

**Deepwater Horizon/Mississippi Canyon 252 Oil Spill  
Sampling and Analysis Plan for  
Jean Lafitte National Historic Park and Preserve  
Submerged Aquatic Vegetation  
Natural Resource Damage Assessment**

**Spring and Fall 2011 Surveys**

Prepared for:

The National Park Service  
Environmental Quality Division  
P.O. Box 25287  
Denver, CO 80225-0287

and

Submerged Aquatic Vegetation Technical Working Group

**May 2011**



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**Prepared by:**

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*Approval of this work plan is for the purposes of obtaining data for the Natural Resource Damage Assessment. Each party reserves its right to produce its own independent interpretation and analysis of any data collected pursuant to this work plan.*

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*This plan will be implemented consistent with existing trustee regulations and policies. All applicable state and federal permits must be obtained prior to conducting work.*

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*Unless otherwise agreed upon by the Trustees and BP, all samples will be sent to University of Maryland Center for Environmental Science Chesapeake Biological Laboratory*

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*Each laboratory shall simultaneously deliver raw data, including all necessary metadata, generated as part of this work plan as a Laboratory Analytical Data Package (LADP) to the trustee Data Management Team (DMT), the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana and to BP (or ENTRIX on behalf of BP). The electronic data deliverable (EDD) spreadsheet with pre-validated analytical results, which is a component of the complete LADP, will also be delivered to the secure FTP drop box maintained by the trustees' Data Management Team (DMT). Any preliminary data distributed to the DMT shall also be distributed to LOSCO and to BP (or ENTRIX on behalf of BP). Thereafter, the DMT will validate and perform quality assurance/quality control (QA/QC) procedures on the LADP consistent with the authorized Quality Assurance Project Plan, after which time the validated/QA/QC'd data shall be made available simultaneously to all trustees and BP (or ENTRIX on behalf of BP). Any questions raised on the validated/QA/QC results shall be handled per the procedures in the Quality Assurance Project Plan and the issue and results shall be distributed to all parties. In the interest of maintaining one consistent data set for use by all parties, only the validated/QA/QC'd data set released by the DMT shall be considered the consensus data set. In order to assure reliability of the consensus data and full review by the parties, no party shall publish consensus data until 7 days after such data has been made available to the parties. Also, the LADP shall not be released by the DMT, LOSCO, BP or ENTRIX prior to validation/QA/QC absent a showing of critical operational need. Should any party show a critical operational need for data prior to validation/QA/QC, any released data will be clearly marked "preliminary/unvalidated" and will be made available equally to all trustees and to BP (or ENTRIX on behalf of BP).*

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*The trustees have developed a preliminary conceptual model of the DWH release, potential pathways and routes of exposure, and potential receptors. This preliminary model has informed the trustees' decision to pursue the studies outlined in the work plan. By signing this work plan and agreeing to fund the work outlined, BP is not endorsing the model articulated in the work plan.*



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## ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
cm	centimeters
DO	dissolved oxygen
FTP	file transfer protocol
GPS	global positioning system
ID	identification
JELA	Jean Lafitte National Historic Park and Preserve
L	liter
mg/L	milligram per liter
mL	milliliter
MC 252	Deepwater Horizon/Mississippi Canyon 252
MLLW	mean lower low water
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NTU	nephelometric turbidity unit
PAR	photosynthetically active radiation
ppt	parts per thousand
QA/QC	quality assurance/quality control
QAP	quality assurance plan
SAV	submerged aquatic vegetation
SM	standard methods
TN	Total Nitrogen
TP	Total Phosphorous
USEPA	U.S. Environmental Protection Agency

## 1.0 INTRODUCTION

During the response to the Deepwater Horizon/Mississippi Canyon 252 (MC 252) Oil Spill, Mississippi River freshwater flows were diverted from the Davis Pond Diversion to Lake Cataouatche, which is adjacent to Jean Lafitte National Historical Park and Preserve (JELA), to reduce the potential for oil intrusion into the inland marshes. As a result, the submerged aquatic vegetation (SAV) community at JELA may be impacted by the increase in freshwater, as well as nutrients into the interior marshes. Potential effects of increased freshwater and nutrients include eutrophication and diminished water quality, including reduced dissolved oxygen (DO) levels which may result in reductions in the diversity and abundance of SAV species and proliferation of nuisance or harmful algal blooms. This document presents a work plan detailing methods for assessments of freshwater SAV habitat following the diversion of Mississippi River water into JELA during the response to the MC 252 Oil Spill.

Previous studies have shown that increased nutrients to lakes result in reductions in species of SAV due to increased density and abundance of phytoplankton and algal epiphytes (Kalf, 2002). In lakes, shifts from SAV-dominated communities to phytoplankton-dominated communities can occur with nutrient addition (Dodson, 2005). Similarly, in marine and estuarine communities SAV is replaced by macroalgae with nutrient addition (Day et al., 1989). Increased nutrients can also result in altering the diversity of the SAV community structure changing it to one that is dominated by species more tolerant to nutrient loading. One means of controlling unwanted SAV in warm-water farm ponds is to add fertilizer to produce algal blooms in early spring which shade new SAV growth from the bottom (Summers, 1963). Based on fundamental SAV ecology, high loading of nitrogen and phosphorus from the incremental increase over historical levels of Mississippi River flow through the Davis Pond Diversion has the potential to adversely affect the SAV community in JELA. These effects may vary seasonally, since nutrients can affect seasonal recruitment and growth patterns of SAV, as well as phytoplankton, floating aquatics, and macroalgae. Therefore, injury assessment studies conducted in the spring and fall of 2011 are needed to assess potential large-scale changes in SAV community structure, floating aquatic vegetation percent cover, and water quality.

### 1.1 Sampling and Testing Objectives

The objective of this study is to collect data that can be used to assess potential impacts from incremental increases in freshwater inputs above historical levels into JELA due to the diversion of Mississippi River freshwater into JELA during the MC 252 Oil Spill. An initial field survey was performed in September 2010 that collected SAV community structure and water quality data. Two follow-up field surveys are proposed in the spring and fall of 2011 to evaluate the extent and magnitude of any potential changes within the SAV community that may have occurred following the increased freshwater flow to JELA during the oil spill response. Spring (May 2011) and fall (September 2011) surveys will be performed to determine if seasonally distinct changes to water quality, floating aquatic vegetation and the SAV community within JELA are evident. Surveys will collect data on physical and chemical water quality parameters, sediment and water nutrient levels, and potential shifts in SAV community structure and/or

floating aquatic species abundance as compared to reference stations, the fall 2010 survey, the Poirrier et al. (2009) survey, and any other relevant historical studies.

Surveys will include assessments of SAV species composition at 39 stations located within the northeast portion of the Barataria Estuary in JELA and at five reference stations located north of the Davis Pond Diversion. The reference stations, located along Humble Canal and Bayou Des Allemandes, are in an area that was not subjected to the increased flow of freshwater from the Mississippi River from May to August of 2010. Determination of the number of stations was based on the U.S. Environmental Protection Agency's (USEPA's) *Guidance for the Data Quality Objectives Process* (USEPA, 2006a) and *Data Quality Assessment: Statistical Methods for Practitioners* (USEPA, 2006b).

Determinations of the relative abundance and distribution of SAV and floating aquatic species, as well as physical water quality assessments, will be performed at all 39 JELA stations and at all five reference stations using methods similar to those used in the June 2006 through April 2008 SAV surveys of 146 locations conducted within JELA by Poirrier et al. (2009). At 14 JELA stations and the five reference stations (referred to as full-analysis stations), water and sediment samples will also be collected for analysis of nutrients (total nitrogen [TN] and total phosphorous [TP]). Nutrient analyses will be performed to measure the levels of nitrogen and phosphorous in JELA as compared to the reference stations.

## **2.0 FIELD COLLECTION PROTOCOL FOR SAV CURRENT CONDITIONS DETERMINATIONS**

Surveys will be conducted aboard shallow-draft vessels, such as air boats or mud boats, which will allow access to SAV throughout JELA and the reference area. A field crew of five personnel will complete each survey over a seven-day period. The crew will consist of a field lead familiar with the SAV survey protocols and local species; two field scientists with experience in SAV surveys, sediment and water chemistry sampling and water quality sampling; and a boat operator knowledgeable of JELA. While it is not mandatory for a responsible party representative to be present during all field activities, the responsible party has the option to have representatives attend and participate in field activities.

### **2.1 Sample Locations**

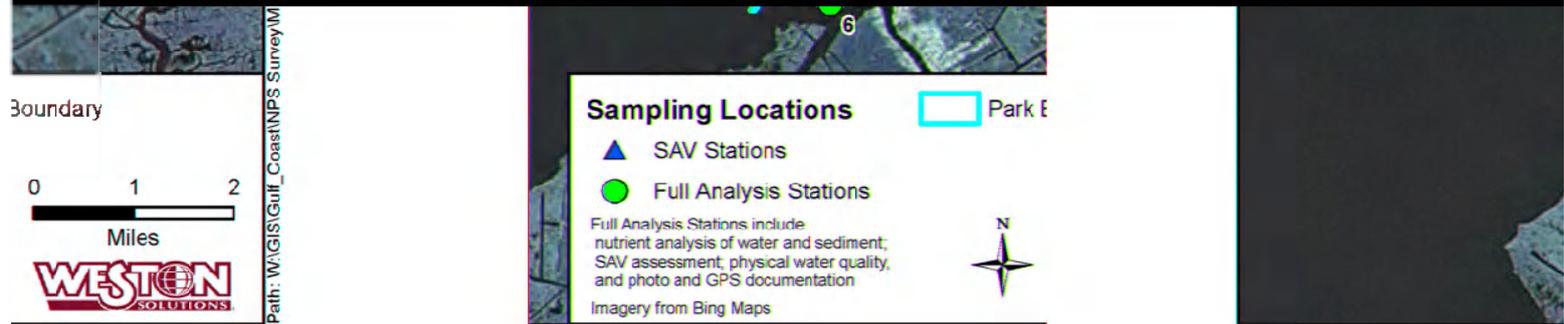
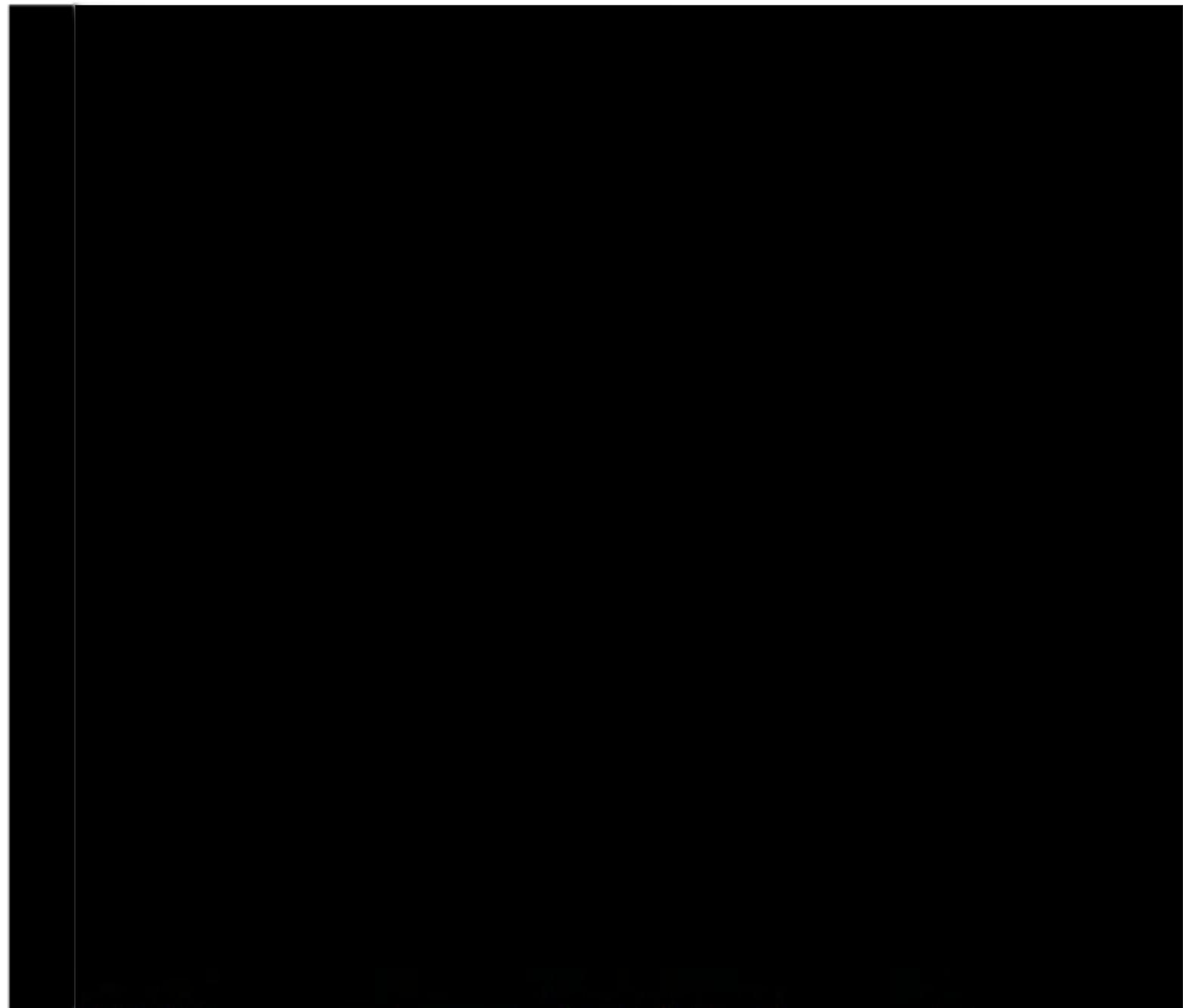
A total of 39 JELA stations and five reference stations will be sampled in the spring and fall of 2011. Sample stations are defined to be areas of approximately 100 square meters (m<sup>2</sup>) located along shorelines or within channels with SAV. The SAV community structure and physical water quality will be surveyed at all stations. Water and sediment nutrient chemistry (measured as TN and TP) will be assessed at the 14 full-analysis JELA stations and five reference stations (Table 1). The JELA stations are located in the northeast portion of Barataria Bay and were selected to correspond with the September 2010 and Poirrier et al. (2009) studies. September 2010 JELA stations are shown in Figure 1. Thirty-three of the 39 JELA stations and five reference stations are identical in location to those previously surveyed in the initial impact study in 2010 (Figure 2 and Figure 3). To better assess potential gradients, three JELA stations that

were in close proximity to other stations in the September 2010 survey were relocated along Bayou Segnette (September 2010 Stations 1, 28, and 29). To increase the spatial coverage of stations within JELA, three additional stations were added, including Station 37 in Tarpaper Canal, Station 38 in Whiskey Canal, and Station 39 in Bayou Segnette (Figure 2). Stations 29 and 39 are full analysis stations. Station locations may be subject to change in the field, as a result of access limitations during the surveys. Any changes in station locations in the field will be discussed amongst all parties and documented on data sheets. All of the sampling stations were located in areas of JELA that have been previously found to support SAV, including the lake shorelines and inland marsh areas. Reference stations were located approximately 17 miles west of JELA along Humble Canal and Bayou des Allemands in an area that was not subjected to increased flow from the Mississippi River through the Davis Pond Diversion. The reference stations were previously found to support a lower-diversity SAV community than JELA.

**Table 1. Sample Locations and Types of Sampling Performed.**

Station	Water Body	Latitude	Longitude	Water and Sediment Nutrient Chemistry	SAV Distribution and Relative Abundance of Floating Aquatics	Physical Water Quality	Photo and GPS Documentation
1	Bayou Segnette	29.86379	-90.16611	X	X	X	X
2	Tarpaper Canal	29.83468	-90.15472	X	X	X	X
3	Parallel Canal	29.82385	-90.12327	X	X	X	X
4	Pipeline Canal	29.77149	-90.14011	X	X	X	X
5	Lower Kenta Canal	29.77394	-90.11115	X	X	X	X
6	Bayou Segnette	29.74202	-90.14191	X	X	X	X
7	Lake Salvador Shoreline	29.79626	-90.16219	X	X	X	X
8	Lake Salvador Shoreline	29.80490	-90.16862		X	X	X
9	Bayou Bardeaux	29.81844	-90.16347	X	X	X	X
10	Lake Cataouatche Shoreline	29.84334	-90.19146	X	X	X	X
11	Horseshoe Canal	29.84441	-90.14751		X	X	X
12	Horseshoe Canal	29.84799	-90.14327		X	X	X
13	Bayou Boeuf	29.84390	-90.15637	X	X	X	X
14	Betty's Crack	29.81397	-90.12721		X	X	X
15	Pipeline Canal	29.78840	-90.13789	X	X	X	X
16	Bayou Aux Carpes	29.78804	-90.07485		X	X	X
17	Bayou Aux Carpes	29.77721	-90.07310		X	X	X
18	Lower Kenta Canal	29.76833	-90.10720		X	X	X
19	Pipeline Canal	29.78662	-90.13634		X	X	X
20	Bayou Aux Carpes	29.78609	-90.08852		X	X	X
21	Lake Salvador Shoreline	29.75728	-90.15387		X	X	X
22	Lake Cataouatche Shoreline	29.86887	-90.23629	X	X	X	X
23	Lake Cataouatche	29.86118	-90.21838		X	X	X

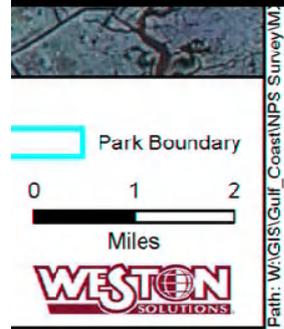
Station	Water Body	Latitude	Longitude	Water and Sediment Nutrient Chemistry	SAV Distribution and Relative Abundance of Floating Aquatics	Physical Water Quality	Photo and GPS Documentation
	Shoreline						
24	Lake Cataouatche Shoreline	29.83181	-90.18000		X	X	X
25	Twin Canals	29.80821	-90.12647		X	X	X
26	Bayou Segnette	29.84260	-90.17283		X	X	X
27	Lake Salvador Shoreline	29.74565	-90.15247		X	X	X
28	Bayou Segnette	29.80517	-90.15751		X	X	X
29	Bayou Segnette	29.79054	-90.13033	X	X	X	X
30	Bayou Segnette	29.76074	-90.14570		X	X	X
31	Bayou Segnette	29.83225	-90.16592		X	X	X
32	Lake Salvador	29.80436	-90.18500		X	X	X
33	Bayou Bardeaux	29.81702	-90.17032		X	X	X
34	Tarpaper Canal	29.83339	-90.15176		X	X	X
35	Yankee Pond	29.85033	-90.17363		X	X	X
36	Lake Cataouatche Shoreline	29.84257	-90.18951		X	X	X
37	Tarpaper Canal	29.82738	-90.13346		X	X	X
38	Whiskey Canal	29.86321	-90.20282		X	X	X
39	Bayou Segnette	29.84257	-90.18951	X	X	X	X
R1	Humble Canal	29.85936	-90.47194	X	X	X	X
R2	Bayou des Allemands	29.85770	-90.48682	X	X	X	X
R3	Bayou des Allemands	29.84702	-90.48385	X	X	X	X
R4	Humble Canal	29.86502	-90.46877	X	X	X	X
R5	Humble Canal	29.85659	-90.46111	X	X	X	X



and Preserve Station

### 2010 Jean Lafitte National Historic Park Locations

Figure 1. September



ly Area Station Locations



ional Historical Park and Preserve Stud



Figure 2. Jean Lafitte Na

**Figure 3. Bayou des Allemands and Humble Canal Reference Station Locations**

## Overview of Site Assessment Protocols

The field crew will perform station assessments consistent with the following protocols:

- Upon approaching the station, the boat operator will take care to arrive at the sampling destination without creating substantial disturbance in the water or sediments. No nutrient chemistry sampling or water quality sampling will be performed at a given station if it appears that turbidity plumes have occurred as a result of the boat's approach. If disturbance has occurred, a minimum waiting period of one hour will pass before returning to the same station to perform sampling.
- The location of the station will be recorded by taking a global positioning system (GPS) way point and recording the latitude and longitude of the station on appropriate forms; and a photograph of the GPS unit will be taken to synchronize the GPS track with the station.
- Photographs of the stations will be taken to record the overall condition of the station and presence of SAV. General notes on SAV will be recorded in field forms for all station locations.
- Water quality monitoring will be performed at all stations and will include measurements of pH, temperature, DO, salinity, turbidity, and chlorophyll *a*.
- Water quality and water chemistry sampling will be performed prior to conducting SAV surveys and sediment sampling in order to limit suspension of sediments at the full-analysis stations.
- SAV community assessments will be performed within three 10-m<sup>2</sup> "SAV survey areas".
- Relative cover of floating vegetation species will be assessed within three 0.25-m<sup>2</sup> quadrats.
- Sediment samples and water samples will be collected for nutrient analyses at the 14 JELA full-analysis stations and five reference stations.
- Information on herbicide spraying in JELA will be obtained by the Trustees and shared with BP within 30 days of receipt of information.

## 2.2 Sampling Equipment

Sampling equipment for SAV surveys will include:

- Study area maps with pre-determined sampling points;
- Hand-held GPS unit with an extra set of batteries;
- Digital camera and extra set of batteries for visual observations;
- Waterproof notebooks, waterproof pens, and waterproof data forms, including SAV site characterization forms (as shown in Appendix A), chain-of-custody, Natural Resource Damage Assessment (NRDA) sample collection forms for both water and sediments, and photo logger forms;
- Graduated five feet (ft) long garden rakes (with graduations on rake handle every ft) for retrieving deeper SAV that may not be visible from the surface;
- 0.25-m<sup>2</sup> quadrats; and
- Meter stick or weighted transect tape that may be used to measure water depth (in the event that the vessel is not fitted with a depth sounder).

Water quality sampling equipment will include:

- Secchi disk and line;
- Photosynthetically active radiation (PAR) sensor with data logger (LICOR spherical sensors, one for air and one for water, and LICOR 1400 data logger, or equivalent setup);
- YSI 6920 sonde with sensors for DO, turbidity, pH, salinity, conductivity, and temperature; and
- 250-milliliter (mL) (8-oz) glass jars for chlorophyll *a* analysis.

Water nutrient chemistry samples will be collected in:

- 60-mL high-density polyethylene (HDPE) sample bottles.

Sediment sampling equipment will include:

- Ponar grab for sediment samples;
- Powdered Alconox™ detergent and de-ionized water for cleaning the ponar grab between sampling locations; and
- 250-mL (8-oz) glass jars for sediment nutrient samples.

## 2.3 Station Characterization

### 2.3.1 GPS Locations

Stations will be located using hand-held GPS units accurate to within ten feet. The field crew will take a waypoint with the GPS unit at each site, and record coordinates in decimal degrees with WGS84 as the datum. The field crew will also take a photograph of the GPS unit, with the time and date visible, in accordance with NRDA field protocols, to synchronize the photos with the GPS track.

### 2.3.2 Photographs

The digital field camera will be set up in accordance with NRDA Field Photography Guidance (NRDA\_Field\_Photography\_Guidance.doc, available on the case file transfer protocol [FTP] site). Photographs will be taken of the station and sample collection procedures, if possible. Because each photograph or series of photographs must be associated with the corresponding sampling locations (e.g., through the use of GPS Photolink software or by keeping a detailed photo log), no photographs may be deleted as it would create gaps and alter the numbering sequence of the photos when they are uploaded from the camera (see separate NRDA Field Photography Guidance).

All photographs will be entered into the National Oceanic and Atmospheric Administration (NOAA) NRDA Trustees Sampler Photo Logger Form, and all required Chain of Custody procedures followed. Original photo files will either be left on flash cards and placed in locked storage or uploaded to a hard drive and not opened. If photo files need to be opened for any reason, a copy must be made of the original, and the copy may then be opened.

## 2.4 Water Quality and Chemistry Assessments

Following initial assessment of the station to establish the presence of SAV and completion of the station characterization, the field crew will complete water quality assessments and collect discrete water samples for chemical analysis at full-analysis stations. Water quality assessments will be completed first, prior to raking for SAV or collecting water chemistry or sediment chemistry samples. Water quality sampling will consist of measuring light penetration with a Secchi disk; light attenuation with a light meter; and pH, turbidity, DO, temperature, conductivity, and salinity with a YSI water quality sonde. Water samples will be collected in 250-mL sample jars for analysis of chlorophyll *a*. Specific procedures for performing water quality assessments are described below.

### 2.4.1 Water Quality Observations

Light penetration (i.e., Secchi depth) will be measured using a Secchi disk — a round black and white weighted 20-centimeter (cm) disc that is lowered through the water until the distinction between white and black quadrants is no longer visible to the human eye. The disk is attached to a non-stretching rope, marked at 10-cm intervals. The observer will lower the disk over the side of the boat facing the sun and not in the shadow of the vessel, until the disk disappears, then raise it until it reappears. The depth at which the disk reappears will then be recorded. Time of day and cloud cover will also be recorded. Sunglasses will not be worn when taking this measurement.

Light attenuation will be measured using a LICOR 1400 data logger (or equivalent) with spherical sensors for air and water. Light attenuation in the water can be calculated using either a 2 pi or 4 pi quantum sensor attached to a data recorder. The sensor will be lowered into the water column to obtain a profile of light readings. A sub-surface reading will be taken just below the water surface and at a minimum of three additional depths down to the bottom. Readings will be taken at closer intervals near the surface to capture higher rates of light attenuation. At each depth, the irradiance value displayed on the data logger will be recorded. At the time of the measurement, the time of day and cloud cover will be recorded. Three profiles will be performed per station.

Light attenuation in each profile can be calculated by taking the natural log of the irradiance values and regressing light on depth. The attenuation coefficient is the absolute value of the slope of the line.

Water quality measurements will also be collected for DO recorded in milligrams per liter (mg/L), salinity recorded in parts per thousand (ppt), conductance measured in milli-Siemens/cm, turbidity measured in nephelometric turbidity units (NTU), and temperature recorded in degrees Celsius (°C) using a YSI 6920 sonde. All values will be recorded onto the SAV site characterization data sheets. Sub-surface grab samples will be collected in laboratory-certified clean jars for analysis of chlorophyll *a*.

## 2.4.2 Water Chemistry Sampling

Water samples for nutrient analysis will be collected from within the first of the four 10-m<sup>2</sup> SAV survey areas positioned at each of the 14 full-analysis and five reference stations. Samples will be collected in an area free from sediment re-suspension due to boat operation. Water chemistry samples will be collected directly into the sample container to minimize risks of cross-contamination. Water nutrient samples will be collected in 60-mL HDPE sample bottles. Nutrient samples will be collected from below the surface of the water to characterize constituents present in particulate and/or dissolved state in the water column. These subsurface samples will be collected by deploying the sample bottle beneath the water's surface, unsealing the cap, allowing water to enter the sample bottle, and then resealing the cap below the surface to avoid inadvertently including surface water constituents. Nutrient and chlorophyll *a* samples will be collected in laboratory-certified clean jars and sent to University of Maryland Center for Environmental Science Chesapeake Biological Laboratory for analysis. Chlorophyll *a* samples will be filtered in the field using a glass microfiber filter.

Two field duplicates will be collected, including one at JELA full-analysis station 1 and one at reference station 1. Field duplicates will be clearly marked and will be assigned a new sample number distinct from the original duplicated sample. On the sample form, the Sample Quality Assurance/Quality Control (QA/QC) column will be marked to indicate that the sample is a duplicate. The associated parent sample number will be identified in the Sample Notes column (the entire Sample Identification [ID] should not be required in most situations since the location ID, matrix, and data should be the same).

Sample ID labels will be affixed to each container and covered with clear tape wrapped around the entire container circumference. Sample labeling will follow NRDA protocols as described in Section 2.8.1.

## 2.5 SAV Characterization

The waters within JELA range from freshwater to low-salinity, brackish water and have been found to support ten SAV species (Poirrier et al. 2009). Of the ten, seven were determined to be native species: *Cabomba caroliniana*, *Ceratophyllum demersum*, *Heteranthera dubia*, *Najas guadalupensis*, *Potamogeton pusillus*, *Vallisneria Americana*, and *Zannichellia palustris*, and three were exotic species: *Egeria densa*, *Hydrilla verticillata*, and *Myriophyllum spicatum*. SAV within JELA is sub-tidal with little lunar tidal variation. Photographs of the SAV species known to occur in JELA are provided in Appendix B.

The SAV characterization will be performed to allow rank order comparisons to previous studies, including “An Inventory and Assessment of the Distribution of Submersed Aquatic Vegetation at Jean Lafitte National Historical Park and Preserve (Poirrier et al. 2009)” and the September 2010 survey.

## 2.5.1 SAV Assessment of Species Relative Abundance

The SAV community will be assessed at all JELA and reference stations. Photographs will be taken to document SAV and floating aquatic plant cover at each station. Daily water level will be recorded using a staff gage located within Jean Lafitte National Historical Park and Preserve. At each station, the habitat setting (canal, bayou, pond, or lake) of the SAV bed will be indicated on the field form and maximum and minimum depth of rooted SAV will be recorded for each replicate survey area. Characterization of SAV will include assessments of the relative abundance of observed SAV species and associated floating aquatics, as well as the presence of epiphyte growth on SAV, as described below.

### *SAV Survey Area Assessments*

Four 10-m<sup>2</sup> SAV survey areas will be positioned in areas representative of the SAV community within each of the thirty-nine 100-m<sup>2</sup> JELA stations and five reference stations. The SAV survey area is comprised of two 1-m by 5-m quadrats positioned along both sides of the sampling vessel. The boat will be moved four times within a station to obtain four replicate 10-m<sup>2</sup> SAV survey area assessments per station. Distances among replicate SAV survey areas will vary somewhat with bed size, depth variation, and water body type. Approximate distances of 15-20 m between replicate sites are anticipated for each of the stations. Each survey area will be recorded with a GPS.

SAV species composition will be determined by direct observation of species present within the four 10-m<sup>2</sup> replicate SAV survey areas. Raking near the bottom with a 5-ft rake will be used to determine the presence of vegetation not visible from the surface. Raking will be performed in areas immediately adjacent to the sampling vessel in a manner that will minimize bottom disturbance. The occurrence of a species as either floating or rooted will be recorded, as will the presence of flowering shoots. Digital photography will be used to document observed species. In the event that SAV cannot be definitively identified in the field, samples will be collected for a more detailed examination.

Percent SAV surface cover will be estimated in the 10-m<sup>2</sup> SAV survey areas to provide an assessment of overall SAV cover and relative species abundance. Where water clarity allows, the ranking of SAV species in order of abundance will be recorded. Where it is possible to supplement SAV abundance data (based on water clarity), total SAV percent cover and relative SAV species percent cover will be recorded. This assessment will be dependent on visibility since dense floating and emergent vegetation and poor water clarity may limit assessments. Areas where water clarity precludes these assessments will be noted on the data sheets.

### *Quadrat Assessments*

Total percent cover of native floating plants, emergent plants, and surface algae will be estimated using randomly tossed 0.25-m<sup>2</sup> quadrats within each of the 10-m<sup>2</sup> replicate SAV survey areas. Additionally, the percent cover of exotic, invasive floating aquatics such as giant salvinia (*Salvinia molesta*), common salvinia (*Salvinia minima*) and Cuban club rush (*Oxycaryum cubense*), as well as other dominant invasive species that potentially shade SAV, will also be recorded in the 0.25-m<sup>2</sup> quadrats.

### *SAV Epiphyte Assessment*

Assessments of epiphyte abundance on SAV will be performed at the 14 full-analysis and five reference stations. Epiphyte cover on five representative SAV leaf samples of all species present in each of the four replicate SAV survey areas will be quantified according to the five following categories:

- (1) Epiphyte growth not visible to the naked eye and no filamentous algae present.
- (2) Filamentous algae present which covers up to 25% of leaf surface.
- (3) Filamentous algae cover 25% to 50% of leaf surface.
- (4) Filamentous algae 50% to 75% of leaf surface.
- (5) Filamentous algae cover 75% to 100% of leaf surface.

The species of SAV on which the percent cover of epiphytic growth was derived will also be recorded.

## **2.6 Sediment Sampling**

Sediment samples will be collected at the 14 full-analysis and five reference stations within the first of the three replicate 10-m<sup>2</sup> SAV survey areas. All non-disposable sampling gear will be decontaminated before using and between sampling stations. Equipment will be washed with laboratory-grade detergent (Alconox) and then rinsed well with clean de-ionized water prior to use. A Ponar grab sampling device will be lowered at a controlled speed of ~1 foot per second during sample collection. The device should contact the bottom gently, with only its weight used to penetrate the sediment. Care will be taken to minimize disturbance to the surface flocculence, which is likely to contain the most recent depositional material.

The sample will be inspected upon retrieval to ensure that it meets the following criteria:

- The sampler is not overfilled and the sediment surface is not pressed against the sampler top.
- Overlying water is present, indicating minimal leakage and likely little to no loss of flocculent material.
- Sediment surface is undisturbed, indicating lack of channeling or sample washout.
- Desired penetration depth is achieved (e.g., 4-5 centimeters [cm] for a 2 cm sample).

Once the Ponar sampler has been brought aboard the sampling vessel, the overlying water will be drained off from the sampler until the sediment is exposed. Special attention will be paid to ensure retention of any surface flocculence. Field staff will wear nitrile or other non-contaminating gloves when handling samples and sampling equipment. A clean stainless steel spoon or scoop will be used to collect the top 2-cm layer while avoiding sediments in contact with the sides or top of the sampler. To avoid cross-contamination, a clean scoop will be used for each sample. The sample will be placed into a clean stainless steel bowl and homogenized before being transferred into a sample jar. Transfer of the sediment from the sampler to the mixing bowl and from the mixing bowl to sample containers will be performed in clean areas of the vessel, up-wind of exhausts. Samples will be labeled in accordance with NRDA protocols and immediately placed into a cooler and kept on ice. Samples will be shipped or delivered to a Sample Intake Center within three days of collection and sent to University of Maryland Center

for Environmental Science Chesapeake Biological Laboratory for analysis within the required holding times.

Two field duplicates will be collected, including one at JELA full-analysis station 1 and one at reference station 1. Field duplicates will be clearly marked and will be assigned a new sample number distinct from the original duplicated sample. On the sample form, the Sample Quality Assurance/Quality Control (QA/QC) column will be marked to indicate that the sample is a duplicate. The associated parent sample number will be identified in the Sample Notes column (the entire Sample ID should not be required in most situations since the location ID, matrix, and data should be the same).

Sample ID labels will be affixed to each container and covered with clear tape wrapped around the entire container circumference. Sample labeling will follow NRDA protocols as described in Section 2.8.1.

## 2.7 Sample Collection Documentation

The field crew will adhere to the following procedures:

The individual who collected the sample will be specified on the field data form. If more than one person, list the field party leader and the person who entered the data (if different).

Sample IDs will be clearly listed under each category. Sample IDs should be assigned in accordance with the instructions in the **NOAA Field Sampling Workbooks** (available on the case's FTP site).

**Samples must also be recorded in the appropriate case-wide NRDA Sample Collection Form** (also available on the case's FTP site).

If a particular type of sample is not collected at a site, "none" will be entered for that sample type.

### 2.7.1 Chemistry Sample Labeling and Documentation

- Sample labels will be prepared following sample ID protocol provided in the instructions from the trustee data management team and will contain the following information:
  - Location code (e.g., LAAN37 for Louisiana grid section 37)
  - Letter indicating the study year that the sample was collected (e.g., A was the first year, B will be the second year, etc.)
  - Month and day of collection (e.g., 0915 for September 15)
  - Matrix (e.g., W or S for sediment or water)
  - Team number (e.g. I9) and the sample number (e.g., 03 if it was the third station sampled)
  - Thus, a water sample taken of September 7 as the 4<sup>th</sup> sample collected would be labeled "LAAN37-A0907-WI904.

- Sample ID labels will be affixed to each container and covered with clear tape wrapped around the entire container circumference. Tape will also be applied to secure the container lid.
- The collection of samples will be recorded in both the **SAV Site Characterization Form (Appendix A)** and in the **NRDA Sample Collection Form for Soils and Sediments**.
- Field duplicates will be clearly marked as separate samples, and will be assigned a new sample number distinct from the original duplicated sample. On the sample form, the Sample QA/QC Type column will be used to indicate that the sample is a duplicate. The associated parent sample number will then be identified in the Sample Notes column (the entire Sample ID should not be required in most situations since the location ID, matrix, and data should be the same).
- All original field notebooks, forms, and notes, will be preserved and will be signed and dated by the field lead. If incorrect entry occurs, the original entry will be crossed out, dated, and initialed. All original records will be gathered and kept on file by the trustees.

## 2.8 Sample Handling and Shipping

All collected samples will be transferred to the sample intake team. Field sampling crews will follow NRDA protocol documents for specific sample shipping and notification/sampling documentation instructions.

### 2.8.1 Preservation/Holding Times

All chemistry samples will be placed immediately in coolers and kept at 4°C. Samples will be transferred to the sample intake team to be frozen as soon as possible (for sediment chemistry samples). Water and sediment chemistry samples for nutrient analyses will be analyzed within the 28-day holding time. Chlorophyll *a* samples will be filtered in the field and the filters will be subsequently frozen and stored in foil packs until their arrival at the chemistry laboratory where analysis will be performed.

## 3.0 COST ESTIMATE

A cost estimate for development of the work plan and implementation of the field work described herein is provided in Appendix B.

### 3.1.1 Durable Equipment

Any durable equipment (such as cameras, GPS, etc.) purchased by BP for this study will be returned to BP or their designated representatives at the conclusion of its use for this study.

## 4.0 SAFETY

Field teams will comply with all existing training and safety protocols as applicable to operations. Prior to commencement of field activities, BP and the Trustees will agree upon a person or persons to whom study participants may report any safety concerns. Such person(s) will take action to address and resolve reported concerns in a timely fashion.

## 5.0 DATA SHARING

Field teams will complete data sheets each day. Each team member will sign the data sheet indicating agreement on the content of the data sheet. The Trustee representative will retain custody of all completed data sheets until they are transferred to the National Park Service's offices at the end of the study for archiving. BP/CardnoENTRIX representatives and Louisiana representatives, if present, may photograph or scan data sheets on a daily basis if desired. Field team members will also share electronic copies of all photographs taken on a daily basis, unless this is impracticable. The field team's camera memory card will remain in the custody of the Trustee representative until the completion of the study and will be archived at the NPS office. In the event that a survey is carried out without BP or its designated representative present, the data (data sheets, track logs, photos) will be e-mailed and/or Fed Ex'd to a designated BP representative within 48 hours of completion of that portion of the study (i.e., spring or fall). If a survey is carried out without a Louisiana Wildlife and Fisheries representative, the data will be e-mailed and/or Fed Ex'd to LOSCO within 48 hours of completion of that portion of the study (i.e., spring or fall). Copies of all analytical data collected in accordance with this work plan will be transmitted to LOSCO and BP/CardnoENTRIX within seven days of receipt.

At the completion of all field work for the spring 2011 portion of the study, a Trustee representative will compile all data sheets and photographs onto one or more CDs (or other electronic storage device) for distribution to BP/CardnoENTRIX, the Louisiana Oil Spill Coordinator's Office (LOSCO) on behalf of the State of Louisiana Natural Resource Trustees, and other Trustee agencies, as requested by such Trustee agencies. The same procedure will be followed at the completion of all field work for the fall 2011 portion of the study.

## 6.0 REFERENCES

- Analytical Quality Assurance Plan for the MS Canyon 252 (Deepwater Horizon) Natural Resource Damage Assessment (QAP)
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- Poirrier, M.A., K. Burt-Utley, J.F. Utley, E.A. Spalding. 2009 *An Inventory and Assessment of the Distribution of Submersed Aquatic Vegetation at Jean Lafitte National Historical Park and Preserve*, New Orleans, April 2009.
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- USEPA. 2006b. *Guidance for Data Quality Assessment: Practical Methods for Data Analysis*. EPA QA/G-9. EPA/240/B-06/003. U.S. Environmental Protection Agency, Office of Environmental Information, Washington, DC.

# APPENDIX A

## SAV Data Form

**SAV TWG- Jean Lafitte NPS Sampling Plan**

**SAV Site Characterization Form #1 [Page 1 of 3]**

Survey Team ID: Team 41

Data Recorder/Affiliation: Brian Riley- Weston Solutions

Other Team Members/Affiliation: Dan McCoy- Weston Solutions; Hyun Jung ("J.") Cho- Weston Solutions.

Location Descriptors

Site Name: \_\_\_\_\_ Lat: \_\_\_\_\_ Long: \_\_\_\_\_

Time: \_\_\_\_\_ Date: \_\_\_\_\_ Weather conditions: \_\_\_\_\_

Habitat Setting (check one): Canal (provide canal width) \_\_\_\_\_ Lake \_\_\_\_\_ Bayou \_\_\_\_\_

Maximum Depth within Quadrat-Rep 1 (ft) \_\_\_\_\_ Rep 2 (ft) \_\_\_\_\_ Rep 3(ft) \_\_\_\_\_

Light meter reading: Time: \_\_\_\_\_ Cloud cover: \_\_\_\_\_

Irradiance Reading/depth: Above water \_\_\_\_\_ Below surface \_\_\_\_\_ 1/3 depth \_\_\_\_\_

2/3 depth \_\_\_\_\_ Bottom \_\_\_\_\_

**Water Quality:**

pH \_\_\_\_\_ Temp. (°C) \_\_\_\_\_ DO (mg/L) \_\_\_\_\_ Turbidity (NTU) \_\_\_\_\_ Cond. (mS/cm) \_\_\_\_\_

Salinity (ppt) \_\_\_\_\_ Secchi Disk Depth (cm) \_\_\_\_\_

**SAV species present:**

**Quadrat 1:**

- Cabomba caroliniana*
- Ceratophyllum demersum*
- Egeria densa*
- Heteranthera dubia*

**Check if Quadrat was raked**

- Hydrilla verticillata*
- Myriophyllum spicatum*
- Najas guadalupensis*
- Other

\_\_\_\_\_ Length of Raked Area

- Potamogeton pusillus*
- Vallisneria americana*
- Zannichellia palustris*

**Quadrat 2:**

- Cabomba caroliniana*
- Ceratophyllum demersum*
- Egeria densa*
- Heteranthera dubia*

**Check if Quadrat was raked**

- Hydrilla verticillata*
- Myriophyllum spicatum*
- Najas guadalupensis*
- Other

\_\_\_\_\_ Length of Raked Area

- Potamogeton pusillus*
- Vallisneria americana*
- Zannichellia palustris*

**Quadrat 3:**

- Cabomba caroliniana*
- Ceratophyllum demersum*
- Egeria densa*
- Heteranthera dubia*

**Check if Quadrat was raked**

- Hydrilla verticillata*
- Myriophyllum spicatum*
- Najas guadalupensis*
- Other

\_\_\_\_\_ Length of Raked Area

- Potamogeton pusillus*
- Vallisneria americana*
- Zannichellia palustris*

**SAV TWG- Jean Lafitte NPS Sampling Plan**

**SAV Site Characterization Form #1 [Page 2 of 3]**

**Quadrat 4:**

- Cabomba caroliniana*
- Ceratophyllum demersum*
- Egeria densa*
- Heteranthera dubia*

**Check if Quadrat was raked**

- Hydrilla verticillata*
- Myriophyllum spicatum*
- Najas guadalupensis*
- Other*

\_\_\_\_\_ **Length of Raked Area**

- Potamogeton pusillus*
- Vallisneria americana*
- Zannichellia palustris*

Comments (flowering shoots, quantity, species etc): \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**SAV, Floating Aquatic, and Emergent Species percent cover: (% cover observed within randomly tossed 0.25m quadrat):**

Vegetation Type	Quadrat 1			Quadrat 2			Quadrat 3			Quadrat 4		
	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3	Rep 1	Rep 2	Rep 3
SAV (0.25m <sup>2</sup> quadrat)												
SAV- 10 m <sup>2</sup> quadrat estimate												
Floating Aquatic Vegetation												
Floating Aquatic Vegetation- 10 m <sup>2</sup> quadrat estimate												
<i>Salvinia molesta</i>												
<i>Salvinia molesta</i> - 10 m <sup>2</sup> quadrat estimate												
<i>Oxycarium cubensis</i>												
Emergent Vegetation												

Comments (SAV Rank Order, Other Invasive Species) \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**SAV TWG- Jean Lafitte NPS Sampling Plan**

**SAV Site Characterization Form #1 [Page 3 of 3]**

**Epiphyte Loading**

SAV Species	Quadrat 1 (10m <sup>2</sup> )	Quadrat 2 (10m <sup>2</sup> )	Quadrat 3 (10m <sup>2</sup> )	Quadrat 4 (10m <sup>2</sup> )
<i>Cabomba caroliniana</i>				
<i>Ceratophyllum demersum</i>				
<i>Egeria densa</i>				
<i>Heteranthera dubia</i>				
<i>Hydrilla verticillata</i>				
<i>Myriophyllum spicatum</i>				
<i>Najas guadalupensis</i>				
<i>Potamogeton pusillus</i>				
<i>Vallisneria americana</i>				
<i>Zannichellia palustris</i>				
<i>Other</i>				

A= No epiphytes present;

B= Epiphytes cover up to 25% of leaves

C= Epiphytes cover between 25% and 50% of leaves

D= Epiphytes cover between 50% and 75% of leaves

E= Epiphytes cover greater than 75% of leaves

**Location, time, and date of grab samples:**

Sample Type	Latitude	Longitude	Time	Date
Water Chemistry				
Sediment Chemistry				
Chlorophyll A				



# APPENDIX B

## Cost Estimate

	\$3,840
	\$7,980
	\$4,260
	\$1,000
	\$300
	\$1,000
	\$18,380
	\$1,103
	\$19,483
	\$30,939
	\$142,506

0	\$1,920	\$1,920
0	\$3,990	\$3,990
0	\$2,130	\$2,130
0	\$500	\$500
	\$150	\$150
	\$500	\$500
	\$9,190	\$9,190
	\$551	\$551
	\$9,741	\$9,741
	\$15,559	\$15,379
	\$71,343	\$71,163

<b>TRAVEL COSTS*</b>
AIR FARE (LAX to New Orleans, LA)
HOTEL
PER DIEM / DAY
VEHICLE RENTAL / DAY
Sample Shipping
MILEAGE
Cost SubTotal
G&A (6.00%)
TOTAL TRAVEL COSTS
TOTAL EXPENSES
TOTAL COST FOR 2011 SURVEYS

The cost estimate assumes the following:

- Field survey labor costs are for three WESTON personnel.
- Each field survey will be completed within a 10-day period (including 2 days for mobilization, 7 field days, and 1 day for demobilization).
- Equipment costs are only charged for field days (i.e., not mobilization or demobilization).
- The National Park Service will supply vessels and vessel operators.
- The estimate includes costs for analytical chemistry.

As detailed in the budget table above, the estimated costs for this scope of work totals \$71,343 for the Spring 2011 survey and \$71,163 for the Fall 2011 survey for a total cost of \$142,506. The Parties acknowledge that this budget is an estimate, and that actual costs may differ. BP's commitment to fund the costs of this work includes any additional reasonable costs within the scope of the approved work plan that may arise. The trustees will make a good faith effort to notify BP in advance of any such increased cost.