0.8	0.8
NAS03	1	0.8	1	1	1
NAS04	0.6	1	0.8	1	0.8
NAS05	0.8	1	0.4	0.6	1
NAS06	0.8	1	1	0.8	0.8

Neanthes Survival and Growth Test — **MACTEC Biology-Toxicology LAB**

Analysis ID:	11-1638-2075	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.7.0
Analyzed:	13 Dec-10 15:37	**Analysis:**	Parametric-Two Sample	**Official Results:**	Yes

Batch ID:	11-9021-9355	**Test Type:**	Survival-Growth	**Analyst:**	
Start Date:	10 Sep-10	**Protocol:**		**Diluent:**	
Ending Date:	01 Oct-10	**Species:**	Neanthes arenaceodentata	**Brine:**	
Duration:	21d 0h	**Source:**		**Age:**	

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
NAS07 (REF)	03-3464-7421	10 Sep-10	10 Sep-10	N/A		
NAS01	11-1046-0661	10 Sep-10	10 Sep-10	N/A		
NAS02	04-1287-5100	10 Sep-10	10 Sep-10	N/A		
NAS03	10-0178-8311	10 Sep-10	10 Sep-10	N/A		
NAS04	17-1619-6284	10 Sep-10	10 Sep-10	N/A		
NAS05	06-1191-8123	10 Sep-10	10 Sep-10	N/A		
NAS06	07-7972-3735	10 Sep-10	10 Sep-10	N/A		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
NAS07 (REF)	Reference sediment	NAS REF (NAS 07)			
NAS01	Sediment	NAS01			
NAS02	Sediment	NAS02			
NAS03	Sediment	NAS03			
NAS04	Sediment	NAS04			
NAS05	Sediment	NAS05			
NAS06	Sediment	NAS06			

Data Transform	Zeta	Alt Hyp	Monte Carlo	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	0	C > T	Not Run					35.8%

Equal Variance t Two-Sample Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	P-Value	Decision(5%)
NAS07 (REF)		NAS01	4.464	1.86	0.3616	0.0011	Significant Effect
		NAS02	-2.247	1.86	0.4882	0.9726	Non-Significant Effect
		NAS03	-3.286	1.86	0.6057	0.9945	Non-Significant Effect
		NAS04	-7.757	1.86	0.7161	1.0000	Non-Significant Effect
		NAS05	-0.8989	1.86	0.9623	0.8025	Non-Significant Effect
		NAS06	-0.389	1.86	0.5488	0.6463	Non-Significant Effect

Auxiliary Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision
Extreme Value	Grubbs Single Outlier	2.992	2.978	0.0470	Outlier Detected

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(5%)
Between	43.42538	7.237564	6	17.96	<0.0001	Significant Effect
Error	11.28514	0.4030408	28			
Total	54.71052	7.640604	34			

ANOVA Assumptions

Attribute	Test	Test Stat	Critical	P-Value	Decision(1%)
Variances	Bartlett Equality of Variance	11.13	16.81	0.0845	Equal Variances
Distribution	Shapiro-Wilk Normality	0.9634		0.2878	Normal Distribution

Neanthes Survival and Growth Test | **MACTEC Biology-Toxicology LAB**

Analysis ID: 11-1638-2075 **Endpoint:** Mean Dry Biomass-mg **CETIS Version:** CETISv1.7.0
Analyzed: 13 Dec-10 15:37 **Analysis:** Parametric-Two Sample **Official Results:** Yes

Mean Dry Biomass-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	Diff%
NAS07 (REF)	5	1.533	1.385	1.681	0.954	1.96	0.07235	0.3896	25.42%	0.0%
NAS01	5	0.6648	0.5914	0.7382	0.484	0.962	0.03585	0.1931	29.04%	56.63%
NAS02	5	2.123	1.956	2.29	1.552	2.656	0.08153	0.4391	20.68%	-38.49%
NAS03	5	2.603	2.369	2.837	1.918	3.358	0.1143	0.6154	23.64%	-69.83%
NAS04	5	4.52	4.228	4.812	3.43	5.484	0.1426	0.7679	16.99%	-194.9%
NAS05	5	1.998	1.584	2.412	0.91	3.722	0.2023	1.09	54.54%	-30.35%
NAS06	5	1.648	1.445	1.85	1.016	2.478	0.09891	0.5327	32.33%	-7.49%

Mean Dry Biomass-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5
NAS07 (REF)	1.712	1.688	1.96	1.35	0.954
NAS01	0.962	0.58	0.548	0.484	0.75
NAS02	2.656	1.81	2.268	2.328	1.552
NAS03	1.918	2.022	3.358	2.918	2.8
NAS04	3.43	4.78	4.166	5.484	4.74
NAS05	3.722	2.248	1.292	0.91	1.818
NAS06	1.016	1.7	1.6	1.444	2.478

EA Engineering, Science,
and Technology, Inc.

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30 December 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Engineering Evaluation/Cost Analysis (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing three original hard copies of the above-referenced Engineering Evaluation/Cost Analysis (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 30 December 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

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21 January 2011

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: Engineering Evaluation/Cost Analysis (Revision 01)
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing three original hard copies of the above-referenced Engineering Evaluation/Cost Analysis (Revision 01) for the above-referenced Task Order. An electronic copy was submitted via email on 21 January 2011.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
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11 February 2011

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: Engineering Evaluation/Cost Analysis (Revision 02)
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing three original hard copies of the above-referenced Engineering Evaluation/Cost Analysis (Revision 02) for the above-referenced Task Order. An electronic copy was submitted via email on 11 February 2011.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 11 February 2011	TRANSMITTAL NO. 00010
TO: **Mr. Gary Miller** **U.S. Environmental Protection Agency Region 6**		FROM: **Al Sloan** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
10.2	Engineering Evaluation/Cost Analysis, Revision 02 Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		3 Hard Copies 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

Engineering Evaluation/Cost Analysis

Non Time Critical Removal Support
Gulfco Marine Maintenance Superfund Site
906 Marlin Avenue
Freeport, Brazoria County, Texas
Contract No. EP-W-06-004
EPA Identification No. TXD055144539

Prepared for

U.S. Environmental Protection Agency
Region 6

1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

Prepared by

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February 2011
Revision: 02
EA Project No. 14342.67

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
AST	Above Ground Storage Tank
AVS/SEM	Acid Volatile Sulfides/Simultaneously Extracted Metals
BCMCD	Brazoria County Mosquito Control Department
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPEC	Constituent of Potential Ecological Concern
DQO	Data Quality Objectives
EA	EA Engineering, Science, and Technology, Inc.
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
GRA	General Response Action
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NFA	No Further Action
NTCRS	Non Time Critical Removal Support
NPL	National Priorities List
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
PAH	Polynuclear Aromatic Hydrocarbons
PBW	Pastor, Behling & Wheeler, LLC
PSCR	Preliminary Site Characterization Report
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
Site	Gulfco Marine Superfund Site
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SOW	Statement of Work
TAC	Texas Administrative Code
TBC	To Be Considered
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
URS	URS Corporation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

ENGINEERING EVALUATION / COST ANALYSIS
Gulfco Marine Maintenance Superfund Site
Non Time Critical Removal Support
Freeport, Brazoria County, Texas

EXECUTIVE SUMMARY

This document presents an engineering evaluation and cost analysis (EE/CA) for select removal alternatives for the North Area of the Gulfco Marine Maintenance Superfund Site (Site) located in Freeport, Texas. EA Engineering, Science, and Technology, Inc. (EA) performed the EE/CA for the U.S. Environmental Protection Agency (EPA) Region 6 as part of Task Order No. 0067-NSEE-06JZ under EPA Contract No. EP-W-06-004, in accordance with a Statement of Work (SOW) issued by EPA (October 2010).

The Site was operated by multiple companies as a barge cleaning and maintenance facility from 1971 to 1999. In May 2003, the EPA named the former Gulfco Marine Maintenance facility to the National Priorities List (NPL). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Identification Number assigned to the Site is TXD055144539. This document focus on the selection of removal action alternatives associated with the former surface impoundments, the North Area surface soils, and North Area Surface Water.

Investigative Activities

Soils, sediments and surface water in the North Areas likely became contaminated with constituents of potential ecological concern (COPECs) due to surface runoff from the former surface impoundment area prior to capping.

The final Potentially Responsible Party (PRP) screening level ecological risk assessment (SLERA) (Pastor, Behling & Wheeler, LLC [PBW] 2010a) identified potential risk to lower-trophic receptors such as soil invertebrates in these upland areas. Surface soil collected in support of the PRP baseline ecological risk assessment (BERA) (in preparation) represents the biologically active zone for soil-dwelling invertebrates. Toxicity tests were conducted on surface soils to assess potential effects to these invertebrates. Sediment and surface water was collected in support of the PRP BERA from the North Area. Toxicity tests were conducted on wetland sediments and surface water to assess potential effects to sediment and surface water dwelling invertebrates.

These analytical results for the PRP BERA soil, sediment, and surface water samples were assessed for overall risk through comparison to literature-based screening values and site-specific toxicity testing of representative receptors to site environmental media. Overall, the data collected in support of the PRP BERA met the data quality objectives (DQO) outlined in the

Final BERA Work Plan & SAP (URS Corporation [URS] 2010b) and are adequate for evaluation and risk characterization in the PRP BERA.

The Streamlined Ecological Risk Evaluation (SERE) in Appendix A focused on further addressing risk from surface soils, sediments, and surface water in the North Area.

Toxicity tests of North Area surface soils to soil invertebrates, represented by the marine polychaete, *N. arenaceodentata,* indicated a difference for growth at one sampling location. Toxicity tests of wetland sediments to sediment dwelling invertebrates, represented by the amphipod, *L. plumulosus,* indicated differences in growth at one location. No differences were observed for survival and growth of N. *arenaceodentata* for the North Area sediment. Acute toxicity to the brine shrimp, *A. salina,* was indicated in one surface water sample from the North Area.

While the results of the site-specific toxicity test indicate the potential for adverse effects to benthic invertebrates, risk is likely overestimated due to the intermittent nature of surface water in the wetlands. Depending on rainfall and tide conditions, many of the areas selected for sediment toxicity analysis can often be completely dry. Significant populations of invertebrates would likely be limited to areas with perennial surface water. While individual effects may be present, it is unlikely that population level effects to growth and survival of invertebrates exist from COPECs in site surface soils, sediments and surface waters.

These findings are similar to those of the EA *Technical Memorandum Ecological and Habitat Health Assessment, Wetlands A, B, and C* (EA 2010) which indicated that observed human impacts to the Site wetland habitats are minor. The Site wetlands are not visually distinguishable from surrounding wetlands in terms of wetland species composition and approximate density, presence of invertebrates, and wildlife usage. These wetlands are providing valuable wetland marsh functions, such as wildlife habitat, food, flood storage, water quality enhancement, and ground water recharge. Any disturbance, such as excavation of sediments or other remedial activities, would require decades for sediments in this area to return to the salty sediment marsh type environment present today.

The Appendix A SERE indicates that no further action is necessary based upon the ecological evaluation.

<u>Surface Impoundment Cap Inspection</u>

Based upon the Technical Memorandum - Surface Impoundment Cap Evaluation for Erosion (EA 2010), the thickness of the clay in the cap is approximately 2.5 to 3.5 feet thick. The clay cap is overlain by a six inch layer of crushed oyster shells as a protective layer. The original clay thickness was supposed to be three feet. Additionally, the cap has ruts from vehicle traffic in the western portion. The majority of the ruts are 3 inches in depth with one rut as much as 6 inches in depth. These ruts appear to be the result of vehicular traffic across the cap. The ruts do not appear to have penetrated the entire thickness of the cap at this time and thus have not compromised the integrity of the cap to date.

Removal Action Alternative Summary

The data presented in the Appendix A SERE along with the site inspections and data collected to evaluate the former surface impoundments cap indicates that repair and rehabilitation of the cap may be warranted to mitigate the potential for the cap to be compromised. To address these concerns about the existing surface impoundment cap, three removal alternatives were identified and evaluated. The three alternatives are:

Alternative # 1 No Further Action (NFA)

Alternative # 2 Repair the ruts in the existing cap and return the clay layer to a minimum thickness of three feet. Cover the clay layer with a six inch protective layer of oyster shell and fence the cap area to control access.

Alternative # 3 Repair the ruts in the existing cap and return the clay layer to a minimum thickness of three feet. Cover the clay layer with 18 inches of top soil and vegetate it as a protective layer and fence the cap area to control access.

A brief description of each alternative is presented in Section 6.1. As the presence of the waste material under the cap will be unchanged, institutional controls (which are currently in place) will remain a part of the recommended alternative.

These three alternatives were evaluated based upon cost, effectiveness and implementability. In the comparative analysis of the three alternatives, Alternative # 3 is the most protective of the alternatives but also the most costly. Alternative # 2 is also protective but does not include the increased protection for the clay layer and is less costly than Alternatives # 3. Alternative # 1 will not be effective in addressing the Remedial Action Objectives (RAOs) of meeting the 1982 Texas Water Commission closure direction and repairing the cap to minimize the potential for waste exposure. The EPA will make the final decision regarding which alternative to implement.

1. INTRODUCTION

This document presents the Engineering Evaluation/Cost Analysis (EE/CA) prepared by EA Engineering, Science, and Technology, Inc. (EA) for the Gulfco Marine Superfund Site (Site) located in Freeport, Brazoria County, Texas. EA performed the EE/CA for the U.S. Environmental Protection Agency (EPA) Region 6 as part of the Non Time Critical Removal Support (NTCRS) Task Order No. 0067-NSEE-06JZ under EPA Contract No. EP-W-06-004, in accordance with a SOW issued by EPA (October 2010).

The Site was operated by multiple companies as a barge cleaning and maintenance facility from 1971 to 1999. In May 2003, the EPA named the former Gulfco Marine Maintenance facility to the National Priorities List (NPL). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Identification Number assigned to the Site is TXD055144539. The purpose of this Task Order was to conduct an engineering evaluation and cost analysis for the planned removal activities and to provide the data necessary to select a remedy that eliminates, reduces, or controls risks to human health and the environment.

The Final Preliminary Site Characterization Report (FPSCR) (URS Corporation [URS], November 2010), the Final Nature and Extent Data Report (Pastor, Behling & Wheeler, LLC [PBW], May 2009), the Final Screening Level Ecological Risk Assessment (SLERA) (PBW, May 2010), and the Streamlined Ecological Risk Evaluation (SERE) (Appendix A) provide the basis for this EE/CA.

1.1 PURPOSE OF REPORT

In this EE/CA, potential remedial alternatives are qualitatively developed and assessed against three evaluation criteria to evaluate the relative merits of each alternative and to help identify the preferred alternative. This document focuses on general response actions associated with the former surface impoundments, the North Area surface soils/sediments and North Area Surface Water. The data presented in the Appendix A SERE, along with the site inspections and data collected to evaluate the former surface impoundments cap, indicates that repair and rehabilitation of the cap may be warranted. As such, an EE/CA identifying remedial alternatives to the cap repair is appropriate. This EE/CA summarizes the removal action objectives, identification of potential removal alternatives, and a detailed evaluation of three alternatives for the cap.

The three criteria to be employed in evaluation of removal alternatives are:

- Effectiveness
- Implementability
- Cost

1.2 REPORT ORGANIZATION

In accordance with the SOW, the following information is included in this EE/CA. A discussion of investigative activities is presented in Section 2. Data analysis is presented in Section 3. Risk Evaluation is presented in Section 4. RAOs are presented in Section 5. Identification and analysis of removal action alternatives is presented in Section 6 and Section 7 presents a comparative analysis of removal alternatives.

1.3 SITE LOCATION AND DESCRIPTION

The site is located in Freeport, Texas at 906 Marlin Avenue (also referred to as County Road 756) (Appendix A - Figure 1). The site consists of approximately 40 acres along the north bank of the Intercoastal Waterway between Oyster Creek (approximately one mile to the east) and the Texas Highway 332 Bridge (approximately one mile to the west). The site includes approximately 1,200 feet of shoreline on the Intercoastal Waterway, the third busiest shipping canal in the United States.

Marlin Avenue divides the site into two primary areas (Appendix A - Figure 2). For the purposes of descriptions in this report, Marlin Avenue is approximated to run due west to east. The property north of Marlin Avenue (the North Area) consists of undeveloped land and closed surface impoundments, while the property south of Marlin Avenue (the South Area) was developed for industrial uses with multiple structures, a dry dock, an above ground storage tank (AST) farm, and two barge slips connected to the Intercoastal Waterway.

Adjacent property to the north, west, and east of the North Area is undeveloped. Adjacent property to the east of the South Area is currently used for industrial purposes while to the west the property is currently vacant and previously served as a commercial marina. The Intercoastal Waterway bounds the site to the south. Residential areas are located south of Marlin Avenue, approximately 300 feet west of the site, and 1,000 feet east of the site.

Some of the North Area is upland created from dredge spoil, but most of this area is considered wetlands, as per the United States Fish and Wildlife Service (USFWS) Wetlands Inventory Map (USFWS, 2008). The most significant surface features in the North Area are two ponds (the Fresh Water Pond and the Small Pond) and the closed former surface impoundments (Appendix A - Figure 2). The former surface impoundments and the former parking area south of the impoundments and Marlin Avenue comprise the vast majority of the upland area within the North Area. An area of buried debris is also present immediately south of the capped surface impoundments.

Field observations during the Remedial Investigation indicate the North Area wetlands are irregularly flooded with nearly all of the wetland area inundated by surface water that can accumulate to a depth of one foot or more during extreme high tide conditions, storm surge events (such as hurricanes), and/or in conjunction with surface flooding of Oyster Creek northeast of the site. Due to very low topographic slope and low permeability surface sediments, the wetlands are also very poorly draining and can retain surface water after major rainfall events. Under normal tide conditions and during periods of normal or below normal rainfall,

standing water within the wetlands (outside of the two identified ponds discussed below) is typically limited to a small, irregularly shaped area immediately north of the Fresh Water Pond and similar areas south and southeast of the former surface impoundments. Depending on rainfall and tide conditions, these areas can often be completely dry. As such, given the absence of any appreciable area of perennial standing water, the wetlands are effectively hydrologically isolated from Oyster Creek, except during intermittent, and typically brief, flooding events.

Water in the Fresh Water Pond is approximately 4 to 4.5 feet deep and is relatively brackish (PBW, 2009). This pond appears to be a borrow pit created by the excavation of soil and sediment as suggested by the well-defined pond boundaries and relatively stable water levels. Water levels in the Fresh Water Pond are not influenced by periodic extreme tidal fluctuations as the pond dikes preclude tidal floodwaters in the wetlands from entering the pond, except for extreme storm surge events.

The small irregularly shaped area immediately north of the Fresh Water Pond is a salt panne, a shallow depression that retains seawater for short periods of time such that salt accumulates to high levels over multiple tidal cycles.

The Small Pond is a very shallow depression located in the eastern corner of the North Area. The Small Pond is not influenced by daily tidal fluctuations and behaves in a manner consistent with the surrounding wetland (*i.e.*, becomes dry during dry weather, but retains water in response to and following rainfall and extreme tidal events). The Small Pond is also indicative of a salt panne.

Aerial spraying of the wetland areas north of Marlin Avenue, including the North Area, for mosquito control has historically been and continues to be performed by the Brazoria County Mosquito Control District and its predecessor agency, the Brazoria County Mosquito Control Department (both referred to hereafter as BCMCD). Aerial spraying for mosquito control has been performed from altitudes of 50 to 100 feet (Lake Jackson News, 1957)(PBW 2010c). Recently, BCMCD has been using Dibrom©, and organophosphate insecticide, with a diesel fuel carrier through a fogging atomizer application (Facts, 2006, 2008a, 2008b), as well as other compounds such as Scourge™, Kontrol 30-30, and Fyfanon® (personal communication between Gary Miller [USEPA] and Fran Henderson [BCMCD]). Truck-based spraying has also been performed along Marlin Avenue. Both types of spraying were observed during the performance of site Remedial Investigation activities.

2. INVESTIGATIVE ACTIVITIES

Multiple phases of investigation have been completed as part of the remedial investigation. Most recently, sediment and surface water, and Intercoastal Waterway sediment samples were collected in support of the PRP BERA. The following section presents a summary of the data pertinent to the development of the EE/CA.

2.1 TERRESTRIAL ENVIRONMENT

Investigation of site terrestrial areas was limited to the upland regions in the North Area including the former surface impoundments and the area south of the former impoundment. Soils in these areas likely became contaminated with constituents of potential ecological concern (COPECs) due to surface runoff from the former surface impoundment area prior to capping. The final PRP SLERA identified potential risk to lower-trophic receptors such as soil invertebrates in these upland areas. Media collected in support of the PRP BERA included surface soils (0-6 inches below ground surface [bgs]), which represents the biologically active zone for soil-dwelling invertebrates. Toxicity tests were also conducted on surface soils to assess potential effects to these invertebrates. The analytical data for each sample are presented in Appendix A of the *Final Preliminary Site Characterization Report* (FPSCR) (PBW, 2010) and are summarized in Appendix A - Table 1 of the SERE.

2.1.1 North Area Surface Soil Sample Collection and Analysis

A total of six surface soil samples were collected (0-6 inches bgs) from the North Area. Five samples (NAS01 to NAS05) were collected in the area south of the former surface impoundment area, and one sample (NAS06) was collected in the northwest corner of the former surface impoundment area (Appendix A - Figure 3a). An additional three samples, NAS07, NAS08, and NAS09, were collected in the soil reference area approximately 2000 ft east of the site (Appendix A - Figure 3b).

All samples were analyzed for the following metals identified as COPECs in previous steps of the risk assessment process:

- Barium
- Chromium
- Copper, and
- Zinc

In addition, 3 of the 6 soil samples from the North Area (NAS02, NAS03, and NAS05) were analyzed for 4,4'-DDT and Aroclor-1254 (see Appendix A SERE).

2.1.2 North Area Surface Soil Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted on the six surface soil samples collected from the North Area and the three reference samples to evaluate direct toxicity to soil-dwelling invertebrates. A 28-day earthworm (*Eisenia fetida*) chronic bioassay was originally proposed in the *Final BERA Work Plan and SAP* (URS, 2010b); however, elevated salinity in the surface soil samples made use of the earthworm problematic. When earthworms were introduced to the North Area soil samples there was an immediate avoidance reaction followed by acute mortality in all of the site and background samples. The elevated salinity levels are believed to be due to frequent inundation of estuarine during storm events. Also, much of the soil was originally dredge spoils from the Intercoastal Waterway, which was used as a fill material.

An alternative to the earthworm bioassays was developed following discussion and agreement by the USEPA. This alternative treated the soils samples as sediments by adding synthetic seawater and exposing the marine polychaetous annelid, *Neanthes arenaceodentata*, to a 21-day bioassay to assess growth and survival. Polychaetes are more taxonomically similar to and occupy a similar feeding guild to earthworms. The North Area soil toxicity testing was conducted from September 10 through October 1, 2010.

2.2 AQUATIC ENVIRONMENT

Investigation of site aquatic areas includes the wetland areas of the North Area. Media (sediments and surface water) in these areas likely became contaminated with COPECs from direct discharge from barge cleaning operations, surface runoff, and flooding mechanisms. The final PRP SLERA identified potential risk to sediment and surface water dwelling invertebrates. Media collected in support of the PRP BERA included bulk sediments (0-6 inches bgs) and surface water from the North Area wetlands. Sediment pore water was also extracted from bulk sediments. The analytical data for each sample are presented in Appendix A of the PSCR and are summarized in Appendix A - Table 2 to Table 4 of the SERE.

2.2.1 North Area Wetland Bulk Sediment Sample Collection and Analysis

A total of seven bulk sediment samples were collected (0-6 bgs) from the North Area wetlands. Five samples (EWSED03 to EWSED07) were collected in the wetland areas south of the former surface impoundment area, and two samples (EWSED01 and EWSED02) were collected north of the Fresh Water Pond (Appendix A - Figure 4). An additional two samples, EWSED08 and EWSED09, were collected in the sediment reference area north of the site and west of the former surface impoundments (Appendix A - Figure 4).

All samples were analyzed for the following parameters identified as COPECs in previous steps of the risk assessment process:

- Polycyclic Aromatic Hydrocarbons (PAHs): 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene
- Pesticides: 4,4'-DDT, endrin aldehyde, endrin ketone, gamma-chlordane
- Metals: arsenic, copper, lead, nickel, zinc
- Acid Volatile Sulfides/Simultaneously Extracted Metals (AVS/SEM)
- Grain size analysis

In addition to the bulk sediment samples, pore water was extracted and analyzed for COPECs for all but one sediment sample (EWSED05). This sample was too dry to extract pore water. These data are presented in Appendix A SERE.

2.2.2 North Area Wetland Bulk Sediment Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted on the seven site sediment samples collected from the North Area and the two reference samples to evaluate direct toxicity to sediment-dwelling invertebrates. Two 28-day chronic bioassays were conducted using the amphipod, *Leptocheirus plumulosus*, and the polychaete, *Neanthes arenaceodentata*. Both organisms were selected for toxicity testing because both are representative of common species found along the Texas gulf coast, are sensitive to site COPECs, and are tolerant to a wide range of sediment and salinity conditions. Study endpoints of growth, mortality, and reproduction were measured for the *Leptocheirus* bioassay, while only the growth endpoint (with mortality data used to assist in the calculations) was used for the *Neanthes* bioassay.

2.2.3 North Area Wetland Surface Water Sample Collection and Analysis

A total of three surface water samples were collected from the North Area wetlands. One sample (EWSW01) was collected in the area north of the Fresh Water pond. One sample (EWSW03) was collected in the small, irregularly shaped waterbody south of the former surface impoundment, and one sample (EWSW04) was collected from the near the Small Pond (Appendix A - Figure 5). Surface water was not present at the reference location (EWSW02), no analysis could be performed.

All surface water samples were analyzed for the following parameters identified as COPECs in previous steps of the risk assessment process:

- Acrolein (EWSW01 only)
- Dissolved copper
- Dissolved nickel
- Dissolved silver
- Dissolved zinc

2.2.4 North Area Wetland Surface Water Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted on the three site surface water samples collected from the North Area to evaluate direct toxicity to surface water-dwelling invertebrates. A 7-day chronic bioassay analysis that measured the survival and growth of the mysid shrimp, *Mysidopsis bahia,* was originally proposed in the *Final BERA Work Plan & SAP* (URS, 2010b); however, elevated salinity in the surface water samples from the salt panne areas (40% salinity at EWSW01 and 39% at EWSW04) made use of this test organism problematic.

An alternative to the mysid shrimp bioassays was developed following discussion and agreement by the USEPA. This alternative used the brine shrimp (*Artemia salina*), which is better suited to high salinities. Furthermore, since *A. salina* is typically more sensitive to environmental contaminants than fish, toxicity data should be protective of the fish community. No standards have been established for toxicity testing conducted on brine shrimp and a standard operating procedure (SOP) was developed by the analytical lab by referencing SOPs available for determining toxicity to produced (oil field) waters. The test protocol was shortened from 7 days

to 96 hours and measured acute mortality of the organisms as the test endpoint. The shortened test period would likely be more representative of the intermittent nature of the surface water being evaluated in the North Area wetlands.

Surface water toxicity tests were conducted three times between September 16 and October 3, 2010 due to several factors including an incorrect food source being used for the test organism and control failures.

2.3 CAP ASSESSMENT

In addition to the supplemental investigative activities detailed above, an evaluation of the cap installed above the former surface impoundments was also performed. The evaluation of the cap was necessary to evaluate the continued effectiveness of this remedy. The surface impoundments were closed under the Texas Water Commission's (Texas Commission on Environmental Quality [TCEQ] predecessor agency) direction in 1982 (PBW, 2010). There is currently no formal operation and maintenance (O&M) program in place. Visual inspections along with samples of surface impoundment cap have been performed by PBW (PBW, May 2009) and EA. The most recent inspection and data collection effort was performed in December 2010. Information regarding this data collection effort was reported in the Technical Memorandum – Surface Impoundment Cap Evaluation for Erosion (EA, December 2010). Soil data collected from the additional borings taken in December 2010 are in Table 1.

The following presents a summary of the available information regarding the current status of the cap:

- The upper surface of the cap consists of crushed shells (approximately six inches in thickness).
- The oyster shell cover seems to have protected the clay layer from erosion during storm events as there are no obvious signs of erosion.
- Cap vegetation consists of mostly volunteer grasses with some brush. The majority of the brush is located along the perimeter of the cap with isolated patches within the interior portions of the cap.
- Access to the cap is not controlled.
- The cap clay layer has been documented to be generally 2.5 to 3.5 feet thick (PBW, May 2009).
- Rutting is present along the western portion of the cap. These ruts are due to vehicular traffic. The ruts are generally no more than 3 inches in depth with one location found to be approximately 6 inches deep.

The ruts do not appear to have penetrated the entire thickness of the cap at this time and do not seemed to have compromised the integrity of the cap to date. It is not known if the rutting could lead to exposure of waste.

3. DATA ANALYSIS

The following section presents a discussion of the data used to support the EE/CA. The data used was collected by both EA (for the cap and borrow pit evaluation) and URS (for the PRP Baseline Ecological Risk Assessment (BERA). The SERE prepared as part of the NTCRS Task Order (EA 2010) is included as Appendix A, and includes data from toxicity studies that are not included in any PRP reports to date. The nature and extent of the contaminants of interest (COIs) was presented in the PBW, May 2009. For the purpose of this document, information regarding the nature and extent of contamination deemed relevant for preparation of the EE/CA is summarized below.

3.1 CAP DATA

As previously stated, the Cap material has been evaluated on several occasions and presented in Section 2.3. A consolidated summary of this information is included in Table 1. The cap could benefit from some repair and rehabilitation.

3.2 ECOLOGICAL DATA SUMMARY

The Appendix A SERE focused on further addressing risk from surface soils and sediments in the North Area and surface waters in the North Area wetlands. Potential risk was evaluated through the additional data analysis.

Toxicity tests of North Area surface soils to soil invertebrates, represented by the marine polychaete, *N. arenaceodentata,* indicated a difference for growth at one sampling location. Toxicity tests of wetland sediments to sediment dwelling invertebrates, represented by the amphipod, *L. plumulosus,* indicated differences in growth at one location. No significant differences were observed for survival and growth of N. *arenaceodentata* for the North Area sediment. Acute toxicity to the brine shrimp, *A. salina,* was indicated in one surface water sample from the North Area.

While the results of the site-specific toxicity test indicate the potential for adverse effects to benthic invertebrates, risk is likely overestimated due to the intermittent nature of surface water in the wetlands. Depending on rainfall and tide conditions, many of the areas selected for sediment toxicity analysis can often be completely dry. Significant populations of invertebrates would likely be limited to areas with perennial surface water. While individual effects may be present, it is unlikely that population level effects to growth and survival of invertebrates exist from COPECs in site surface soils, sediments and surface waters.

These findings are similar to those of the EA *Technical Memorandum Ecological and Habitat Health Assessment, Wetlands A, B, and C* (EA 2010) which indicated that observed human impacts to the Site wetland habitats are minor. The Site wetlands are not visually distinguishable from surrounding wetlands in terms of wetland species composition and approximate density, presence of invertebrates, and wildlife usage. These wetlands are providing valuable wetland marsh functions, such as wildlife habitat, food, flood storage, water quality enhancement, and ground water recharge. Any disturbance, such as excavation of sediments or other remedial

activities, would require decades for sediments in this area to return to the salty sediment marsh type environment present today.

4. RISK EVALUATION

The following section presents a summary of the risk assessments performed for the site. Both human health and ecological receptors were considered. The PRP Final Baseline Human Health Risk Assessment (BHHRA) (PBW 2010a) presented a detailed summary of the human health risks. Conclusions from the PRP Final BHHRA indicated there were not unacceptable cancer risks nor non-cancer hazard indices for any of the five current or future exposure scenarios except for future exposure to an indoor industrial worker if a building is constructed over impacted ground water. The ecological risk evaluation presented in the Appendix A SERE concluded the saltwater marsh area is a sensitive marsh sediment habitat created by years of temporary inundation by saltwater. Any disturbance of surficial sediments would require decades for sediments in this area to return to the salty sediment marsh type environment present today. This fact, along with the data presented in the Appendix A SERE, suggests that response actions for the risk associated with direct contact to invertebrates in the soil, sediments, and surface water is not warranted.

5. REMOVAL ACTION OBJECTIVES

According to the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] §300.430[a][1][I]), the goal of the remedy selection process is "to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste." RAOs are medium-specific (e.g., soil or ground water) goals that address the requirements for protecting the human health and the environment (USEPA, 1988). In addition, Site actions must comply with Applicable or Relevant and Appropriate Requirements (ARARs) relating to each action taken.

5.1 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

As discussed in Section 2.3, existing site conditions indicate the need for some sort of repair to the cap in the form of a removal action to maintain protection over time. The RAOs are typically developed for exposure pathways posing an unacceptable risk. RAOs were identified for the Former Surface Impoundments to maintain protection over time.

5.1.1 Former Surface Impoundments

As evidenced by the data from the cap investigations and the requirements set forth in the TCEQ Technical Guideline No. 3 (TCEQ, June 2009), the cap material is of sufficient vertical hydraulic conductivity but does not meet the criteria set forth in the 1982 Texas Water Commission's closure direction, for clay layer thickness. Additionally the rutting on the western portion of the cap needs repair. Based on this information, the RAOs for this area are: (1) Repair the cap to

minimize the potential for waste exposure; and (2) restore the thickness of the clay layer to three feet.

5.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are federal and state environmental laws and regulations that specify clean-up levels or performance standards for CERCLA sites.

Section 121(d) of CERCLA, as amended by Superfund Amendments and Reauthorization Act, states that on-site remedial actions must attain ARARs. ARARs may include regulations, standards, criteria, or limitations promulgated under federal or state laws. An ARAR may be either "applicable" or "relevant and appropriate," but not both. The NCP in 40 CFR §300 defines ARARs (EPA, 1994).

Three categories of ARARs exist: chemical-, location-, and action-specific requirements. Chemical-specific ARARs are health- or risk-based numerical values or methodologies that, when applied to site-specific conditions, result in the establishment of numerical clean-up values. These values establish the acceptable amount or concentration of a chemical that may be detected in or discharged to the ambient environment. Location-specific ARARs are restrictions on the concentrations of hazardous substances or on activities conducted at the Site that result from site characteristics or its immediate environment. For example, location of the Site or proposed remedial action in a flood plain, wetland, historic place, or sensitive ecosystem may trigger location-specific ARARs. Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken. These requirements are triggered by the specific remedial activities selected. Action-specific ARARs do not in themselves determine the remedial alternative; rather, they indicate how an alternative must be conducted (EPA, 1994).

In addition to the legally binding requirements established as ARARs, many federal and state programs have developed criteria, advisories, guidelines, or proposed "To Be Considered" (TBC) standards. TBC material may provide useful information or recommend procedures if no ARAR addresses a particular situation or if existing ARARs do not provide protection. In such situations, TBC criteria or guidelines should be used to set remedial action levels. TBC criteria are not legally binding and do not have the status of ARARs.

Chemical-, location-, and action-specific ARARs for the remedial alternatives are listed below.

<u>Federal Chemical-Specific ARARs</u>

- Clean Water Act (33 USC Section 1251-1376)
    - 40 CFR Part 131 (Water Quality Criteria) – Sets criteria for ambient water quality on the basis of toxicity to aquatic organisms and human health.
    - 40 CFR Part 136 (EPA Guidelines Establishing Test Procedures for the Analysis of Pollutants) – Establish EPA regulations on test procedures for the analysis of pollutants
- Resource Conservation and Recovery Act (RCRA) (42 USC 6905, 6912, 6924, 6925)

- 40 CFR Part 261 (Identification and Listing of Hazardous Waste) – Defines those solid wastes that are subject to regulation as hazardous waste under 40 CFR Parts 262-265 and Parts 124, 270, and 271.

Federal Action-Specific ARARs

- 40 CFR 264.228 – Surface Impoundments – Provides criteria for closure and post-closure care

State of Texas Action-Specific ARARs

- Title 30 Texas Administrative Code (TAC) Chapter 111 - Requires that all reasonable precautions shall be taken to prevent particulate matter from becoming airborne, including use of water or chemicals for control of dust. Applicable during site excavation activities.
- Title 31 TAC Chapter 501 Subchapter B 501.23 – Policies for development in critical areas.
- Texas Commission on Environmental Quality – Industrial Solid Waste Management, Technical Guideline No. 3 – Sets forth requirements for landfill cover design.
- Title 30 TAC Chapter 335, Subchapter F – Sets forth specific requirements for industrial hazardous waste landfills.
- Title 30 TAC Chapter 335, Subchapter T – Sets forth specific requirements for commercial industrial nonhazardous waste landfills.
- Title 30 TAC Chapter 335, Subchapter O – Land Disposal Restriction standards for the disposal of hazardous wastes.

Federal Chemical-Specific Potential ARARs

- Clean Air Act (42 USC Section 7401-7642)
  - 40 CFR Part 50 (National Primary and Secondary Ambient Air Quality Standards)–Establish standards for ambient air to protect public health and welfare (including standards for particulate matter and lead).
- Resource Conservation and Recovery Act (RCRA) (42 USC 6905, 6912, 6924, 6925)
  - 40 CFR Part 264 (RCRA Ground Water Protection) – Provides for ground water protection standards, general monitoring requirements, and technical requirements.
  - 40 CFR Part 257.3-4 (RCRA Solid Waste Disposal Facility Requirements)- Provides for protection of ground water at solid waste disposal facilities.

Federal Chemical- and Action-Specific Potential ARARs

- RCRA (42 USC 6905, 6912, 6924, 6925)
  - 40 CFR Part 268 (Land Disposal Restrictions) – Establish a timetable for restriction of burial of wastes and other hazardous materials.

Federal Action-Specific Potential ARARs

- RCRA (42 USC Sections 6901-6987)
  - 40 CFR Part 257 (Criteria for Classification of Solid Waste Disposal Facilities and Practices) – Establish criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health, and thereby constitute prohibited open dumps.
- Hazardous Materials Transportation Act (49 USC Sections 1801-1813)
  - 49 CFR Parts 107, 171-177 (Hazardous Materials Transportation Regulations) – Regulate transportation of hazardous materials.

Federal Location-Specific Potential ARARs

- Fish and Wildlife Coordination Act (16 USC Sections 661-666) – Requires consultation when a federal department or agency proposes or authorizes any modification of any stream or other body of water and adequate provision for protection of fish and wildlife resources.
- Endangered Species Act of 1973 (16 USC 1531-1544) – Provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife and plants depend.
- Clean Water Act (33 USC Section 1251-1376) – Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into waters of the United States.

State of Texas Chemical-Specific Potential ARARs

Title 30 TAC Chapter 307 – Establishes limits for constituents for the protection of surface water quality.

State of Texas TBCs

- Texas Risk Reduction Program (TRRP) Title 30 Chapter 350 – Establishes the TCEQ's minimum remediation standards for present and past uncontrolled constituent releases using risk evaluation to determine if corrective action is necessary.

Federal Potential TBCs

- EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9347.3-06FS – Guidance in establishing cleanup goals dealing with treatment levels for contaminated soil and sediment.
- Final Guidance, Superfund Removal Guidance for Preparing Action Memoranda, September 2009.
- Federal Ambient Water Quality Criteria – Establish protection of aquatic organisms and human health from contaminated sediment.

6. IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section presents a list of potential alternatives and then evaluates the alternatives against the criteria. This is used to discuss the merits of each alternative.

6.1 APPLICABLE REMOVAL ALTERNATIVES

This section presents a list of removal alternatives potentially applicable to remediation of the impacted soils/sediments at the former surface impoundment area in Lot 56. Figure 1 shows the current topography of the closed former surface impoundment area in Lot 56.

In general, the alternatives fit into one or more category of general response actions (GRA). GRAs are generic, medium-specific, remedial actions that will satisfy the RAOs discussed earlier. GRAs may include no action, institutional controls, containment, removal, treatment, disposal, monitoring, or a combination thereof (EPA, 1988). The development of remedial alternatives begins with the identification of GRAs that can meet RAOs, which are then screened and developed into remedial alternatives to address all contaminated media at the Site. Alternatives for the remediation of soil will fall into GRAs No Further Action (NFA), institutional controls, containment, removal, and treatment. All alternatives deal with the former surface impoundment area shown on Figure 1.

The following three alternatives were considered.

Alternative # 1 No Further Action (NFA).

Alternative # 2 Repair the ruts in the existing cap and return the clay layer to a minimum thickness of three feet. Cover the clay layer with a six inch protective layer of oyster shell and fence the cap area to control access (Containment).

Alternative # 3 Repair the ruts in the existing cap and return the clay layer to a minimum thickness of three feet. Cover the clay layer with 18 inches of top soil and vegetate it as a protective layer and fence the cap area to control access (Containment).

A brief description of each alternative is presented below. As the presence of the waste material under the cap will be unchanged, institutional controls will be required to remain a part of each of the recommended alternatives.

6.1.1 Alternative # 1

As required by the NCP (40 CFR § 300.430 [e] [6]), remedial alternatives must include the NFA alternative to be used as the baseline alternative against which the effectiveness of all other remedial alternatives are judged. The NFA alternative may not be effective in addressing the RAOs for the Site, but is retained per NCP requirement for future evaluation to provide a baseline for comparison against other technologies. At present there are institutional controls in the form of Restrictive Covenants on Lots 55, 56, and 57, executed in July of 2009. The

covenants restrict the use of the property to commercial/industrial use and allow no human habitation. The covenant also restricts use of ground water for any purpose. The EPA and TCEQ must approve of any plans to construct a building on any of the Lots.

6.1.2 Alternative # 2

Implementation of the second alternative would include repairing the rutted areas of the existing cap. The rehabilitation of the surface impoundment cap would include removal of the oyster shells that lie on top of the cap, the addition of approximately 0.5 feet of additional clay material to bring the minimum thickness of the clay layer up to three feet to meet the 1982 Texas Water Commission's directive and install approximately six inches of oyster shell as a protective layer. A three wire barbed fence would then be installed at the toe of the cap around the entire perimeter to control access with an access gate on the south side. An operations and maintenance program would also be implemented to maintain the cap.

6.1.3 Alternative # 3

Implementation of the third alternative would include repairing the rutted areas of the existing cap. The rehabilitation of the surface impoundment cap would include removal of the oyster shells that lie on top of the cap, the addition of approximately 0.5 feet of additional clay material to bring the minimum thickness of the clay layer up to three feet to meet the 1982 Texas Water Commission's directive and install approximately 18 inches of topsoil. The surface of the cap would then be seeded to provide vegetative cover for the cap. A three wire barbed fence would then be installed at the toe of the cap around the entire perimeter to control access with an access gate on the south side. An operations and maintenance program would also be implemented to maintain the cap.

6.2 ALTERNATIVE EVALUATION

Three criteria (effectiveness, implementability, and cost) were used to evaluate remedial alternatives. Definitions for these evaluation criteria are presented below, and the results of the evaluation are summarized on Table 2.

6.2.1 Effectiveness

This criterion is a measure of the ability of an option to: (1) reduce toxicity, mobility, or volume; (2) minimize residual risks; (3) afford long-term protection; (4) comply with ARARs; (5) minimize short-term impacts; and (6) achieve protectiveness in a limited duration. Alternatives that offer significantly less effectiveness than other proposed technologies may be eliminated from the alternative development process. Options that do not provide adequate protection of human health and the environment likewise are eliminated from further consideration.

6.2.2 Implementability

Implementability is a measure of the technical feasibility and availability of the option and the administrative feasibility of implementing it (e.g., obtaining permits for off-site activities, rights-

of-way, or construction). Options that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period may be eliminated from further consideration.

6.2.3 Cost

Qualitative relative costs for implementing the remedy are considered. Alternatives that cost more to implement, but offer no benefit in effectiveness or implementability over other technologies, may be excluded from the alternative development process.

6.3 ALTERNATIVE EVALUATION SUMMARY

The results of the alternative evaluation are summarized in Table 2. Each of the three alternatives discussed above have been retained for further evaluation. The alternatives are subjected to further analysis in Section 7.0.

7. COMPARATIVE ANALYSIS OF REMOVAL ALTERNATIVES

This section evaluates the remedial alternatives presented in Section 6 using the three criteria mentioned previously: 1) Effectiveness, 2) Implementability, and 3) Cost. The comparison criteria and evaluation process are discussed below and Table 2 presents the evaluation of the three remedial alternatives.

7.1 COMPARATIVE ANALYSIS

Each alternative is evaluated in terms of risk that remains at the Site after the RAO has been met. The primary focus of this evaluation is the extent and effectiveness of controls used to manage the risk posed by treatment residuals or untreated wastes.

7.1.1 Effectiveness

The following factors will be considered in evaluating this criterion:

- Adequacy of remedial controls
- Reliability of remedial controls
- Magnitude of the residual risk

Alternative # 1

Since this alternative consists of no action, this alternative may not be effective at addressing the potential risk for release of contaminants if the surface impoundment cap is not repaired or maintained. This alternative is used as a reference for the remaining alternatives.

Alternative # 2

Alternative # 2 consists of repairing and rehabilitating the existing surface impoundment cap. This alternative will reduce the risks posed by the potential for a breach of the cap and control access. This alternative will be more effective than Alternative # 1.

Alternative # 3

Alternative # 3 consists of repairing and rehabilitating the cap and installing thicker vegetated cover. This alternative will reduce the risks posed by the potential for a breach of the cap. Additionally, this alternative will be more protective of the clay layer and control access. This alternative will be more effective than Alternative # 1, however the soil cover will be more susceptible to erosion before it is fully vegetated and during storm events may not be as effective as Alternative # 2 in controlling erosion in the long term.

7.1.2 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials that may be required during its implementation. The following factors were considered:

- Ability to construct the technology
- Monitoring requirements
- Availability of equipment and specialists
- Ability to obtain approvals from regulatory agencies

For each of the three alternatives, standard earth-moving equipment such as dozer and excavator are necessary to implement the alternative. Locating a borrow source with sufficient clay material for the cap would be the most challenging task. Each alternative would be implementable.

7.1.3 Cost

The cost for each alternative is calculated from estimates of capital and operation and maintenance (O&M) costs. Capital costs consist of direct and indirect costs. Direct costs include the purchase of equipment, labor, and materials necessary to implement the alternative. Indirect costs include engineering, financial, and other services such as testing and monitoring. Annual O&M costs for each alternative include operating labor, maintenance materials and labor, auxiliary materials, and energy. For the alternatives described herein, the O&M costs would consist of costs for cap maintenance.

The cost estimate is normally expected to fall within the range of 50 percent above to 30 percent below the actual project cost (accuracy of + 50% and – 30 %). Cost estimates for remediation alternatives are presented in Tables 3 and 4 and are summarized below.

Alternative	Annualized Cost + 50% - - 30%
1	$0
2	(b) (4) [redacted]
3	(b) (4) [redacted]

The evaluation of the three alternatives is summarized in Table 2. The EPA will make the decision as to which alternative to implement.

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Tables

Table 1
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SUMMARY OF CAP INVESTIGATION DATA
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Boring Location	Cap Material Description	Observed Cap Thickness (feet)	Liquid Limit (2) (%)	Plastic Limit (2) (%)	Plasticity Index (2) (%)	Percent Passing # 200 Sieve (3) (%)	Moisture Content (4) (%)	Vertical Hydraulic Conductivity (5) (cm/sec)
PBW Investigation - 2009								
ND1GT01	Sandy Lean Clay	2.9	48	16	32	70	20	3.5×10^{-8}
ND2GT02	Lean Clay with Sand	>3.5	49	14	35	84	23	1.4×10^{-8}
NE1GT03	Lean Clay with Sand	2.5	49	13	35	74	19	5.0×10^{-9}
NE2GT04	Fat Clay	3.6	58	15	43	88	26	5.9×10^{-9}
EA Investigation - December 2010								**Vertical Hydraulic Conductivity (6) (cm/sec)**
South Cap Boring	Light Brown Clay	--	--	--	--	--	25	4.4×10^{-9}
Central Cap Boring	Brown Clay	--	--	--	--	--	25	5.6×10^{-9}
West Cap Boring	Tan Clay	--	--	--	--	--	25	4.3×10^{-9}
TCEQ Technical Guideline No. 3 Recommended Value/Range			--	--	10-35	> 20	--	$< 1.0 \times 10^{-7}$

Notes:
1) Crushed oyster shell surface observed above clay cap at all boring locations - PBW 2009, EA 2010.
2) ASTM Method D 4318
3) ASTM Method D 1140
4) ASTM Method D 2216
5) US Army Corp of Engineers, Engineering Manual Method 1110-2-1906
6) ASTM-D 5084

TABLE 2
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REMOVAL ALTERNATIVE EVALUATION
GULFCO MARINE MAINTENANCE SUPERFUND SITE

General Response Action	Alternative #	Components	Brief Description	Effectiveness	Implementability	Cost	Status
No Action	1	No Action	No action	Not effective in addressing RAOs	Implementable	Low	Retained
Containment	2	Repair Existing Surface Impoundment Cap Return to Original Specifications, Perimeter Fence.	Address the potential risk for breaching of the existing surface impoundment cap due to existing ruts and access.	Would be effective in reducing risks associated with the existing surface impoundment cap and controls access.	Implementable - cap maintenance will need to be performed for life of the cap.	Moderate	Retained
Containment	3	Repair Existing Surface Impoundment Cap Return to Original Specifications Install Topsoil and Vegetative Cover, Perimeter Fence.	Address the potential risk for breaching of the existing surface impoundment cap, provides more protection for the clay by increasing top cover thickness and access.	Would be effective in reducing risks associated with the existing surface impoundment cap and provides additional protection that will aid in maintenance costs and controls access.	Implementable - cap maintenance will need to be performed for life of the cap.	Moderate	Retained

Table 3 - COST ESTIMATE - ALTERNATIVE # 2

Gulfco Marine Maintenance Superfund Site

Site: Gulfco Marine Maintenance
Location: Freeport, Brazoria County, Texas
Base Year: 2010
Date: January 14, 2011

Description: Perform Upgrade to the Cap. Includes 5 years cap maintenance.

Assumptions: Upgrades to the cap will include removing the approximately 0.5' layer of oyster shells on top of the cap, installing an additional 0.5- foot layer of clay material, placing 0.5' of oyster shells on cap and installing a 3-wire fence around former surface impoundment at toe.

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES	PRESENT VALUE AT 7%
CAPITAL COSTS						
REMEDIAL DESIGN						
Remedial Design						
Remedial Design	[redacted]	LS	$ [redacted]	$ [redacted]	Professional estimate (8% of Site Preparation and Cap Upgrade Construction)	
REMEDIAL DESIGN SUBTOTAL				**$**		**$** [redacted]
SITE PREPARATION						
Site Prep						
Erosion Control Plan Development & Submittals	[redacted]	LS	$ [redacted]	$ [redacted]	Professional estimate	
Site Survey/Utility Locate	[redacted]	acres	$ [redacted]	$ [redacted]	RS Means *2005 Environmental Remediation Cost Data*	
Erosion Control Implementation - Silt Fencing	[redacted]	ft	$ [redacted]	$ [redacted]	Professional estimate	
Construct Decon Station for Trucks and Heavy Equipment	[redacted]	LS	$ [redacted]	$ [redacted]	Professional estimate	
Equipment Delivery	[redacted]	each	$ [redacted]	$ [redacted]	Professional estimate	
Miscellaneous Materials	[redacted]	each	$ [redacted]	$ [redacted]	Professional estimate	
Wheel Loader	[redacted]	days	$ [redacted]	$ [redacted]	Hertz equipment rental	
Pickup Trucks (2)	[redacted]	days	$ [redacted]	$ [redacted]	Professional estimate	
Labor						
Site Superintendent	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
QA Officer	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Operator (2)	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Technician	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Site Safety and Health Officer	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Per Diem	[redacted]	days	$ [redacted]	$ [redacted]	Professional estimate	
Site Prep Subtotal	[redacted]		[redacted]	**$** [redacted]		
Professional Services, Project Management, and Fees						
Legal Fees for Institutional Controls and Deed	[redacted]	LS	$ [redacted]	$ [redacted]		
Project management	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Pollution Liability Insurance	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Payment and performance bond	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Construction/program management	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Undefined scope and market allowance	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Professional Services, Project Management, and Fees Subtotal	[redacted]		[redacted]	**$** [redacted]		
SITE PREPARATION SUBTOTAL				**$**		**$** [redacted]
CAP UPGRADE AND FIELD OVERSIGHT						
Heavy Equipment Rental for Installation of Cover	[redacted]					
Dozer	[redacted]	days	$ [redacted]	$ [redacted]	Hertz equipment rental	
Backhoe	[redacted]	days	$ [redacted]	$ [redacted]	Hertz equipment rental	
Roller/Compactor	[redacted]	days	$ [redacted]	$ [redacted]	Hertz equipment rental	
Dump Truck	[redacted]	days	$ [redacted]	$ [redacted]	Hertz equipment rental	
Pickup Trucks (2)	[redacted]	days	$ [redacted]	$ [redacted]	Hertz equipment rental	
Earthwork and Fencing	[redacted]					
Clay Layer (includes compaction)	[redacted]	CY	$ [redacted]	$ [redacted]	Professional estimate	
Clay volume assumes 9 inches of clay across cap to fill ruts and increa [redacted] s by 6 inches.						
Top Soil	[redacted]	CY	$ [redacted]	$ [redacted]	Professional estimate	
Quality Control Testing (includes compaction testing)	[redacted]	LS	$ [redacted]	$ [redacted]	Professional estimate	
Oyster Shells	[redacted]	tons	$ [redacted]	$ [redacted]	Professional estimate	
Assumes 25% of original oyster shell cover requires replacement.						
Hydroseeding	[redacted]	SF	$ [redacted]	$ [redacted]	Professional estimate	
3-Strand Fence	[redacted]	LF	$ [redacted]	$ [redacted]	Professional estimate	
Double Gate	[redacted]	each	$ [redacted]	$ [redacted]	Professional estimate	
Subcontractor Labor	[redacted]					
Site superintendent	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
QA Officer	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Operators (2)	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Technicians (2)	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Site Safety and Health Officer	[redacted]	hrs	$ [redacted]	$ [redacted]	Professional estimate	
Per Diem	[redacted]	days	$ [redacted]	$ [redacted]	Professional estimate	
SUBTOTAL	[redacted]		[redacted]	**$** [redacted]		
Professional Services, Project Management, and Fees	[redacted]					
Project management	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Pollution Liability Insurance	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Payment and performance bond	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Construction/program management	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Undefined scope and market allowance	[redacted]	of subtotal	[redacted]	$ [redacted]	Rounded	
Professional Services, Project Management, and Fees Subtotal	[redacted]		[redacted]	**$** [redacted]		
SOIL EXCAVATION, FIELD OVERSIGHT, TREATMENT AND BACKFILL SUBTOTAL				**$**		**$** [redacted]
CAPITAL COST TOTAL				**$**		**$** [redacted]

Table 3 - COST ESTIMATE - ALTERNATIVE # 2

Gulfco Marine Maintenance Superfund Site

Site: Gulfco Marine Maintenance
Location: Freeport, Brazoria County, Texas
Base Year: 2010
Date: January 14, 2011

Description: Perform Upgrade to the Cap. Includes 5 years cap maintenance.

Assumptions: Upgrades to the cap will include removing the approximately 0.5' layer of oyster shells on top of the cap, installing an additional 0.5- foot layer of clay material, placing 0.5' of oyster shells on cap and installing a 3-wire fence around former surface impoundment at toe.

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES	PRESENT VALUE AT 7%
ANNUAL CAP MAINTENANCE						
Subcontractor Costs						
Clay Repair	(b) (4) [redacted]	EA	$ (b) (4) [redacted]	$ (b) (4) [redacted]	Professional estimate	
Mowing		EA	$	$	Professional estimate	
Subcontractor Labor						
Inspection		hrs	$	$	Professional estimate (6 inspections/yr at 8 hours each)	
Repair Oversight		hrs	$	$	Professional estimate (one repair per year at 30 hours)	
Per Diem		days	$	$		
SUBTOTAL				**$**		
Professional Services, Project Management, and Fees						
Project management		of subtotal		$	Rounded	
Pollution Liability Insurance		of subtotal		$	Rounded	
Payment and performance bond		of subtotal		$	Rounded	
Undefined scope and market allowance		of subtotal		$	Rounded	
Professional Services, Project Management, and Fees Subtotal				**$**		
ANNUAL CAP MAINTENANCE COST				**$**		
ANNUAL CAP MAINTENANCE (Year 1)		LS	$	**$**	Cap maintenance at 7% net present value	$ (b) (4) [redacted]
ANNUAL CAP MAINTENANCE (Year 2)		LS	$	**$**	Cap maintenance at 7% net present value	$
ANNUAL CAP MAINTENANCE (Year 3)		LS	$	**$**	Cap maintenance at 7% net present value	$
ANNUAL CAP MAINTENANCE (Year 4)		LS	$	**$**	Cap maintenance at 7% net present value	$
ANNUAL CAP MAINTENANCE (Year 5)		LS	$	**$**	Cap maintenance at 7% net present value	$
TOTAL ESTIMATED COST					**ANNUALIZED COSTS**	**$**
					ROM ESTIMATE (-30%)	$
					ROM ESTIMATE (+50%)	$

Table 4 - COST ESTIMATE - ALTERNATIVE # 3

Gulfco Marine Maintenance Superfund Site

Site: Gulfco Marine Maintenance
Location: Freeport, Brazoria County, Texas
Base Year: 2010
Date: January 14, 2011

Description: Perform Upgrade to the Cap. Includes 5 years cap maintenance.

Assumptions: Upgrades to the cap will include removing the approximately 0.5' layer of oyster shells on top of the cap, installing an additional 0.5- foot layer of clay material, placing 1.5' of topsoil, hydroseeding and installing a 3-wire fence around former surface impoundment at toe.

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES	PRESENT VALUE AT 7%
CAPITAL COSTS						
REMEDIAL DESIGN						
Remedial Design						
Remedial Design	[redacted]	LS	$ [redacted]	$ [redacted]	Professional estimate (8% of Site Preparation and Cap Upgrade Construction)	
REMEDIAL DESIGN SUBTOTAL				**$**		**$** [redacted]
SITE PREPARATION						
Site Prep						
Erosion Control Plan Development & Submittals	[redacted]	LS	$ [redacted]	$ [redacted]	Professional estimate	
Site Survey/Utility Locate		acres	$	$	RS Means *2005 Environmental Remediation Cost Data*	
Erosion Control Implementation - Silt Fencing		ft	$	$	Professional estimate	
Construct Decon Station for Trucks and Heavy Equipment		LS	$	$	Professional estimate	
Equipment Delivery		each	$	$	Professional estimate	
Miscellaneous Materials		each	$	$	Professional estimate	
Wheel Loader		days	$	$	Hertz equipment rental	
Pickup Trucks (2)		days	$	$	Professional estimate	
Labor						
Site Superintendent		hrs	$	$	Professional estimate	
QA Officer		hrs	$	$	Professional estimate	
Operator (2)		hrs	$	$	Professional estimate	
Technician		hrs	$	$	Professional estimate	
Site Safety and Health Officer		hrs	$	$	Professional estimate	
Per Diem		days	$	$	Professional estimate	
Site Prep Subtotal				**$**		
Professional Services, Project Management, and Fees						
Legal Fees for Institutional Controls and Deed		LS	$	$		
Project management		of subtotal		$	Rounded	
Pollution Liability Insurance		of subtotal		$	Rounded	
Payment and performance bond		of subtotal		$	Rounded	
Construction/program management		of subtotal		$	Rounded	
Undefined scope and market allowance		of subtotal		$	Rounded	
Professional Services, Project Management, and Fees Subtotal				**$**		
SITE PREPARATION SUBTOTAL				**$**		**$** [redacted]
CAP UPGRADE AND FIELD OVERSIGHT						
Heavy Equipment Rental for Installation of Cover						
Dozer	[redacted]	days	$ [redacted]	$ [redacted]	Hertz equipment rental	
Backhoe		days	$	$	Hertz equipment rental	
Roller/Compactor		days	$	$	Hertz equipment rental	
Dump Truck		days	$	$	Hertz equipment rental	
Pickup Trucks (2)		days	$	$	Hertz equipment rental	
Earthwork and Fencing						
Clay Layer (includes compaction)		CY	$	$	Professional estimate	
Clay volume assumes 9 inches of clay across cap to fill ruts and increase cap thickness by 6 inches.						
Top Soil	[redacted]	CY	$	$	Professional estimate	
Quality Control Testing (includes compaction testing)		LS	$	$	Professional estimate	
Oyster Shells		CY	$	$	Professional estimate	
Hydroseeding		SF	$	$	Professional estimate	
3-Strand Fence		LF	$	$	Professional estimate	
Double Gate		each	$	$	Professional estimate	
Subcontractor Labor						
Site superintendent		hrs	$	$	Professional estimate	
QA Officer		hrs	$	$	Professional estimate	
Operators (2)		hrs	$	$	Professional estimate	
Technicians (2)		hrs	$	$	Professional estimate	
Site Safety and Health Officer		hrs	$	$	Professional estimate	
Per Diem		days	$	$	Professional estimate	
SUBTOTAL				**$**		
Professional Services, Project Management, and Fees						
Project management		of subtotal		$	Rounded	
Pollution Liability Insurance		of subtotal		$	Rounded	
Payment and performance bond		of subtotal		$	Rounded	
Construction/program management		of subtotal		$	Rounded	
Undefined scope and market allowance		of subtotal		$	Rounded	
Professional Services, Project Management, and Fees Subtotal				**$**		
SOIL EXCAVATION, FIELD OVERSIGHT, TREATMENT AND BACKFILL SUBTOTAL				**$**		**$** [redacted]
CAPITAL COST TOTAL				**$**		**$** [redacted]

Table 4 - COST ESTIMATE - ALTERNATIVE # 3

Gulfco Marine Maintenance Superfund Site

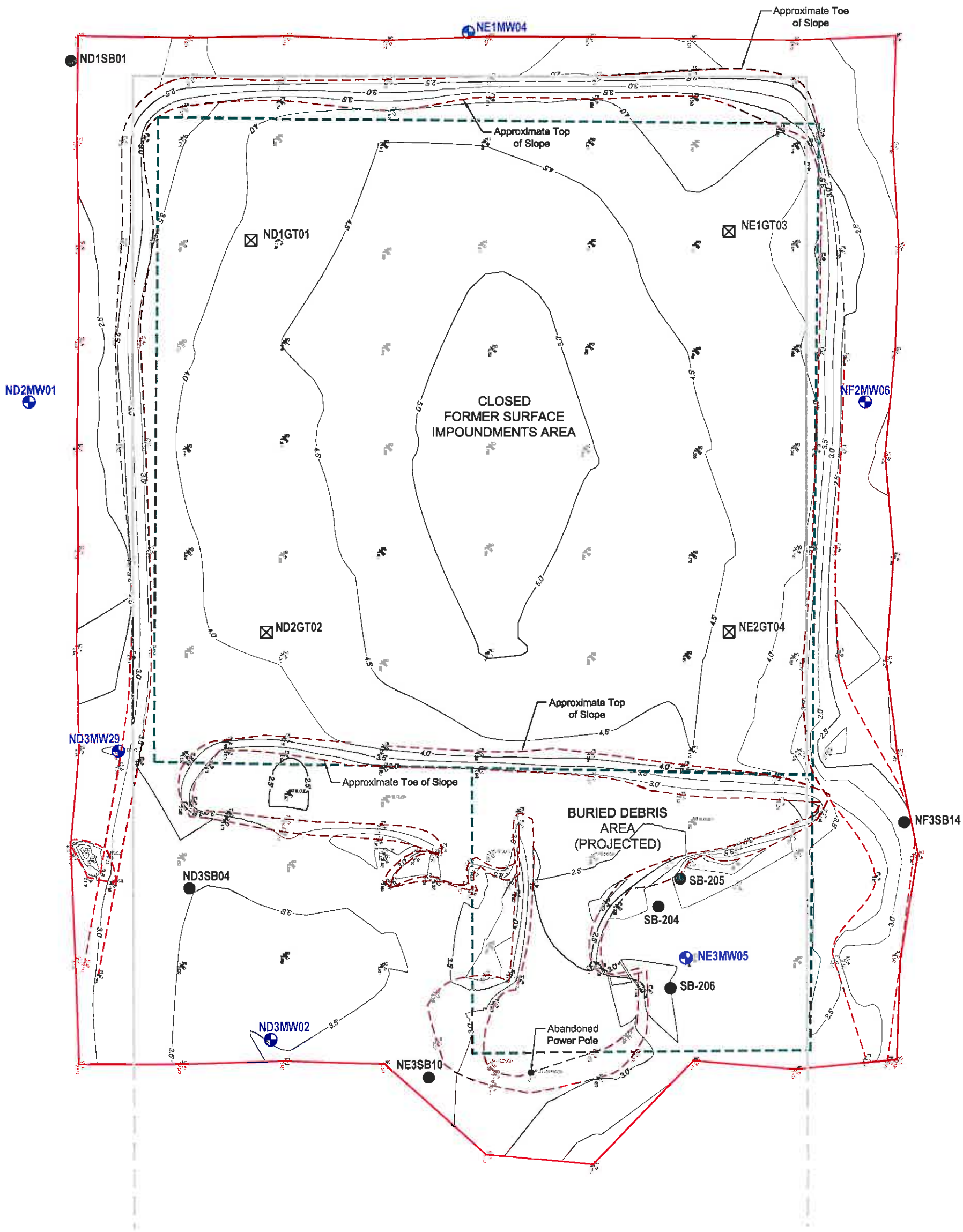
Site: Gulfco Marine Maintenance
Location: Freeport, Brazoria County, Texas
Base Year: 2010
Date: January 14, 2011

Description: Perform Upgrade to the Cap. Includes 5 years cap maintenance.

Assumptions: Upgrades to the cap will include removing the approximately 0.5' layer of oyster shells on top of the cap, installing an additional 0.5- foot layer of clay material, placing 1.5' of topsoil, hydroseeding and installing a 3-wire fence around former surface impoundment at toe.

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES	PRESENT VALUE AT 7%
ANNUAL CAP MAINTENANCE						
Subcontractor Costs						
Clay Repair	(b) (4) [redacted]	EA	$ (b) (4) [redacted]	$ (b) (4) [redacted]	Professional estimate	
Mowing		EA	$	$	Professional estimate	
Subcontractor Labor						
Inspection		hrs	$	$	Professional estimate (6 inspections/yr at 8 hours each)	
Repair Oversight		hrs	$	$	Professional estimate (one repair per year at 30 hours)	
Per Diem		days	$	$		
SUBTOTAL				**$**		
Professional Services, Project Management, and Fees						
Project management		of subtotal		$	Rounded	
Pollution Liability Insurance		of subtotal		$	Rounded	
Payment and performance bond		of subtotal		$	Rounded	
Undefined scope and market allowance		of subtotal		$	Rounded	
Professional Services, Project Management, and Fees Subtotal				**$**		
ANNUAL CAP MAINTENANCE COST				**$**		
ANNUAL CAP MAINTENANCE (Year 1)		LS	$	**$**	Cap maintenance at 7% net present value	$ (b) (4) [redacted]
ANNUAL CAP MAINTENANCE (Year 2)		LS	$	**$**	Cap maintenance at 7% net present value	$
ANNUAL CAP MAINTENANCE (Year 3)		LS	$	**$**	Cap maintenance at 7% net present value	$
ANNUAL CAP MAINTENANCE (Year 4)		LS	$	**$**	Cap maintenance at 7% net present value	$
ANNUAL CAP MAINTENANCE (Year 5)		LS	$	**$**	Cap maintenance at 7% net present value	$
TOTAL ESTIMATED COST					**ANNUALIZED COSTS**	**$**
					ROM ESTIMATE (-30%)	$
					ROM ESTIMATE (+50%)	$

Figures



EXPLANATION

- Monitoring Well Location
- Geotechnical Soil Boring
- Soil Boring Location
- Elevation Measurement Location
- 2.0 — Ground Surface Elevation (Ft Mean Sea Level, NGVD 29) - Minor Contour Line
- 2.5 — Ground Surface Elevation (Ft Mean Sea Level, NGVD 29) - Major Contour Line
- Extent of Surface Impoundments and Buried Debris Area (Projected)
- Top/Toe of Slope (Approximate)
- Lot 56 Property Line
- Limits of Topographic Survey

Approx. Scale in Feet

0 25 50

Source: Doyle & Wachtstetter, Inc. Field Survey May 26, 2009

GULFCO MARINE MAINTENANCE
FREEPORT, BRAZORIA COUNTY, TEXAS

Figure 1

FORMER SURFACE IMPOUNDMENTS TOPOGRAPHIC MAP

PROJECT 1352	BY ZGK	REVISIONS
DATE DEC., 2010	CHECKED EFP	

PASTOR, BEHLING & WHEELER, LLC
CONSULTING ENGINEERS AND SCIENTISTS

Appendix A
Streamlined Ecological Risk Evaluation
EA – February 2011

Streamlined Ecological Risk Evaluation (SERE)

Non-Time Critical Removal Support
Gulfco Marine Maintenance Superfund Site
Freeport,Brazoria County, Texas
Contract No. EP-W-06-004
Task Order: 0067-NSEE-06JZ

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

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February 2011
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LIST OF ACRONYMS AND ABBREVIATIONS

AST	Above Ground Storage Tank
AVS/SEM	Acid Volatile Sulfides/Simultaneously Extracted Metals
BCMCD	Brazoria County Mosquito Control Department
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
Chromalloy	Chromalloy American Corporation
COPEC	Constituent of Potential Ecological Concern
DDT	dichlorodiphenyltrichloroethane
DESR	Data Evaluation Summary Report
DOW	The DOW Chemical Company
DQO	Data Quality Objective
EA	EA Engineering, Science, and Technology, Inc.
EC20	Effects concentration 20 percent reduction
EPA	Environmental Protection Agency
ESV	Ecological Screening Value
Facts	Brazoria County Facts
FPSCR	Final Preliminary Site Characterization Report
FS	Feasibility Study
ft	feet
FWS	Fish & Wildlife Service
GRG	Gulfco Restoration Group
LC50	Lethal Concentration 50 percent
LDL	LDL Coastal Limited LP
µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/L	milligram per liter
µmol/goc	micromole per gram organic carbon
NPL	National Priorities List
NTCRS	Non Time Critical Removal Support
OC	organic carbon
PAH	Polycyclic Aromatic Hydrocarbon
PBW	Pastor, Behling & Wheeler
PCA	Principal Components Analysis
PSCR	Preliminary Site Characterization Report
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SLERA	Screening Level Ecological Risk Assessment
SMDP	Scientific Management Decision Point
SOP	Standard Operating Procedure
TCEQ	Texas Commission of Environmental Quality
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon

UAO	Unilateral Administrative Order
URS	URS Corporation

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) named the former site of Gulfco Marine Maintenance, Inc. in Freeport, Brazoria County, Texas (the site) to the National Priorities List (NPL) in May 2003. The EPA issued a modified Unilateral Administrative Order (UAO), effective July 29, 2005, which was subsequently amended effective January 31, 2008. The UAO required a Remedial Investigation (RI) and Feasibility Study (FS) be conducted for the site. As part of the RI/FS, a *Screening Level Ecological Risk Assessment* (SLERA) was prepared (Pastor, Behling & Wheeler [PBW] 2010a) on behalf of LDL Coastal Limited LP (LDL), Chromalloy American Corporation (Chromalloy) and The Dow Chemical Company (Dow), collectively known as the Gulfco Restoration Group (GRG). The Scientific/Management Decision Point (SMDP) provided in the final SLERA concluded there was a potential for adverse ecological effects, and a more thorough assessment was warranted.

This document summarizes the site investigation activities and analysis that has been performed in accordance with the *Final Baseline Ecological Risk Assessment (BERA) Work Plan & Sampling and Analysis Plan (SAP)* (URS Corporation [URS] 2010b) and presents the assessment of ecological risk in the form of a Streamlined Ecological Risk Evaluation (SERE) for the Gulfco Marine Maintenance Superfund Site located in Freeport, Texas to assess if there is a need for a Non-Time Critical Removal at this Site north of Martin Avenue.

This SERE has been prepared using EPA guidance (EPA 1997; EPA 1998; EPA 1999) and the Texas Natural Resource Conservation Commission (TNRCC) guidance (TNRCC 2001).

1.1 SITE BACKGROUND

The site is located in Freeport, Texas at 906 Marlin Avenue (also referred to as County Road 756) (Figure 1). The site consists of approximately 40 acres along the north bank of the Intercoastal Waterway between Oyster Creek (approximately one mile to the east) and the Texas Highway 332 bridge (approximately one mile to the west). The site includes approximately 1,200 feet (ft) of shoreline on the Intercoastal Waterway, the third busiest shipping canal in the United States.

Marlin Avenue divides the site into two primary areas (Figure 2). For the purpose of descriptions in this report, Marlin Avenue is approximated to run due west to east. The property north of Marlin Avenue (the North Area) consists of undeveloped land and closed surface impoundments, while the property south of Marlin Avenue (the South Area) was developed for industrial uses with multiple structures, a dry dock, an above ground storage tank (AST) farm, and two barge slips connected to the Intercoastal Waterway. This SERE addresses only the area north of Martin Avenue.

Adjacent property to the north, west, and east of the North Area is undeveloped. Adjacent property to the east of the South Area is currently used for industrial purposes while to the west the property is currently vacant and previously served as a commercial marina. The Intercoastal Waterway bounds the South area to the south. Residential areas are located south of Marlin Avenue, approximately 300 ft west of the site, and 1,000 ft east of the site.

Some of the North Area is upland created from dredge spoil, but most of this area is considered wetlands, as per the U.S. Fish and Wildlife Service (FWS) Wetlands Inventory Map (FWS 2008). The most significant surface features in the North Area are two ponds (the Fresh Water Pond and the Small Pond) and the closed former surface impoundments (Figure 2). The former surface impoundments and the former parking area south of the impoundments and Marlin Avenue comprise the vast majority of the upland area within the North Area.

Field observations during the PRP RI indicate the North Area wetlands are irregularly flooded with nearly all of the wetland area inundated by surface water that can accumulate to a depth of one ft or more during extreme high tide conditions, storm surge events (such as hurricanes), and/or in conjunction with surface flooding of Oyster Creek located northeast of the site. Due to very low topographic slope and low permeability surface sediments, the wetlands are also very poorly draining and can retain surface water after major rainfall events.

During site reconnaissance performed by EA Engineering, Science, and Technology, Inc. (EA) on 15 December 2010 it was noted that the wetlands are part of the contiguous high marsh/salt pan area between the site and Oyster Creek. These wetland areas were inundated with water (surface to 4 cm below grade), and connecting ditches and the marsh pan held several centimeters of water (EA 2010b).

Under normal tide conditions and during periods of normal or below normal rainfall, standing water within the wetlands (outside of the two identified ponds discussed below) is typically more limited. Depending on rainfall and tide conditions, these areas can either be completely full of water or completely dry.

Water in the Fresh Water Pond is approximately 4 to 4.5 ft deep and is relatively brackish (PBW, 2009). This pond appears to be a borrow pit created by the excavation of soil and sediment as suggested by the well-defined pond boundaries and relatively stable water levels. Water levels in the Fresh Water Pond are not influenced by periodic extreme tidal fluctuations as the pond dikes preclude tidal floodwaters in the wetlands from entering the pond, except for during extreme storm surge events.

The small irregularly shaped area immediately north of the Fresh Water Pond (Figure 2) is a salt panne, a shallow depression that retains seawater for short periods of time such that salt accumulates to high levels over multiple tidal cycles.

The Small Pond is a very shallow depression located in the eastern corner of the North Area. The Small Pond is not influenced by daily tidal fluctuations and behaves in a manner consistent with the surrounding wetland (*i.e.*, becomes dry during dry weather, but retains water in response to and following rainfall and extreme tidal events). The Small Pond is also indicative of a salt panne.

Aerial spraying of the wetland areas north of Marlin Avenue, including the North Area, for mosquito control has historically been and continues to be performed by the Brazoria County Mosquito Control District and its predecessor agency, the Brazoria County Mosquito Control Department (both referred to hereafter as BCMCD). Aerial spraying for mosquito control has been performed from altitudes of 50 to 100 ft (Lake Jackson News 1957). Recently, BCMCD

has been using Dibrom©, and organophosphate insecticide, with a diesel fuel carrier through a fogging atomizer application (Brazoria County Facts [Facts] 2006, 2008a, 2008b), as well as other compounds such as Scourge™, Kontrol 30-30, and Fyfanon® (personal communication between Gary Miller [EPA] and Fran Henderson [BCMCD 27 October 2010]). Truck-based spraying has also been performed along Marlin Avenue. Both types of spraying were observed during the performance of site RI activities by the PRP.

1.2 STREAMLINED ECOLOGICAL RISK EVALUATION PROCESS

In the superfund program, ecological risk is evaluated in an eight-step process, as defined in the Ecological Risk Assessment Guidance for Superfund (EPA 1977):

1) Screening Level Problem Formulation
2) Screening Level Exposure Estimate and Risk Calculation
3) BERA Problem Formulation
4) Study Design and Data Quality Objective Process
5) Field Sampling Plan Verification
6) Site Investigation and Data Analysis
7) Risk Characterization
8) Risk Management

The first two steps of the process were completed in the final PRP SLERA for the site (PBW 2010a). At the conclusion of the SLERA, the potential for adverse risk to several ecological receptors was determined and a SMPD was made to continue in the risk assessment process.

The third step in the process (BERA Problem Formulation) was completed for the site by the PRP in the *Final Baseline Ecological Risk Assessment Problem Formulation* (URS 2010a). In the problem formulation step, the list of constituents of potential ecological concern (COPEC) is further refined, contaminant fate and transport is evaluated, assessment endpoints, and a conceptual site model are defined, and questions of risk are developed.

The fourth and fifth steps in the BERA process were completed by the PRP in the *Final Baseline Ecological Risk Assessment Work Plan & SAP* (URS 2010b). In these steps, a work and sampling plan is developed for collecting additional media in support of the PRP BERA(in preparation) and the methods for evaluating the potential for risk at the site (*i.e.,* toxicity testing) are outlined. Data quality objectives (DQOs) are also defined in these steps. The PRP is in the process of completing the BERA (steps 6 through 8).

This document is a focused SERE, evaluating the need for a Non-Time Critical Removal at the Site north of Martin Avenue. As such, this document should not be considered as a formal part of the 8-step ecological risk assessment process discussed above but rather a limited and focused assessment of the wetlands north of Martin Avanue, to determine if sufficient risk is present to warrant a removal action. If the results of the SERE indicate a potential for ecological risk, a risk management decision is developed concerning what future actions, if any, may be warranted to manage that risk.

1.3 SCOPE OF DOCUMENT AND REPORT ORGANIZATION

Because there is no guidance for a focused SERE, this document follows the outline of the site investigation and analysis (Step 6) conducted in support of a BERA and the resulting risk characterization (Step 7) of the ecological risk process. Risks are estimated using both qualitative and quantitative methods (toxicity testing). The results of this SERE will support Step 8 (risk management) if needed. Possible decision outcomes from the SERE include:

- There is adequate information to conclude that no adverse ecological risk is present (i.e., risk is within acceptable limit and further evaluation is not needed)
- There is adequate information to conclude that adverse ecological risk is present and development of remedial alternatives is warranted (i.e., continue to Step 8)
- Available information is not adequate to estimate risk (i.e., data gaps are present)

Section 2 of this document provides a discussion of the site investigation activities that were completed in support of this SERE and outlined in the PRP's *Final Baseline Ecological Risk Assessment Work Plan & SAP* (URS 2010b). Section 3 summarizes the media concentrations and exposure point concentrations for site samples. Section 4 provides an analysis of the effects to ecological receptors. Section 5 provides the risk characterization. Section 6 provides a discussion of the uncertainties associated with the BERA, and Section 7 summarizes the conclusions of the SERE.

2.0 SITE INVESTIGATIONS IN SUPPORT OF THE PRP BERA

This section describes the data collected from North Area surface soil, wetland sediment and surface water samples, and used in this SERE. Sampling activities were conducted by the PRP between August 2010 and September 2010. The sample collection methods, analytical methods, and toxicity testing methods are described in the *Final BERA Work Plan & SAP* (URS 2010b) and summarized below. Overall, the data collected by the PRP in support of the BERA met the DQOs outlined in the *Final BERA Work Plan & SAP* (URS 2010b) and are adequate for evaluation and risk characterization used in this SERE.

2.1 TERRESTRIAL ENVIRONMENT

Investigation of site terrestrial areas was limited to the upland regions in the North Area including the former surface impoundments and the area south of the former impoundment. Soils in these areas likely became contaminated with COPECs due to surface runoff from the former surface impoundment area prior to capping. The final PRP SLERA identified potential risk to lower-trophic receptors such as soil invertebrates in these upland areas (PBW 2010a). Media collected in support of the PRP BERA included surface soils (0-6 inches below ground surface [bgs]), which represents the biologically active zone for soil-dwelling invertebrates. Toxicity tests were also conducted on surface soils to assess potential effects to these invertebrates. The analytical data for each sample are presented in Appendix A of the *Final Preliminary Site Characterization Report* (PSCR) (PBW 2010b) and summarized in Table 1.

2.1.1 North Area Surface Soil Sample Collection and Analysis

A total of six (6) surface soil samples were collected (0-6 inches bgs) from the North Area. Five (5) samples (NAS01 to NAS05) were collected in the area south of the former surface impoundment area, and one sample (NAS06) was collected in the northwest corner of the former surface impoundment area (Figure 3a). An additional three (3) samples were collected in the soil reference area approximately 2000 ft east of the site (Figure 3b). Analytical results are shown in Table 1.

All samples were analyzed for the following metals identified as COPECs in previous steps of the risk assessment process:

- Barium
- Chromium
- Copper, and
- Zinc

In addition, three of the six soil samples from the North Area (NAS02, NAS03, and NAS05) were analyzed for 4,4'- dichlorodiphenyltrichloroethane (DDT) and Aroclor-1254.

2.1.2 North Area Surface Soil Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted using the six surface soil samples collected from the North Area and the three reference samples to evaluate direct toxicity to soil-dwelling invertebrates. A 28-day earthworm (*Eisenia fetida*) chronic bioassay was originally proposed by the PRP in the *Final BERA Work Plan and SAP* (URS 2010b); however, elevated salinity in the surface soil samples made use of the earthworm problematic. When earthworms were introduced to the North Area soil samples there was an immediate avoidance reaction followed by acute mortality in all of the site and background samples. The elevated salinity levels are believed to be due to frequent inundation of estuarine during storm events. Also, much of the soil was originally dredge spoils from the Intercoastal Waterway, which was used as a fill material.

An alternative to the earthworm bioassays was developed following discussion and agreement by the EPA. This alternative treated the soils samples as sediments by adding synthetic seawater and exposing the marine polychaetous annelid, *Neanthes arenaceodentata*, to a 21-day bioassay to assess growth and survival. Polychaetes occupy a similar feeding guild to earthworms. The North Area soil toxicity testing was conducted from September 10 through October 1, 2010.

2.2 AQUATIC ENVIRONMENT

Sediments and surface water in the areas of the North area likely became contaminated with COPECs from direct discharge from barge cleaning operations, surface runoff, and flooding mechanisms. The final PRP SLERA identified potential risk to sediment and surface water dwelling invertebrates (PBW 2010a). Media collected in support of the PRP BERA included bulk sediments (0-6 inches bgs) and surface water from the North Area wetlands. Sediment pore

water was also extracted from bulk sediments. Toxicity tests were conducted using wetland sediments and surface water to assess potential effects to sediment and surface water dwelling invertebrates. The analytical data for each sample are presented in Appendix A of the Final Preliminary Site Characterization Report (FPSCR) and summarized in Table 2 through Table 4.

2.2.1 North Area Wetland Bulk Sediment Sample Collection and Analysis

A total of seven (7) bulk sediment samples were collected by the PRP at depths of 0-6 inches bgs from the North Area wetlands. Five (5) samples (EWSED03 to EWSED07) were collected in the wetland areas south of the former surface impoundment area, and two samples (EWSED01 and EWSED02) were collected north of the Fresh Water Pond (Figure 4). An additional two (2) samples were collected in the sediment reference area north of the site and west of the former surface impoundments (Figure 4). Analytical results are shown in Table 2.

All samples were analyzed for the following parameters identified as COPECs in previous steps of the risk assessment process:

- Polycyclic Aromatic Hydrocarbons (PAHs): 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene
- Pesticides: 4,4'-DDT, endrin aldehyde, endrin ketone, gamma-chlordane
- Metals: arsenic, copper, lead, nickel, zinc
- Acid Volatile Sulfides/Simultaneously Extracted Metals (AVS/SEM)
- Grain size analysis

In addition to the bulk sediment samples, pore water was extracted and analyzed for COPECs for all but one sediment sample (EWSED05)(Table 3). This sample was too dry to extract pore water.

2.2.2 North Area Wetland Bulk Sediment Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted using the seven site sediment samples collected from the North Area and the two reference samples to evaluate direct toxicity to sediment-dwelling invertebrates. Two 28-day chronic bioassays were conducted using the amphipod, *Leptocheirus plumulosus*, and the polychaete, *N. arenaceodentata*. Both organisms were selected for toxicity testing because both are representative of common species found along the Texas gulf coast marshes, are sensitive to site COPECs, and are tolerant to a wide range of sediment and salinity conditions. Study endpoints of growth, mortality, and reproduction were measured for the *L. plumulosus* bioassay, while only the growth endpoint (with mortality data used to assist in the calculations) was used for the *N. arenaceodentata* bioassay.

2.2.3 North Area Wetland Surface Water Sample Collection and Analysis

A total of three (3) surface water samples were collected from the North Area wetlands. One sample (EWSW01) was collected in the area north of the Fresh Water pond. One sample

(EWSW03) was collected in the small, irregularly shaped waterbody south of the former surface impoundment, and one sample (EWSW04) was collected from the near the Small Pond (Figure 5). Surface water was not present at the reference location (EWSW02) and analysis and this location could not be performed. Analytical results are shown in Table 4.

All surface water samples were analyzed for the following parameters identified as COPECs in previous steps of the risk assessment process:

- Acrolein (EWSW01 only)
- Dissolved copper
- Dissolved nickel
- Dissolved silver
- Dissolved zinc

2.2.4 North Area Wetland Surface Water Toxicity Testing

Laboratory toxicity tests (bioassays) were conducted using the three site surface water samples collected from the North Area to evaluate direct toxicity to surface water-dwelling invertebrates. A 7-day chronic bioassay analysis that measured the survival and growth of the mysid shrimp, *Mysidopsis bahia*, was originally proposed in the *Final BERA Work Plan & SAP* (URS 2010b); however, elevated salinity in the surface water samples from the salt panne areas (40% salinity at EWSW01 and 39% at EWSW04) were outside the testing tolerances for this test organism.

An alternative to the mysid shrimp bioassays was developed following discussion and agreement by the EPA. This alternative used the brine shrimp (*Artemia salina*), which is better suited to testing at high salinities. No standards have been established for toxicity testing conducted on brine shrimp and a standard operating procedure (SOP) was developed by the analytical lab by referencing SOPs available for determining toxicity to produced (oil field) waters. The test protocol was shortened from 7 days to 96-hours and measured acute mortality of the organisms as the test endpoint. The shortened test period would likely be more representative of the intermittent nature of the surface water being evaluated in the North Area wetlands.

Surface water toxicity tests were conducted three times between September 16 and October 3, 2010.

3.0 EFFECTS ANALYSIS

This section presents effects analysis of the data collected through the supplemental sampling activities and toxicity testing of site media for the Gulfco site. This analysis evaluates the potential adverse impacts associated with COPCs and calculates effects concentration 20 percent reduction (EC20s), where relevant. The toxicity test reports are available in the *Final Preliminary Site Characterization Report (FPSCR)* (PBW 2010b). The independent evaluation by the EA project team is included in the Data Evaluation Summary Report (DESR) (EA 2010a).

3.1 TERRESTRIAL ENVIRONMENT

The following section discusses the comparison of soil analytical data to benchmarks and the results of the toxicity testing.

3.1.1 Comparison of North Area Surface Soil Concentrations to Literature-Based Ecological Screening Values (ESVs)

Table 1 provides a summary of the 2010 surface soil analytical results generated from implementation of the PRP BERA sampling plan. Table 1 also compares the Texas Commission of Environmental Quality (TCEQ) soil benchmarks to the 2010 North Area surface soil concentrations.

The 2010 surface soil data shows exceedances of soil benchmarks for barium, chromium, copper, and zinc. Barium (which ranges from 52.2 milligram per kilogram [mg/kg] to 502 mg/kg) exceeded the TCEQ soil benchmark of 300 mg/kg in one site location (NAS04) and one reference sample (NAS07). Chromium (which ranges from 7.86 mg/kg to 97.3 mg/kg) exceeded the TCEQ soil benchmark of 30 mg/kg in two site locations (NAS01 and NAS05). Copper (which ranges from 10.1 mg/kg to 221 mg/kg) exceeded the soil benchmark of 61 mg/kg at only one site location (NAS01). Zinc (which ranges from 62.3 mg/kg to 5770 mg/kg) exceeded the TCEQ soil benchmark of 120 mg/kg at five of the six site locations (NAS01 to NAS05) and two of the reference samples (NAS07 and NAS08).

TCEQ soil benchmarks were not available for the organics (4,4'-DDT and Aroclor-1254).

3.1.2 Results of the *N. arenaceodentata* Toxicity Tests

The results of the *N. arenaceodentata* toxicity tests are presented in Table 5 and summarized below from the PSCR (PBW 2010b). The testing of *N. arenaceodentata* over a 21-day exposure period showed no statistically significant difference between the North Area surface soil samples and the reference samples to the survival and growth endpoints for *N. arenaceodentata*. Survival of the six site samples ranged from 76 percent to 96 percent and the survival of the three reference samples ranged from 60 percent to 92 percent. Growth data show a similar relationship between the site and reference samples. The complete report for the 21-day *N. arenaceodentata* is presented in the PSCR (PBW 2010b).

In the evaluation, reference soils in NAS08 and NAS09 were pooled since they showed similar toxicological responses; however, reference soils at NAS07 were compared independently to site samples due to a significant difference at this location for both assessment endpoints. No site samples exhibited reduced survival to *N. arenaceodentata* when compared to either NAS07 or the pooled references consisting of NAS08 and NAS09. For the growth endpoint, however, growth at NAS01 was 57 percent lower than growth in reference NAS07 which is a statistically significant difference. The analytical results for NAS01 and the reference soils are provided on Figures 3a and 3b. No other site samples exhibited reduced growth when compared to NAS07. The output files for the analysis are presented in the DESR (EA 2010a).

3.2 AQUATIC ENVIRONMENT – NORTH AREA WETLANDS

The following section discusses the comparison of sediment and surface water analytical results to benchmarks and toxicity test results.

3.2.1 Comparison of Sediment and Pore Water Concentrations to Literature-Based ESVs

Table 2 summarizes the analytical results for the 2010 wetland sediment samples collected in support of the BERA. There were several exceedances of the sediment benchmarks for multiple individual PAHs (acenaphthene, acenaphthylene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene, phenanthrene, pyrene) and metals (lead, nickel, and zinc). Acenaphthene (which ranges from 0.0013 mg/kg to 0.075 mg/kg) exceeded the TCEQ sediment benchmark of 0.016 mg/kg in one site location (EWSED05). Acenaphthylene (which ranges from 0.0008 mg/kg to 0.057 mg/kg) exceeded the TCEQ sediment benchmark of 0.044 mg/kg in one site location (EWSED01). Benzo(a)pyrene (which ranges from 0.01 mg/kg to 0.79 mg/kg) exceeded the TCEQ sediment benchmark of 0.43 mg/kg in one site location (EWSED05). Chrysene (which ranges from 0.014 mg/kg to 0.77 mg/kg) exceeded the TCEQ sediment benchmark of 0.384 mg/kg in three site locations (EWSED01, EWSED02, and EWSED05). Dibenzo(a,h)anthracene (which ranges from 0.0026 mg/kg to 0.17 mg/kg) exceeded the TCEQ sediment benchmark of 0.0634 mg/kg in three site locations (EWSED01, EWSED02, and EWSED05). Fluoranthene (which ranges from 0.02 mg/kg to 1.3 mg/kg) exceeded the TCEQ sediment benchmark of 0.6 mg/kg in one site location (EWSED05). Phenanthrene (which ranges from 0.013 mg/kg to 0.78 mg/kg) exceeded the TCEQ sediment benchmark of 0.24 mg/kg in one site location (EWSED05). Pyrene (which ranges from 0.021 mg/kg to 1.1 mg/kg) exceeded the TCEQ sediment benchmark of 0.665 mg/kg in one site location (EWSED05). Lead (which ranges from 12 mg/kg to 76.1 mg/kg) exceeded the TCEQ sediment benchmark of 46.7 mg/kg in two site locations (EWSED03 and EWSED05). Nickel (which ranges from 14.4 mg/kg to 22.5 mg/kg) exceeded the TCEQ sediment benchmark of 20.9 mg/kg in two site locations (EWSED03 and EWSED05). Zinc (which ranges from 70.1 mg/kg to 959 mg/kg) exceeded the TCEQ sediment benchmark of 150 mg/kg in four site locations (EWSED03 to EWSED06).

Analytical results for additional parameters including grain size analysis and SEM/AVS are also presented in Table 2. The SEM/AVS ratios are all above 1.0, except EWSED08 (SEM/AVS ratio of 0.157). Sediment grain sizes are fairly consistent between locations, except for the relatively high fraction of gravel and low fraction of clay found at EWSED02 and EWSED03, which is the opposite of the typical sediment profile (i.e., low fraction of gravel and high fraction of clay).

Table 3 summarizes the analytical results for the 2010 sediment pore water samples. The only exceedances of surface water benchmarks from site sediment pore water samples were for endrin aldehyde, endrin ketone, copper, and zinc. Endrin aldehyde (which ranges from <0.00000046 milligrams per liter [mg/L] to 0.000015 mg/L) exceeded the TCEQ surface water benchmark of 0.000002 mg/L in three site locations (EWSED01 to EWSED03). Endrin ketone (which ranges from <0.00000066 mg/L to 0.000007 mg/L) exceeded the TCEQ surface water benchmark of 0.000002 mg/L in one site location (EWSED03). Copper (which ranges from <0.000342 mg/L

to 0.00702 mg/L) exceeded the TCEQ surface water benchmark of 0.0036 mg/L in two site locations (EWSED03 and EWSED05). Zinc (which ranges from <0.00135 mg/L to 0.626 mg/L) exceeded the TCEQ surface water benchmark of 0.0842 mg/L in two site locations (EWSED04 and EWSED06).

The only exceedances of either sediment or surface water benchmarks in the background samples were 4,4'-DDT in sediment and 4,4'-DDT, endrin aldehyde, and nickel in pore water.

3.2.2 Results of the *N. arenaceodentata* Toxicity Tests

The results of the *N. arenaceodentata* toxicity tests are presented in Table 5 and summarized below from the PSCR (PBW 2010b). For *N. arenaceodentata* and the survival endpoint there were no statistically significant differences between the seven site samples and the two reference samples. Survival rates ranged from 72 percent to 96 percent in site samples and 68 percent to 76 percent in the reference samples. For the primary growth endpoint, there were also no statistical differences between the seven site samples and the two reference samples (PBW 2010b).

In the evaluation, reference soils in NAS08 and NAS09 were pooled since they showed similar toxicological responses. No Site samples exhibited reduced survival or growth to *N. arenaceodentata* when compared to the pooled references consisting of NAS08 and NAS09. The output files for the analysis are presented in the DESR (EA 2010a).

3.2.3 Results of the *L. plumulosus* Toxicity Tests

For the amphipod *L. plumulosus*, there were no statistical differences between the seven site samples and the two reference samples for either the survival or growth endpoint. Survival rates ranged from 13 percent to 58 percent in site samples and between 19 percent and 33 percent in reference samples (Table 5). There were insufficient offspring available for statistical analysis of reproduction as an endpoint.

In the evaluation, reference soils in NAS08 and NAS09 were pooled since they showed similar toxicological responses. Site samples did not exhibit significantly reduced survival when compared to the pooled reference data set.

Growth was lower in sample EWSED06 when compared with the pooled reference data set. The magnitude of the reduced growth was 74 percent in EWSED06. The output files for the analysis are presented in the DESR (EA 2010a).

3.2.4 Comparison of Wetland Surface Water Concentrations to Literature-Based ESVs

Table 4 provides a summary of the 2010 wetland surface water samples collected in support of the PRP BERA and includes the TCEQ surface water benchmarks. The only exceedance of a surface water benchmark was for dissolved copper at EWSW03. The background location (EWSW02) could not be sampled for surface water during the 2010 sampling event as this area was dry.

3.2.5 Results of the *A. salina* Toxicity Tests

The results of the *A. salina* toxicity tests are presented in Table 7 and summarized below from the FPSCR (PBW 2010b). The surface water toxicity tests were conducted three times between September 16 and October 3, 2010. EWSW01 and EWSW04 showed no evidence of acute toxicity since survival in the undiluted samples were greater than or equal to 80 percent for all test durations where the corresponding control survival was greater than or equal to 90 percent. EWSW03 was found to be non-toxic in test runs 1 and 2 (survival in the undiluted sample was greater than or equal to 80 percent for all test durations where the corresponding control survival was greater than or equal to 90 percent. In test run 3, a concentration-related mortality response was observed for EWSW03. The corresponding medial lethal concentrations are as follows:

- 24 hour = 30.7 percent
- 48 hour = 10.6 percent
- 72 hour = 6.2 percent

While the mortality response for EWSW03 in test run 3 is consistent with the detection of copper at a concentration above the TCEQ chronic surface water benchmark (0.00854 mg/L vs. 0.00360 mg/L), the magnitude of the exceedance is not consistent with the observed mortality in test run 3, and is not consistent with the absence of toxicity in the first two runs (PBW 2010b). The TCEQ acute and chronic freshwater values at a hardness of 237mg/L (Oyster Creek USGS,1998) would be 0.032mg/L and 0.0198mg/L respectively.

The evaluation included an independent review of the results for run 3 for all samples, which exhibited an acceptable control survival for 72 hours. By relevant test method guidance (EPA 2002), the Probit Method is the preferred procedure for determining the lethal concentration 50 percent (LC50) if the data passes the chi-square test. The Probit Method was appropriate for the data from these tests, and was used in the analysis. The results were generally consistent with those presented in the FPSCR (PBW 2010b):

- Samples EWSW01 and 4 did not exhibit acute toxicity (LC50 > 100 percent)
- Sample EWSW03 had an LC50 at 6 percent dilution

The analytical results of at sample EWSW03 (the only place to indicate toxicity) are shown on Figure 5 and in Table 4.

3.3 SUMMARY

In the analysis of North Area surface soils, where reference samples were pooled for NAS08 and NAS09 and evaluated independently of reference sample NAS07, site sample NAS01 exhibited reduced growth of *N. arenaceodentata* when compared with reference sample NAS07.

When assessing survival and growth in the polychaete, *N. arenaceodentata*, and the amphipod, *L. plumulosus*, where reference samples were pooled, wetland sediment EWSED06 exhibited significantly reduced growth of *L. plumulosus* when compared with wetland sediment reference samples.

In the analysis, using pooled reference data to evaluate the results of the acute toxicity tests of three surface water samples to brine shrimp (*A. salina*), Samples EWSW01 and EWSE04 did not exhibit acute toxicity (LC50 > 100 percent), and Sample EWSW03 had an LC50 between 5 and 6 percent dilution.

4.0 RISK CHARACTERIZATION

This section serves to analyze the data presented to this point in the SERE and provide an estimate of risk to the identified receptors in the North Area terrestrial environment and the aquatic environments located in the North Area. The risk characterization process will help address the ecological risk questions posed in the *Final BERA Work Plan & SAP (URS 2010b)*:

1) Does direct exposure to COPECs in surface soil adversely affect the abundance, diversity, productivity, and function of the soil invertebrate community?
2) Does direct exposure to COPECs in bulk sediments and pore water adversely affect the abundance, diversity, productivity, and function of benthic invertebrates?
3) Does direct exposure to COPECs in surface water adversely affect the abundance, diversity, productivity, and function of the fish community?

Addressing these assessment endpoints will assist in answering the risk management decision regarding the need for a non-time critical removal action in the north area of the Site.

4.1 IDENTIFICATION OF POTENTIAL STRESSORS

One step in characterizing risk is the identification of potential stressors in each ecological area where toxicity is observed. Initial steps in this dose-response evaluation uses techniques that are occasionally referred to as “data mining” techniques intended to identify relationships between parameters. Procedures used included development of correlation matrices and Principal Components Analysis (PCA). Upon review of findings of these statistical procedures, the concentrations of a selected number of indicator chemicals that are significantly associated with a 20 percent reduction in measurement endpoints (effects concentration 20 percent reduction, or EC20) were estimated. EC20s were estimated by the smoothed linear interpolation procedure recommended by relevant EPA test methods (see for example, EPA 2000, Section 16.2.5.7).

It is generally true that statistical associations are not conclusive regarding cause and effect. Because many of the chemicals are significantly correlated with other chemicals in the samples, the ability to conclude cause and effect from the statistical analyses is difficult. A subset of chemicals with the strongest statistical association with adverse effects was selected as indicator chemicals for estimation of EC20s. It is possible that these chemicals are not the cause of the adverse effect; adverse effects may actually be caused by one or more other chemicals that are correlated with the indicator chemicals. Nonetheless, the indicator chemicals selected have the strongest association with the adverse effects, and may be used to identify sediments that are likely to impair the identified ecological receptors.

Parameters evaluated included concentration of chemicals in bulk sediment, concentrations of organic chemicals normalized by the organic carbon (OC) content of the sediments/soils, concentrations of chemicals in pore water, ΣSEM/AVS, (ΣSEM-AVS)/Total Organic Carbon (TOC), OC, and grain size (indicated by percent gravel, sand, silt, and clay).

The PCA procedure was implemented using SYSTAT 11 (SYSTAT Software, Inc. 2004). Two factors were sought. The first factor is a linear combination of the chemical concentrations that explains the largest portion of the variance in the concentration data. The second factor is orthogonal (not correlated) to the first and explains as much of the remaining variance in the data as possible. The results of this correlation analysis is provided in the DESR (EA 2010a).

4.2 DIRECT EXPOSURE OF SOIL INVERTEBRATES

The potential for adverse effects to the soil invertebrate community were evaluated primarily through comparison of COPEC concentrations in North Area surface soils to literature-based benchmarks and the 21-day bioassay results of *N. arenaceodentata*.

4.2.1 Comparison of North Area Surface Soils to Literature-Based Benchmarks

Only barium, chromium, copper, and zinc exceeded soil benchmarks. Exceedances of these benchmarks were limited to three site samples except zinc, which was present in five of six site samples. Only barium and zinc were present above screening levels in the reference area soils. While comparison to literature-based benchmarks can be a tool for assessing risk, this method has the highest uncertainty and lowest confidence because they are not site-specific toxicity values.

4.2.2 *N. arenaceodentata* Toxicity Testing and Identification Potential Stressors

The evaluation of toxicity testing results for this receptor indicates the potential for reduced growth of *N. arenaceodentata* at NAS01, which had the highest metals concentrations, when compared with reference sample NAS07. A limited number of potential stressors were quantified in the North Area Soils exposure area. These were barium, chromium, copper, and zinc. Chromium, copper, and zinc were significantly correlated with each other (co-located), while barium was not associated with the other metals analyzed. As discussed in the DESR, chromium, copper, and zinc also appeared to be negatively associated with *N. arenaceodentata* growth, however the apparent relationships were not significant at the 0.10 level of significance, and were not investigated further (EA 2010a).

4.3 DIRECT EXPOSURE OF BENTHIC INVERTEBRATES IN WETLANDS SEDIMENTS

The potential for adverse effects to the benthic invertebrate community were evaluated primarily through comparison of COPEC concentrations in North Area sediments to literature-based benchmarks and the bioassay results of *N. arenaceodentata* and *L. plumulosus.*

4.3.1 Comparison of North Area Sediments to Literature-Based Benchmarks

Multiple PAHs and several metals exceeded sediment benchmarks. Exceedances of these benchmarks were limited in number for most COPECs (one to three samples at the most) and exceedances were typically within the same order of magnitude as the benchmark concentrations. The exception to this was zinc, which was present in four of the seven site samples. While comparison to literature-based benchmarks can be a tool for assessing risk, this method has the highest uncertainty and lowest confidence because they are not site-specific toxicity values.

4.3.2 *N. arenaceodentata* and *L. plumulosus* Toxicity Testing and Identification of Potential Stressors.

In the hypothesis analysis, where reference samples were pooled, wetland sediment EWSED06 exhibited reduced growth of *L. plumulosus* when compared with wetland sediment reference samples. No statistical difference was observed between wetland sediment samples and reference sediment samples when assessing survival and growth in the polychaete *N. arenaceodentata*.

Exploratory correlation and PCA revealed that, although PAH compounds were strongly correlated with each other (co-located) they were not closely associated with the toxic endpoint (*L. plumulosus* growth) (EA 2010a). To reduce the number of variables considered in the analysis, Total PAHs and Σ(PAHs/TOC) were determined, and individual PAH compounds were eliminated from the data set.

Correlation analysis showed that sediment grain size was not significantly associated with *Leptocheirus* growth, while zinc in bulk sediment, (ΣSEM-AVS)/TOC, and copper in pore water were negatively associated (i.e. as one goes up the other goes down) with *Leptocheirus* growth (EA 2010a). Significant association is indicated at the 0.05 level of significance.

Pore water was not analyzed in all the samples that were analyzed for bulk sediment chemistry and AVS/SEM. Therefore, the correlation analysis was performed separately (EA 2010a). Copper was the only pore water analyte that was significantly associated with adverse effects to *L. plumulosus* growth at the 0.05 level of significance.

As a result of these analyses, the following analytes appear to be associated with the observed growth effects to *L. plumulosus* in wetland sediments:

- Copper (pore water)
- Zinc (bulk sediment)

- (ΣSEM-AVS)/TOC

Correlation matrices for *L. plumulosus* endpoints versus bulk sediment chemistry and pore water chemistry are included in DESR (EA 2010a).

4.4 DIRECT EXPOSURE OF AQUATIC ORGANISMS IN NORTH AREA SURFACE WATER

The potential for adverse effects to the aquatic organisms were evaluated primarily through comparison of COPEC concentrations in North Area surface water to literature-based benchmarks and the bioassay results of *A.salina*.

4.4.1 Comparison of North Area Sediments to Literature-Based Benchmarks

The only exceedance of a surface water benchmark was for dissolved copper at EWSW03. Comparison to background levels was not available for surface water. While comparison to literature-based benchmarks can be a tool for assessing risk, this method has the highest uncertainty and lowest confidence because they are not site-specific toxicity values.

4.4.2 *A. salina* Toxicity Testing and Identification of Potential Stressors

The results of the acute toxicity tests of three surface water samples to brine shrimp (*A. salina*) were generally consistent between the original analysis presented in the FPSCR and the analysis using pooled reference data: Samples EWSW01 and EWSW04 did not exhibit acute toxicity (LC50 > 100 percent), and Sample EWSW03 had an LC50 between 5 and 6 percent dilution.

Acute toxicity to *A. salina* was indicated in 1 of 3 samples (EWSW03). These samples were analyzed for copper, nickel, silver, and zinc to aid in the determination of potential stressors. The data set is too small for quantitative statistical evaluation; however, concentrations of copper (8.54 microgram per liter [μg/L]) and silver (0.049 μg/L) are greater in the sample that exhibited acute toxicity to brine shrimp than in the other samples. If toxicity is attributable to copper, it appears that concentrations less than 3.4 μg/L would not cause toxicity to *A. salina.*

5.0 UNCERTAINTY

Uncertainty exists in many areas of risk assessment. The nature of the uncertainties depends on the data available, the degree of knowledge of site conditions, and the assumption made throughout the risk assessment process. Site-specific uncertainties inherent in the SERE are provided below:

- Toxicity to soil dwelling invertebrates was assessed using site toxicity data from *N. arenaceodentata*, a sediment dwelling marine polychaete, due to the high salinity of surface soils in the North Area. Site soils were submerged with synthetic seawater for the toxicity tests. The treatment of surface soils as sediments and the use of a marine

invertebrate may over- or underestimate risk to soil-dwelling invertebrates present in the North Area terrestrial environment.

- Site media concentrations were compared to literature-based benchmarks, or ESVs, which are not site-specific. This may over or underestimate risk.
- Toxicity to surface water dwelling invertebrates was assessed using site toxicity test data for the brine shrimp, *A. salina*, for which no established SOP was available. Multiple runs of the surface water toxicity tests were required due to potential feeding issues of test organisms and repeated control failure. Surface water reference data was also not available due to dry conditions in the reference area for comparison to toxicity test results. These factors may over- or underestimate risk to surface water-dwelling invertebrates present in the North Area aquatic environment.
- The results of the toxicity studies are not always well correlated to the results of the analytical chemistry. For example, while reference samples were elevated in soil sample NAS07, the survival of *N. arenaceodentata* in that sample was high (92 percent). Contrastingly, reference concentrations of all metal COPECs were below the TCEQ soil benchmarks at sample location NAS09, yet this sample indicated the highest mortality (60 percent). Factors other than site COPECs may explain the observed toxicity. This could over- or underestimate risk.
- The use of synthetic seawater to treat the soils as sediments for the toxicity test could also over or underestimate risks.
- SEM/AVS ratios for wetland sediments are generally above 1.0, indicating that conditions do not highly favor the formation of metal sulfides making them less bioavailable. The ratio of “excess” SEM to the fraction OC content in sediment is below 130 micromoles per gram organic carbon (µmol/goc) which is the concentration predicted to be non-toxic by the EPA (EPA, 2005) for six of the seven site samples. This may overestimate risk to metals from wetland sediments.
- The differences in how hypothesis testing were performed resulted different outcomes for wetland sediment and surface soils. This may over- or underestimate risk.

6.0 CONCLUSIONS

This SERE focused on characterizing potential risk from surface soils, sediments, and surface waters in the North Area. Potential risk was evaluated through the additional data analysis.

Toxicity tests of North Area surface soils to soil invertebrates, represented by the marine polychaete, *N. arenaceodentata*, indicated a significant difference for growth at one sampling location. Toxicity tests of wetland sediments to sediment dwelling invertebrates, represented by the amphipod, *L. plumulosus*, indicated significant difference in growth at one location. No significant differences were observed for survival and growth of N. *arenaceodentata* for the North Area sediment. Acute toxicity to the brine shrimp, *A. salina*, was indicated in one surface water sample from the North Area.

While the results of the site-specific toxicity test indicate the potential for some adverse effects to benthic invertebrates, risk is likely overestimated due to the intermittent nature of surface

water in the wetlands. Depending on rainfall and tide conditions, many of the areas selected for sediment toxicity analysis can often be completely dry. Significant populations of invertebrates would likely be limited to areas with perennial surface water. While individual effects may be present, it is unlikely that population level effects to growth and survival of invertebrates exist from COPECs in site surface soils, sediments and surface waters.

These findings are similar to those of the EA *Technical Memorandum Ecological and Habitat Health Assessment, Wetlands A, B, and C* (EA 2010b) which indicated that observed human impacts to the Site wetland habitats are minor. The Site wetlands are not visually distinguishable from surrounding wetlands in terms of wetland species composition and approximate density, presence of invertebrates, and wildlife usage. These wetlands are providing valuable wetland marsh functions, such as wildlife habitat, food, flood storage, water quality enhancement, and groundwater recharge. Any disturbance, such as excavation of sediments or other remedial activities, would require decades for sediments in this area to return to the salty sediment marsh type environment present today.

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TABLES

TABLE 1

DATA SUMMARY FOR NORTH AREA SURFACE SOILS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Location**	**Comments**	**4,4'-DDT**	**Aroclor-1254**	**Barium**	**Chromium**	**Copper**	**Zinc**
TCEQ Soil Benchmark			*NA*	*NA*	*300*	*30*	*61*	*120*
NAS01	North Area Soil				272	**97.3**	**221**	**5770**
NAS02	North Area Soil		0.0075 J	0.093 J	163	27.2	26.0	**296** JH
NAS02DUP	North Area Soil		0.015 J	0.16 J	261	23.1	24.9	**307** J
NAS03	North Area Soil		0.0078	--	190	15.4	22.9	**307** J
NAS04	North Area Soil		--	0.01	**502**	7.86	10.8	**321** J
NAS05	North Area Soil		0.008	--	198	**30.9**	27.4	**309** J
NAS06	North Area Soil		--	--	52.2	13.4	10.8	62.3 J
NAS07	North Area Soil	Background location BSS-01	--	--	**340**	12.4	10.1	**501**
NAS08	North Area Soil	Background location BSS-02	--	--	182	13.6	12.6	**182**
NAS09	North Area Soil	Background location BSS-03	--	--	172	13.3	11.0	63.1

Notes:
Values in mg/kg, dry weight
J = Estimated Concentration
H = Concentratin Biased High
mg/kg = milligrams per kilograms
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	Location	Date	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene
TCEQ Marine Sediment Benchmark	--	--	*0.07*	*0.016*	*0.044*	*0.0853*
EWSED01	Wetland	8/12/2010	0.0038 J	0.0046 J	**0.057**	0.043
EWSED02	Wetland	8/12/2010	0.002 J	0.0018 J	0.041	0.032
EWSED02DUP	Wetland	8/12/2010	**0.0026** J	0.0013 J	0.03	0.024
EWSED03	Wetland	8/13/2010	**0.0068**	0.0043 J	0.0032 J	0.005
EWSED04	Wetland	8/13/2010	0.0037 J	0.0026 J	0.0069	0.006
EWSED05	Wetland	8/12/2010	**0.02**	**0.075**	0.018	0.078
EWSED06	Wetland	8/12/2010	0.0016 J	0.0013 J	0.0008 J	0.0011 J
EWSED07	Wetland	8/13/2010	**0.0053**	0.009	0.0091	0.027
EWSED08	Wetland	8/13/2010	0.001 J	< 0.00088	< 0.00069	0.001 J
EWSED09	Wetland	8/13/2010	0.00061 J	< 0.00076	< 0.00059	< 0.00058

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Arsenic**	**SEM/AVS**	**Benzo(a)pyrene**	**Benzo(g,h,i)perylene**	**Copper**	**Indeno(1,2,3-cd)pyrene**
TCEQ Marine Sediment Benchmark	*8.2*	*NA*	*0.43*	*NA*	*34*	*NA*
EWSED01	2.97	0.089	0.24	0.63	20.6	0.22
EWSED02	2.4	0.014	0.12	0.46	13.3	0.18
EWSED02DUP	2.51	--	0.097	0.35	14.6	0.16
EWSED03	5.36	0.002	0.028	0.058	25	0.034
EWSED04	4.35	0.039	0.04	0.076	20.3	0.064
EWSED05	3.06	0.002	**0.79**	0.68	28.9	0.79
EWSED06	3.23	0.084	0.01	0.019	28.1	0.019
EWSED07	5.94	0.005	0.087	0.1	30.7	0.1
EWSED08	2.92	6.4	0.014	0.017	15.8	0.019
EWSED09	2.58	0.062	0.0027 J	0.0032 J	11.7	0.0032 J

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Lead**	**Nickel**	**4,4'-DDT**	**Endrin Aldehyde**	**Benzo(a)anthracene**	**Endrin ketone**
TCEQ Marine Sediment Benchmark	*46.7*	*20.9*	*0.00119*	*NA*	*0.261*	*NA*
EWSED01	17.2	18.9	< 0.001 J	0.0007 J	< 0.066 J	< 0.000093
EWSED02	12	15.6	< 0.00017	< 0.00012	< 0.043 J	< 0.000093
EWSED02DUP	14.7	17.3	< 0.00017	< 0.001 J	< 0.00072 J	< 0.0011 J
EWSED03	**48.4**	**21.7**	**0.0028**	0.00027 J	0.024	< 0.00011 J
EWSED04	37.4	16.9	--	--	0.031	--
EWSED05	**76.1**	14.4	< 0.019 J	0.0014 J	**0.55**	< 0.001 J
EWSED06	32.9	**22.5**	**0.0012**	< 0.00012	0.0069	< 0.000093
EWSED07	32.7	20.1	--	--	0.09	--
EWSED08	19.8	16.3	**0.0014**	0.00052 J	0.011	< 0.00012
EWSED09	17.4	16.5	**0.0016**	< 0.00012	0.0024 J	< 0.000093

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Chrysene**	**gamma-Chlordane**	**Dibenz(a,h)anthracene**	**Flourene**	**Flouranthene**
TCEQ Marine Sediment Benchmark	*0.384*	*0.00226*	*0.0634*	*0.019*	*0.6*
EWSED01	**0.39**	< 0.00009	**0.17**	0.019	0.038
EWSED02	**0.62**	< 0.00009	**0.11**	0.013	0.023
EWSED02DUP	**0.49**	< 0.00009	**0.094**	0.011	0.019
EWSED03	0.064	< 0.00009	0.0074	0.0048	0.052
EWSED04	0.05	--	0.01	0.0032 J	0.076
EWSED05	**0.77**	< 0.00009	**0.14**	**0.065**	**1.3**
EWSED06	0.014	0.00025 J	0.0026 J	0.001 J	0.02
EWSED07	0.14	--	0.019	0.016	0.26
EWSED08	0.017	< 0.00012 J	0.003 J	0.00092 J	0.031
EWSED09	0.004	< 0.00023 J	< 0.0008	< 0.00061	0.0055

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Phenanthrene**	**Pyrene**	**Total Organic Carbon**	**Zinc**	**GRAVEL, MEDIUM,%**	**GRAVEL, FINE,%**
TCEQ Marine Sediment Benchmark	*0.24*	*0.665*	*NA*	*150*	*NA*	*NA*
EWSED01	0.032	0.091	59400	115	2.52	3.49
EWSED02	0.016	0.14	24100	70.1	53.7	5.66
EWSED02DUP	0.014	0.11	30500	86.1	--	--
EWSED03	0.049	0.069	18200	**585**	47.9	7.73
EWSED04	0.041	0.075	16700	**417**	0.57	2.19
EWSED05	**0.78**	**1.1**	18100	**595**	0.34	2.64
EWSED06	0.013	0.021	21500	**959**	18.7	0.87
EWSED07	0.15	0.19	23900	**318**	--	--
EWSED08	0.015	0.027	46800	94.3	12.7	12.1
EWSED09	0.0024 J	0.0044 J	11200	88.3	1.97	2.31

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**SAND, VERY COARSE,%**	**SAND, COURSE,%**	**SAND, MEDIUM,%**	**SAND, FINE,%**	**SAND, VERY FINE,%**	**SILT,%**	**CLAY,%**
TCEQ Marine Sediment Benchmark	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
EWSED01	5.58	2.82	1.8	2.12	2.42	61.6	21.2
EWSED02	2.91	1.77	1.15	2.29	1.64	13.7	10.8
EWSED02DUP	--	--	--	--	--	--	--
EWSED03	4.83	3.01	1.75	1.93	0.93	29.2	1.7
EWSED04	2.88	3.18	2.98	7.02	4.59	81.4	0.6
EWSED05	2.83	4.49	4.93	8.91	6.96	38.7	27.5
EWSED06	0.67	0.41	0.27	2.06	1.24	21.6	61.7
EWSED07	--	--	--	--	--	--	--
EWSED08	8.04	3.92	1.93	2.62	2.51	44.3	14.6
EWSED09	1.35	0.54	0.4	1.87	5.24	40.4	48.5

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Acid-volatile sulfide, µmol/gsed**	**Cadmium, SEM, µmol/gsed**	**Copper, SEM, µmol/gsed**	**Lead, SEM, µmol/gsed**	**Nickel, SEM, µmol/gsed**	**Zinc, SEM, µmol/gsed**
TCEQ Marine Sediment Benchmark	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
EWSED01	0.018 J	< 0.0006	0.024	0.015	0.015	0.148
EWSED02	< 0.005	0.0007	0.03	0.029	0.03	0.259
EWSED02DUP	--	--	--	--	--	--
EWSED03	< 0.004	0.0011	0.057	0.038	0.012	1.55
EWSED04	0.05	0.0012	0.16	0.088	0.016	1.02
EWSED05	< 0.004	< 0.0005	0.082	0.055	0.011	1.74
EWSED06	0.33	0.0019	0.092	0.04	0.019	3.79
EWSED07	--	--	--	--	--	--
EWSED08	2.04	< 0.0008	0.016	0.021	0.028	0.255
EWSED09	0.004	< 0.0005	0.011	0.009	0.005	0.039

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 2

DATA SUMMARY FOR NORTH AREA WETLAND SEDIMENTS
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**∑SEM, µmol/gsed**	**∑SEM/AVS**	**foc,goc/gsed**	**∑SEM-AVS, µmol/gsed**	**(∑SEM-AVS)/foc, µmol/goc**
TCEQ Marine Sediment Benchmark	*NA*	*NA*	*NA*	*NA*	*NA*
EWSED01	0.2	11.3	0.0594	0.185	3.1
EWSED02	0.3	69.7	0.0273	0.344	12.6
EWSED02DUP	--	--	--	--	--
EWSED03	1.7	415	0.0182	1.654	90.9
EWSED04	1.3	25.7	0.0167	1.235	74
EWSED05	1.9	472	0.0181	1.885	104.1
EWSED06	3.9	11.9	0.0215	3.613	168
EWSED07	0.7	184	0.0239	0.731	30.6
EWSED08	0.3	0.157	0.0468	--	--
EWSED09	0.1	16.1	0.0112	0.061	5.4

Notes:
Values in mg/kg, dry weight
IW = Intercoastal Waterway
J = Estimated Concentration
L = Concentratin Biased Low
< indicates samples was below indicated detection limit.
mg/kg = milligrams per kilograms
AVS = Acid Volatile Sulfides
SEM = Simultaneously Extracted Metals
-- Not Analyzed

Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**2-Methylnaphthalene**	**4,4'-DDT**	**Acenaphthene**	**Acenaphthylene**
TCEQ Marine Surface Water Benchmark	*0.03*	*0.000001*	*0.0404*	*NA*
EWSED01	0.000018 U	< 0.000012 J	<0.0000052	0.000024
EWSED02	0.000026 U	< 0.0000047 J	<0.0000044	<0.0000034
EWSED03	0.000022 U	< 0.000016 J	<0.0000047	<0.0000036
EWSED04	0.000046	--	<0.0000085 J	0.000014 J
EWSED04DUP	--	--	--	--
EWSED06	0.000019 U	< 0.00000058	0.0000091 J	<0.0000035
EWSED07	0.000013 U	--	<0.000012	0.000032 J
EWSED08	0.0000083 U	**0.000003** J	<0.000005	<0.0000039
EWSED09	0.000018 U	< 0.0000014 J	<0.0000044	<0.0000034

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Anthracene**	**Arsenic**	**Benzo(a)anthracene**	**Benzo(a)pyrene**	**Benzo(g,h,i)perylene**
TCEQ Marine Surface Water Benchmark	*0.00018*	*0.078*	*NA*	*NA*	*NA*
EWSED01	0.000067	0.0037 J	<0.0000031	<0.0000051	0.000012 J
EWSED02	<0.0000036	0.0041 J	<0.0000026	<0.0000043	0.000012 J
EWSED03	0.000013 J	0.0019 J	<0.0000028	<0.0000046	<0.0000031
EWSED04	0.000047	0.00072 J	<0.0000026	<0.0000043	<0.0000029
EWSED04DUP	--	0.00325	--	--	--
EWSED06	<0.0000037	0.00177 J	0.0000095 U	0.0000097 U	0.000023 U
EWSED07	0.000066	0.00063 J	<0.0000067	<0.000012	<0.0000075
EWSED08	<0.0000041	0.00576 J	<0.000003	<0.0000049	<0.0000033
EWSED09	<0.0000036	0.00171 J	<0.0000026	<0.0000043	<0.0000029

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Chrysene**	**Copper**	**Dibenz(a,h)anthracene**	**Endrin Aldehyde**
TCEQ Marine Surface Water Benchmark	*NA*	*0.0036*	*NA*	*0.000002*
EWSED01	<0.000004	0.000922	<0.000003	**0.000013**
EWSED02	0.000049	0.000342 U	0.0000034 J	**0.0000067** J
EWSED03	<0.0000036	**0.00456**	<0.0000027	**0.000015** J
EWSED04	<0.0000034	**0.00426**	<0.0000025	--
EWSED04DUP	--	**0.00531** U	--	--
EWSED06	0.0000096 U	**0.00702**	0.000015 U	<0.00000046
EWSED07	<0.0000088	0.00303	<0.0000065	--
EWSED08	<0.0000039	0.00137	<0.0000029	**0.0000026** J
EWSED09	<0.0000034	0.000761 U	<0.0000025	<0.0000033 J

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Endrin ketone**	**Fluorene**	**Fluoranthene**	**gamma-Chlordane**
TCEQ Marine Surface Water Benchmark	*0.000002*	*0.05*	*0.00298*	*0.000004*
EWSED01	<0.00000078	0.000013 J	<0.0000052	<0.00000038
EWSED02	<0.0000013 J	<0.0000038	<0.0000044	<0.0000013 J
EWSED03	**0.000007** J	<0.000004	<0.0000047	<0.000016 J
EWSED04	--	0.0000047 J	<0.0000044	--
EWSED04DUP	--	--	--	--
EWSED06	<0.00000066	0.0000091 J	<0.0000045	<0.00000032
EWSED07	--	<0.0000098	<0.000012	--
EWSED08	<0.0000007	<0.0000044	<0.000005	0.0000033 J
EWSED09	<0.0000011	<0.0000038	<0.0000044	<0.000016 J

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 3

DATA SUMMARY TABLE FOR NORTH AREA WETLAND SEDIMENT PORE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Indeno(1,2,3-cd)pyrene**	**Lead**	**Nickel**	**Phenanthrene**	**Pyrene**	**Zinc**
TCEQ Marine Surface Water Benchmark	*NA*	*0.0053*	*0.0131*	*0.0046*	*0.00024*	*0.0842*
EWSED01	0.0000051 J	0.000115 U	0.00944	0.000012 J	<0.0000042	0.0101
EWSED02	0.0000062 J	0.000113 U	0.00486	<0.000005	<0.0000035	0.00135 U
EWSED03	<0.0000028	0.000425 U	0.00749 U	0.0000053 U	<0.0000037	0.0413
EWSED04	<0.0000026	0.00015 U	0.0114	<0.000005	<0.0000035	**0.101**
EWSED04DUP	--	0.000239 U	--	--	--	0.083
EWSED06	0.000014 U	0.000443 U	0.00915	0.0000068 J	<0.0000036	**0.626**
EWSED07	<0.0000067	0.000184	0.00917	<0.000013	<0.000009	0.0599
EWSED08	<0.000003	0.00128 U	**0.0142**	<0.0000057	<0.000004	0.039
EWSED09	<0.0000026	0.000236 U	0.00669	<0.000005	<0.0000035	0.00124 U

Notes:
Values in mg/L
mg/L = milligrams/liter
< or U indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 4
1 of 1
DATA SUMMARY FOR NORTH AREA WETLAND SURFACE WATER
GULFCO MARINE MAINTENANCE SUPERFUND SITE

Sample ID	**Acrolein**	**Copper**	**Nickel**	**Silver**	**Zinc**
TCEQ Marine Surface Water Benchmark	*0.005*	*0.0036*	*0.0131*	*0.00019*	*0.0842*
EWSW01	<0.00096	0.00338 J	0.00616	0.000020 J	0.029
EWSW01DUP	<0.00096	0.00331	0.00601	0.000021 J	0.0279
EWSW03	--	**0.00854**	0.00474	0.000049	0.0242
EWSW04	--	0.00154	0.00396	0.000011 J	**0.122**

Notes:
Values in mg/L
mg/L = milligrams/liter
< indicates samples was below indicated detection limit.
J = Estimated Concentration
-- Not Analyzed
Values in **bold** exceed screening benchmark

TABLE 5

SUMMARY OF TOXICITY TESTING FOR NORTH AREA SOIL AND SEDIMENT
GULFCO MARINE MAINTENANCE SUPERFUND SITE

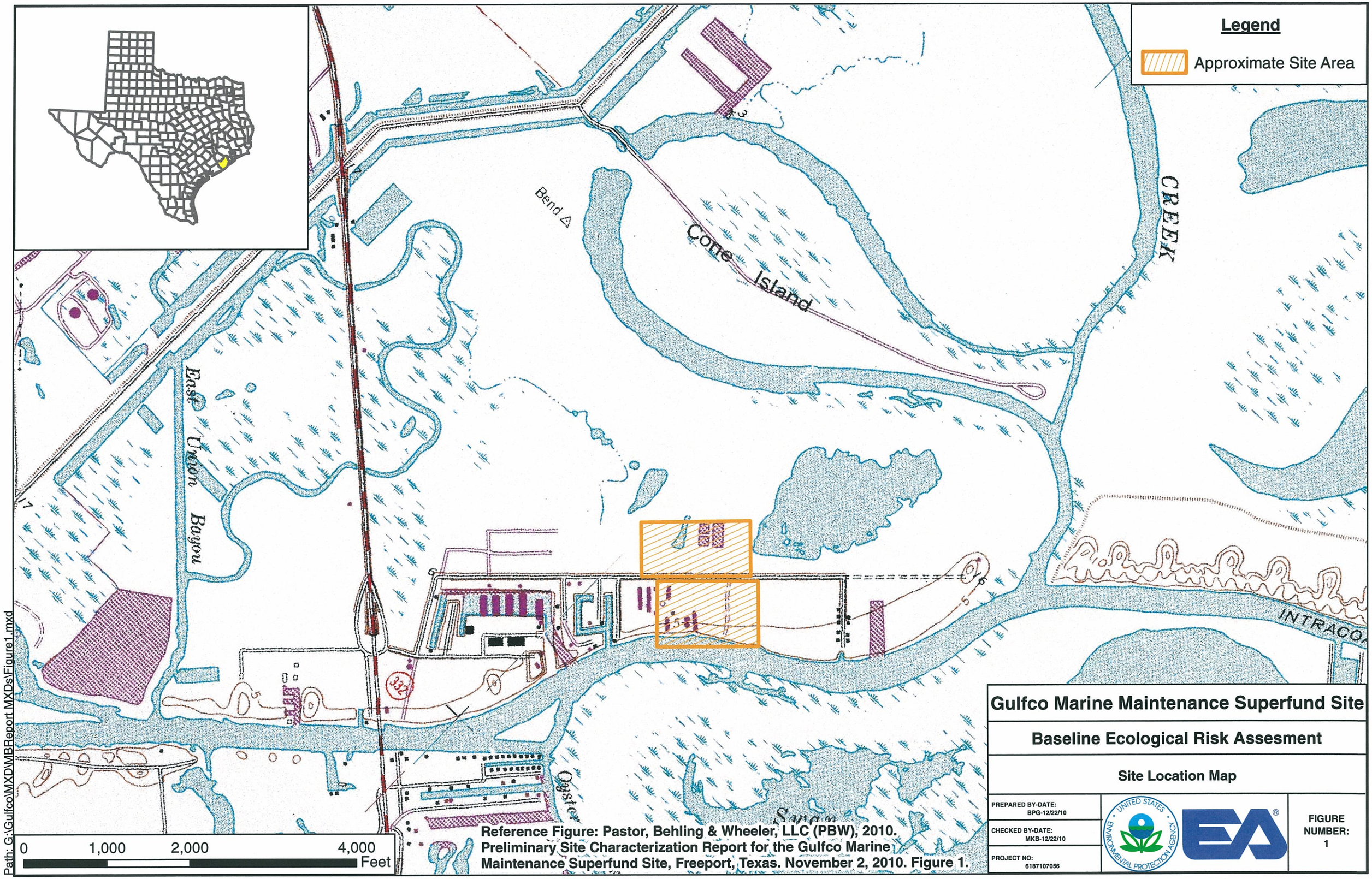
North Area Soils	***21-day Neanthes arenaceodentata:* Survival and Growth**		
Sample ID	**Survival (%)**	**Growth - Biomass (mg)**	**Growth - Dry Wt. (mg)****
Lab Control for North Area Soils	100	2.058	2.058
Site Locations:			
BERA SAmple ID: NAS01	76	0.6648	0.9817
BERA Sample ID: NAS02	88	2.123	2.407
BERA Sample ID: NAS03	96	2.603	2.704
BERA Sample ID: NAS04	84	4.52	5.423
BERA Sample ID: NAS05	76	1.998	2.695
BERA Sample ID: NAS06	88	1.648	1.894
North Area Reference Locations:			
BERA Sample ID: NAS07	92	1.533	1.679
BERA Sample ID: NAS08	64	0.688	1.008
BERA Sample ID: NAS09	60	0.5512	0.9815

Wetlands Sediments	***28-day Neanthes arenaceodentata:* Mean Survival and Growth**			***28-day Leptocheirus plumulosus:* Mean Survival, Growth and Reproduction**			
Sample ID	**Survival (%)**	**Growth - Biomass (mg)**	**Growth - Dry Wt. (mg)****	**Survival (%)**	**Offspring (Mean)**	**Growth - Biomass (mg)**	**Growth - Dry Wt. (mg)****
Lab Control *	96	4.073	4.28	81.5	5.3	0.6773	0.8304
Site Locations:							
BERA Sample ID: EWSED01	96	3.073	3.234	35	0	0.2607	0.6566
BERA Sample ID: EWSED02	76	2.285	3.334	58	0.2	0.2313	0.4916
BERA Sample ID: EWSED03	84	2.004	2.421	20	0	0.2015	0.4202
BERA Sample ID: EWSED04	84	2.53	2.988	23.75	0	0.1518	0.529
BERA Sample ID: EWSED05	72	2.248	3.285	38	0	0.1614	0.4109
BERA Sample ID: EWSED06	80	1.78	2.36	13	0	0.05525	0.3764
BERA Sample ID: EWSED07	72	2.451	3.371	30	0.8	0.124	0.3924
Wetland Sediment Reference Locations:							
BERA Sample ID: EWSED08	66	1.586	2.741	33	0.6	0.2238	0.5988
BERA Sample ID: EWSED09	76	2.15	2.95	19	1.8	0.1162	0.5035

* Average of Lab Control 1 and 2

* * The primary growth endpoint Dry Wt is the dry weight of surviving organisms divided by the number of surviving organisms. Biomass (the dry weight of surviving orgamisms divided by initial number of organisms) is not routinely applied to sediment testing (EPA, 2000)

FIGURES



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 1.

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

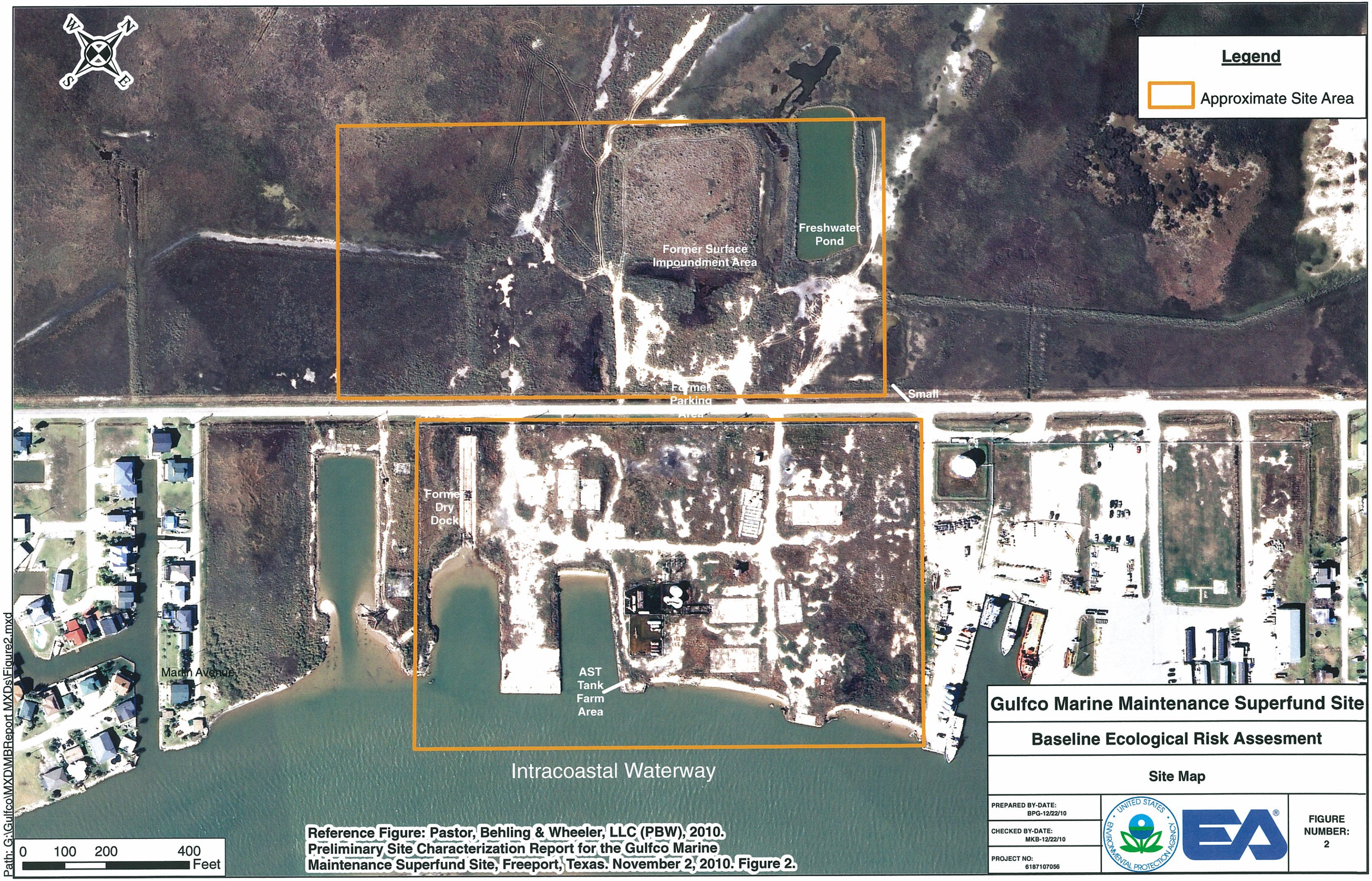
Site Location Map

PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 1



Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 2.

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Site Map

PREPARED BY-DATE: BPG-12/22/10	FIGURE NUMBER: 2
CHECKED BY-DATE: MKB-12/22/10	
PROJECT NO: 6187107056	

BERA Sample ID: NAS01	
Constituent	Concentration (mg/kg)
Metals	
Chromium	97
Copper	221
Zinc	5770

Reference Figure: Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 2.

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Sample Locations and Potential Stressors in North Area Soils

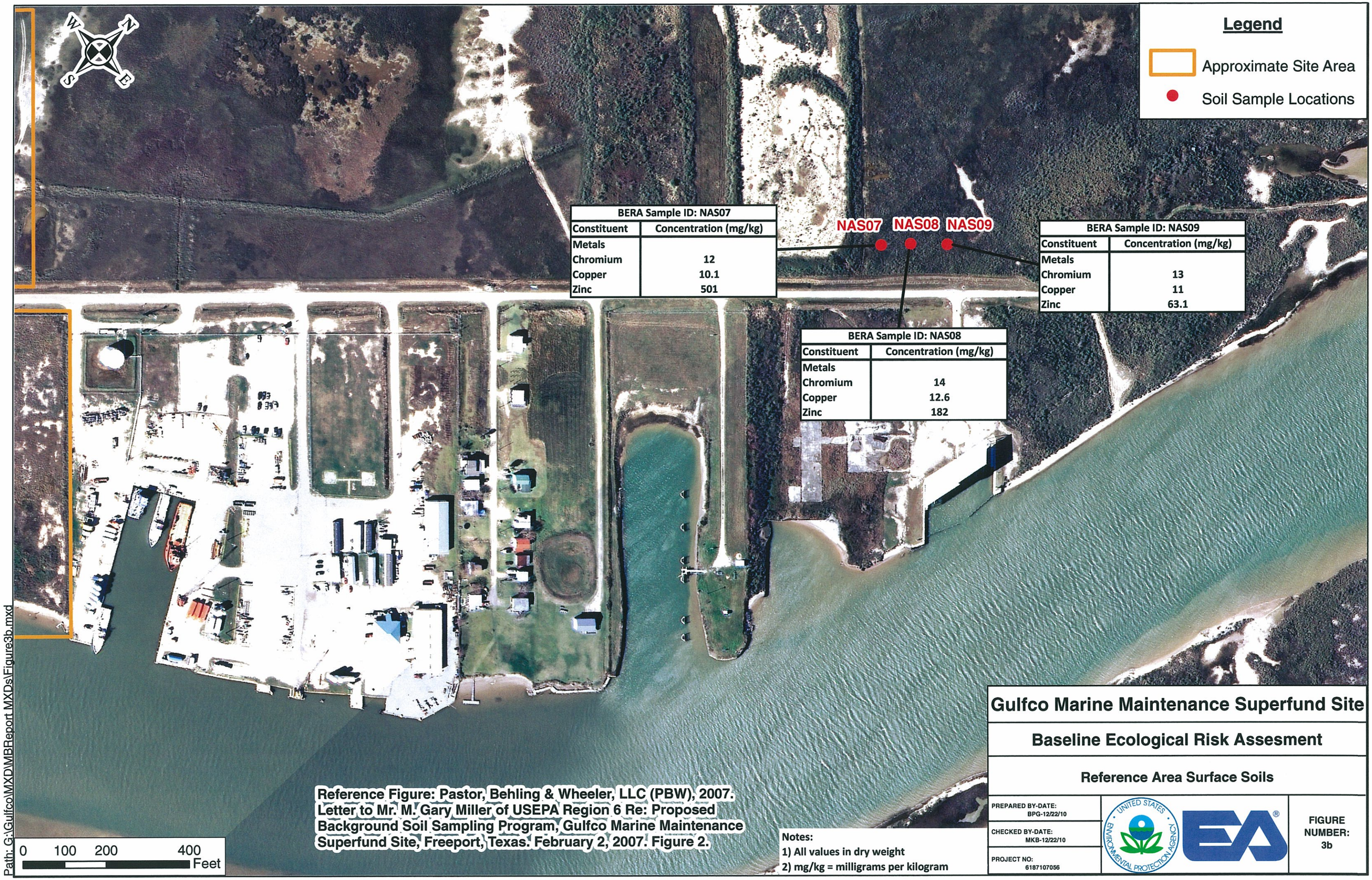
PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 3a

Path: G:\Gulfco\MXD\MBReport MXDs\Figure3a.mxd



BERA Sample ID: NAS07	
Constituent	Concentration (mg/kg)
Metals	
Chromium	12
Copper	10.1
Zinc	501

BERA Sample ID: NAS08	
Constituent	Concentration (mg/kg)
Metals	
Chromium	14
Copper	12.6
Zinc	182

BERA Sample ID: NAS09	
Constituent	Concentration (mg/kg)
Metals	
Chromium	13
Copper	11
Zinc	63.1

Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2007. Letter to Mr. M. Gary Miller of USEPA Region 6 Re: Proposed Background Soil Sampling Program, Gulfco Marine Maintenance Superfund Site, Freeport, Texas. February 2, 2007. Figure 2.

Notes:
1) All values in dry weight
2) mg/kg = milligrams per kilogram

Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Reference Area Surface Soils

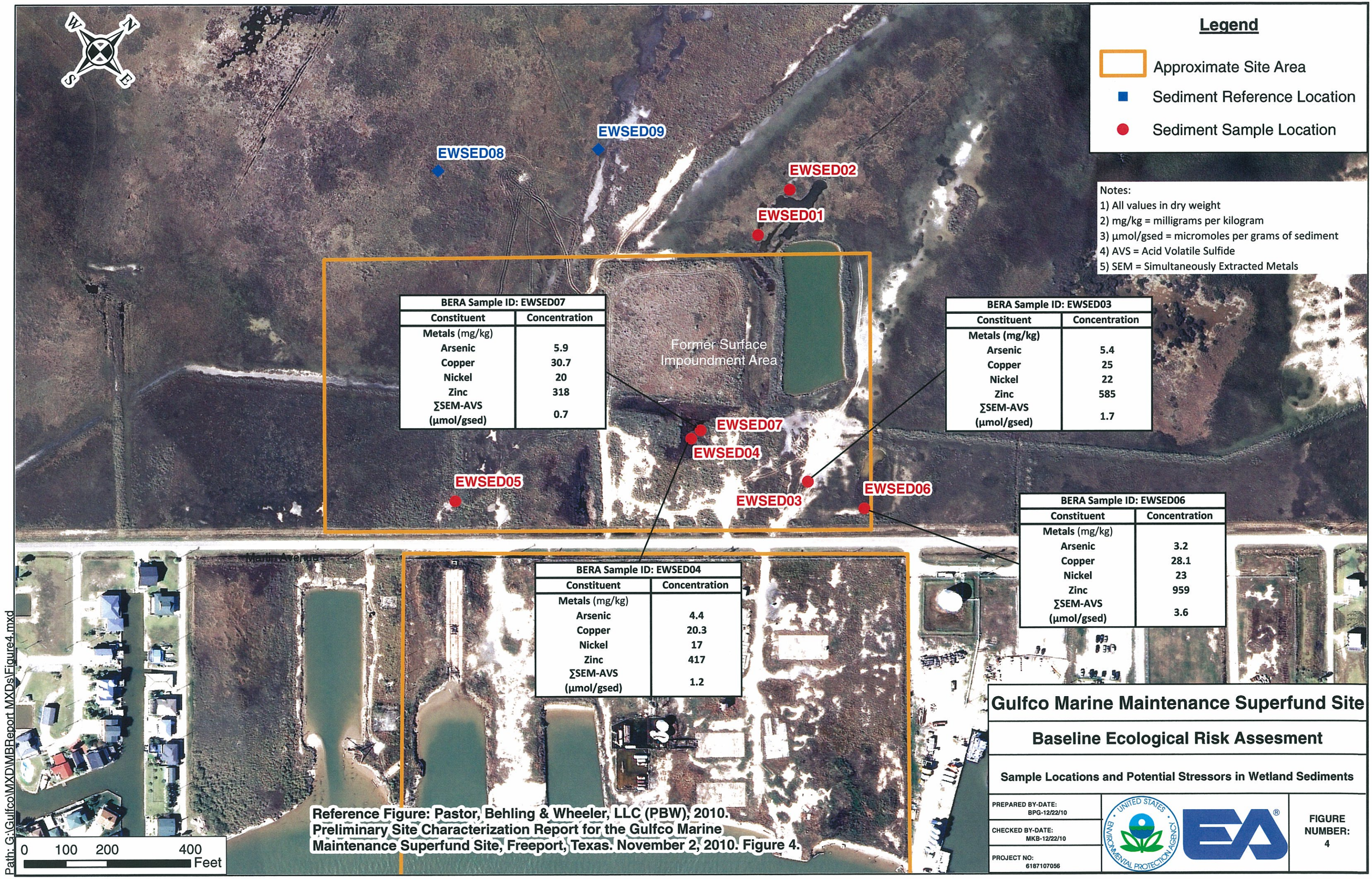
PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 3b

Path: G:\Gulfco\MXD\MBReport MXDs\Figure3b.mxd



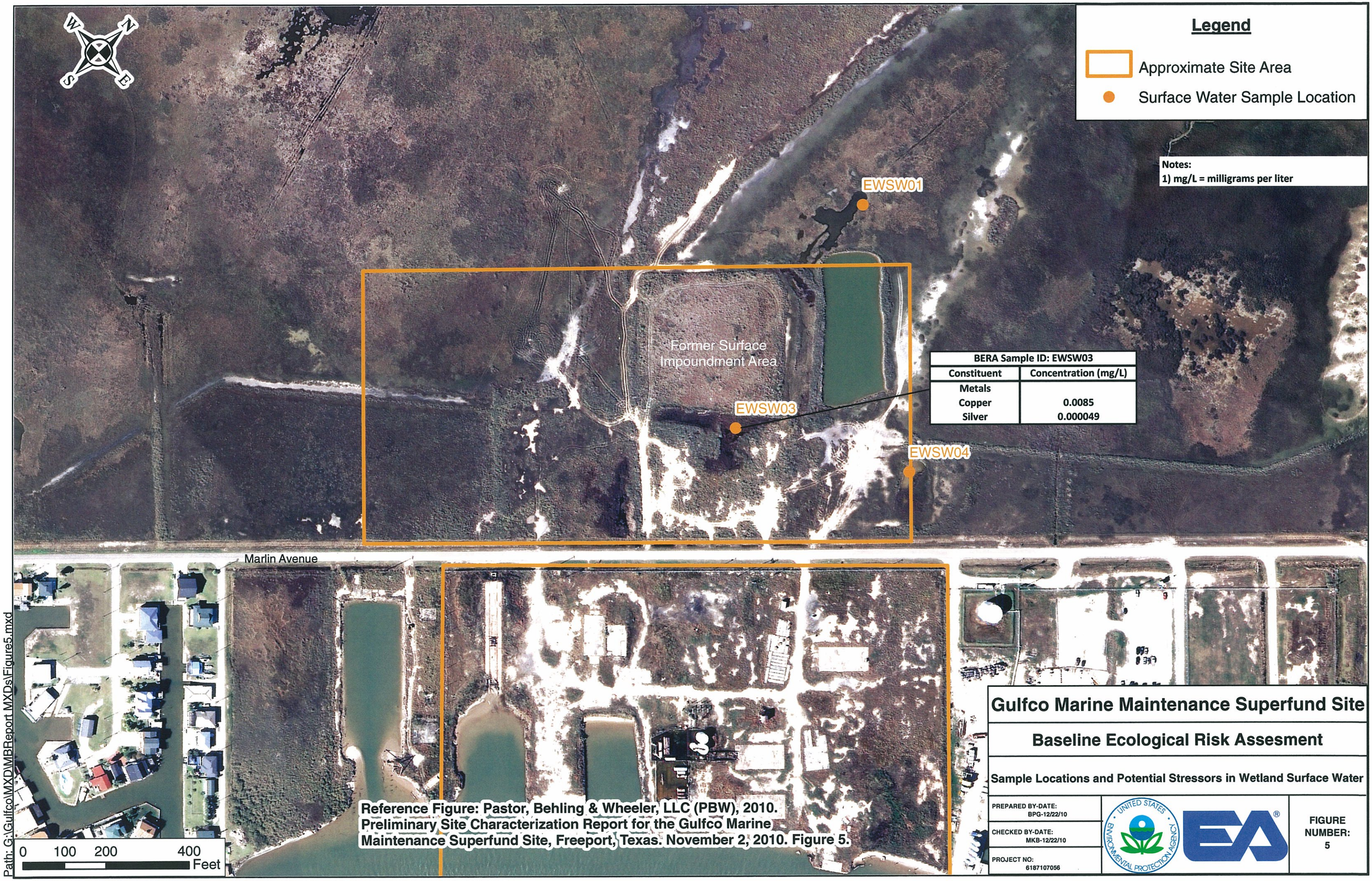
BERA Sample ID: EWSED07	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	5.9
Copper	30.7
Nickel	20
Zinc	318
∑SEM-AVS (µmol/gsed)	0.7

BERA Sample ID: EWSED03	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	5.4
Copper	25
Nickel	22
Zinc	585
∑SEM-AVS (µmol/gsed)	1.7

BERA Sample ID: EWSED06	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	3.2
Copper	28.1
Nickel	23
Zinc	959
∑SEM-AVS (µmol/gsed)	3.6

BERA Sample ID: EWSED04	
Constituent	Concentration
Metals (mg/kg)	
Arsenic	4.4
Copper	20.3
Nickel	17
Zinc	417
∑SEM-AVS (µmol/gsed)	1.2

Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 4.



BERA Sample ID: EWSW03	
Constituent	Concentration (mg/L)
Metals	
Copper	0.0085
Silver	0.000049

Reference Figure: Pastor, Behling & Wheeler, LLC (PBW), 2010. Preliminary Site Characterization Report for the Gulfco Marine Maintenance Superfund Site, Freeport, Texas. November 2, 2010. Figure 5.

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Gulfco Marine Maintenance Superfund Site

Baseline Ecological Risk Assesment

Sample Locations and Potential Stressors in Wetland Surface Water

PREPARED BY-DATE: BPG-12/22/10

CHECKED BY-DATE: MKB-12/22/10

PROJECT NO: 6187107056

FIGURE NUMBER: 5

EA Engineering, Science,
and Technology, Inc.

South Central Region
405 S. Highway 121, Suite C-100
Lewisville, TX 75067
Telephone: 972-315-3922
Fax: 972-315-5181
www.eaest.com

24 November 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Health and Safety Plan (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Health and Safety Plan (HASP) (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 24 November 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

EA Engineering, Science,
and Technology, Inc.

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www.eaest.com

29 November 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Sampling and Analysis Plan (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Sampling and Analysis Plan (SAP) (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 29 November 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

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26 May 2011

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency (EPA)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Task Order Closeout Report**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one hard copy of the Task Order Closeout Report (TOCR) for the Gulfco Marine Maintenance Site. EA will transmit an electronic version of the TOCR to EPA via e-mail.

EA is also providing one electronic copy on compact disc (CD) of the closeout files including the project index, final deliverables, and relevant correspondence. The data contained on the CD is for the designated recipient only and contains privileged and EA Confidential Business Information (CBI).

The period-of-performance expires on 31 May 2011. The Task Order was finished within the initial approved budget. The total cumulative cost for the Task Order is (b) (4) [redacted].

If you have any questions regarding this submittal, please call me at (972) 315-3922.

Sincerely,

Al Sloane
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
File

EA Engineering, Science,
and Technology, Inc.

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Lewisville, TX 75067
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www.eaest.com

28 December 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Revision 01)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the above-referenced Technical Memorandum (Revision 01) for the above-referenced Task Order. An electronic copy was submitted via email on 28 December 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

EA Engineering, Science,
and Technology, Inc.

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Lewisville, TX 75067
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www.eaest.com

21 December 2010

Mr. Gary Miller
Task Order Monitor
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: **Technical Memorandum Ecological and Habitat Health Assessment Wetlands A, B, and C (Revision 00) and Technical Memorandum Surface Impoundment Cap Evaluation for Erosion (Revision 00)**
Gulfco Marine Maintenance Site NTCRS
U.S. Environmental Protection Agency Region 6
Remedial Action Contract 2
Contract: EP-W-06-004
Task Order: 0067-NSEE-06JZ

Dear Mr. Miller:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the above-referenced Technical Memoranda (Revision 00) for the above-referenced Task Order. An electronic copy was submitted via email on 21 December 2010.

If you have any questions regarding this submittal, please call me at (972) 459-5040.

Sincerely,

Al Sloan
Project Manager

Enclosure

cc: Michael Pheeny, EPA Contracting Officer (letter only)
Rena McClurg, EPA Project Officer (letter only)
Tim Startz, EA Program Manager (letter only via e-mail)
Jeff Hills, EA Financial Manager (letter only via e-mail)
Mark Paddack, EA Alternate Project Manager
File

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and Technology, Inc.

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Lewisville, TX 75067
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www.eaest.com

29 October 2010

Mr. Michael Pheeny
Contracting Officer
U.S. Environmental Protection Agency (EPA)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: Work Plan and Cost Estimate (Revision 01)
Gulfco Marine Maintenance Superfund Site
Non-Time Critical Removal Support
U.S. EPA Region 6 Remedial Action Contract 2
Contract: EP-W-06-004

Dear Mr. Pheeny:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Work Plan and Cost Estimate for the above-referenced Task Order. This revised Work Plan is based upon the Statement of Work (SOW) issued by EPA on 6 October 2010, EPA responses provided on 15 October 2010 to questions that EA submitted for the SOW, and a 29 October 2010 teleconference to discuss the Task Order deliverables schedule. The revised Work Plan and Cost Estimate includes a revised Task Order Schedule, with no additional cost to EPA, due to the schedule revisions. EA estimates $(b) (4) [redacted] in total funding to perform the Task Order outlined in the EPA SOW. EA will also transmit to EPA an electronic copy of this submittal via e-mail.

If you have any questions regarding this work plan and cost estimate, please call me at (410) 584-7000.

Sincerely,

Fritz Meyer
Program Manager

Enclosure

cc: Rena McClurg, EPA Project Officer
Gary Miller, EPA Task Order Monitor
Jeff Hills, EA Financial Manager
Mark Paddack, EA Project Manager
File

EA Engineering, Science,
and Technology, Inc.

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www.eaest.com

27 October 2010

Mr. Michael Pheeny
Contracting Officer
U.S. Environmental Protection Agency (EPA)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: Work Plan and Cost Estimate
Gulfco Marine Maintenance Superfund Site
Non-Time Critical Removal Support
U.S. EPA Region 6 Remedial Action Contract 2
Contract: EP-W-06-004

Dear Mr. Pheeny:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Work Plan and cost estimate for the above-referenced Task Order. This Work Plan is based upon the Statement of Work (SOW) issued by EPA on 6 October 2010, and 15 October 2010 EPA responses to questions that EA submitted for the SOW. EA estimates (b) (4) [redacted] in total funding to perform the Task Order outlined in the EPA SOW. EA will also transmit to EPA an electronic copy of this submittal via e-mail.

If you have any questions regarding this work plan and cost estimate, please call me at (410) 584-7000.

Sincerely,

Fritz Meyer
Program Manager

Enclosure

cc: Rena McClurg, EPA Project Officer
Gary Miller, EPA Task Order Monitor
Jeff Hills, EA Financial Manager
Mark Paddack, EA Project Manager
File

EA Engineering, Science,
and Technology, Inc.

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29 October 2010

Mr. Michael Pheeny
Contracting Officer
U.S. Environmental Protection Agency (EPA)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Subject: Work Plan and Cost Estimate (Revision 01)
Gulfco Marine Maintenance Superfund Site
Non-Time Critical Removal Support
U.S. EPA Region 6 Remedial Action Contract 2
Contract: EP-W-06-004

Dear Mr. Pheeny:

EA Engineering, Science, and Technology, Inc. (EA) is enclosing one original hard copy of the Work Plan and Cost Estimate for the above-referenced Task Order. This revised Work Plan is based upon the Statement of Work (SOW) issued by EPA on 6 October 2010, EPA responses provided on 15 October 2010 to questions that EA submitted for the SOW, and a 29 October 2010 teleconference to discuss the Task Order deliverables schedule. The revised Work Plan and Cost Estimate includes a revised Task Order Schedule, with no additional cost to EPA, due to the schedule revisions. EA estimates (b) (4) [redacted] in total funding to perform the Task Order outlined in the EPA SOW. EA will also transmit to EPA an electronic copy of this submittal via e-mail.

If you have any questions regarding this work plan and cost estimate, please call me at (410) 584-7000.

Sincerely,

Fritz Meyer
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Gary Miller, EPA Task Order Monitor
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File

TRANSMITTAL OF DOCUMENTS FOR ACCEPTANCE BY EPA			DATE: 29 October 2010	TRANSMITTAL NO. 0002
TO: **Mr. Michael Pheeny** **U.S. Environmental Protection Agency Region 6**		FROM: **Fritz Meyer** **EA Engineering, Science, and Technology, Inc.**		X New Transmittal ☐ Resubmittal of Transmittal No. _____
SUBTASK NO.	DELIVERABLE		NO. OF COPIES	REMARKS
1.1.3	Work Plan/Cost Estimate (Rev. 01) Gulfco Marine Maintenance Superfund Site Non-Time Critical Removal Support (NTCRS)		1 Hard Copy 1 Electronic Copy via email	
ACCEPTANCE ACTION				
DOCUMENTS FOUND ACCEPTABLE (LIST BY SUBTASK NO.)		NAME/TITLE/SIGNATURE OF REVIEWER DATE		

NON-TIME CRITICAL REMOVAL SUPPORT
GULFCO MARINE MAINTENANCE SUPERFUND SITE
BRAZORIA COUNTY, TEXAS
EPA IDENTIFICATION NO. TXD055144539

Response Action Contract 2 Full Service
Contract: EP-W-06-004

Prepared for

U.S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Prepared by

EA Engineering, Science, and Technology, Inc.
405 S. Highway 121
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October 2010
Revision: 01

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2	SCHEDULE OF DELIVERABLES
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1. INTRODUCTION

EA Engineering, Science, and Technology, Inc. (EA) received the Statement of Work (SOW) for the Gulfco Marine Maintenance Superfund Site (Site) from the U.S. Environmental Protection Agency (EPA) under Response Action Contract No. EP-W-06-004. This Work Plan and cost estimate (Revision 01) is based on the SOW issued by the EPA Contracting Officer (CO) on 6 October 2010, responses to questions provided by EPA on 15 October 2010, and a teleconference with EPA on 29 October 2010 to discuss the task order deliverables schedule. Under this Task Order, EA is authorized to implement non-time critical removal support (NTCRS) for the Site (EPA Identification No. TXD055144539).

The following subsections provide a description of the Site and discuss the purpose and requirements of the required tasks and subtasks of this Task Order.

1.1 SITE DESCRIPTION

The Site is located in Freeport, Texas at 906 Marlin Avenue (also referred to as County Road 756). The Site consists of approximately 40 acres within the 100-year coastal floodplain along the north bank of the Intracoastal Waterway between Oyster Creek approximately one mile to the east and the Texas Highway 332 bridge approximately one mile to the west. The Site includes approximately 1,200 feet (ft.) of shoreline on the Intracoastal Waterway, a coastal shipping canal that extends from Port Isabel to West Orange on the Texas Gulf Coast.

Marlin Avenue divides the Site into two areas. The property to the north of Marlin Avenue consists of wetlands and the closed surface impoundments. The property south of Marlin Avenue was developed for industrial uses with a dry dock, sand blasting areas, an aboveground storage tank (AST) tank farm, and two barge slips connected to the Intracoastal Waterway. The Site was operated as a barge cleaning and repair facility from 1971 until 1999.

The former surface impoundments were three earthen pits with natural clay liners located in Lot 56 on the north side of Marlin Avenue. These former impoundments were used for storage of waste oils, caustics, various organic chemicals, and wash waters generated during barge cleaning activities. The former impoundments were closed in 1982 when the liquids and majority of sludges were removed and the remaining sludge was solidified with soil and left in place. The former impoundments were then capped with 3-feet of clay cover and a hard wearing (shell) surface. During recent investigations at the Site, the cap was found to be between 2.5-feet and 3.6-feet thick, and was rutted on the western end.

Recent investigations at the Site found that the sediment north of Marlin Avenue contained several chemicals of potential ecological concern at concentrations exceeding the screening levels. These chemicals include polynuclear aromatic hydrocarbons and several metals. At this time sediment samples are being collected by the Respondents for the Site, and the Respondents will conduct bioassays to determine the toxicity of this material.

1.2 PURPOSE

The purpose of this task order is to implement the NTCRS at the Site to select a removal action to eliminate, reduce, or control risks to human health and the environment. This SOW sets forth the frame work and requirements for the NTCRS. The NTCRS shall consist of preparation of an Engineering Evaluation and Cost Analysis (EE/CA) report and a PRELIMINARY DRAFT Action Memorandum for the repair of an existing cap over the former impoundments and for a wetlands sediment hot-spot removal. However, EPA shall determine the selected removal alternative. Current sampling being performed at the Site will determine whether the wetland sediment hot-spot removal will be necessary. For planning purposes, the sediment removal is to be included in the scope of this EE/CA, and will remain a part of this SOW until or unless the current sampling results indicate that the sediment hot-spot removal is not necessary to protect human health and the environment. The sampling results are expected to be available sometime in the October 2010 timeframe. The goal for completion of this task order is May 31, 2011.

1.3 GENERAL REQUIREMENTS

Under this fixed rate task order, EA will provide a completed Engineering Evaluation and Cost Analysis (EE/CA) report that, when implemented through a removal action, will eliminate, reduce or control risks to human health and the environment. EA will furnish all necessary and appropriate personnel, materials, and services needed for, or incidental to, performing and completing the NTCRS. The NTCRS and associated deliverables required under this task order shall be consistent with the EE/CA, the *Remedial Design/Remedial Action (RD/RA) Handbook* (U.S. EPA Office of Solid Waste and Emergency Response (OSWER) 9355.0-04B, EPA 540/R-95/059, June 1995), all other guidance used by EPA in conducting an NTCRS (Attachment 3), and the requirements of this SOW. The NTCRS involves the procurement of an analytical subcontractor(s).

In conducting the task order, EA will propose the most appropriate and cost-effective procedures and methodologies using accepted engineering practices and controls. Throughout the performance of this task order, EA will be performing services and providing products at the lowest reasonable cost. If there are changes to the SOW, EPA will issue a formal amendment to the task order and request a revised work plan and cost estimate from EA.

The EPA Region 6 CO is Mr. Michael Pheeny. His contact information is as follows:

Phone No.: (214) 665-2798
E-mail: pheeny.michael@epa.gov

The EPA Region 6 Project Officer (PO) is Ms. Rena McClurg. Her contact information is as follows:

Phone No.: (214) 665-8314
E-mail: mcclurg.rena@epa.gov

The EPA Task Order Monitor (TOM) for this Task Order is Mr. Gary Miller. His contact information is as follows:

Phone No.: (214) 665-8318
E-mail: miller.garyg@epa.gov

EA will communicate at least weekly with the EPA TOM, either in face-to-face meetings or through conference calls. All decisions that are made in meetings and conversations with EPA will be communicated via the monthly progress reports. EA will also notify the EPA CO, PO, and TOM, in writing, when 75 percent of the approved Task Order budget has been expended.

The applicable tasks and major deliverables are discussed in Section 3. EA will submit the major deliverables using the form "Transmittal of Documents for Acceptance by EPA." EA will maintain the Task Order files as specified in the contract and by the EPA TOM.

1.4 RECORDKEEPING REQUIREMENTS

EA will maintain all technical and financial records for the NTCRS in accordance with the contract. At the completion of the task order, EA will submit an official record of the NTCRS in both compact disk and a hardcopy to the TOM. EA will provide the deliverables using electronic media.

1.5 PROJECT CLOSEOUT

At the completion of the task order, EA will perform all necessary project closeout activities as specified in the contract. These activities include closing out any subcontracts, indexing and consolidating project records and files as required above, and providing a technical and financial closeout report to EPA. The goal is to complete task order technical activities and closeout activities by May 31, 2011.

2. OBJECTIVE

As discussed above, the objective of this Task Order is to complete all NTCRS activities in accordance with EPA SOW.

3. PROJECT APPROACH

This section discusses the tasks and associated activities under this Task Order and the assumptions that EA used to prepare the cost estimate. The defined tasks and work breakdown structure are as specified in the SOW. EA will provide the personnel, including subcontractors, services, materials, and equipment required to perform RI/FS activities under this Task Order.

Table 1 provides a summary of major tasks and their status based on information provided in the EPA SOW issued on 6 October 2010 and EPA responses to questions on 15 October 2010

TABLE 1 MAJOR TASK SUMMARY AND STATUS

EPA SOW Task	Task Description	Status
1	NTCRS Work Planning	Active
2	Community Involvement	Active
3	Field Investigation/Data Acquisition	Active
4	Sample Analysis	Active
5	Analytical Support and Data Validation	Active
6	Data Evaluation	Active
7	Risk Assessment	Active
8	Identification and Screening of Removal Alternatives	Active
9	Analysis of Removal Alternatives	Active
10	Engineering Evaluation/Cost Analysis Report	Active
11	Post EE/CA Support	Active
12	Administrative Record	Inactive
13	Task Order Closeout	Active

Table 2 presents a schedule of deliverables for each task.

TABLE 2 SCHEDULE OF DELIVERABLES

EPA Task	Deliverable	No. of Paper Copies	No. of Electronic Copies (e-mail)	Estimated Due Date
1.1.3	Non-Time Critical Removal Support Work Plan (Rev 00)	1	1	27 October 2010
1.1.3	Non-Time Critical Removal Support Work Plan (Rev 01)	1	1	29 October 2010
1.4.1	Monthly Progress Reports	1	1	20th of the month
1.2.2	Health and Safety Plan (HASP)	1	1	13 November 2010
1.2.1	Sampling and Analysis Plan (SAP)	1	1	13 November 2010
1.2.1	Quality Assurance Project Plan (QAPP)	1	1	13 November 2010
2.4	Fact Sheets	----	1	Five days after notification from EPA)
2.3	Public Meeting Support Materials	TBD	TBD	One week prior to scheduling meeting)
3.0	Field Reports	---	1	Friday of every week of field activities (covering activities through noon on Thursday)
5.9	Data Validation Report	1	1	Seven days after receipt of all analytical results from laboratory
6.1	Data Evaluation Summary Report	1	1	19 December 2010

EPA Task	Deliverable	No. of Paper Copies	No. of Electronic Copies (e-mail)	Estimated Due Date
10.1	Draft EE/CA Report	3	1	30 December 2010
10.2	Final EE/CA Report	3	1	16 January 2011 (8 days after receipt of EPA comments on draft EE/CA Report)
11.3	Preliminary Draft Action Memo	1	1	30 January 2011 (14 days after final EE/CA report submitted)
13.5	Closeout Report	1	1	1 March 2011 (30 days after Preliminary Draft Action Memo submitted)
	Final Costs	1	1	30 May 2011 (90 days after task order closeout)

Appendix A presents the proposed cost estimate, which is business confidential. Appendix B contains the proposed staffing plan for this Task Order. Appendix C contains the Task Order schedule.

3.1 TASK 1—PROJECT PLANNING AND SUPPORT (EPA SOW TASK 1)

The purpose of this task is to plan for the execution and overall management of tasks specified under this Task Order. This Work Plan details the technical and managerial activities required to complete the NTCRS activities and the costs associated with implementation of the active tasks.

EA estimates that a total of (b) (4) hours and (b) (4) will be required to complete EPA SOW TASK 1. Appendix A presents the estimated costs associated with completing EPA SOW TASK 1. Appendix B provides EA's staffing assumptions.

Anticipated activities to be conducted under EPA SOW TASK 1 are discussed in the following subsections.

3.1.1 Project Planning (EPA SOW Subtask 1.1)

The project planning subtask includes activities required to manage the Task Order as needed throughout the period of performance. EA's cost to complete activities under EPA SOW Subtask 1.1 will not be billed as a Task Order-specific cost. EA will perform the following activities as part of the project planning subtask:

Attend Scoping Meeting (EPA SOW Subtask 1.1.1)—A Scoping Meeting was not held for this task Order.
Conduct Site Visit (EPA SOW Subtask 1.1.2)—A site visit was not held for this Task Order.

Develop Work Plan and Cost Estimate (EPA SOW Subtask 1.1.3)—EA prepared and submitted this initial Work Plan on 27 October 2010. EA used information from the appropriate EPA guidance.

The Work Plan includes a comprehensive description of project tasks, procedures to accomplish them, project documentation, estimated costs to complete the Task Order, and project schedule. The Work Plan includes the following:

- EA's technical approach to each task to be performed, including a detailed description of each task, assumptions used, any information to be produced during and at the conclusion of each task, and a description of the work products that will be submitted to EPA. Information has been presented in a sequence consistent with the EPA SOW.

- EA's cost estimate to complete the Task Order, including subcontractor costs, for each element of the EPA SOW. Breakdown of estimated costs has been provided at the task and subtask levels in accordance with the work breakdown structure in the SOW.

- EA's Task Order implementation schedule with projected dates for completion of each required major activity and submission of each deliverable required by the EPA SOW. This schedule also includes information regarding timing, initiation, and completion of all critical path milestones for each major activity and deliverable, and the expected review time for EPA. Appendix C provides the schedule for NTCRS activities to be conducted under this Task Order.

Provide Conflict of Interest Disclosure (EPA SOW Subtask 1.1.4)—On 7 October 2010, EA submitted Conflict of Interest Disclosure to EPA for the Task Order.

3.1.2 Site-Specific Plans (EPA SOW Subtask 1.2)

EA will update the following plans that have already been prepared for PRP RI/FS field oversight activities as part of a separate Task Order (TO 006). The plans will be updated in accordance with applicable guidance, as necessary for NTCRS implementation. Plans that EA will update include the following:

Sampling and Analysis Plan (EPA SOW Subtask 1.2.1)—EA will update the Sampling and Analysis Plan (SAP) that will describe the sampling and data collection methods for the project, sample locations and frequency, sampling equipment and procedures, sample handling and analysis, and a breakdown of samples to be analyzed through the Contract Laboratory Program (CLP), EPA Region 6 Laboratory, and/or private laboratories. This plan will also describe the project objectives and organization, functional activities, and quality assurance/quality control (QA/QC) protocols that will be used to achieve the desired data quality objectives. The SAP will address field activities to be conducted by EA and comply with Title 40 Code of Federal Regulations (40 CFR) Part 300.415, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (QA/R-5)* (Office of Environmental Information, EPA/240/B-01/003, March 2001), and *EPA Guidance for Quality Assurance Project Plans (QA/G-5)* (Office of Environmental Information, EPA/240/R-02/009, December 2002). The SAP will also function as the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP), as described below.

The FSP portion of the SAP will define the sampling and data gathering methods that will be used for the project to define the nature and extent of contamination and risk assessment-related studies under Task 7 (Risk Assessment). It will include sampling objectives, sample location

and frequency, sampling equipment and procedures, and sample handling and analysis. The FSP will contain a completed Sample Design Collection Worksheet and a Method Selection Worksheet, or similar worksheets/tables. These worksheet templates can be found in the EPA guidance document entitled *Guidance for Data Usability in Risk Assessment* (1992). Statistical approaches, including the background evaluation, consistent with EPA guidance, including, but not limited to: *Data Quality Assessment - Statistical Methods for Practitioners* (2006); *Guidance for Data Quality Assessment* (2000); *Guidance on Systematic Planning Using the Data Quality Objectives Process* (2006); *ProUCL 4.0 User Guide* (2007); *EPA Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites* (2002); and *Role of Background in CERCLA Cleanup Program* (2002).

The FSP portion of the SAP will present a statement of the problem(s) and potential problem(s) posed by the Site and the objectives of the NTCRS. Furthermore, the FSP will include a Site background summary setting forth the Site description, which includes the geographic location of the Site, and to the extent necessary, a description of the Site's hydrology, geology, and demographics; the Site's ecological, cultural and natural resource features; a synopsis of the Site history; a description of previous responses that have been conducted at the Site by local, state, federal, or private parties; and a summary of the existing data in terms of physical and chemical characteristics of the contaminants identified and their distribution among the environmental media at the Site.

The ecological risk evaluation baseline ecological risk assessment requires that the sampling be conducted to demonstrate that the data is statistically representative of the Site. EA will also confirm that the detection limits for laboratories are in accordance with the goals stated in the EPA risk assessment guidance or are otherwise agreed upon with EPA.

The FSP portion of the SAP will consider the use of all existing data and may justify the need for additional data whenever existing data does not meet the objective. The FSP will be written so that a field sampling team unfamiliar with the Site will be able to gather the samples and field information required. EA will refer to the EPA guidance document entitled *Remedial Design/Remedial Action (RD/RA) Handbook* (U.S. EPA Office of Solid Waste and Emergency Response (OSWER) 9355.0-04B, EPA 540/R-95/059, June 1995), all other guidance used by EPA in conducting an NTCRS, and the requirements of the 6 October 2010 SOW.

The QAPP portion of the SAP will describe the project objectives and organization, functional activities, and QA/QC protocols used to achieve the desired data quality objectives (DQOs). EA will refer to the EPA guidance document entitled *Guidance on Systematic Planning Using the Data Quality Objectives Process (QA/G-4)* (2006) and *Systematic Planning: A Case Study for Hazardous Waste Site Investigations (QA/CS-1)* (2006) in developing the Site-specific DQOs. The DQOs will reflect the use of analytical methods for identifying contamination and remediating contamination consistent with the levels for remedial action objectives identified in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300). In addition, the QAPP will reflect sampling procedures; sample custody; analytical procedures; data reduction, validation, and reporting; and personnel qualifications. EA will refer to the EPA guidance documents entitled *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operation (QA/R-5)* (2001 or the latest revision) and *Guidance for Quality Assurance Project Plans (QA/G-5)* (2002 or the latest revision) which describes the QAPP format and the required content.

Health and Safety Plan (EPA SOW Subtask 1.2.2)—EA will update the site-specific Health and Safety Plan (HSP) that specifies employee training, protective equipment, personal air monitoring procedures, medical surveillance requirements, standard operating procedures, and a contingency plan in accordance with Occupational Safety and Health Administration requirements (29 CFR 1910.120) and the NCP (40 CFR Part 300.150).

3.1.3 Pollution Liability Insurance (EPA SOW Subtask 1.3) (NOT REQUIRED)

Task Order-specific Pollution Liability Insurance will not be required; coverage will be provided under EA's Corporate Pollution Liability Insurance.

3.1.4 Project Management (EPA SOW Subtask 1.4)

EA will perform activities required to effectively manage the Task Order. These activities typically include, but are not limited to, the following:

Monitor Costs and Prepare Periodic Status Reports (EPA SOW Subtask 1.4.1)—EA will monitor costs and progress on a regular basis and provide the EPA TOM weekly updates, either in face-to-face meetings, through conference calls, and or by e-mail communications.

Monthly progress reports will also be provided to EPA that provides a status of project costs and progress. The monthly progress reports will document cost and performance status. EA will document the technical progress and status of each task for the reporting period in accordance with contract requirements. Project management hours will be required for weekly review of Task Order financial information, including approving subcontractor invoices, coordinating with the project team, ensuring information and data transfer between team members, setting schedules and internal milestones, and checking on Task Order progress.

EA will prepare and submit monthly invoices in accordance with the level of detail specified in the contract. These monthly invoices will report costs and hours (by labor category) for the reporting period, as well as cumulative amounts expended to date. Also, the financial team will provide information weekly to the Project Manager on labor hours spent and other direct costs incurred during the week. The Project Manager will track the budget of the Task Order on a weekly basis to ensure control of approved budgets.

EA estimates that project management hours will be expended monthly for preparation of monthly progress reports.

Participate in Meetings and Communicate Routinely (EPA SOW Subtask 1.4.2)— EA will participate in meetings and document all issues/decisions via the monthly progress reports. EA will also provide the EPA TOM weekly updates, either in face-to-face meetings, through conference calls, and or by e-mail communications.

Manage, Track, and Report Equipment Status (EPA SOW Subtask 1.4.3)—EA is prepared to manage, track, and report the status of all government-furnished equipment and contract-acquired property in accordance with the contract requirements listed in Section G.5, Government Property (EPAAR 1552.245-73) (June 2003) Deviation. Labeling and recordkeeping requirements for government personal property are outlined in EA's Defense

Contract Management Command-approved *Government Property Control Procedures Manual*. However, EA has not included costs for this activity in this Work Plan.

Accommodate Audit/Review (EPA SOW Subtask 1.4.4)—EA will accommodate any external audit or review mechanism that EPA may require; however, EA has not included costs for this activity in this Work Plan.

Evaluate Existing Data (EPA SOW Subtask 1.4.5)—EA will evaluate existing data, including usability, necessary for NTCRS implementation. EA will assume that these data are available electronically to facilitate review and incorporation into the EE/CA, as appropriate. Costs for these activities have been included under EPA SOW TASK 6.

Coordinate with Emergency Response Teams (EPA SOW Subtask 1.4.6)—If this subtask is activated by EPA, EA will coordinate with local and emergency response teams in preparation for onsite NTCRS field activities. EA has not included costs for this subtask.

Review Background Documents (EPA SOW Subtask 1.4.7)—EA will review background documentation necessary for NTRCS implementation. Costs for this activity have been included under EPA SOW TASK 6.

Attend EPA-held Training (EPA SOW Subtask 1.4.8)—EA will attend EPA-held training if required by EPA. EA has not included costs for this subtask.

3.1.5 Project Initiation and Support (EPA SOW Subtask 1.5)

EA will perform activities required for project initiation and support that will lead to the selection of a removal action that eliminates, reduces, or controls risks to human health and the environment. These activities typically include, but are not limited to, the following:

Develop Data Summaries (EPA SOW Subtask 1.5.1)—EA will develop data summaries based on existing analytical and field data relating to the NTCRS. This activity will be performed in conjunction with EPA SOW Subtask 1.5.2.

Compile Existing Site Data and Reports (EPA SOW Subtask 1.5.2)—EA will compile existing analytical and field data relating to the NTCRS. EA will provide data in a format that is compatible with the Regional or National electronic data management network. Data shall be used in the preparation of the EE/CA Report tables, maps, and figures. Costs for this subtask have in included in the Data Evaluation Task (EPA SOW TASK 6).

Identify Significant Data Gaps (EPA SOW Subtask 1.5.3)—While compiling the existing site data specific to the NTCRS, EA will also evaluate the data to determine if data gaps exist that could impact the outcome of the NTCRS task order. If significant data gaps are identified, these discrepancies will be communicated to the EPA so that corrective action can be taken to fill data gap needs during implementation of data acquisition under EPA SOW TASK 3. Costs for this subtask have in included in the Data Evaluation Task (EPA SOW TASK 6).

Develop a Conceptual Understanding of the Site (EPA SOW Subtask 1.5.4)—EA will develop a conceptual understanding of the Site based on the evaluation of existing data. Costs for this subtask have been included in the Data Evaluation Task (EPA SOW TASK 6).

Identify Likely Response Scenarios and Potentially Applicable Technologies (EPA SOW Subtasks 1.5.5)—During this phase of the project, EA will also start developing tentative response scenarios and technologies that can be implemented at the site in order to meet task order objectives. These response scenarios and technologies will continue to be evaluated and refined as the project progresses, and will be incorporated into the EE/CA. Costs for this subtask have been included in the Identification and Screening of Removal Alternatives (EPA SOW TASK 8).

Prepare a Conceptual Exposure Pathway Analysis (EPA SOW Subtask 1.5.6)—EA will prepare a conceptual pathway analysis in accordance with regional EPA guidelines and OSWER Directives 9285.7-02B, 12/89, *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A, Baseline Risk Assessment),* Interim Final; 9285.7-01B, 12/91, *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*; 9285.7-01C, 12/91 *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part C, Risk Evaluation of Remedial Alternatives)*; 9285.7-47, 12/01 *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part D, Standardization Planning, Reporting and Review of Superfund Risk Assessments)* Final; and 9285.7-25, 2/97 *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA 540-R-97-006, 1997).* Costs for this subtask have in included in the Data Evaluation Task (EPA SOW TASK 6).

Initiate Identification of ARARs (EPA SOW Subtask 1.5.7)—EA will review and identify Applicable or Relevant and Appropriate Requirements (ARARs) relating to the NTCRS. These ARARS will be taken into account when developing the EE/CA for the task order. Costs for this subtask have in included in the Identification and Screening of Removal Alternatives (EPA SOW TASK 8).

3.2 TASK 2—COMMUNITY INVOLVEMENT (EPA SOW TASK 2)

EA will not prepare and implement a Community Involvement Plan (CIP) for the site. However, EA will perform community involvement activities in support of EPA throughout the NTCRS in accordance with the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP, 40 CFR Part 300) and the *Community Relations in Superfund - A Handbook*, (U.S. EPA, Office of Emergency and Remedial Response, OSWER Directive No. 9230.0-3C, January 1992).

EA estimates that a total of (b) (4) hours and $(b) (4) will be required to complete EPA SOW Task 2. Appendix A presents the estimated costs associated with completing EPA SOW Task 2. Appendix B provides EA's staffing assumptions.

These tasks include, but are not limited to, the following:

3.2.1 Conduct Community Interviews (EPA SOW Subtask 2.1) — (NOT REQUIRED)

3.2.2 Prepare Community Involvement Plan (CIP) (EPA SOW Subtask 2.2) — (NOT REQUIRED)

3.2.3 Provide Public Meeting and/or Open House Support (EPA SOW Subtask 2.3)

In our cost estimate, EA has budgeted for preparation for one (1) open house. EA also assumes it will make arrangements for the meeting location.

3.2.4 Prepare Fact Sheets, Notices and Other Informational Documents (EPA SOW Subtask 2.4)

In our cost estimate, EA has budgeted for preparation of two (2) fact sheets.

3.2.5 Provide Support for Proposed Plan (EPA SOW Subtask 2.5) — (NOT REQUIRED)

3.2.6 Provide Public Hearing Support (EPA SOW Subtask 2.6)—(NOT REQUIRED)

3.2.7 Publish Public Notices in Local Newspapers Serving the Site Community (EPA SOW Subtask 2.7)

In our cost estimate, EA has budgeted for one (1) newspaper notice with The Facts News Paper in Clute, Texas.

3.2.8 Maintain Public Information Repository (EPA SOW Subtask 2.8)

In our cost estimate, EA has included time to coordinate with the local library system to set up a public information repository.

3.2.9 Develop and Update Site Mailing Lists (EPA SOW Subtask 2.9)—(NOT REQUIRED)

3.2.10 Provide Administrative and Technical Support for Responsiveness Summary (EPA SOW Subtask 2.10)—(NOT REQUIRED)

3.2.11 Prepare Presentation Materials (EPA SOW Subtask 2.11)

In our cost estimate, EA has assumed five posters for presentation during the public meeting.

3.2.12 Implementation of Other Community Involvement Activities as Identified by the Site-Specific CIP or EPA (EPA SOW Subtask 2.12)

In our cost estimate, EA has included time for a Senior Scientist time to cover community involvement activities that occur during the course of the task order.

3.2.13 Provide Technical Support to Review Community Involvement Deliverables and Participate in Public Meetings (EPA SOW Subtask 2.13)

In our cost estimate, EA has assumed that two people will attend one (1) public meeting as part of EPA SOW Subtask 2.3. EA has also included time for a Senior Scientist to review community involvement deliverables related to the task order.

3.3 TASK 3—FIELD INVESTIGATION/DATA ACQUISITION (EPA SOW TASK 3)

Under this task, EA will perform field investigative activities to collect environmental data in support of the NTCRS. EA will conduct EPA SOW Task 3 activities in accordance with the EPA-approved SAP developed under Task 1.

EA estimates that a total of (b) (4) hours and $(b) (4) will be required to complete EPA SOW TASK 3. Appendix A presents the estimated costs associated with completing EPA SOW TASK 3. Appendix B provides EA's staffing assumptions.

The following subsections discuss the tasks that will be performed during the field investigation.

3.3.1 Mobilization and Demobilization (EPA SOW Subtask 3.1)

During the NTCRS field program, EA will coordinate with subcontractors and obtain necessary field equipment prior to mobilizing to the site for the collection of field data. Due to the limited nature of field activities, a base of operations will not be established. To the extent possible, EA will be utilizing local personnel for collection of soil cores and wetlands sediment samples. However, more specialized activities, such as the ecological reconnaissance and public meetings, will require personnel with the appropriate experience to perform these functions. Accordingly, costs for mobilization and demobilization of these personnel have been included under EPA SOW Tasks 2, 7, 10, and 13.

3.3.2 Hydrogeological Assessment (EPA SOW Subtask 3.2) (NOT REQUIRED)

3.3.3 Soil Boring, Drilling, and Testing (EPA Subtask 3.3)

As part of this task, EA assumes that up to three test borings will be installed using a geoprobe rig equipped with hollow-stem auger and Shelby tubes. Based on existing cap data, EA assumes the soil borings will be advanced no more than five feet below ground surface (bgs) (at each boring location). The soil cores retained for vertical hydraulic conductivity analysis will be left in an undisturbed condition (e.g., in the Shelby Tubes) and will be shipped to a non-CLP geotechnical laboratory for analyses (EPA SOW Task 4).

The purpose of the subsurface soil investigation activities is to collect soil cores for soil parameter testing of the existing cap material. GPS coordinates will be collected for each of the boring locations.

3.3.4 Environmental Sampling (EPA SOW Subtask 3.4)

Environmental sampling for the NTCRS will include the following:

- Field Screening—(**NOT REQUIRED)**
- Ground Water Sampling—(**NOT REQUIRED**)
- Surface soil sampling—EA has budgeted for the collection of eight (8) wetland sediment samples to support the NTCRS task order. These samples will be collected in accordance with the EPA approved Field Sampling Plan (EPA SOW Subtask 1.2.1) and undergo laboratory analyses for volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), metals, and pesticides, as part of EPA SOW TASK 4. Per the 15 October 2010 EPA responses to EA questions, in addition to the eight (8) sediment samples described above, EA has also assumed that up to two additional samples of clay material will be collected from an off-site borrow pit providing material for the cap repair. These samples will also be analyzed for volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), metals, and pesticides, as part of EPA SOW TASK 4.
- Soil boring/permeability sampling—EA has budgeted for the collection of up to three (3) soil cores to be analyzed for vertical hydraulic conductivity. Per the 15 October 2010 EPA response to EA questions, EA has also included collection of up to two (2) soil samples from the borrow pit for soil parameter and chemical analyses. These samples will be collected in accordance with the EPA approved Field Sampling Plan (EPA SOW Subtask 1.2.1) and undergo laboratory analyses as part of EPA SOW TASK4.
- Surface water and sediment sampling— **(NOT REQUIRED)**
- Air monitoring—**(NOT REQUIRED)**
- Indoor sampling—**(NOT REQUIRED**

3.3.5 Reuse Assessment (EPA SOW Subtask 3.5) (NOT REQUIRED)

3.3.6 Geotechnical Survey (EPA SOW Subtask 3.6) (NOT REQUIRED)

3.3.7 Field-generated Waste Characterization and Disposal in Accordance with Local and Federal Regulations (EPA SOW Subtask 3.7)

EA assumes that no investigation-derived waste will be generated as part of the task order. Because soil cores will be collected from the existing cap, the excess cap material not retained for analysis will be returned to the boring it was collected from in conjunction with sealing the borehole with bentonite chips

Sediment samples will be collected with dedicated, disposable sampling trowels, eliminating the need for decontamination of sampling equipment. These trowels, along with any other disposable personal protective equipment, paper/cardboard materials, etc., will be disposed of as municipal waste.

3.3.8 Site Reconnaissance (EPA SOW Subtask 3.8)

EA will perform a site reconnaissance as part of the NTCRS task order. EA assumes the following field activities will be performed as part of this site reconnaissance:

- Ecological resources reconnaissance – An ecological resources reconnaissance will be performed as part of this subtask. The data gathered during the reconnaissance will be

used as part of the Baseline Ecological Risk Assessment being performed for the NTCRS (EPA SOW TASK 7).

- Well inventory **(NOT REQUIRED)**
- Existing well development and establishment of sampling points **(NOT REQUIRED)**
- Landfill gas emission sampling **(NOT REQUIRED)**
- Surface geophysical survey **(NOT REQUIRED)**
- On-site and residential well sampling **(NOT REQUIRED)**
- Surface water sampling **(NOT REQUIRED)**
- Soil sampling—EA assumes that subsurface soil core collection, consisting of the collection of three undisturbed soil cores using Shelby tubes (EPA SOW Subtask 3.4), will occur in conjunction with a site reconnaissance. These soil cores will undergo vertical hydraulic testing under EPA SOW TASK 4. Up to two soil samples will also be collected from the borrow pit that provides clay for cap repair/maintenance. These samples will be analyzed for VOCs, SVOCs, pesticides, metals (minus mercury) and soil parameters.
- Sediment sampling—EA assumes that wetland sediment sample collection (EPA SOW Subtask 3.4) will occur in conjunction with the site reconnaissance. Up to eight sediment samples, plus QA/QC samples, will be analyzed under EPA SOW TASK 4.
- Leachate sampling **(NOT REQUIRED)**
- Field screening **(NOT REQUIRED)**
- Tank and drum sampling **(NOT REQUIRED)**

3.3.9 Ecological Characterization (EPA SOW Subtask 3.9) (NOT REQUIRED)

3.4 TASK 4—SAMPLE ANALYSIS (EPA SOW TASK 4)

As directed in the 6 October 2010 SOW, this task consists exclusively of performing sample analyses and producing analytical data. For cost estimating purposes, EA has not included direct labor costs under this task. This task only includes costs for laboratory analyses of the collected samples. Costs for collection, preparation, and shipment of these samples have been included under SOW Subtasks 3.3 and 3.4.

3.4.1 Sample Analysis and Production of Analytical Data (EPA SOW Subtask 4.1)

Samples collected under EPA SOW TASK 3 will be analyzed. A variety of mechanisms will be used to implement this task for the soil cores and wetland sediment samples, including the Contract Laboratory Program (CLP), laboratories or procured laboratories.
Based on technical direction provided by EPA as part of the 15 October 2010 response to questions, EA will utilize the EPA Region 6 or CLP laboratory for the wetland sediment and borrow pit clay material samples collected for environmental analyses. Analyses that will be conducted by the EPA Region 6 or CLP laboratory services include:

- VOCs by EPA 8260B
- SVOCs by EPA 8270C
- Metals by EPA 6010B (mercury will not be required as part of the analysis)
- Pesticides by EPA 8081A

The use of the EPA Region 6 or CLP laboratory will likely impact the task order schedule due to the need of advance notice for reserving laboratory space. Therefore, EA has provided a modified project schedule taking this into account.

EA will subcontract non-CLP laboratories for the following specialized analytical services:

Vertical hydraulic conductivity analysis (e.g., Flexible Wall Permeability by ASTM D 5084) of up to three undisturbed cores collected from the existing cap. Up to two additional bulk soil samples will be collected from the borrow pit used to provide additional cap material, and these soil samples will be analyzed for natural moisture content, particle size analysis, Atterberg limits, modified proctor compaction, and flexible wall permeability.

EA estimates that a total of (b) (4) will be required to complete EPA SOW Task 4. Appendix A presents the estimated costs associated with completing EPA SOW Task 4. No hours are included under EPA SOW Task 4; hours and costs associated with subcontractor laboratory management/oversight are reflected under EPA SOW Task 5.

3.5 TASK 5—ANALYTICAL SUPPORT AND DATA VALIDATION (EPA SOW TASK 5)

EA will schedule, coordinate, track, and oversee sample analyses and validate analytical data under this Task. EA estimates that a total of (b) hours and $(b) (4) will be required to complete EPA SOW TASK 5. Appendix A presents the estimated costs associated with completing EPA SOW TASK 5.

Typical activities include, but are not limited to, the following:

3.5.1 Collecting, Preparing, and Shipping Environmental Samples (EPA SOW Subtask 5.1)

The following types of sampling will be required as part of this task order:

- Field Screening (EPA SOW Subtask 5.1.1) (NOT REQUIRED)
- Ground Water Sampling (EPA SOW Subtask 5.1.2) (NOT REQUIRED)
- Surface and Subsurface Soil Sampling (EPA SOW Subtask 5.1.3)
- Surface Water and Sediment Sampling (EPA SOW Subtask 5.1.4)
- Air Monitoring and Sampling (EPA SOW Subtask 5.1.5) (NOT REQUIRED)
- Biota Sampling (EPA SOW Subtask 5.1.6) (NOT REQUIRED)
- Other Types of Media Sampling and Screening (EPA SOW Subtask 5.1.7) (NOT REQUIRED)

As discussed under EPA SOW TASK 3, EA anticipates collecting, preparing, and shipping the samples in accordance with the EPA-approved FSP. Sample collection, preparation, and shipping activities have been included as part of EPA SOW Subtasks 3.3 and 3.4.

3.5.2 Develop Data Quality Objectives (DQO) (EPA SOW Subtask 5.2)

EA will develop sampling event-specific DQOs for the EPA-approved SAP (EPA SOW Subtask 1.2.1). These DQOs shall be a determinative factor for assessing the success or failure of the sampling activities.

3.5.3 Request, Obtain, and Perform Oversight of Analytical Services (EPA SOW Subtask 5.3)

EA will request, obtain, and perform oversight of subcontract non-CLP analytical services in accordance with EPA requirements.

3.5.4 Coordinate with the EPA Sample Management Office (SMO), the Regional Sample Control Coordinator (RSCC), and/or the Region 6 Houston Laboratory (EPA SOW Subtask 5.4)

EA will coordinate with the EPA Sample Management Office, Regional Sample Control Coordinator, and/or the Environmental Services Division regarding analytical support, data validation, and QA issues.

3.5.5 Implement the EPA-Approved Laboratory Quality Assurance Program (EPA SOW Subtask 5.5)

If deemed necessary, EA will implement the EPA-approved laboratory QA program that provides oversight of in-house and subcontracted laboratories through periodic performance evaluation sample analyses and/or onsite audits of operations. EA has not budgeted for this subtask, but is prepared to do so, if deemed necessary.

3.5.6 Provide Sample Management Including Chain of Custody Procedures, Information Management, Sample retention, and 10-Year Data Storage (EPA SOW Subtask 5.6)

EA will ensure proper management of samples in the field, including chain-of-custody procedures and information management and storage. EA will also utilize EPA's Forms II Lite database software to facilitate sample management. EA will set up the Forms II Lite database prior to mobilizing to the Site. Finally, QA/QC samples will be designated prior to the field effort to the extent possible prior to field activities.

3.5.7 Perform Data Validation (EPA SOW Subtask 5.7)

Analytical data generated by the EPA Region 6 or CLP laboratory will not require data validation by EA. Additionally, soil parameter data analyzed by the non-Region 6/non-CLP geotechnical laboratory cannot be validated. Therefore, EA has not included costs for this subtask.

3.5.8 Review Data for Usability (EPA SOW Subtask 5.8)

EA will evaluate all data collected during the NTCRS field program for usability for its intended purpose. Costs for this effort have been included under EPA SOW Task 6.

3.5.9 Provide Reports on Data Validation and Usability (EPA SOW Subtask 5.9)

Analytical data generated by the EPA Region 6 or CLP laboratory services will not require data validation by EA. However, EA will prepare a Preliminary and Final Data Validation Report, which will summarize the EPA Region 6 or CLP laboratory services validation activities, as well as EA validation of non-CLP laboratory data, if any, and evaluate data usability for its intended purpose under EPA SOW Task 6.

3.6 TASK 6—DATA EVALUATION (EPA SOW TASK 6)

EA will compile analytical and field data into a format that is compatible with EPA Region 6 or National Electronic Data Management Network. EA will use the data to prepare the EE/CA Report tables, maps, and figures. EA estimates that a total of (b hours and $(b) (4) will be required to complete EPA SOW Task 6. Appendix A presents the estimated costs associated with completing EPA SOW TASK 6. Appendix B provides EA's staffing assumptions. The basis of our estimated costs includes the following assumptions:

- Recently collected data specified in the SOW and data validation summaries for existing data will be made available by EPA by mid November 2010 for incorporation into the Data Evaluation Report and no data validation effort will be required for this existing data;

- All Data to be used for the Data Evaluation Report will be provided by the laboratory or EPA in electronic format with data quality flags attached and the data will be suitable for use in Excel and GIS without significant correction or reentry. The exception is the soil parameter data, which is not expected to have flags;

- The Data Evaluation Report will be approximately 5 pages of text and 5-10 pages of tables. Copies of the analytical data reports for the sediment investigation will be included either as appendices or as separate electronic files on CD; and

- Boring logs will not be required for the cap borings.

Typical activities for the data evaluation will include, but are not limited to, the following:

3.6.1 Combine Analytical and Field Data (EPA SOW Subtask 6.1)

EA will compile analytical and field data. EA will provide data in a format that is compatible with the Regional or National electronic data management network. Data shall be used in the preparation of the EE/CA Report tables, maps, and figures. EA will also prepare and submit a Data Evaluation Summary Report discussing the findings of the below subtasks.

Data Usability Evaluation and Field Quality Assurance/Quality Control (EPA SOW Subtask 6.1.1)—EA will evaluate the usability of the laboratory analytical data in terms of the CLP data validation summaries and field QA/QC.

Data Reduction and Tabulation (EPA SOW Subtask 6.1.2)—EA will reduce and tabulate applicable data collected from previous PRP contractors for the wetlands sediment area and

impoundment cap area located onsite north of Marlin Avenue. EA will also incorporate the recent data from sampling and analysis performed under Tasks 3 and 4 of this task order.

The following type of data will fall under this task:

- Soil boring and monitoring well logs
- Field sampling data
- Hydrogeological testing data. **(NOT REQUIRED)**
- Geophysical data (downhole geophysics, survey). **(NOT REQUIRED)**
- Analytical results.

Data Trend Evaluation and/or Modeling (EPA SOW Subtask 6.1.3)—(NOT REQUIRED)

3.6.2 Data Reduction, Tabulation, and Evaluation (EPA SOW Subtask 6.2)

EA has included costs for this task under EPA SOW Subtask 6.1.2

3.6.3 Environmental Fate and Transport Modeling/Evaluation (EPA SOW Subtask 6.1.4)—(NOT REQUIRED)

3.7 TASK 7—RISK ASSESSMENT (EPA SOW TASK 7)

The following subtasks discuss risk assessment activities that EA will perform for the NTCRS task order. EA estimates that a total of (b) (4) hours and (b) (4) will be required to complete Task 7. Appendix A presents the estimated costs associated with completing Task 7. Appendix B provides EA's staffing assumptions.

3.7.1 Conduct a Baseline Human Health Risk Assessment (EPA SOW Subtask 7.1) (NOT REQUIRED)

3.7.2 Conduct an Ecological Risk Evaluation Baseline Ecological Risk Assessment (EPA SOW Subtask 7.2)

EA will conduct a streamlined ecological risk evaluation in accordance with applicable Agency guidance, directives and procedures. The objective of this evaluation will be to characterize and quantify, where appropriate, the current and potential environmental risks that would prevail if no further remedial action is taken.

Per the potentially resposible party (PRP) Baseline Ecological Risk Assesment (BERA) WP and SAP dated May 10, 2010, wetlands sediments in the area near the capped former impoundments have been impacted by overland runoff and erosion. A Screening Level Ecological Risk Assessment (SLERA) has been completed for the Site. According to the BERA Problem Formulation document dated May 10, 2010, localized wetland areas in the North Area of the Site had hazard quotients (HQs) greater than one for several PAHs. The BERA WP and SAP lists chemicals of potential ecological concern (COPECs) to be addressed for the wetland sediments as PAHs, 4,4-DDT, endrin aldehyde, endrin ketone, gamma-chlordane, and nickel.

According to the PRP BERA WP and SAP, sediment, sediment pore water, and sediment chronic bioassays currently being analyzed by the PRP are to be completed for nine sample locations. Sediments will be analyzed for site COPECs, acid volatile sulfide/simultaneously extracted metals (AVS/SEM) and total organic carbon (TOC). Sediments will also be analyzed for grain size.

Assumptions in preparation of the ecological evaluation:

- Per the 6 October 2010 SOW, no surface water samples will be collected and surface water receptors will not be evaluated in the Baseline Ecological Risk Assesment (BERA) being peformed for the NTCRS task order;

- As a basis of our cost estimate, EA also assumes no additional ecological risk assessment activities for other areas of the site, including but not limited to, the Intercoastal Waterway, the South Area, and soil areas in the North Area. The former surface water impoundments are limited to Lot 56. Per the SOW, the former impoundments were used for the storage of waste oils, caustics, various organic chemicals, and barge wash waters;

- The risk question developed specific to this area relates to whether or not exposure to COPECs in sediment adversely affect the abundance, diversity, productivity, and function of sediment invertebrates. The SLERA concluded that upper trophic level (non-sedentary) receptors were not at risk from site COPECs. Soil invertebrates and water-column invertebrates are assumed to not be included in the BERA being performed for this task order;

- The evaluation will include impacts to sediment invertebrates only within Lot 56 wetlands;

- Validated data will be in excel format usable for the risk assessment;

- The evaluation will provide recommendations for cleanup of sediments based on the results of the current sediment analysis and bioassays being performed by the PRP, and those wetland sediment samples being collected under Tasks 3 and 4 of this task order. Historical data from the RI/FS will not be used to characterize risk; and

- The BERA completed for this task order will consist of pproximately 50 pages of text, 15 tables, and 150 pages of appendices.

A site visit will be conducted during the site reconissance to complete a ecological resources reconnaisance.

This cost estimate and work plan assumes time to review existing literature for the site and for the COPECs and ability to depend on conclusions and observations from site documents which could include, but are not limited to, the following:

- Final Screening Level Ecological Risk Assessment (3 May 2010)
- Final Baseline Ecological Risk Assessment Problem Formulation (10 May 2010)
- Final Baseline Ecological Risk Assessment Work Plan and Sampling and Analysis Plan (10 May 2010)

- Nature and Extent Data Report (May 2009)

The BERA will be included as part of the EE/CA Report and site information included in the EE/CA can be referenced from the BERA. BERA will also be performed in accordance with CERCLA ecological risk assessment guidance documents.

3.7.3 Prepare Draft Risk Evaluation Reports (EPA SOW Subtask 7.3)

Per the 6 October 2010 SOW, the findings of the draft Ecological Risk Evaluation will be incorporated into the Draft EE/CA Report (EPA SOW TASK 10)

3.7.4 Prepare Final Risk Evaluation Reports (EPA SOW Subtask 7.4)

Per the 6 October 2010 SOW, the findings of the final Ecological Risk Evaluation will be incorporated into the Final EE/CA Report (EPA SOW TASK 10).

3.8 TASK 8—IDENTIFICATION AND SCREENING OF REMOVAL ALTERNATIVES (EPA SOW TASK 8)

EA estimates that a total of (b) (4) hours and $(b) (4) will be required to complete Task 8. Appendix A presents the estimated costs associated with completing Task 8. Appendix B provides EA's staffing assumptions.

3.8.1 Identify and Screen Appropriate Removal Alternatives (EPA SOW Subtask 8.1)

Under this task, EA will develop and screen removal alternatives appropriate to the purpose and scope of the NTCRS, and that will comply with ARARs to the maximum extent practicable. It will include a site visit by the Project Manager and Senior Engineer to assess site conditions.

Up to ten removal alternatives will be identified and screened to address the exeedance of COPECs in the wetlands sediment. The potential alternatives will encompass, as appropriate, a range of options in which removal or treatment is used to reduce the toxicity, mobility, or volume of wastes but vary in the degree to which long-term management of residuals or untreated waste is required; one or more alternatives involving containment with little or no treatment; and a no-action alternative.

Alternatives that involve minimal efforts to reduce potential exposures (e.g., site fencing and deed restrictions) will also be presented as "limited action" alternatives. The alternatives are to encompass a range including innovative treatment technologies consistent with the regulations outlined in the NCP (40 CFR Part 300) and applicable EPA guidance, procedures, and directives. The analysis will include institutional controls to the extent appropriate.

Under this task, recommendations for repair and or upgrade to the existing impoundment cap will also be developed, and an ARAR analysis will be performed and summary of the applicable ARARs will be prepared.

3.9 TASK 9—ANALYSIS OF REMOVAL ALTERNATIVES (EPA SOW TASK 9)

Under this task, EA will prepare an Engineer's opinion of cost for up to five removal alternatives with an accuracy of +50%/-30%. The task will also include performance of an analysis for the five individual removal alternatives against the criteria of effectiveness, implementability and cost, in addition to comparative analysis of options.

EPA shall determine the selected removal alternative. The outcome of this analysis, including EPA's selection, will be incorporated into the EE/CA (EPA SOW Task 10).

EA estimates that a total of (b hours and (b) (4) will be required to complete TASK 9. Appendix A presents the estimated costs associated with completing TASK 9. Appendix B provides EA's staffing assumptions.

3.9.1 Assess Individual Removal Alternatives (EPA SOW Subtask 9.1)

Under this subtask, EA will assess individual removal alternatives against the criteria of effectiveness, implementability and cost.

3.9.2 Perform a Comparative Analysis of Options (EPA SOW Subtask 9.2)

EA will perform a comparative analysis of remedial options under this subtask. This analysis will be presented as part of the EE/CA (EPA SOW Task 10).

3.9.3 Recommend Treatability Studies (EPA SOW Subtask 9.3)

If warranted by EPA, EA shall produce and provide recommendations for treatability studies under this subtask. Costs for these recommendations have not been included as part of this subtask.

3.9.4 Conduct Treatability Studies at Direction of EPA (EPA SOW Subtask 9.4)

If warranted by EPA, EA shall conduct treatability studies under this subtask. Costs for treatability studies have not been included as part of this subtask.

3.10 TASK 10—ENGINEERING EVALUATION/COST ANALYSIS REPORT (EPA SOW TASK 10)

EA estimates that a total of (b) hours and (b) (4) will be required to complete TASK 10. Appendix A presents the estimated costs associated with completing TASK 10. Appendix B provides EA's staffing assumptions.

Under this task, EA will prepare the findings developed during identification, screening, and removal alternatives (EPA SOW TASK 8 and EPA SOW TASK 9), and prepare a draft EE/CA to be reviewed by EPA. This document will also include the BERA (EPA SOW TASK 7) as an attachment. The EE/CA will be finalized following EPA review. EA will also provide technical assistance in the preparation of the PRELIMINARY DRAFT Action Memorandum, however, EPA shall determine the selected removal alternative.

The EE/CA Report will include a discussion of the following and is expected to be no more than 50 pages. The background information used in this report will be compiled from government furnished information. Our assumptions do not include recreating the historical information. The report will include the following:

- Executive Summary

- Site Characterization.
  — Site description and background
  — Analytical data
  — Site conditions that justify a removal action
  — Reuse Assessment and Reasonably Anticipated Future Land Uses

- Risk Evaluation.

  — Human health risks **(NOT REQUIRED)**
  — Ecological risks
  — Proposed cleanup levels

- Identification of Removal Action Objectives.

  — Statutory limits on removal actions
  — Removal action scope
  — Removal action schedule
  — Applicable or Relevant and Appropriate Requirements

- Identification and Analysis of Removal Action Alternatives.

  — Effectiveness
  — Implementability
  — Cost

- Comparative Analysis of Removal Action Alternatives

- Identification of ARARs.

EA will provide technical assistance in the preparation of the Action Memorandum and evaluation of post-removal site control activities necessary to sustain the integrity of the Removal Action.

3.10.1 Prepare Draft EE/CA Report(s) (EPA SOW Subtask 10.1)

Under this subtask, EA will prepare the draft EE/CA Report for EPA review following the above format.

3.10.2 Prepare Final EE/CA Report (EPA SOW Subtask 10.1)

Under this subtask, EA will finalize the final EE/CA Report per EPA recommendations.

3.11 TASK 11—POST EE/CA SUPPORT (EPA SOW TASK 11)

EA estimates that a total of (b) (4) hours and (b) (4) will be required to complete EPA SOW Task 11. Appendix A presents the estimated costs associated with completing EPA SOW Task 11. Appendix B provides EA's staffing assumptions.

EA will provide EPA with technical and administrative support required subsequent to the EE/CA for the Site. The selected removal action and the Action Memorandum will represent the opinion and recommendation of EPA, and not that of EA.

Typical activities include, but are not limited to, the following:

3.11.1 Attend Public Meeting, Briefing, or Hearing (EPA SOW Subtask 11.1)

EA assumes that two (2) persons will attend up to one (1) public meeting in support of EPA post-EE/CA support activities.

3.11.2 Provide Technical Assistance in the Preparation of the Responsiveness Summary (EPA SOW Subtask 11.2)

EA will provide technical assistance to EPA in preparing the Responsiveness Summary for this Task Order. EA assumes there will be 20 issues that each require two hours of effort to address, in addition to report preparation efforts.

3.11.3 Provide Technical Assistance in the Preparation of the Action Memorandum (EPA SOW Subtask 11.3)

EA will provide technical assistance to EPA in preparation of the Draft Action Memorandum. EA has assumed this will be a five to 10 page technical memorandum.

3.12 TASK 12—ADMINISTRATIVE RECORD (EPA SOW Subtask 12) (NOT REQUIRED)

This task is inactive per the EPA SOW.

3.13 TASK 13—TASK ORDER CLOSEOUT (EPA SOW TASK 13)

EA estimates that a total of (b) hours and (b) (4) will be required to complete EPA SOW Task 13. Appendix A presents the estimated costs associated with completing EPA SOW Task 13. Appendix B provides EA's staffing assumptions.

EA will perform the necessary activities to close out the Task Order in accordance with contract requirements.

Typical activities include, but are not limited to, the following:

3.13.1 Package and Return Documents to the Government (EPA SOW Subtask 13.1)

EA will package and return sensitive documents at the request of EPA Region 6.

3.13.2 Duplicate/Distribute/Storage of Files (EPA SOW Subtask 13.2)

EA will duplicate, distribute, and store files per contract requirements.

3.13.3 Archive Files in Accordance with Federal Center Requirements (EPA SOW Subtask 13.3)

EA will archive the Task Order files in accordance with Federal Record Center requirements.

3.13.4 Produce Microfiche/Microfilm/Optical Disk or Other EPA Approved Storage Format (EPA SOW Subtask 13.4)

EA will provide data for the NTCRS Task Order in a format approved by EPA.

3.13.5 Prepare Task Order Closeout Report (EPA SOW Subtask 13.5)

EA will prepare and submit a Task Order Closeout Report as directed in the Task Order Closeout Notification, in accordance with EPA Region 6 guidance or other procedures as specified in the Task Order. If the final hours and/or costs are not within 10 percent of the original approved Work Plan or Task Order hours and budget, the Task Order Closeout Report will describe the circumstances for this discrepancy.

4. TASK ORDER PERIOD OF PERFORMANCE

The period-of-performance for this Task Order extends through 31 May 2011.

5. SCHEDULE OF DELIVERABLES

Table 2 presents the anticipated schedule of deliverables (Section 3). Appendix C provides the schedule for NTCRS activities to be conducted under this Task Order. As indicated on Table 2 and Appendix C, EA has provided a modified schedule, which is based on when EA is able to receive all validated data from the EPA Region 6 and/or CLP lab, and have time to reduce, evaluate, and incorporate this data into task order deliverables.

6. QUALITY CONTROL

EA's internal QC process requires review of all project deliverables to promote technical adequacy and completeness. EA's QA Manager, or designee not associated with the Task Order, will perform internal QC checks of Task Order activities. Internal QC checks will cover

adherence to this Work Plan and EA's Quality Management Plan for the EPA Region 6 Remedial Action Contract.

The cost of QC reviews is included in the cost estimate for this Task Order. Typically, QC activities account for 10 to 15 percent of the total hours expended for deliverable preparation.

7. COST ESTIMATE

The estimated labor hours and funding needed for the work to be performed by EA under this Task Order are (b) (4) hours and (b) (4) .

Appendix A provides the cost estimate, which is business confidential. Appendix B presents the proposed staffing assumptions for the Task Order. Appendix C presents the Task Order schedule.

APPENDIX A

COST ESTIMATE

TARGET SHEET

SITE NAME: GULFCO MARINE MAINTENANCE

CERCLIS I.D.: TXD055144539

TITLE OF DOC.: TASK ORDER CLOSEOUT FILES GULFCO MARINE MAINTENANCE SITE

DATE OF DOC.: 02/23/2011

NO. OF PGS. THIS TARGET SHEET REPLACES: 79

SDMS #: 9191440 **KEYWORD:** 14.99

SENSITIVE ?	X	MISSING PAGES ?	
ALTERN. MEDIA ?		CROSS REFERENCE ?	

LAB DOCUMENT ?		LAB NAME:	
ASC./BOX #:			
CASE #:		SDG #:	

COMMENTS : THIS TARGET SHEET REPLACES PAGES 688 THROUGH 766 THAT HAVE BEEN REDACTED DUE TO FOIA EXEMPTION (b) (4) - CONFIDENTIAL BUSINESS INFORMATION - THE NON-REDACTED DOCUMENT IS LOCATED IN THE U.S. EPA REGION 6 SUPERFUND RECORDS CENTER.