DRAFT ENVIRONMENTAL ASSESSMENT

Suemaur's Proposed 3-D Seismic Survey Within the McFaddin and Anahuac National Wildlife Refuges, Texas

Prepared for:

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1.0 PURPOSE AND NEED FOR ACTION

The Federal action being considered within this Environmental Assessment (EA) is the issuance of a Special Use Permit (SUP) by the U.S. Fish and Wildlife Service (Service or USFWS), Department of Interior, to Suemaur Exploration & Production, LLC (Suemaur), to access surface lands of the McFaddin and Anahuac National Wildlife Refuges (McFaddin NWR, Anahuac NWR, or collectively as Refuges) to conduct a 3-D seismic survey as part of the exploration of the subsurface mineral interests.

1.1 INTRODUCTION AND BACKGROUND

The McFaddin and Anahuac NWRs are located in southeast Texas, and are both part of the Texas Chenier Plain National Wildlife Refuge Complex. The McFaddin NWR is composed of fresh water, intermediate and brackish marshes, and the Anahuac NWR is composed of coastal marshes and prairies adjacent to the northeastern portion of Galveston Bay. These Refuges were established to preserve and protect migratory birds and other native fish and wildlife and the habitats upon which they depend. Both of these refuges contain important coastal habitats and teem with an abundance of wildlife including waterfowl, shorebirds, wading birds and other migratory birds and a thriving population of American alligators.

The Anahuac NWR was established on February, 27 1963, and the McFaddin NWR on May 2, 1980, under the authority of the Migratory Bird Conservation Act (16 U.S.C. 715d), "…for use as an inviolate sanctuary, and for any other management purposes, for migratory birds." The Refuges are administered by the USFWS, Department of Interior, as units of the National Wildlife Refuge System. Lands or certain interests in lands added to the Refuges since their original establishment were also acquired under the authority of the Migratory Bird Conservation Act, with the same establishment purpose. Lands have been added to Anahuac NWR under three additional authorities, with the following purposes:

> "… the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" 16 U.S.C. 3901(b), 100 Sta. 3583 (Emergency Wetlands Resources Act);
>
> "…suitable for—(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" 16 U.S.C. 460K-1 (Refuge Recreation Act); and,
>
> "…for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon,…" 16 U.S.C. 661-667e (Fish and Wildlife Coordination Act).

Currently, the McFaddin NWR consists of approximately 58,916 acres, and the Anahuac NWR consists of approximately 34,296 acres of coastal wetlands and associated coastal habitats.

The USFWS acquired all the lands comprising the Anahuac and McFaddin NWRs subject to the exercise of privately-held mineral rights, which include rights to explore and develop oil, gas and other hydrocarbons. For example, the 1977 Environmental Assessment (EA) addressing the original establishment of McFaddin NWR stated that the Service "…proposes to acquire 54,500 acres of Texas gulf coast waterfowl wintering and breeding habitat, through the acquisition of private land in fee title (less any oil, gas, and mineral reservation)." Further, the EA stated "Continued mineral development would be permitted under U.S. Fish and Wildlife Service administration. The U.S. Fish and Wildlife Service would have the right to regulate access and surface use during exploration, drilling, development, transportation, and removal of minerals." The USFWS clearly stated its intent to acquire lands within the Refuge subject to already outstanding minerals interests and to allow the reservation of any minerals that the sellers owned. For each acquisition, the USFWS determined that acquiring the land subject to outstanding mineral interest and allowing the reservation of mineral interests by the seller was compatible with the purposes for which the lands were being acquired.

With respect to State of Texas law on subsurface mineral rights in Texas, the subsurface mineral owner has specific property rights to pursue recovery of its minerals. Texas property law allows the subsurface mineral owner to make reasonable and necessary use of the surface to explore for, develop, and produce its mineral interest. The legal concept is commonly described as the mineral estate being the dominant estate and the surface estate being the subordinate estate.

The USFWS manages oil and gas operations on refuge lands through the Special Use Permit (SUP) process. When oil and gas operators representing the underlying mineral owners request access to refuge lands, the USFWS reviews the planned oil and gas operations and develops a set of stipulations necessary to provide refuge resource protection. The stipulations, which contain both requirements and limitations, are attached to and become part of the SUP as Special Conditions. The oil and gas operator is then offered the SUP conditioned on their acceptance of the stipulations contained in the SUP. The terms of the SUP and the proposed oil and gas operation must comply with applicable sections of federal regulations dealing with minerals management on National Wildlife Refuges. The specific Code of Federal regulations (CFR) dealing with "mineral rights reserved and expected" is 50 CFR 29.32, as follows in full:

> "*Persons holding mineral rights in wildlife refuge lands by reservation in the conveyance to the United States and persons holding mineral rights in such lands which rights vested prior to the acquisition of the lands by the United States shall, to the greatest extent practicable, conduct all exploration, development, and production operations in such a manner as to prevent damage, erosion, pollution, or contamination to the lands, waters, facilities, and vegetation of the area. So far as practicable, such operations must also be conducted without interference with the operation of the refuge or disturbance to the wildlife thereon. Physical occupancy of the area must be kept to the minimum space compatible with the conduct of efficient mineral operations. Persons conducting mineral operations on refuge areas must comply with all applicable Federal and State laws and regulations for the protection of wildlife and administration of the area. Oil field brine, slag, and all other waste and contaminating substances must be kept in the smallest practicable area, must be confines so as to prevent escape as a result of rains and high water or otherwise, and must be removed from the area as quickly as practicable in such*

a manner as to prevent contamination, pollution, damage, or injury to the lands, waters, facilities, or vegetation of the refuge or to wildlife. Structures and equipment must be removed from the area when the need for them has ended. Upon the cessation of operations the area shall be restored as nearly as possible to its condition prior to the commencement of operations. Nothing in this section shall be applied so as to contravene or nullify rights vested in holders of mineral interests on refuge lands."

Suemaur owns the rights to explore for minerals underlying the McFaddin and Anahuac NWRs. Suemaur contacted the USFWS seeking access to refuge lands to conduct a 3-D seismic survey to explore the subsurface mineral estate. Following discussions concerning the type of exploration activities proposed, the USFWS proposed a set of stipulations, which would be the Special Conditions of the SUP providing surface access to refuge lands. Suemaur then requested a SUP for all of the lands, approximately 18,103 acres, within the Refuge upon which they are proposing a 3-D seismic survey and agreed to conduct the 3-D seismic survey pursuant to the stipulations contained in the SUP. This Environmental Assessment addresses the issuance of a SUP with stipulations attached to Suemaur to conduct a 3-D seismic survey on refuge lands.

Issuance of a SUP to Suemaur for 3-D seismic survey operations on refuge lands is conditioned upon Suemaur providing satisfactory evidence to USFWS documenting that they do in fact legally own the rights to explore for minerals underlying the Refuges. Absent that, satisfactory evidences showing a legal right to make use of the surface for exploration of subsurface minerals, the USFWS would not issue a SUP and deny surface access.

1.2 DESCRIPTION OF THE PROPOSED FEDERAL ACTION

The Proposed Federal Action is the issuance of a Special Use Permit by the U.S. Fish and Wildlife Service to govern the implementation of a 3-D seismic survey by Suemaur on the McFaddin and Anahuac NWRs. The Special Use Permit contains a number of general provisions and stipulations aimed at protecting natural and cultural resources and minimizing conflicts with public uses and other USFWS management activities within the Refuges.

The USFWS is requiring a Special Use Permit for those lands for which there is a permitting requirement specified in the original conveyance documents, and consistent with agency policy, the USFWS has pursued voluntary permitting arrangements with Suemaur for conducting the 3-D seismic survey on lands within the McFaddin and Anahuac National Wildlife Refuges for which the original deeds or other documents of conveyance contain no provisions requiring a Special Use Permit and on lands for which the USFWS has no conveyance documents from the underlying mineral interest owners. The USFWS is proposing to issue a Special Use Permit to Suemaur to govern implementation of a 3-D seismic survey on all areas to be covered by the survey within the McFaddin and Anahuac NWRs. Suemaur has agreed to conduct the 3-D seismic survey under the USFWS Special Use Permit for all areas within the Refuges.

2.0 DESCRIPTION OF PROPOSED 3-D SEISMIC SURVEY SEISMIC OPERATIONS PLAN

Suemaur is proposing to conduct a 3-D seismic survey within and adjacent to McFaddin and Anahuac NWRs between April 15 and October 15, 2006. The project area includes a total area of 76 square miles and encompasses approximately 4,870 acres of the McFaddin NWR and 13,233 acres of the Anahuac NWR (**See Figures 1 and 2**). The seismic program will be conducted by Suemaur, using a Veritas DGC Land Inc. (Veritas) seismic crew. Suemaur and Veritas are fully committed to conducting the program under the terms and conditions of a USFWS Special Use Permit for work to be conducted on all areas within the Refuges.

The proposed project is a state-of-the-art 3-D seismic survey, which will provide a high-resolution image of the subsurface geological features. The data gathered from this survey will allow Suemaur to effectively image the hydrocarbons underlying the Refuges, while keeping the disruption of the Refuges at an absolute minimum.

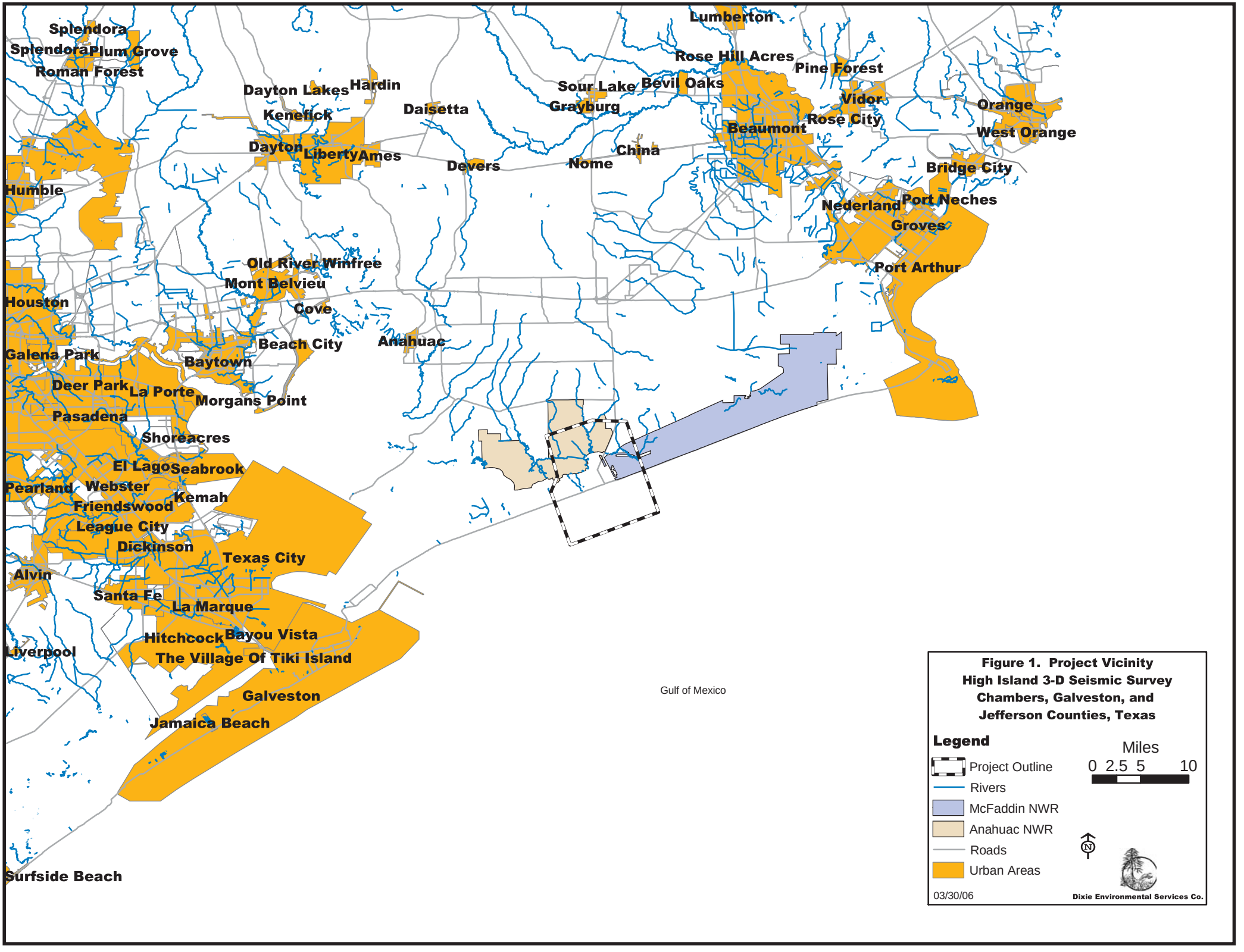
Suemaur owns the rights to explore for minerals in the entire area covered by the survey. The seismic survey is proprietary, and the data generated from the survey will be owned by Suemaur.

The proposed 3-D survey requires the deployment of motion sensing devices (receivers), which will be deployed at regular intervals, with spacing between receiver lines of 1760 feet in the majority of the project area and 880 feet (stub lines) in the High Island area (**Figure 3).** The closer spacing of receiver lines in the High Island area is necessary to allow the client to define fracture and fault patterns over the salt dome that underlies the area. The portion of the Anahuac NWR covered by the more closely spaced stub lines is approximately 15,000 acres in size, and the portion of the McFaddin NWR is approximately 7,000 acres in size. The survey design will also incorporate both explosive and air gun energy sources. Air gun energy sources would be utilized in the Gulf of Mexico and explosive energy sources would be used on land.

The charge depth and configuration proposed for land consists of single, 80-100 foot holes drilled at intervals of 245.967 feet along each source line in a diagonal pattern. Source line spacing on land is 1760 feet. Each source location will be loaded with a 5.5-pound *Pentalite* explosive charge.

Air gun energy sources in the Gulf of Mexico would be located at intervals of 220 feet along source lines, which are spaced 220 feet apart. An airgun boat would produce impulsive signals (airgun pops) at each source point location by rapidly releasing compressed air into the water column. These signals would be directed downward through the substrate and reflected back upward from the underlying strata. The resulting sound waves would be recorded by motion sensing devices and transmitted to data collection units.

As many as 10 receiver lines will be active at any one time, with one line being deployed and one line being picked up as the spread generally progresses from west to east. Each portion of the program will be occupied for about 14 days as the 13-mile long active spread traverses the program area.


Splendora
Splendora
Plum Grove
Roman Forest
Dayton Lakes
Hardin
Kenefick
Daisetta
Dayton
Liberty
Ames
Devers
Sour Lake
Grayburg
Nome
China
Lumberton
Rose Hill Acres
Pine Forest
Bevil Oaks
Vidor
Orange
Rose City
Beaumont
West Orange
Bridge City
Port Neches
Nederland
Groves
Port Arthur
Humble
Houston
Old River-Winfree
Mont Belvieu
Cove
Beach City
Anahuac
Galena Park
Baytown
Deer Park
La Porte
Morgans Point
Pasadena
Shoreacres
El Lago
Seabrook
Pearland
Webster
Kemah
Friendswood
League City
Dickinson
Texas City
Alvin
Santa Fe
La Marque
Hitchcock
Bayou Vista
Liverpool
The Village Of Tiki Island
Galveston
Jamaica Beach
Surfside Beach
Gulf of Mexico
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High Island 3-D Seismic Survey
Chambers, Galveston, and
Jefferson Counties, Texas
Legend
Project Outline
Rivers
McFaddin NWR
Anahuac NWR
Roads
Urban Areas
Miles
0 2.5 5 10
N
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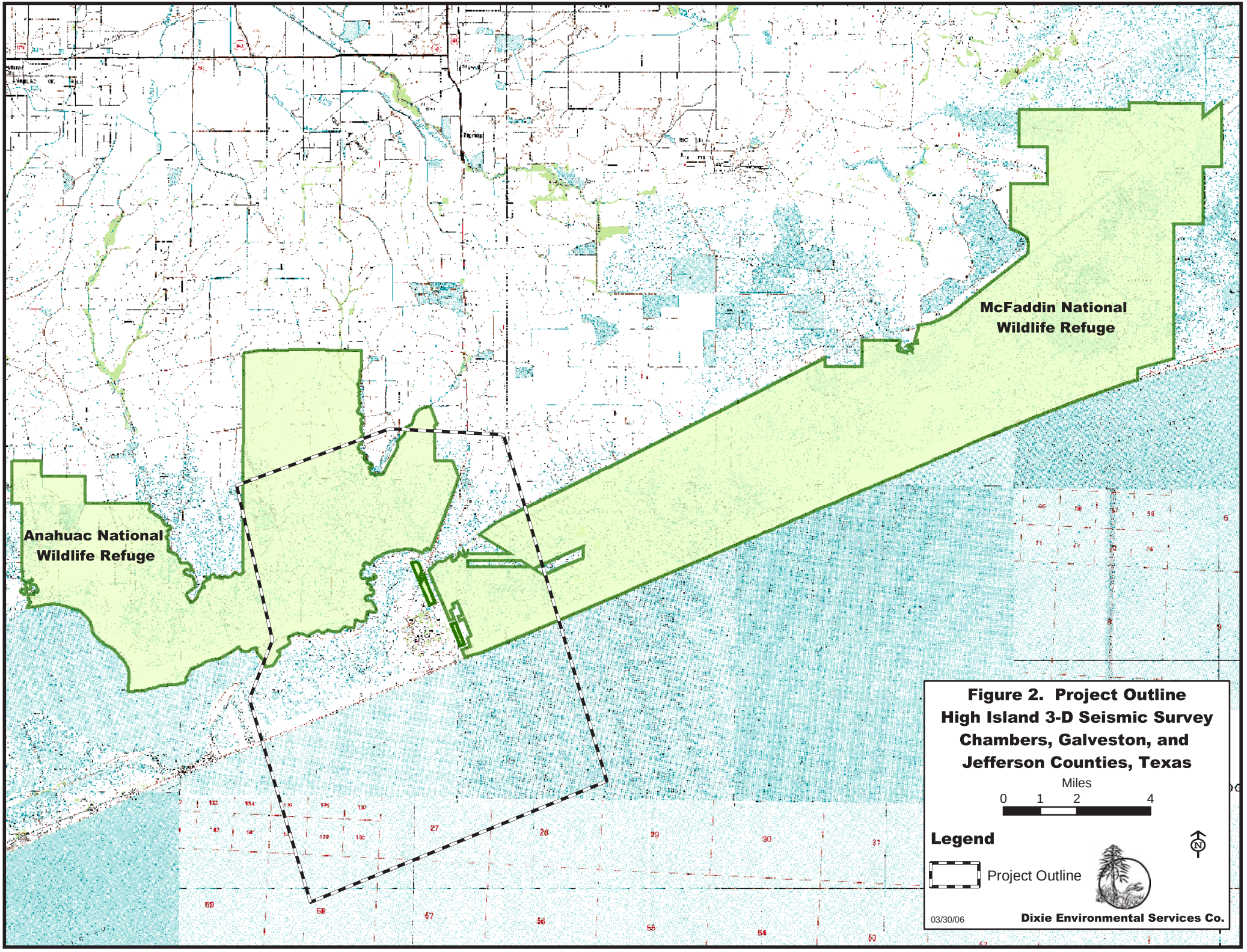
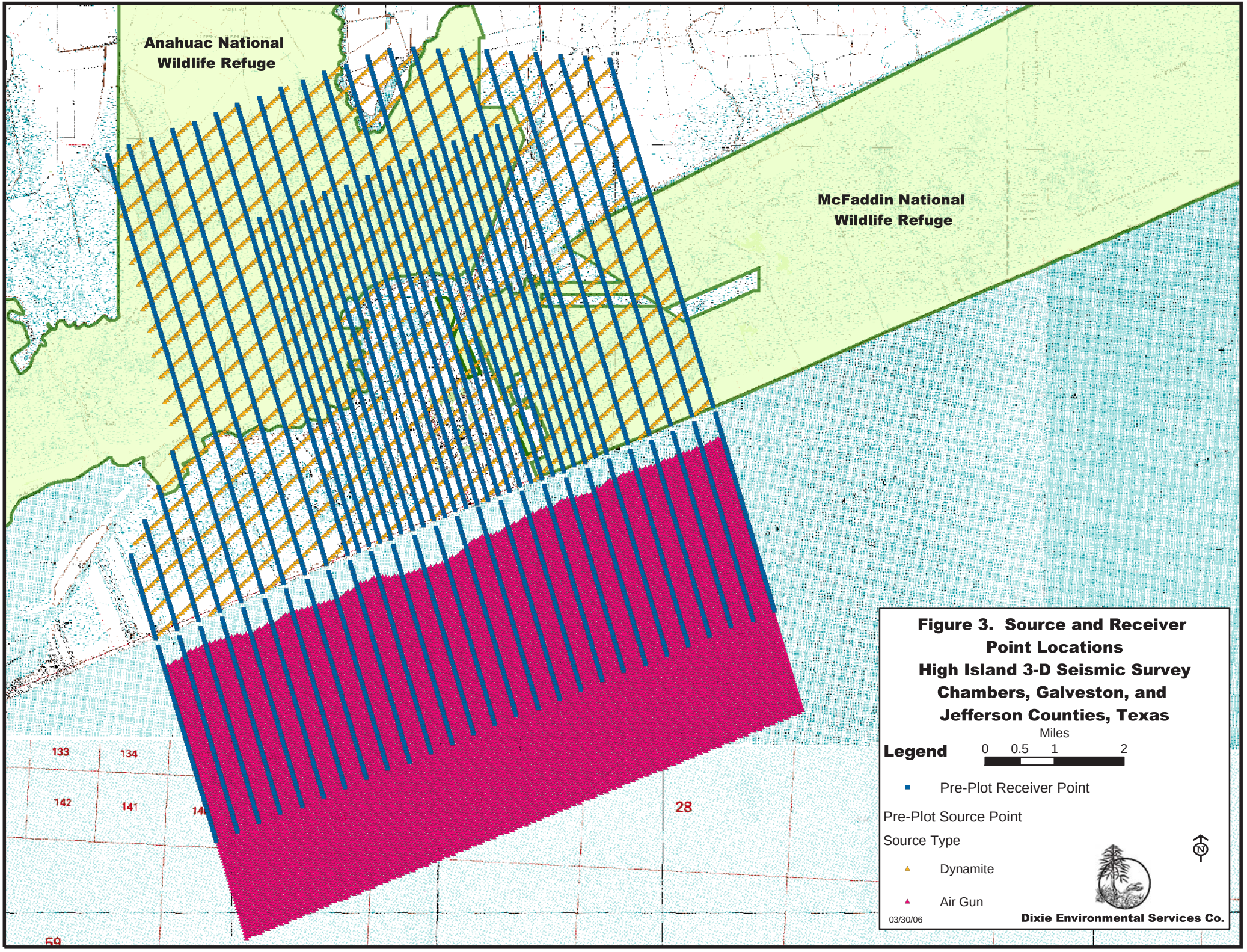
Dixie Environmental Services Co.


McFaddin National
Wildlife Refuge
Anahuac National
Wildlife Refuge
Figure 2. Project Outline
High Island 3-D Seismic Survey
Chambers, Galveston, and
Jefferson Counties, Texas
Miles
0 1 2 4
Legend
Project Outline
03/30/06
Dixie Environmental Services Co.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Wildlife Refuge
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Miles
0 0.5 1 2
Legend
Pre-Plot Receiver Point
Pre-Plot Source Point
Source Type
Dynamite
Air Gun
N
03/30/06
Dixie Environmental Services Co.

As specified by the USFWS, the seismic survey program within the McFaddin and Anahuac National Wildlife Refuges will be completed in an approximate 135-day period during the time period of June 1, 2006 through October 15, 2006, and will progress from east to west. The main goals of this schedule and geographic progression are to: 1) finish the program before the majority of migratory waterfowl and other migratory birds return from northern latitudes and begin utilizing the area for foraging and nesting; 2) avoid drilling, shooting, and recording in the Refuge's primary mottled duck nesting habitats until after the peak nesting season; 3) minimize overall time spent on the Refuges; and 4) reduce traffic on receiver and shot lines.

Logistical support, living quarters, and food services for the 50 to 70 persons working on the seismic project will primarily be supplied from the vicinity of Winnie in Chambers County, TX.

A complete description of the proposed seismic survey including equipment, methods of operation, and schedule is included in the following Sections 2.1 through 2.4.

2.1 PROPOSED PROJECT AREA

The project area for the proposed 3-D seismic survey is presented in **Figures 1 and 2**. The project area covers approximately 76 square miles (48,640 acres) and includes approximately 4,870 acres within McFaddin NWR and 13,233 acres within the Anahuac National Wildlife Refuge.

2.2 EQUIPMENT

Seismographic equipment developed for transition zone environments will be utilized during the proposed survey. This equipment includes mobile shot-hole drills mounted on buggies, single and/or double-wide airboats, and lightweight aluminum tracked vehicles; recording equipment consisting of RF radio telemetry recording instrumentation, geophones, hydrophones, cables, sealed gel-cell batteries, GPS based navigation systems, ATV's, airboats, lightweight aluminum tracked vehicles, an air gun boat, and a helicopter for transport of equipment and personnel.

Hydrologic conditions, vegetative cover and wetland habitat types within the project area will determine the equipment types proposed for use during the seismic survey. Prior to entering an area, the conditions will be evaluated by USFWS to determine which equipment type is suitable for use and how to best access the sites. In general:

- For submerged lands and shallow water conditions, airboats will be required for transportation of personnel and drilling equipment.

- For emergent wetland operations, to minimize rutting, lightweight aluminum tracked vehicles will be required for transportation of personnel and drilling equipment.

- Dependent upon soil and water conditions, drilling in salty prairie and other "highland" areas will occur using either lightweight aluminum tracked buggies or traditional highland drilling buggies. For general travel in highland operations, ATV's will be used and restricted to existing natural and man made travel lanes (roads, trails, two tracks) to minimize environmental impact.

- For submerged land and shallow water, most personnel and light equipment transportation, including recording equipment, will be accomplished using airboats or flatboats.

Whenever possible, the layout, troubleshooting, and pick-up of receiver lines will be carried out on foot. A helicopter equipped with a long-line will be used to deploy and recover recording equipment to and from the receiver lines. Shot hole drilling rigs mounted on buggies, airboats, or tracked vehicles will be used during the entire survey within the Refuges.

Additional crew vehicles will consist of approximately 20 utility trucks or vans for operations, logistics, and transportation to and from the crew accommodation site. Airboats and tracked vehicles will enter wetland areas; all other support vehicles will be restricted to designated roadways. Approval from the environmental monitor and Refuge Manager will be requested, on a case-by-case basis, in the event that off-road access for support vehicles becomes necessary.

A generic list of equipment proposed for use during this project is listed below:

SURVEY CREW
- 5 Airboats
- 5 Pickup Trucks
- 2 Lightweight aluminum tracked vehicles

DRILL CREW
- 6 Airboat Drills
- 4 Lightweight aluminum tracked vehicle drills
- 4 Support Airboats
- 8 Vehicles

RECORDING CREW
- 15 Airboats
- 4 Flatboats
- 6 Lightweight aluminum tracked vehicles
- 1 Air Gun Boat (Gulf of Mexico)
- 15 Vehicles
- 4 ATV's
- 1 Helicopter

2.3 SCHEDULE

The proposed seismic survey program will require approximately 135 days of fieldwork, from the commencement of hazard/access mapping and topographic survey operations through the completion of acquisition recording. The project is proposed for the period from April 15, 2006 through October 15, 2006, including an allowance for inclement weather as specified by the USFWS. Topographic surveying of receiver and source lines would begin after receiving authorization from the Refuge Manager. Shot hole drilling could begin two weeks after the start of surveying and source line flagging. Seismic recording would begin after a sufficient drill lead was established, starting at the eastern limit of the seismic grid and recording to the west.

2.4 TYPICAL METHOD OF OPERATIONS

Veritas will be the seismic company acquiring the 3-D seismic data and plans to use equipment that is well suited for seismic acquisition work in coastal marshes and wetlands. Veritas has met with the Refuge Managers and understands their responsibility for minimizing the effect of operations on the resources of the Refuge to the extent practical and to keep their occupancy to a minimum that is compatible with safe and efficient operations. Veritas is committed to using low ground pressure buggies, airboats, tracked vehicles, and helicopters in sensitive environments located within the Refuges.

The seismic survey will require a continuous effort during the project by the three crews: 1) surveying crew; 2) shot hole drilling crew; 3) recording crew. Before each crew enters any Refuge area they shall have first met with the Refuge Manager. Environmental monitors, hired with prior approval of the Refuge Manager, will watch crew activities during the project and report directly to the Refuge Manager. Veritas and the environmental monitors will make evaluations of ground conditions as equipment is removed from areas within the Refuges.

Survey Work

The initial phase of the project will begin with hazard/access mapping, followed by topographic surveying of receiver and source lines. Survey crews will mark source and receiver lines utilizing real time GPS navigational systems in most open areas. Where heavy tree cover is present, a combination of GPS and Electronic Distance Measuring (EDM) systems will be used. Source and receiver line locations will be marked with cane poles and flagging. Material used to mark source lines will be removed after shot holes have been recorded. Material used to mark receiver lines will be removed after all ground equipment has been picked-up. Approximately 9 to 12 personnel will be working on-foot during the surveying phase of the project.

Shot Hole Drilling

The shot hole drilling crews (approximately 20 personnel, with 10 drills mounted on low ground pressure buggies, airboats and/or tracked vehicles) will follow the surveyors. Source lines will be oriented in an east/west direction, spaced approximately 1760 feet apart with source points positioned at 220 foot intervals along each line (**Figure 3)**. Shot holes will be between 2.5 to 4.5 inches in diameter, drilled to a design depth of between to 80-100 feet.

Lightweight aluminum tracked vehicles are proposed for shot hole drilling in emergent wetlands and in salty prairies when soils are saturated. The critical zone for vehicular access is in areas of saturated soils or where vegetation is severely lacking. The USFWS and environmental monitor(s) will be involved in identifying these zones to ensure the use of appropriate vehicle types. The goal for this project is to minimize the signature (tracks) of vehicles by minimizing rutting or gouging of exposed hydric (wetland) soils.

In shallow water areas, airboat drills will be used to drill the shot holes. The changeover zone between airboat drills and tracked vehicle drills will be determined on a site-specific basis in conjunction with recommendations provided by the environmental monitor(s).

Every effort will be made to use a "one-pass" drilling operation in an effort to minimize environmental impact. Each detonator will be tested before and after a shot hole is loaded to reduce the need for re-drills. However, if re-drilled shot holes were needed, prior approval from the environmental monitor or Refuge Manager would be requested before making the additional passes. The project goal is to minimize surface disturbance and damage to vegetation.

Water Sources and Transport of Water for Drilling

Water is typically required in the drilling of most shot holes on land. The amount of water required for each hole is site specific and will be determined during the course of operations. The Refuge Manager will approve water sources for use during shot hole drilling operations. Drilling water will be transported in by low-ground pressure vehicles from outside sources, or where approved, from irrigation ditches, bayous, and similar natural watercourses. Holes dug to provide drilling water would be refilled and restored to ground elevation immediately upon completion of drilling (backfill and plugging) operations.

Backfilling and Plugging of Shot Holes

Cuttings produced during drilling will be used to backfill shot holes. Shot holes drilled in standing water will cave-in and plug the hole naturally, while shot holes drilled in highland areas will be backfilled with cuttings; excess cuttings (not used as backfill for the source hole) will be spread (leveled) on-site to prevent "mounding".

Safety and Setbacks

Shot hole cap wire will be buried (when necessary) with a small magnet attached to the cap wire leads. The magnets, which are recovered and reused, will aid in locating shot holes with the use of a metal detector (Schoenstadt).

The crew will have at least one full time Quality, Health, Safety, Environmental and Security (QHSES) Advisor available on-site during the survey. Veritas considers workplace safety and environmental awareness to be of the utmost importance and is committed to the use of methodology and procedures that enhance both safety and environmentally responsible work practices. All personnel operating vehicles on public roads will have received driver training.

Table 1 indicates the energy source operating distances commonly accepted by the geophysical industry.

Table 1: Energy Source Distance Chart						
	Explosives Energy Source Charge size shown in pounds					Vibroseis
Object	5 or under	6 to 10	11 to 20	21 to 40	41 to 100	
Pipeline less than 6" in diameter	100'	140'	190'	230'	290'	300'
Pipelines 6'' to 12'' in diameter	150'	215'	280'	350'	430'	300'
Pipeline greater than 12" in diameter	200'	290'	380'	460'	580'	300'
Telephone Line	40'	56'	76'	80'	115'	**
Railroad track or main paved highways	150'	215'	280'	350'	430'	**
Electric power line (Shot hole not to exceed 200' depth)	TWO TIMES THE HOLE DEPTH					
Water well, buildings, underground cistern, and all other objects not mentioned above.	300'	430'	560'	700'	860'	300'

The Refuge Manager may establish additional offsets for the protection of sensitive areas or wildlife.

Recording Operations

Recording crew operations will be coordinated from a staging area set-up at an approved field location. The staging area serves as a base for equipment repair and helicopter operations and should ideally be located on a highland site to facilitate the movement of trucks and trailers. However, the staging area could be located within the Refuge boundaries if approved by the Refuge Manager. A coordinator's trailer, battery charging truck, equipment maintenance trailer, highboy transport trailers, and helicopter fuel trailer are typically located at the staging area for the duration of recording operations. A dumpster or skip will be rented locally and kept at the staging area for the storage/removal of all trash and waste materials. It will be emptied periodically and removed upon completion of the project. Data acquisition will be managed from the main instrumentation truck (recorder), which will be located at various road accessible sites around the survey area.

Recording equipment will be transported to the receiver lines on land using a helicopter. The recording equipment will be comprised of remote seismic recorder (RSR) boxes, sealed gel-cel batteries, main cables and geophones and/or hydrophones. These items will be loaded into equipment bags (helibags) for transport by helicopter. The helibags will be deployed along

receiver lines at intervals of approximately 1,000 feet using a bag runner deployment system. Bag drop coordinates are programmed into the helicopter's navigation electronics to ensure that helibags are deployed at precise locations. Line crews working on-foot, or from airboats and/or tracked vehicles in wet areas, will unpack the helibags and layout the ground equipment. Troubleshooting crews will repair any of the ground equipment that is "out of specs" or becomes non-operational during data acquisition operations. Recording equipment will be transported and deployed from flatboats in the Gulf of Mexico.

Once deployed, the equipment is ready for data acquisition (recording) operations to begin, with shotholes being recorded on land only during the day and airgun operations occurring in the Gulf of Mexico through the night and into the early morning. Shooting crews working on-foot, or from airboats and/or tracked vehicles in wet areas, will make their way to each shot hole on land. The shot hole's detonator leads will be connected to the "blaster" that is fired electronically by a radio signal sent from the recording truck. An airgun boat would produce impulsive signals (airgun pops) at each source point location by rapidly releasing compressed air into the water. These signals would be directed downward through the substrate and reflected back upward from the underlying strata.

The energy reflections are recorded by the geophones or hydrophones and stored in the RSR boxes. The data stored in each RSR box is periodically downloaded into a data collection unit (DCU) for processing and copying to tape. Data collection will be performed on a continuous basis as part of the data acquisition operation.

Upon completion of recording operations, all ground equipment will be picked-up by the line crews and packed into the helibags on land. The helicopter will recover the helibags using the bag runner system and fly the equipment back into the staging area. Equipment will be deployed and recovered in the Gulf of Mexico using boats. All remaining trash (flagging, cane poles, etc.) will be removed from the project area. A final inventory of all equipment will be made to ensure that no equipment is left in the field.

Crew personnel will be accommodated locally at the nearest motel/hotel. A recording crew office will be established locally (typically, at the same location) to administer and manage crew operations. Approximately 45 to 62 personnel will be working during the recording phase of the project.

Staging and Storage Areas

Locations of staging areas for storage and explosives and/or equipment will be determined ahead of initiating survey activities. Veritas will coordinate any need to establish staging areas on the Refuges with the Refuge Manger, and the Refuge Manager must approve any staging area location sited on the McFaddin or Anahuac NWRs.

3.0 DESCRIPTION OF ALTERNATIVES

3.1 ALTERNATIVE A: NO ACTION. The USFWS Would Not Issue a Special Use Permit for the 3-D Seismic Survey

The National Environmental Policy Act and the Council for Environmental Quality (CEQ) Regulations on the implementation of NEPA require consideration and analysis of the "No Action Alternative." Since the USFWS is considering taking a new action, issuance of a Special Use Permit (SUP) for a 3-D seismic survey, the NEPA "No Action Alternative" is the USFWS not acting at all. Therefore, the "No Action Alternative" addresses not issuing a SUP for a 3-D seismic survey.

The "No Action Alternative" would occur under the following described set of circumstances. The USFWS would propose a SUP with attached stipulations to Suemaur; and, if Suemaur refused to accept the SUP and agree to conduct operations pursuant to the stipulations, the USFWS would not issue a SUP. At that point, Suemaur could abandon its 3-D seismic project or could elect to proceed with the 3-D seismic project relying on the underlying mineral interest owners' state property right to make reasonable and necessary use of the surface to explore for and development of its mineral interests. If Suemaur did proceed with the 3-D seismic operations without a SUP, the USFWS would, of course, continue to enforce all of the applicable state and federal statutes and regulations.

It can be reasonably anticipated that several operational aspects of a 3-D seismic survey conducted on the McFaddin NWR and Anahuac NWR without the issuance of a Special Use Permit by the USFWS would differ from a seismic survey whose operations are governed by the general provisions and specific stipulations contained in the Special Use Permit. For example, operational aspects of a 3-D seismic survey conducted without the issuance of a Special Use Permit could include:

1) conduct of the seismic survey outside of the seasonal timeframes specified by the USFWS, which could be during the periods of highest migratory bird use and result in the greatest overall disturbance impacts to migratory birds and other wildlife (fall and spring migrations and wintering periods)

2) not using trained environmental monitors who are responsible for serving as daily liaison between the Refuge Manager and seismic personnel, and ensuring that all operations are conducted in adherence to Special Use Permit stipulations, i.e., in a manner which minimizes environmental impacts.

3) laying out shot and receiver lines and conducting operations without full consideration of possibilities to avoid sensitive habitat, wildlife or other natural resource features.

4) increased use of types of equipment for shot hole drilling operations such as terra-tired marsh buggies, which have a higher ground pressure than other specialized drilling equipment, and which are generally more available and can be used at lower cost than other specialized equipment.

5) increased travel using a variety of mechanized equipment along the shot and receiver lines and cross-country travel between shot and receiver lines.

6) not taking special precautions to limit soil and vegetation damages along shot and receiver lines and at specific locations such as waterway crossings and pond shorelines which are particularly susceptible to soil and vegetation damage..

7) not modifying seismic operations to reduce conflicts with public recreational, educational and scientific uses of the Refuge.

In addition to those listed above, it can reasonably be expected that many other operational procedures which are restricted or modified by the stipulations of the USFWS Special Use Permit in order to minimize environmental impacts would likely be conducted in a manner which would result in greater environmental impacts.

3.2 ALTERNATIVE B: PROPOSED ACTION. The USFWS Would Issue a Special Use Permit for the 3-D Seismic Survey

Under Alternative B, the USFWS would issue a Special Use Permit to Suemaur for the 3-D seismic survey for all areas on the McFaddin and Anahuac NWRs to be covered by the 3-D seismic survey. The Special Use Permit contains stipulations and regulations aimed at protecting natural and cultural resources on the Refuges, and minimizing conflicts with public uses and other USFWS management activities. The provisions and stipulations of the Special Use Permit are fully described in Section 5 of this Environmental Assessment. Through the issuance of a Special Use Permit and its subsequent administration to ensure strict adherence to its provisions and stipulations by Suemaur, the USFWS is actively managing the proposed activity to protect natural and cultural resources and public safety on McFaddin and Anahuac NWRs. This is the Proposed Action. In addition to the Special Use Permit provisions and stipulations, the USFWS, would, of course, enforce all applicable state and federal statutes and regulations.

By agreeing to conduct the seismic survey within areas of the McFaddin and Anahuac NWRs under the USFWS Special Use Permit, Suemaur is agreeing to conduct all operations within the Refuges under stipulations aimed at protecting natural and cultural resources and minimizing conflicts with other uses of the Refuges including public recreation, environmental education, and scientific research. Under the Proposed Action, the overall environmental impacts of the proposed seismic survey will be reduced. For example, the seismic survey will be conducted within the seasonal timeframe specified by the USFWS in order to reduce disturbance impacts during the periods of highest migratory bird use on the Refuges (spring/fall migrations, wintering), will utilize trained environmental monitors to serve as daily liaisons with Refuge staff, monitor adherence to SUP stipulations, provide on-site guidance on the SUP stipulations and provisions, and document any damages to Refuge resources within the McFaddin and

Anahuac NWRs, will require use of specialized equipment and special operating procedures aimed at reducing habitat damages and disturbance impacts to wildlife, and will be required to the maximum extent practicable to avoid sensitive wildlife and habitat features. All surface damages to soils, vegetation, and infrastructure will be documented. Suemaur will be responsible for restoration and/or mitigation for all habitat and infrastructure damages caused by 3-D seismic survey activities.

3.3 ADDITIONAL CONSIDERATIONS IN PERMITTING A 3-D SEISMIC PROJECT

The proposed seismic survey project is described in Sections 1.0 and 2.0. Briefly, the proposed project calls for a 3-D seismic survey covering approximately 4,870 acres within the McFaddin NWR and 13,233 acres within the Anahuac NWR (**Figures 1 and 2**). The seismic survey within the Refuges will be acquired by drilling a series of shot holes, loading the holes with 5.5 pounds of biodegradable explosives, firing the shots one at a time, and receiving the resultant reflected energy signal with geophones or hydrophones placed in a grid at approximately 220 ft intervals along lines separated by either 880 ft. or 1,760 ft. between adjacent receiver lines. As many as 10 receiver lines will be active at any one time, with one line being deployed and one line being picked up as the spread generally progresses from east to west. Each portion of the program will be occupied for about 14 days as the 13-mile long active spread traverses the project area. The seismic survey will be completed in an approximate 135-day period, and is proposed for the time period of June 1, 2006 through October 15, 2006.

3.3.1 Alternative Areas and Change of Area of Operations

Because the project area is defined by the area in which Suemaur owns the right to explore for and develop mineral resources, there is no alternative area for the proposed action. However, the survey could proceed from either a west to east or east to west direction. The USFWS has directed Suemaur to proceed from east to west in order to avoid drilling, shooting, and recording activities in portions of each Refuge (Western portion of McFaddin NWR, Eastern and Southern portions of Anahuac NWR), which contain large amounts of mottled duck nesting habitat until after the peak nesting period for this species (March through May). In addition, the boundary of the area of operations and the actual layout of shot and receiver lines and subsequent operations along those lines will be modified to the maximum extent practicable in order to avoid sensitive habitat, wildlife, and cultural resource features within the McFaddin NWR and Anahuac NWR.

3.3.2 Alternative Operational Methods

The USFWS and Suemaur have considered various alternatives in operational methods including: 1) alternative source/receiver layout patterns; 2) alternative energy sources; and 3) the use of existing or the acquiring of new 2-D seismic data. These alternatives, and the reasoning behind selecting the proposed operational design, which will be incorporated within provisions and stipulations of the Special Use Permit, are presented below.

Alternative Source/Receiver Layout Patterns

Due to the size and shape of the proposed project, the orientation of receiver lines becomes quite significant as to the overall impacts of the project on the McFaddin and Anahuac Refuges. For the proposed project, receiver lines oriented north to south would be excessively long, and would therefore need to remain in place for a much longer period of time than if oriented northwest to southeast (**Figure 3**). The receiver lines being in the field for an extended period of time would have two consequences. One, receiver lines will require more maintenance and trouble-shooting, and two, too much data will accumulate to allow the crew to refrain from retrieving data until the lines are picked up, as would be the case with shorter receiver lines. The end result is much more traffic along receiver lines (with no offsetting reduction of traffic in any other respect) than would be the case with shorter receiver lines oriented northwest to southeast.

With receiver lines oriented north to south, the added maintenance and troubleshooting time would add directly to the total length of time required for the project. Furthermore, the time actually spent on the Refuge, as a percent of the total job, would be much larger because the receiver lines must remain in place longer. By laying the receiver lines out in a northwest to southeast pattern and the shot lines in a southwest to northeast pattern, overall traffic and time spent on the Refuge will be kept to a minimum.

Additionally, while receiver lines may arguably be subjected to more traffic, the traffic along shot lines may be of greater concern, since this traffic entails the transport of much heavier equipment. Orienting the shot lines southwest to northeast should permit more efficient transport of drills and a much greater percentage of shot holes that will be accessible by airboat, which in turn will minimize impacts on the sensitive habitat of the Refuges.

This seismic acquisition program can be conducted in less time with far less overall traffic, thus minimizing the impact on the Refuge, if the receiver line orientation follows the northwest to southeast pattern.

Alternative Energy Sources

As discussed in Section 2, 5.5 pound explosive charges will be used as the energy source on land, and an air gun boat will be utilized as the energy source in the Gulf of Mexico. An alternative source of energy for geophysical exploration is the use of land vibrators. Land vibrators require heavy, truck-mounted equipment that require solid ground and road access. Attempting to use these types of vehicles would result in more tracks and rutting damage than tracked drill buggies and airboats. It would not be feasible to transport these heavy pieces of equipment within the Refuges.

2-D Seismic Data

Available 2-D data for the project has been studied by the oil and gas industry. While the 2-D data has been valuable in general interpretation of the subsurface, only data acquired by 3-D will resolve the intricate faulting and depositional relationships in this area and properly image the deeper structures, which are the current target areas for exploration. The advantage of using 3-D seismic technology relative to older methods such as 2-D seismic technology is that it greatly

enhances the subsurface imaging and allows for more efficient and effective development of hydrocarbons. For example, data provided by 3-D technology can facilitate the intersection of several hydrocarbon-bearing objectives with a single well. The utilization of 3-D technology typically raises the individual well chance of success from 40% to 90% over wells drilled using 2-D data. Therefore, the more accurate data provided by 3-D seismic technology would likely increase the efficiency of any future oil and gas exploration, development, and production activities within or adjacent to McFaddin and Anahuac NWRs. As well, 3-D seismic technology will minimized the impacts associated with future oil and gas development by pinpointing well locations and limiting the infrastructure needed to support multiple wells in a single area.

4.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 INTRODUCTION

The Texas Chenier Plain Refuge Complex (Refuge Complex or Complex) currently includes over 104,000 acres of public land managed and administered by the USFWS as part of the National Wildlife Refuge System. The Complex includes four refuges: McFaddin NWR, Anahuac NWR, Texas Point NWR, and Moody NWR. Habitats currently protected on the Complex include low lying coastal prairies, near coastal woodlots, and coastal wetlands occurring between East Galveston Bay to the west and the Sabine River on the east.

The McFaddin and Anahuac NWRs are located on the southeastern tip of the Upper Texas Coast, adjacent to the Gulf of Mexico. The McFaddin NWR occurs primarily within Jefferson County, with the westernmost portion of the Refuge including lands in Chambers and Galveston counties. McFaddin NWR is bounded on the south by the Gulf of Mexico, containing approximately 15 miles of Gulf shoreline.

The Anahuac NWR occurs within Chambers County, on the far eastern edge of Galveston Bay. The Gulf Intracoastal Waterway comprises the southern boundary of the Anahuac NWR, and dissects McFaddin NWR, dividing once contiguous watersheds into two distinct units. The town of High Island is located between the two Refuges, with McFaddin NWR to the east and Anahuac NWR to the northwest.

The Refuge Complex lies within a biogeographical region known as the Chenier Plain (Gosselink *et al.* 1979). Geographically, the Chenier Plain region extends from Vermillion Bay in southwestern Louisiana to East Galveston Bay in southeastern Texas. A distinguishing feature of the region is the presence of cheniers, ridges representing the ancient Gulf shorelines which are generally aligned parallel to the Gulf or as fan-shaped alluvial deposits at the mouths of rivers. The higher cheniers support woody vegetation, hence the name chenier, a French word which means “place of oaks”. Cheniers are more prevalent in Louisiana than in Texas, perhaps because of the alignment of the Gulf shoreline and its proximity to the Mississippi River, the Chenier Plain region’s primary sediment source. Given the region’s significant annual rainfall, wetlands isolated from the Gulf by the cheniers developed into highly productive and diverse freshwater coastal marsh habitats.

The coastal marshes, prairies, and woodlots of the Chenier Plain region of southwestern Louisiana and southeast Texas comprise a hemispherically important biological area. These habitats are an important part of the primary wintering area for Central Flyway ducks and geese. Additionally, the coastal marshes, prairies, and prairie wetlands of the Chenier Plain region serve as a critical staging area for Central Flyway waterfowl migrating to and from Mexico and Central and South America. Hundreds of thousands of shorebirds, wading birds, and other marsh and waterbirds also winter or migrate through the region, including several identified by the USFWS as avian Species of Conservation Concern (USFWS 2005). Coastal prairie and coastal woodlots on the Refuge Complex and adjacent areas support over 150 migratory and resident landbird species, including 9 species of grassland birds and 7 species utilizing woodland

habitats listed as Rare and Declining within the Coastal Prairies Region of Texas (Shackleford and Lockwood 2000). The wetland, prairie, and woodland habitats on the Refuge Complex provide important habitat for 35 of the 48 avian species listed by the USFWS as Species of Conservation Concern in the Gulf Prairies Bird Conservation Region (USFWS 2005).

4.2 GEOLOGY AND SOILS

According to the *Geologic Atlas of Texas, Houston Sheet* (Aronow, S. and V. E. Barnes, 1996), the surface geologic units present within the project area are Barrier island deposits and Alluvium of the Holocene Era, and the Beaumont Formation of the Holocene or Late Pleistocene Era. Barrier island deposits are present in a small ridge along the Gulf Coast, and Alluvium is present throughout the majority of the portions of the McFaddin and Anahuac NWRs within project boundaries. The Beaumont Formation is present in the High Island area, as well as in the northern portions of the Anahuac NWR.

McFaddin and Anahuac NWRs are located in the Chenier Plain of the upper Texas Gulf Coast. Relatively high chenier beach ridges, known as the modern strandplain-chenier system, occur east of the Refuges near Sabine Pass and State Highway 87. Due to erosion and shoreline retreat, only a much lower and narrower "beach ridge" remains along the Gulf of Mexico on McFaddin NWR, which varies in elevation from approximately 2.5 feet to 5 feet above MSL between Clam Lake and High Island. Inland from the beach ridge of McFaddin NWR and the Gulf Intracoastal Waterway (GIWW) embankment (which comprises the southern boundary of Anahuac NWR), is a topographically lower area, predominantly composed of coastal marsh interspersed with slightly higher salty prairie habitats. Topography ranges from below mean sea level (MSL) to approximately 2.5 feet above MSL in the marshes and salty prairie ridges. The Anahuac NWR contains mainly fresh, brackish, intermediate and saline marsh habitats, as well as salty prairies.

The Chenier Plain region is part of a recent geologic plain. Most soils within the McFaddin and Anahuac NWRs are remnants of ancient floodplains and Gulf of Mexico beaches and consist of old alluvium and marine sediment deposited by ancient streams and the Gulf of Mexico. These deposits are mostly clayey and sandy soils and exhibit a wide range in textural differences due to their origin within historic floodplain systems (Crout, 1976). All Refuge lands are located within the 100-year floodplain. The soil types, both acidic and alkaline, are poorly drained with slow permeability, moderate to high salinity, and a high shrink-swell potential (Crout, 1976).

Three principle soil types are found within the portion of the Anahuac and McFaddin NWRs within the project area and include: Harris clay, Beaumont clay, and Barnett mucky peat. On a more coarse scale, two principal soil associations found in the project area are Harris-Veston-Ijam and Beaumont-Morey-Lake Charles associations.

According to the Chambers County Soil Survey, the Harris-Veston-Ijam association consists of alkaline and saline, clayey and loamy soils. Harris soils are on broad flats and are covered with coarse, salt-tolerant vegetation. Veston soils are in slightly elevated areas near the Gulf and bays. Ijam soils are on slightly elevated spoil banks that were created as the Intracoastal canal was dug or dredged out. More upland from the coast, the Beaumont-Morey-Lake Charles

association is composed of acidic to neutral, clayey to loamy soils. The Beaumont and Lake Charles soils are in the wider, more nearly level areas of the association, and Morey soils are in the slightly higher areas (Crout 1976).

The most prevalent soil types are the saline Harris and Beaumont clay found within the coastal marshes within Anahuac NWR. This area consists of broad flats covered with course, salt tolerant vegetation. Other wetland soils located in pockets within the Anahuac NWR consist of the Beaumont clay and Morey silt loam. The Harris clay is a nearly level, very poorly drained, saline, clayey soil that has a clayey subsoil that is very slowly permeable and surface runoff is very slow. Salt spray, storm tides, and salty high water tables restricting the kind and density of vegetation present affect these soils. The Beaumont clay consists of very deep, poorly drained, very slowly permeable soils and found on heavy clayey low uplands. The Morey silt loam soils are nearly level, poorly drained, nonsaline with loamy subsoils and are generally found on uplands on the project area within Anahuac NWR (NRCS Web Soil Survey 1.1. 2006).

Between the GIWW and Gulf of Mexico, the Barnett mucky peat soil is most common on the McFaddin NWR in the project area. The Barnett series consists of a very deep, very poorly drained, very slowly permeable, and nearly level soil in the marshes. Other wetland soils located in pockets within the McFaddin NWR consist of the Leerco muck and Creole mucky peat, which are both very poorly drained and very slowly permeable soils that formed in clayey alluvial sediments in low brackish marshes (NRCS Web Soil Survey 1.1. 2006).

Upland habitats (prairies and coastal ridges) on the Refuges are found on the well-drained Sabine soils (predominantly acid Morey silt loam, Anahuac silt loam, and saline Veston loam). Coastal land soils are found on the lower slopes of these sandy ridges and along the Gulf. These soil types form the Sabine-Coastal land Association. The shoreline of Jefferson County is made up of this Association and the Saltwater Marsh Tidal Association. Coastal soils generally consist of deep, dark colored and slightly acidic sands. As remains of ancient Gulf of Mexico beaches, they are relatively low in nutrients. Specifically, the coastal soils differ dramatically in PH, color, texture, available water capacity, and drainage.

McFaddin NWR's Gulf beaches are composed primarily of tidal marsh and Galveston fine sand, which have virtually no organic matter, are excessively drained, and have a low available water capacity. The Gulf beach within this Refuge has a high percentage of shell material, reflecting a scarcity of sand. Clay outcroppings from the underlying strata are exposed in many areas following erosive events such as tropical storms and winter frontal passages.

4.3 CLIMATE

The region has a subtropical climate. Summers are hot and humid with prevailing southerly winds from offshore; winters are cool and wet. The seasonal precipitation based on a 40-year average of 51.7 inches is fairly uniform with the months of October, November, and March being drier than other months. The spring season and the month of September prove to be the wettest months. July receives the greatest amount of precipitation. The wettest year in the region's history had over 70 inches of rainfall (Gosselink *et al.* 1979).

The region's climate is highly variable and exerts both short-term and long-term influences. Sea level rise to its approximate present position resulted from long-term climatic influences. The dynamic nature of precipitation, temperature, and wind are the climatic factors influencing water and sediment movement and subsequently the development of the Chenier Plain region.

Gulf disturbances occur from late spring through late fall. Hurricanes and tropical storms cause both wind and water erosion. Storm surges and heavy rains produce abnormally large volumes of water that exit to the Gulf through restricted waterways. The predicted level of water for a hurricane in this area is 10.7 feet above mean sea level (MSL). The storm interval that would produce 15-foot tides is predicted to be 1 in 100 years, 13.5 foot tides 1 in 50 years, 10.7 foot tides 1 in 25 years, 7.8 foot tides 1 in 10 years, and 5.4 foot tides 1 in 5 years.

The average annual temperature is about 68 degrees Fahrenheit, with an average maximum temperature of about 77 degrees F, and an average minimum temperature of 58 degrees F. The average growing season is 250 days. Temperatures are rarely lower than 25 degrees F. Major freezes are extremely infrequent, with frost occurring only on a few days during an average winter.

4.4 HYDROLOGY

The Gulf Intracoastal Waterway (GIWW) cutoff and diverted freshwater inflows as it divided the once continuous watersheds and marsh systems in the project area. The GIWW runs along the northern boundary of the portion of the McFaddin NWR within the proposed project area and forms a portion of the southern boundary of the Anahuac NWR. The elevated banks of the GIWW, comprised of soils excavated during the canal's construction, are eroding rapidly. Maintenance of these levees is a key management strategy to protect the interior marshes on both refuges from saltwater intrusion.

Hydrology of McFaddin and Anahuac NWRs consists of a series of shallow ponds and tidal bayous, sloughs, and canals that drain primarily to East Galveston Bay, the GIWW, or the Sabine-Neches Ship Channel. The western-most portion of the McFaddin NWR within the project area is in the Mud Bayou drainage basin. Significant bayous present on Anahuac NWR include Oyster, Onion, Elm and East Bay Bayou. Portions of the McFaddin and Anahuac NWRs are subject to daily tidal flows, however, high storm tides and hurricanes are capable of flooding the entire area. Numerous marsh flats, small potholes, and shallow marsh ponds are found on both refuges. There are water control structures, levees, and weirs present within each of the refuges.

4.5 VEGETATION

Vegetation communities on the Refuge Complex are primarily determined by soil type, water depth and salinity. These vegetation communities are important for waterfowl, shorebirds, wading birds, and other waterbirds wintering on or migrating through the upper Texas Gulf Coast.

Wetland habitats within the Chenier plain region include coastal marshes, forested wetlands along major river and bayou systems, natural and man-made wetlands (i.e. reservoirs, livestock ponds, rice fields) associated with upland prairies inland of the marshes, and open water of bays, rivers bayous and other waterways. Wetland habitats include estuarine, palustrine, riverine, and lacustrine wetlands (Moulton *et al*. 1997).

The intermediate, brackish, and saline emergent marshes found within the Refuge Complex are estuarine intertidal wetlands (USFWS, National Wetland Inventory). Fresh water wetland habitat within the Refuge Complex consists of palustrine emergent (fresh marsh and wet prairies) and palustrine open water habitats (ponds, lakes and reservoirs). Several categories of estuarine intertidal and freshwater (palustrine) wetlands are recognized as nationally- declining wetland types (USFWS, National Wetland Inventory).

Upland habitats present within the Refuge Complex include salty prairies, remnant tall-grass prairies, and small remnant woodlands. Salty Prairies occur as elevated ridges interspersed within marsh habitats. Remnant stands of tall-grass coastal prairies occur in the northern-most sections of the Anahuac and McFaddin NWRs.

Other upland habitats found on the Refuge Complex are the beach ridges and dunes along the Gulf of Mexico and small coastal woodlands located on the chenier ridges or on elevated features (both natural and man-made) including bayou banks and levees. Typical woody vegetation present in coastal woodland areas includes red mulberry, hackberry, Chinese tallow, live oak, southern wax myrtle, yaupon holly, and sweetgum. These woodlots are heavily used rest areas during spring and fall migrations by neotropical migrant birds.

No endangered or threatened plants as listed by the USFWS or Texas Department of Parks and Wildlife occur in Chambers or Jefferson County. However, two plant species, listed by the state as rare, occur in these counties. Theses species include Texas windmill grass (*Chloris texensis*), which is listed as occurring in Chambers County, and Chapman's orchid (*Platanthera chapmanii*), which is listed as occurring in Jefferson County. Texas windmill grass is an endemic species, which occurs in sandy to sandy loam soils in open to sometimes barren areas in prairies, grasslands, ditches and roadsides. This habitat type does exist within the project area. Chapman's orchid exists in wetland pine savannahs. This type of habitat does not occur within the project area.

Scientific names of the vegetation referenced in this section were not included in the text; however, all vegetation referenced in this section is included in **Tables 2 and 3,** along with scientific names.

4.5.1 Wetland and Aquatic Habitats

Estuarine and Palustrine Wetlands: Estuarine intertidal, palustrine emergent and open water wetlands on the Refuge Complex include the continuum of coastal marsh types found in the Chenier Plain region, from fresh to saline along a salinity gradient. This continuum includes freshwater marshes (salinities less than 0.5 parts per thousand), intermediate marsh (salinities range from 0.5 to <5.0 ppt, with an average salinity of 3.3 ppt), brackish marsh (salinities range

from 5.0 to 18.0 ppt, with an average salinity of 8.0 ppt) and saline marsh with salinities grater that 18.0 ppt. Emergent and aquatic plant species have different tolerances to salinity, and water and soil salinities are important influencing factors on plant species composition, as well as fish and wildlife composition in the various marsh types. **Table 2** lists the common indicator plant species for the emergent marsh types and aquatic habitat occurring within the portion of the Refuge Complex included in the project area.

Both local precipitation and drainage of inland waters along natural and man-made waterways provide freshwater inflows to the Refuge Complex's coastal marshes. The freshwater marsh and wet prairies generally occur adjacent to upland prairies, where freshwater from precipitation and/or inland drainage accumulated in level and low lying areas. These palustrine emergent and open water wetlands are non-tidal, and receive influx of saltwater only under high storm surge conditions generated by the more severe hurricanes and tropical storms. Palustrine emergent and open water wetlands within the portions of the Refuge Complex included within the proposed project area are located in an intermittent band between the upland tall grass prairies to the north and the intermediate marshes to the south. Some are found in scattered "freshwater inclusions" within the intermediate marshes. Plant species found exclusively in freshwater marsh are intolerant of salt except at very low levels. Emergent plants common in restricted freshwater marsh include rice cutgrass and giant cutgrass (**Table 2**). On northern portions of Anahuac NWR, shallow freshwater wetlands are interspersed within upland prairie habitats in the form cultivated rice fields (palustrine "farmed wetlands"), moist soil units and shallow depressional "prairie wetlands" and wet prairies.

The intermediate marsh generally lies seaward (south) of the freshwater marsh. Intermediate marshes are primarily micro-tidal; they are not subject to daily tidal action, but receive influxes of saltwater during higher tides associated with storms and the vernal and autumnal equinoxes. Intermediate marsh is the predominant marsh type on the Refuge Complex, and contains the greatest overlap of plant species whose salinity tolerances range from fresh to brackish. Common emergent plant species include marshhay cordgrass, Olney bulrush, and seashore paspalum.

Brackish marshes lie generally seaward of intermediate marshes and adjacent to tidally influenced waterways. Brackish marshes receive greater tidal influx than intermediate marshes. Common emergent plant species include marshhay cordgrass, seashore saltgrass, and saltmarsh bulrush.

Saline marshes are subject to daily tidal influences. These marsh areas lie adjacent to bays and other tidally influenced waterways. Smooth cordgrass and black rush are the two dominant emergent plant species found in saline marshes.

The full continuum of marsh types supports highly diverse and productive biological communities, and conservation of native biological diversity on the Refuge Complex is dependent on maintaining this continuum of wetland habitats. Plant and animal diversity is greater in the fresh and intermediate marshes that in the brackish or saline marsh types. Intermediate marsh receives the highest use of any of the marsh types by wintering and migrating waterfowl and by many wading bird species. Fresh and brackish marshes also are extremely important to the migratory bird resource. Brackish and saline marshes provide

important habitat for many shorebird and colonial-nesting water bird species, and are the primary nursery habitat for larval and post-larval stages of many commercially and recreationally important marine fish and shellfish species.

Aquatic Habitats: Aquatic habitats with in the Refuge Complex include all inland open water bodies. These open water bodies include ponds, lakes, reservoirs, bayous, sloughs, tidal creeks, drainage ditches, and canals.

Similar to estuarine and palustrine emergent wetlands, inland open water habitats occur along a salinity gradient that ranges from below 0.5 ppt (fresh) to over 25 ppt (saline). Plant communities vary greatly as the salinity changes along the gradient. Saline open water habitat is generally shallow and turbid and is not likely to support any rooted vascular plants. Phytoplankton are the most likely plant or plant-like species to occur in this habitat. As salinity decreases, the potential for, and the diversity of vascular plants increases. Common vascular plant species include a number of rooted and floating aquatic plant species such as wigeongrass, several pondweeds, banana waterlily and American lotus (**Table 2**).

Salinity ranges in inland open water habitats have a significant influence on the plant and animal community composition that occurs in these habitats. In general, the salinity gradient produces a high species richness.

Table 2: Common Indicator Plant Species Of Wetland and Aquatic Habitats on the Anahuac and McFaddin NWRs

Marsh Type	Associated Plant Species	
	Common Name	**Scientific Name**
Saline	Smooth cordgrass	*Spartina alterniflora*
	Glassworts	*Salicornia* spp.
	Marshhay cordgrass	*Spartina patens*
	Maritime saltwort	*Batis maritime*
	Seashore saltgrass	*Distichlis spicata*
	Blackrush	*Juncus roemerianus*
	Saline marsh aster	*Aster tenuifolius*
	Carolina wolfberry	*Lycium carolinianum*
	Bushy sea-oxeye daisy	*Borrichia frutescens*
Brackish	Saltmarsh bulrush	*Bulbuschoesus robustus*
	Widgeon grass	*Ruppia marirema*
	Dwarf spikerush	*Eleocharis parvula*
	Marsh pea	*Vigna luteola*
	Water hemp	*Amaranthus australis*
	Marshhay cordgrass	*Spartina patens*
	Seashore saltgrass	*Distichlis spicata*
Intermediate	Olney bulrush	*Bulbuschoesus olneyi*
	Coastal water hyssop	*Bacopa monneri*
	California bulrush	*Scirpus californicus*
	Banana waterlily	*Nymphaea mexicana*
	Colorado river hemp	*Sesbania macrocarpa*
	Marshhay cordgrass	*Spartina patens*
	Seashore paspalum	*Paspalum virginatum*

Table 2: Common Indicator Plant Species Of Wetland and Aquatic Habitats on the Anahuac and McFaddin NWRs		
Marsh Type	**Associated Plant Species**	
	Common Name	**Scientific Name**
	Baby pondweed	*Potamogeton pusillus*
	Sand spikesedge	*Eleocharis montividensis*
	Narrow leaf cattail	*Typha augustifolia*
	Common reed grass	*Phragmites australis*
	Spikerushes	*Eleocharis* spp.
	Sago pondweed	*Potamogeton pectinatus*
	Coast cockspur	*Echinochloa walteri*
	Sprangletop	*Leotochloa* spp.
Fresh	Maiden cane	*Panicum hemitomon*
	Duckweed	*Lemna* spp.
	Giant cutgrass	*Zizaniopsis miliacea*
	Fanwort	*Cabomba caroliniana*
	Rice cutgrass	*Leersia oryzoides*
	Watershield	*Rasenia scherberi*
	Marsh millet	*Echinochloa* spp.
	American lotus	*Nelunbo lutea*
	Arrowheads	*Sagittaria* spp.
	Blatterworts	*Utricularia* spp.
	White waterlily	*Nymphaea odorata*
	Marshhay cordgrass	*Spartina patens*
	Alligatorweed	*Alternathera philoxeroides*
	Jamaica sawgrass	*Cladium jamaicense*
	Southern naiad	*Najas quadalupensis*
	Smartweeds	*Polygonum* spp.
	Flat sedges	*Cyperus* spp.
	Sand rush	*Eleocharis montevidensis*
	Sprangletop	*Leptochloa* spp.
	Longtom	*Paspalum lividum*
	Burheads	*Echinodorus* spp.
	Squarestem spikerush	*Eleocharis quadrangulata*
	Rattlebox	*Sesbania texana*
Inland Open Water*	Sago pondweed	*Potamogeton pectinatus*
	Duckweed	*Lemna* spp.
	Southern naiad	*Najas quadalupensis*
	Water lettuce	*Pistia stratiotes*
	Widgeon grass	*Ruppia maritime*
	Alligatorweed	*Alternathera philoxeroides*

*Inland open water-ditches, canals, tidal creeks, bayous, lakes, and ponds

4.5.2 Upland Habitats

Upland habitats in the Refuge Complex include native prairie (salty prairie and non-saline tall grass prairie), upland forest and woodlots, and beach and dunes.

Native Prairie: Salty prairie habitats are found on low-lying coastal ridges and flats, which are slightly higher in elevation than the adjacent marshes. Plant communities typical of salty prairies can also be found on elevated man-made features including dredged material deposits (spoil) and

levees. Underlying soils are of the Harris-Made Land Association and are saline. Salty prairies are characterized by the presence of gulf cordgrass as the dominant vegetative species. Other common native plant species include knotroot bristlegrass, bushy bluestem, seaside goldenrod, western ragweed, wooly rosemallow, saltmarsh aster, seepweed, annual sumpweed, and bigleaf sumpweed (**Table 3**). Highly disturbed salty prairie sites are likely to also include species such as rabbitfoot grass, shoregrass, bushy ox-eye daisy, and salt heliotrope. Salty prairies provide important nesting habitat for mottled ducks, a resident waterfowl species (Stutzenbaker, 1988).

Remnant tallgrass prairie habitats in the region generally lie inland of the coastal marshes on slightly drier upland sites. They occur on non-saline soils of the Sabine Coastal Land Association. It is recognized that the transition between marsh and prairie habitat is usually not distinct and certain vegetative communities and species are found in both habitats (Smeins, *et al*., 1991). Typical of native remnant tallgrass prairies in the region are mid and tallgrass species such as little bluestem, big bluestem, Indiangrass, switchgrass, brownseed paspalum, eastern gammagrass, and gulf coast muhly (McFarland, 1995, Smeins *et al*., 1991) (**Table 3**). Numerous forbs and legumes are also present in the native tallgrass prairie habitat, along with one native shrub, southern wax myrtle.

Over 9 million acres of native tallgrass prairie once occurred along the western gulf coast in Texas and Louisiana (Smeins, *et al*., 1991). Based on remnant stands, native grassland prairies along the upper Texas coast were characterized by little bluestem, brownseed paspalum, and Indian grass or eastern gammagrass and switchgrass vegetation associations, depending on hydrology (Diamond and Smeins, 1984). It is now estimated that 99.8% to 99.6% of the little bluestem and eastern gamma grass/switchgrass prairies, respectfully, have been lost in Texas (McFarland, 1995). The little bluestem-brownseed paspalum community has been identified as an endangered natural community by the Texas Organization for Endangered Species (Diamond *et al*., 1992). Both communities are assigned global conservation status rank of "Critically Imperiled" (G1) by The Nature Conservancy (2002).

Many faunal species typical of prairies, such as Henslow's sparrow, smooth green snake, and prairie voles, were found year round in the gulf coast prairies. Dickissels still nest in these coastal grasslands, and many other avian species utilize gulf coast prairies as wintering and /or mitatory habitat. Many of the birds that would benefit from protection and management of native coastal prairie habitats are species that are declining in the Coastal Prairies Region of Texas (Shackelford and Lockwood, 2000), and /or are among several species listed by USFWS as "Avian Species of Conservation Concern" in the Gulf Prairies Bird Conservation Region (USFWS, 2002). For example, mottled duck, white-tailed hawk, northern bobwhite, yellow rail, black rail, buff-breasted sandpiper, short-eared owl, sedge wren, and LeConte's sparrow are all species of conservation concern that utilize native prairie habitats.

Table 3: Indicator Plant Species of Terrestrial Upland Habitats on the ANWR and MNWR

Upland Habitat Type	Associated Plant Species	
	Common Name	**Scientific Name**
Salty Prairie	Gulf cordgrass	*Spartina spartinea*
	Knotroot bristlegrass	*Seteria geniculata*
	Seaside goldenrod	*Solidago sempevirens*

Table 3: Indicator Plant Species of Terrestrial Upland Habitats on the ANWR and MNWR		
Upland Habitat Type	**Associated Plant Species**	
	Common Name	**Scientific Name**
	Eastern baccharis	*Baccharis halimifolia*
Native Prairie (non-saline)	Little bluestem	*Schizachyrium scoparium*
	Indiangrass	*Sorgastrum nutans*
	Switchgrass	*Panicum virgatum*
	Brownseed paspalum	*Paspalum plicatulum*
	Southern wax myrtle	*Myrica cerifera*
	Bushy bluestem	*Andropogon glameratus*
	Panicum grasses	*Panicum* spp.
Prairie Grasslands (non-saline)	Broomsedge bluestem	*Andropogon verginicus*
	Bushy bluestem	*Andropogon glomeratus*
	Brownseed paspalum	*Paspalum* spp.
	Vaseygrass	*Paspalum urvillei*
	Bermuda grass	*Cynodon dactylon*
	Blue verbena	*Verbena brasiliensis*
	Seacoast sumpweed	*Iva annuua*
	Giant ragweed	*Ambrosia trifida*
	Southern dewberry	*Rubus trivialis*
	Eastern baccharis	*Baccharis halimifolia*
	Chinese tallow	*Sapium sebiferum*
Upland Forrest and Woodlots	Hackberry	*Celtis occidentalis*
	Red mulberry	*Morus rubra*
	Black willow	*Salix nigra*
	Live oak	*Quercus virginiana*
	Common persimmon	*Diospyros virginiana*
	Sugarberry	*Celtis leavigata*
	Prickly ash	*Zanthoxylum clava-herculis*
	Slash pine	*Pinus ellioti*
	Salt cedar	*Tamarix gallica*
	Chinese tallow	*Sapium sebiferum*
Beach Ridges and Dune	Sea pursane	*Sesuvium maritium*
	Whorled dropseed	*Sporobolus pyramidatus*
	Saltmeadow cordgrass	*Spartina patens*
	Bitter panicum	*Panicum amarum*
	White morningglory	*Ipomoea stolenifera*
	Camphor daisy	*Haglopappus phyllocephalus*
	Silver croton	*Croton punctatus*
	Virginia dropseed	*Sporobolus virginicus*
	Goat-foot morningglory	*Ipomoea pes-caprea*
	Beach evening primrose	*Oenothera drummondii*
	Glassworts	*Salicornia* spp.
	Salt heliotrope	*Heliotropium curassavicum*
	Sea-lavender	*Limonium carolinianum*
	Bushy ox-eye daisy	*Borrichia frutescens*

The mottled duck is a southern species that spends its whole life cycle in coastal prairies and adjacent marshes. The historical prairie-wetland continuum of the upper Texas coast provided nesting cover and brood habitat in close proximity. In a study of mottled ducks nesting in agricultural lands in Louisiana, the habitat category that was most like native coastal prairie,

permanent pasture with knolls, provided better nesting habitat than any other (Durham and Afton, 2003). The dense nesting cover and mima mounds that are characteristic of coastal prairie probably provided excellent nesting habitat for resident mottled ducks. Stutzenbaker (2003) identified shallow depressional wetlands found in the prairie zone, known as "sennabean ponds" as a valuable brood rearing habitat for this species.

Upland Forest and Coastal Woodlots: Upland forest and coastal woodlots generally occur on higher elevation uplands that contain acidic soil conditions and are composed of mixed hardwood species, primarily loblolly and slash pine. With a dense overstory and understory, the upland forest community is characterized by structural diversity and high biomass of standing vegetation and surface litter material, which provides refuge for many animals. Common overstory species includes live oak, water oak, overcup oak, willow, sweetgum, southern magnolia, prickly ash, American elm, cedar elm, huisache, green ash, hawthorns, red mulberry, and common persimmon. Typical understory species include eastern red cedar, black cherry, rough-leaf dogwood, sugarberry, American beautyberry, poison ivy, palmetto, blackberry, grape, Appian cactus, wax myrtle, common elderberry, arrowwood, peppervine, honeysuckle, greenbriar and salt cedar (**Table 3**).

In pre-settlement times, upland habitats in the Chenier Plain Region were dominated by bluestem prairies and trees were restricted to riparian areas (Diamond and Smeins, 1984, Smeins *et al*., 1991) and the more elevated chenier ridges. The amount of native coastal woodlot habitat in the region has been reduced mainly through development, conversion to pasture, and logging of bottomland hardwoods. Mueller (1981) estimated that only 22 woodlots of an acre or larger remain on the upper Texas Gulf Coast. Woody habitat has significantly increased in the region with the rapid expansion of the exotic Chinese tallow trees. However these new woodlands provide poor habitat for migrant songbirds (Gutzwiller and Barrow, 2001).

Coastal woodlots in the Chenier Plain region are extremely important to migrating songbirds. Coastal woodlots mark the first landfall for hundreds of thousands of neotropical migratory birds making the trans-gulf flight from Mexico, Central, and South America during spring migration. These birds spend one to several days in these woodlands, resting and foraging to help replenish fat reserves before continuing their migration to breeding habitats (Sprunt, 1975, Mueller, 1981). Migrant land birds make greater use of woodlots with larger trees and dense understories (Mueller and Sears, 1987). Coastal woodlots also provide the last opportunity for neotrpoical landbirds to increase fat reserves for the trans-gulf migration to wintering areas (Caldwell *et al*., 1963).

Although comprising less than 1% of the Refuge Complex acreage, woodland habitats help support its diverse avian community, which include several sensitive songbird species. Six of the seven avian species listed as Rare and Declining in the Coastal Prairies Region in Texas are present in the Refuge Complex woodlands (Shackelford and Lockwood, 2000). In 2005, USFWS listed four species that occur in the Refuge Complex woodlands as Avian Species of Conservation Concern in the Gulf Prairies Bird Conservation Region.

Beach, Beach Ridges, and Dunes: Gulf of Mexico beaches along the McFadddin NWR's southern boundary are generally narrow and fairly steep, backed by a low beach ridge/dune

complex (Morton, 1998). Coarse sediment supply was probably never in this mud dominated littoral system, and it has been further decreased by river diversions, dams, navigational channels, and jetty systems (Texas GLO, 1996). Most of the Gulf of Mexico shoreline on the McFaddin NWR is retreating, resulting in a loss of vegetated beach dune ridge, salty prairie, and marsh habitats.

The vegetation of beach/beach ridge and dunes is a mixture of typical salt tolerant marsh and beach plants characteristic of subtropical areas (Gosselink, et al., 1979) (**Table 3**). Plants typical of this habitat include saltmeadow cordgrass, camphor weed, bitter panicum, gulf croton, common cocklebur, coast dozedaisy, little bluestem, Indiangrass, and switchgrass (**Table 3**). Traditional salt tolerant species behind dunes and ridges are those found in vegetated salt flats such as shoregrass, Bigelow glasswort, Virginia glasswort, maritime saltwort, salt helitrop, sea lavender, and bushy sea oxeye daisy (**Table 3**). When grasses are overgrazed, Bermuda grass, carpet grass, and annual weeds and forbs invade the site. Overall, plant productivity in beach habitats is limited.

Cheniers and natural ridge habitats, such as riparian corridors found along bayous and streams, are above the normal tidal influence and in some cases support upland forest/shrub communities. Coastal woodlots occurring on these ridges provide high species richness compared to the surrounding marshes and prairies (Gosselink, et al., 1979).

Artificial ridges in the project area are generally much younger and smaller than natural cheniers and because of the salinity of the spoil are usually colonized by vines, herbs, various shrubs, willow and the exotic Chinese tallow. As salts are leached from the spoil sediments, trees invade these areas and plant communities change toward the climax communities typical of cheniers.

4.6 WILDLIFE

The Chenier Plain region provides important habitats for numerous fish and wildlife species, including over three hundred documented avian species. The following description of wildlife resources applies to the entire Refuge Complex, with information specific to the Anahuac and McFaddin NWRs noted. According to the Texas Parks and Wildlife Department, over 75 species of fresh water fish, and over 400 salt and brackish water species occur in the marshes, bays, bayous, and Gulf of Mexico waters on and adjacent to the Refuge Complex.

4.6.1 Avian Species

A total of 285 avian species have been recorded on the Refuge Complex, of which 52 species have been documented nesting in the area. Wetland habitats on the refuge Complex support major concentrations of wintering and migrating waterfowl, shorebirds, and wading birds and provide important habitat for many species of marsh birds and water birds. Many species of land birds, including many species of neo-tropical migrants, use the coastal woodlots and other forested habitats within and adjacent to the Refuge Complex in large numbers during the spring and fall migrations. Remnant stands of native prairie and other upland grassland habitats provide habitat for many grassland songbirds, including several species whose continental populations are in decline. Birds commonly found on the Refuge Complex are listed in **Table 4**.

Waterfowl: The coastal marshes, wet prairies, rice fields, and moist soil units of the refuge complex are used by 27 species of ducks and five species of geese including lesser snow geese, Ross's geese, greater white fronted geese, Canada geese and black brant (rare) (USFWS, 1994b). The Refuge Complex is a part of the southern terminus for most ducks and geese of the Central Flyway, and some waterfowl from the Mississippi, Atlantic and Pacific Flyways also winter on the Texas Gulf Coast. The 2004 Mid-winter Waterfowl Survey for the Central Flyway indicated that 7,901,489 waterfowl used the Central Flyway. Of those birds, 5,110,022 waterfowl (65%) wintered in Texas.

The USFWS conducts aerial waterfowl surveys monthly from September through March on national wildlife refuges on the Texas Gulf Coast. On Anahuac NWR between 1997 and 2004, numbers of ducks peaked at 188,182 in November of 2002 (**Table 5**). Goose numbers peaked at 118,634 in February of 2004 for this survey period (**Table 6**). On McFaddin NWR during the same time period, numbers of ducks peaked at 153,206 in March 2001 (**Table 7**). Goose numbers peaked at 97,786 in January 2001 (**Table 8**). The most common duck species observed were, in order of abundance, American green-winged teal (*Anas crecca)*, gadwall (*Anas strepera)*, northern shoveler (*Anas clypeata)*, blue-winged teal (*Anas discors)* and northern pintail (*Anas acuta).* Following the top five species were American wigeon (*Anas americana)*, mallard (*Anas platyrhynchos)* and mottled duck (*Anas fulvigula)*, respectively. Snow geese (*Chen caerulescens)* are the principal goose species found on the refuges. Other geese include greater white-fronted (*Anser albifrons*), Canada geese (*Branta hutchinsii*), and Ross's geese (*Chen rossii*).

Table 4: Common Names of Avian Species Frequently Observed on the McFaddin and Anahuac NWRs

Pied-billed grebe	Common moorhen
Eared grebe	American coot
Laughing gull	Killdeer
American white pelican	Black-necked stilt
Ring-billed gull	Greater yellowlegs
Double-crested cormorant	Lesser yellowlegs
Gull-billed turn	Willet
Least bittern	Long-billed curlew
Forster's tern	Semipalmated sandpiper
Great blue heron	Western sandpiper
Great egret	Dunlin
Snowy egret	Long-billed dowitcher
Tricolored heron	Common snipe
Cattle egret	Mourning dove
Green heron	Loggerhead shrike
Common yellowthroat	Swamp sparrow
Black-crowned night heron	Red-winged blackbird
White ibis	Eastern meadowlark
White-faced ibis	Brown-headed cowbird

Table 4: Common Names of Avian Species Frequently Observed on the McFaddin and Anahuac NWRs	
Roseate spoonbill	House sparrow
Green-winged teal	Horned lark
Mottled duck	Savannah sparrow
Mallard	Sedge wren
Northern pintail	European starling
Northern shoveler	Seaside sparrow
Gadwall	Common grackle
Lesser scaup	Boat-tailed grackle
Ruddy duck	Turkey vulture
Northern bobwhite	Northern harrier
Clapper rail	Red-tailed hawk
King rail	

Table 5. Number of Ducks Counted During Aerial Winter Waterfowl Surveys on Anahuac NWR

Year	Sept	Oct	Nov	Dec	Jan	Feb	Mar	High Count
1997/1998	13709	18836	48583	75821	50139	78477	74937	**78477**
1998/1999	27454	6906	28589	90982	128086	73775	57427	**128086**
1999/2000	33735	88028	79863	77386	90091	81845	64410	**90091**
2000/2001	28954	16142	96779	90091	70856	69987	57156	**96779**
2001/2002	556	13374	40801	94271	71658	*	59731	**94271**
2002/2003	49	7216	188182	94710	43820	*	26314	**188182**
2003/2004	2429	14586	66010	74636	35073	53573	22110	**74636**
Average	**15269**	**23584**	**78401**	**85413**	**69960**	**71531**	**51726**	**107217**

* Survey not conducted in February 2002 and 2003.

Table 6. Number of Geese Counted During Aerial Winter Waterfowl Surveys on Anahuac NWR

Year	Sept	Oct	Nov	Dec	Jan	Feb	Mar	High Count
1997/1998	0	106	36702	6902	13607	14091	0	**36702**
1998/1999	0	168	113155	33559	7128	9702	274	**113155**
1999/2000	0	717	20441	8085	18669	18077	56	**20441**
2000/2001	0	0	1529	5915	9336	5319	0	**9336**
2001/2002	0	7300	7401	38329	25813	*	6031	**38329**
2002/2003	0	0	4534	21376	7736	*	0	**21376**
2003/2004	0	120	366	24238	64620	118634	49	**118634**
Average	**0**	**1201**	**26304**	**19772**	**20987**	**33164**	**915**	**51139**

* Survey not conducted in February 2002 and 2003.

Table 7. Number of Ducks Counted During Aerial Winter Waterfowl Surveys on McFaddin NWR								
Year	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**High Count**
1997/1998	3356	17561	23533	39308	80756	51387	107821	**107821**
1998/1999	63306	38138	62032	173152	70570	117599	104864	**173152**
1999/2000	16788	35323	44490	66127	46912	51665	25626	**66127**
2000/2001	26010	10485	30489	30743	75781	49704	153206	**153206**
2001/2002	16631	78	16231	1517	28635	*	43621	**43621**
2002/2003	28	387	644	14930	6847	*	6591	**14930**
2003/2004	420	3779	7049	7461	20421	30722	26793	**30722**
Average	**18077**	**15107**	**26353**	**47605**	**47132**	**60215**	**66932**	**66932**

* Survey not conducted in February 2002 and 2003.

Table 8. Number of geese counted during aerial winter waterfowl surveys on McFaddin NWR.								
Year	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**High Count**
1997/1998	0	187	9674	13350	55081	56477	0	**56477**
1998/1999	0	952	3908	12865	11985	10338	1254	**12865**
1999/2000	0	353	621	4796	21143	11407	0	**21143**
2000/2001	0	0	2330	79993	97786	78186	101	**97786**
2001/2002	0	0	0	203	47046	*	3759	**47046**
2002/2003	0	0	536	288	18258	*	0	**18258**
2003/2004	0	0	224	1238	1804	1707	0	**4973**
Average	**0**	**213**	**2470**	**16105**	**36158**	**31623**	**78995**	**78995**

* Survey not conducted in February 2002 and 2003.

The Refuge Complex provides important year-round habitat for the resident mottled duck. Although not in large numbers, other waterfowl species nesting in the area include blue-winged teal, ruddy duck, and masked duck (a rare species). Nesting populations of fulvous and black-bellied whistling ducks have increased in recent years.

The mottled duck is a resident waterfowl species that is entirely dependent upon coastal habitats along the Gulf of Mexico. Two populations of mottled duck are recognized; one in Florida, and the western gulf population, which utilizes coastal habitats in Alabama, Mississippi, Louisiana, Texas and Mexico. No interchange between these two populations is believed to occur. Mottled duck numbers in Texas have declined in recent years. The Upper Texas Gulf Coast, including the Refuge Complex, has historically been the core of mottled duck habitat in Texas. Wetland and grassland habitat, as well as rice agricultural fields here, continue to be extremely important to the western gulf mottled duck population.

Waterfowl hunting is a traditional and an important outdoor recreational activity throughout the region. The Refuge Complex and State Wildlife Management Areas provide a wide range of waterfowl hunting opportunities for the public.

Shorebirds, Wading Birds, Marsh Birds, and Water Birds: The tidal flats, beaches, marshes, and intensively managed habitats such as rice fields, and moist soil impoundments on the Refuge Complex and adjacent areas provide shallow water feeding, breeding and resting habitat for numerous shorebirds, wading birds, marsh birds, and other water birds. The Anahuac NWR was designated a "Shorebird Site of International Importance" by the Western Hemisphere Shorebirds Reserve Network in 2005.

Thirty-two species of shorebirds regularly occur on the Refuge Complex, ten of which are considered 'highly imperiled' or of 'high concern.' In addition, the Anahauc NWR regularly supports over 2200 whimbrel in the spring migration, greater than 10% of the Flyway population of this species.

Shorebird counts were conducted along the Texas Coast between March 22 and May 17 during two-week intervals in the spring of 1993 (Lee Elliot, USFWS biologist, personal communication, February 2000). Peak numbers of shorebirds were recorded between March 22 and April 12 at three sites on or near the Refuge Complex (Bolivar Peninsula, Anahuac NWR, and Harris/Waller Counties). The Bolivar Peninsula, site of the Houston Audubon Society's Bolivar Flats Shorebird Preserve, had the greatest shorebird concentrations, with over 17,000 birds observed. The most abundant species observed during the surveys were American avocet, western sandpiper, long-billed and short-billed dowitchers, semi-palmated sandpiper, pectorial sandpiper, black-bellied plover, dunlin, sanderling, willit, semi-palmated plover, least sandpiper, and snowy plover. All of these species occur on the Refuge Complex. Common nesting shorebird species include killdeer, black-necked stilt, and willet. Other shorebird and related species commonly observed on the Refuge Complex include long-billed curlew, Wilson's snipe, ringed-billed gull, laughing gull, herring gull, least tern (a nesting species), royal terns and Caspian terns (USFWS, 1997).

Small rookeries of colonial nesting birds occur throughout the Chenier Plain region, including rookeries containing the following wading birds: great egret, snowy egret, cattle egret, green heron, great blue heron, black-crowned night heron, yellow-crown night heron, and roseate spoonbill. Nesting colonies of other colonial nesters including least terns and black skimmers occur on beaches, wash-over terraces, and occasionally on man-made sites such as oil and gas well pad sites. On the Refuge Complex, nesting and/or wading, marsh and water bird species include great blue heron, little blue heron, green heron, tri-colored heron, great egret, snowy egret, American bittern, least bittern, common moorhen, purple gallinule, pied-billed grebe, least tern, and American coot. Additional species that are commonly observed but not known to nest on the refuge Complex include the double-crested cormorant, white-faced ibis, white ibis, roseate spoonbill, and eared grebe (USFWS, 1997).

All six North American species of rail occur in the marshes and wet prairie grassland of the Refuge Complex. King and clapper rail nest on the Refuge Complex and are present year-round. The black rail has not been documented as nesting on the Refuge Complex, but is also present year-round. Sora, Virginia and yellow rails utilize these habitats during spring and fall migrations.

Migratory and Resident Land Birds: Many passerines that nest in temperate North America and winter in Central and South America migrate through the Chenier Plain region, crossing the Gulf of Mexico during spring and fall migrations. During spring migrations, coastal woodlots, alluvial forest, and other wooded habitats on the Refuge Complex provide the first landfall for these trans-gulf neo-tropical migrants. Migrant passerines that use the Refuge Complex include many species of warblers, vireos, tanagers, thrushes and buntings, as well as many Avian Species of Conservation Concern (USFWS, 2005). Songbird species nesting on the Refuge Complex include orchard oriole, eastern kingbird, and scissor-tailed flycatcher.

Native prairie remnants and other upland grassland habitats on the Refuge Complex provide wintering and migrational habitat for several grassland songbird species, including LeConte's sparrow and Nelson's sharp-tailed sparrow, and nesting habitat for dicksissel and eastern meadowlark among others.

Several species of raptors commonly observed on the Refuge Complex include red-tailed hawk, red-shouldered hawk, turkey vulture, American kestrel, white-tailed kite, northern harrier and short-eared owl (USFWS, 1994a). Many other raptor species are observed during spring and fall migrations.

Several hundred thousand people, including many international visitors, visit the Refuge Complex annually from late March to early May to bird watch during spring migration. Popular destinations on or near the project area include the Refuge Complex, local State Wildlife Management Areas and State Parks, the Audubon Society Preserves at High Island and Bolivar Flats, and the Texas Ornithological Society Sabine Woods Sanctuary near Sabine Pass.

Avian Species of Conservation Concern: Conservation priorities for North American avian species and recommendations for habitat protection, management and restoration in support of conservation of these species have been developed and identified recently through several international, national and regional avian conservation plans. These plans include the North American Waterfowl Management Plan (NAWMP), US Shorebird Conservation Plan, the North American Waterbird Conservation Plan, and the Partners in Flight Landbird Conservation Plan. At a regional level, several step-down plans have been developed to guide conservation efforts at a more local scale. Examples applicable to avian conservation on the Refuge Complex and the project area as a whole, include the Gulf Coast Joint Venture Chenier Plain Initiative Area Plan (Esslinger and Wilson, 2001) under the North American Waterfowl Management Plan and the Lower Mississippi/Western Gulf Coast regional Plan (Elliot and McKnight, 2000) under the U.S. Shorebird Conservation Plan.

In 2005, the USFWS published a national list of "Avian Species of Conservation Concern." Thirty-seven of the 48 Avian Species of Conservation Concern listed for the Gulf Coast Prairie Bird Conservation Region (BCR) occur on the Refuge Complex. Wetland dependent Avian Species of Conservation Concern occurring on or near the project area include yellow and black rails, American bittern, white ibis, Hudsonian godwit, long-billed curlew, short-billed dowitcher, least tern, seaside sparrow, and Sprague's pipit. Avian Species of Conservation Concern utilizing prairie grasslands on or near the project area include LeConte's sparrow, Nelson's sharp-tailed sparrow, Henslow's sparrow, buff-breasted sandpiper, sedge wren, loggerhead

shrike and white-tailed hawk. Neo-tropical migrant landbirds listed as Avian Species of Conservation Concern, which utilize the woodland habitats on or near the project area include Swainson's warbler, prothonotary warbler, Kentucky warbler, and swallow-tailed kite.

The Partners in Flight (PIF) Conservation Program is an international, multi-agency and multi-organizational conservation initiative for North American landbirds and waterbirds. PIF recently completed an assessment of the status and conservation needs of all North American land and waterbirds. This assessment included consideration of population trends, habitat trends, and threats on wintering and breeding grounds. National, regional, and more local conservation priorities were determined. These species represent conservation priorities for USFWS and other PIF partners including state wildlife agencies, the US Forest Service, and other governmental and private partners. Multi-agency PIF conservation strategies for Texas are currently under development, and these strategies will guide management activities at the local and regional scale. In Texas, the PIF partners have identified priority species for conservation, monitoring, and management in relation to the specific habitat types and seasons within the Texas Coastal Prairies Region (Shackleford and Lockwood, 2000), which include the Refuge Complex. Habitats on and adjacent to the Refuge Complex provide wintering, migrational, and/or nesting habitat for 16 species of wetland associated birds, 10 species of grassland birds, and 13 species utilizing woodland habitats, which are listed as Rare or Declining within the Texas Coastal Prairies Region (**Table 9**).

Wetland habitats on the Refuge Complex provide important wintering and migrational habitat for many of Central Flyway waterfowl, including several species whose continental are below goals established under the North American Waterfowl Management Plan (NAWNP) and/or listed by USFWS as Game Birds Below Desired Condition (USFWS, 2004). These species include the northern pintail, lesser scaup, and ring-necked duck. Mottled duck is a year-round resident of the Texas Gulf Coast, and conservation and management of this species is a major goal of the NAWMP's Gulf Coast Joint Venture Chenier Plain Initiative Area Plan (Esslinger and Wilson, 2001). Steep declines in mottled duck numbers on coastal national wildlife refuges in Texas have been documented in recent years (Haukos and Neaville, 2002), and this species is considered to be rare and declining in the Coastal Prairies Region of Texas (Shackleford and Lockwood, 2000).

Table 9. List of Rare and Declining Birds In the Coastal Prairies Region of Texas (Shackleford and Lockwood, 2000) Occurring on the Texas Chenier Plain Refuge Complex

Wetland Associated	Grasslands	Woodland or Scrub
Piping plover	Dickcissel	Swainson's warbler
Brown pelican	Scissor-tailed flycatcher	Prothonotary warbler
Bald eagle	Whit-tailed hawk	Yellow-billed cuckoo
Peregrine falcon	Loggerhead shrike	Hooded warbler
Reddish egret	Northern bobwhite	Swallow-tailed kite
Mottled duck	Barn owl	Kentucky warbler
Seaside sparrow	Sprague's pipit	American woodcock
Clapper rail	Short-eared owl	Painted bunting

Table 9. List of Rare and Declining Birds In the Coastal Prairies Region of Texas (Shackleford and Lockwood, 2000) Occurring on the Texas Chenier Plain Refuge Complex		
Wetland Associated	**Grasslands**	**Woodland or Scrub**
Forester's tern	LeConte's sparrow	Golden-winged warbler
Snowy plover		Cerulian warbler
Least tern		Blue-winged warbler
Black rail		Bay-breasted warbler
Yellow rail		Bobolink
Wood stork		
Hudsonian godwit		
Buff-breasted sandpiper		

Coastal marsh, coastal prairie, and agricultural habitats within Jefferson, Chambers, and Orange Counties historically supported the highest densities of breeding mottled ducks in Texas (Stutzenbaker, 1988), and continue to be very important to the long-term conservation of this species.

The Refuge Complex and adjacent habitats lie within the Gulf Coast Prairie (GCP) Region under the U.S. Shorebird Conservation Plan (USSCP). Thirty-nine shorebird species occur in this region, and are considered to be of "extremely high importance" to 14 of the species and of "considerable importance" for 21 additional species. Of these 35 species, 17 are considered species of conservation concern under the USSCP. Four species are considered "Highly Imperiled," which are the snowy plover, piping plover, long-billed curlew, and Eskimo curlew (believed extirpated). Thirteen species are considered "Species of High Concern," and include American golden plover, Wilson's plover, Mountain plover, American oystercatcher, whimbrel, Hudsonian godwit, marbled godwit, ruddy turnstone, red knot, sanderling, buff-breasted sandpiper, American woodcock, and Wilson's phalarope.

The North American Waterbird Conservation Plan (Kushlan *et al.*, 2002) classified colonial and semi- colonial breeding waterbird species into several "at risk" categories, including "not currently at risk," "low," "moderate," "high," and "highly imperiled," and identified those species for which there is "insufficient information available to assess risk." Wetland habitats on or near the Refuge Complex provide important wintering, migrational, and/or nesting habitat for 14 colonial and semi-colonial waterbird species deemed at moderate risk, and 6 species are deemed at high risk. High risk species include tri-colored heron, little blue heron, snowy egret, least tern (all four nest on the Refuge Complex), wood stork, and gull-billed tern. The population status of solitary breeding marshbirds will be assessed in the second version of the NAWMP. The refuge Complex and adjacent habitats are extremely important for many of these species, including several already identified by USFWS as Species of Conservation Concern. These include the yellow rail, black rail and American bittern.

Wetland habitats on or near the Refuge Complex provide important wintering, migrational, and/or nesting habitat for the shorebird species identified as needing conservation attention within the GCP Region, including three "Highly Imperiled" species and ten "Species of High Concern". The three "Highly Imperiled" species are piping plover, long-billed curlew and

snowy plover. The ten "Species of High Concern" include American golden plover, whimbrel, Hudsonian godwit, marbled godwit, ruddy turnstone, red knot, sanderling, buff-breasted sandpiper, American woodcock, and Wilson's phalarope.

4.6.2 Mammals

Records indicate that approximately 24 species of mammals utilize the various habitats on or near the Refuge Complex. Some of the more common mammals found in the area include the nine-banded armadillo (*Dasypus novemcinctus*), Virginia opossum (*Didelphis marsupialis*), cotton-tailed rabbit (*Sylvilagus floridians*), swamp rabbit (*Sylvilagus aquaticus*), raccoon (*procyon lotor*) and the striped skunk (*Mephitis mephitis*). As well, muskrat (*Ondatra zibethicus*), nutria (*Mycoaster coypus*), river otter (*Lutria canadensis*), feral pigs (*Sus scrofa*), coyote (*Canis latrans*), and bobcat (*Lynx rufus*) can be observed year-round on or near the Refuge Complex.

Both muskrat and nutria populations are cyclical, and populations of these species have been relatively low in recent years. Muskrat populations in the region as a whole supported a once-thriving fur trapping industry, and marsh habitats now part of the Refuge Complex included some of the highest quality muskrat habitat in the area. Muskrat populations on the Refuge Complex were low throughout most of the 1990's but are currently increasing. Nutria are not native to North America, but were introduced in Louisiana in 1937. In Louisiana and some other coastal ecosystems, overpopulations of nutria have resulted in significant damage to native habitats and negative impacts to native wildlife species. Although nutria have reached high population densities in the Chenier Plain region, concentrations have been localized and widespread damage has not been reported in Texas.

4.6.3 Reptiles and Amphibians

Common reptiles on the Refuge Complex (**Table 10)** include the American alligator, western cottonmouth, speckled king snake, red-eared slider, and snapping turtle. Common amphibians include the pig frog, southern leopard frog, gulf coast toad, bullfrog, and several species of salamanders. The lesser siren and two-toed amphiuma are probably common but seldom seen amphibians found in freshwater habitats. A total of 46 species of frogs and toads have been documented to occur in Texas, and 23 of these species potentially could be encountered on or near the Refuge Complex.

Alligators currently occur in 90% of their historic range, with the largest concentrations in Texas occurring in the middle and upper coastal counties and suitable inland habitats. Preferred habitats include river valleys, streams, ox-bows lakes, swamps, estuaries, bayous, and slow moving creeks where they will feed on fish, turtles, snakes, and small mammals such as muskrat and nutria. American alligator populations on the Refuge Complex have trended upwards since surveys of this species were initiated in the mid 1980's (USFWS, unpublished data). Alligators can now be found in all wetland habitat types in the area.

Alligators received protection under the Endangered Species Act in 1974, when they were listed as endangered. Following population increases; the listing status was changed to threatened due

to the similarity of appearance with the endangered American crocodile (*Crocodylus acutus*). Harvest of alligators was reinitiated in Texas in 1984. Alligators are harvested on the Refuge Complex. The Texas Parks and Wildlife Department sets hide tag allocations for the refuges, and annual harvests on the Refuge Complex from 1998 to 2004 ranged from 250-450 alligators (USFWS, unpublished data).

Table 10. Common Reptiles and Amphibians in the Refuge Complex	
Common Name	**Scientific Name**
American alligator	*Alligator mississippiensis*
Bullfrog	*Rana catesbeiana*
Glossy crayfish snake	*Regina rigida* (ssp.)
Green treefrog	*Hyla cinerea*
Gulf Coast toad	*Bufo valliceps*
Gulf salt marsh snake	*Nerodia clarkii clarkia*
Lesser siren	*Siren intermedia* (ssp.)
Mississippi mud turtle	*Kinosternon subrubrum hippocrepis*
Pig frog	*Rana grylio*
Red-eared slider	*Trachemys scripta elegans*
Salamander	*Ambystoma* spp.
Snapping turtle	*Chelydra serpentina*
Soft-shell turtle	*Apalone* (spp.)
Southern leopard frog	*Rana sphenocephala*
Speckled king snake	*Lampropeltis getula holbrooki*
Texas diamondback terrapin	*Malaclemys terrapin littoralis*
Two-toed amphiuma	*Amphiuma means*
Western cottonmouth	*Agkistrodon piscivorus leucostoma*
Green anole	*Anoles carolinensis carolinensis*

4.6.4 Fish and Other Aquatic Resources

The region's coastal fishery is classified as a warm water fishery resource with moderate to high numbers of salt and brackish water species occurring in the Gulf of Mexico and large estuarine bay systems. Over 95% of the estuarine organisms found in the Gulf of Mexico depend on estuarine habitats (salt, brackish, and intermediate marshes) for their survival, and estuaries are often referred to as the food pantry of the ocean. These species spend a portion of their life cycle, generally in the post-larval and juvenile stages, in costal wetlands. These include white and brown shrimp (*Penaeus setiferus* and *P. aztecus*) and blue crab (*Callinectes sapidus*).

This natural resource base is the cornerstone for an economically very important commercial and sport fishing industry based on the harvest and sale of seafood. Millions of tons of penaid shrimp, portunid, crabs, finfish, oysters, clams, and other marine life are dependent on the biological richness provided by the estuaries. Segments of the estuarine habitats are important nursery habitat for a variety of living marine resources, especially in their early life stages.

Important commercial and recreational finfish and shellfish species in the area include brown shrimp, white shrimp, American oyster (*Crassostrea virginica*), and blue crab. The major game fish include spotted sea trout (*Cynoscion nebulosus*), sand sea trout (*Cynoscion arenarius*), and red fish or red drum (*Sciaennops acellatus*). Other important recreational fish include southern flounder (*Paralichthys lethostigma*), black drum (*Pogonias cromis*), Atlantic croaker (*Micropogonias undulatus*), gafttopsail catfish (*Bagre marinus*), and sheepshead (*Archosargus probatocephalus*). Ancillary species include bay anchovy (*Achoa mitchilli*), gulf menhaden (*Brevoortia tyrannus*), striped mullet (*Mugil cephalus*), and gizzard shad (*Dorosoma cepedianum*).

The inland fishery resources support low numbers of game fish and high numbers of forage and rough fishes. Important inland game fish include flathead catfish (*Pylodictis olivaris*), blue catfish (*Ictalurus furcatus*), channel catfish (*Ictalurus puntatus*), largemouth bass (*Micropterus salmoides*), white bass (*Morone chrysops*), and white and black crappie (*Pomoxis annularis* and *P. nigromaculatus*). The most common baitfish include stripped mullet, gizzard shad and threadfin shad (*Dorosoma petenense*). Some species of rough fish include common carp (*Cyprinus carpio*), small mouth buffalo (*Ictiobus bubalus*), freshwater drum (Aplodinotus grunniens), bowfin (*Amia calva*), and three species of gar: alligator, long nose, and spotted (*Lepisosteus spatula, L. osseus*, and *L. oculatus*). The Refuge Complex includes both saltwater and freshwater fishing and crabbing opportunities. Both fishing and crabbing are popular activities on Anahuac and McFaddin NWRs.

4.6.5 Invertebrates

Invertebrate populations are an essential food resource for migratory bird and estuarine fishery species. Various amphipods, mysid shrimp, grass shrimp, crayfish, and numerous crabs are present within all marsh habitats in the Refuge Complex. Some of these invertebrate populations occur in tremendous quantities. Mosquitoes, biting flies, chiggers, and imported fire ants are other common invertebrates.

Recent surveys have documented 38 butterfly and 16 dragonfly species on the Anahuac NWR (USFWS, unpublished data). Common butterfly species include monarch, little yellow and gulf fritillary butterflies. Common dragonfly species include the common green darner and seaside dragonlet.

4.6.6 Threatened and Endangered Species

Several Federally-listed Threatened and Endangered Species (T&E species), listed under the Endangered Species Act of 1973, occur within the project area. Of these species, as well as several additional species, are listed by the State of Texas as endangered, threatened, or species of concern (rare).

Several recent actions by the USFWS under the Endangered Species Act have changed the status of Threatened and Endangered species occurring within the project area. In 1999, the USFWS de-listed and removed the Arctic Peregrine Falcon from the list of T&E species. However, it

remains on the state list as threatened. The Bald Eagle was down-listed from Endangered and reclassified as Threatened in 1995.

The Refuge Complex lies within historic ranges of four Federally-listed species: Attwater's prairie chicken, red wolf, Eskimo curlew, and West Indian manatee. These species have been extirpated within this region.

The discussion of threatened and endangered species does not imply that these rare species necessarily occur within the area of influence of the proposed seismic survey. **Table 11** provides a list of the species state and/or federally listed as endangered, threatened, or as rare species of special concern, which occur or have potential for occurrence in Jefferson and Chambers counties. These species could occur the refuge complex at some time during the year (the sea turtles occur in the Gulf of Mexico adjacent to the Refuge). The U.S. Fish and Wildlife Service lists no endangered or threatened plants as occurring in Jefferson County.

Table 11. Federally and State Listed Threatened and Endangered Species and Species of Concern, Which Occur In Jefferson and Chambers Counties, TX

Scientific Name	Common Name	Federal Status	County	Occurrence in Refuge Complex
Amphibians				
Rana grylio	Pig Frog	Rare	Jefferson	Known
Birds				
Falco peregrinus tundrius	Arctic peregrine falcon	State Threatened	Jefferson and Chambers	Known
Aimophila aestivalis	Bachman's sparrow	State Threatened	Jefferson	No Habitat
Haliaeetus leucocephalus	Bald eagle	State and Federal Threatened, PDL	Jefferson and Chambers	Known
Laterallus jamaicensis	Black rail	Rare	Chambers	Known
Pelecanus occidental/s	Brown pelican	State and Federal Endangered	Jefferson and Chambers	Known
Ammodramus henslowii	Henslow's sparrow	Rare	Jefferson and Chambers	Known
Charadrius montanus	Mountain plover	Rare	Chambers	Potential
Charadrius melodus	Piping plover	State and Federal Threatened	Jefferson and Chambers	Known
Charadrius ale.+andrinus	Snowy plover	Rare	Jefferson and Chambers	Known
Egretta rufescens	Reddish egret	State Threatened	Jefferson and Chambers	Known
Sterna fuscata	Sooty tern	State Threatened	Jefferson	Potential
Elanoides forficatus	Swallow-tailed Kite	State Threatened	Jefferson and Chambers	Known
Plegadis chihi	White-faced ibis	State Threatened	Jefferson and Chambers	Known
Buteo albicaudayus	White-tailed hawk	State Threatened	Chambers	Potential
Mycteria americana	Wood stork	State Threatened	Jefferson and Chambers	Known

Table 11. Federally and State Listed Threatened and Endangered Species and Species of Concern, Which Occur In Jefferson and Chambers Counties, TX				
Scientific Name	**Common Name**	**Federal Status**	**County**	**Occurrence in Refuge Complex**
Fishes				
Anguilla americanus	American eel	Rare	Jefferson and Chambers	Potential
Mammals				
Ursus americanus	Black bear	State and Federal Threatened, S/A	Jefferson and Chambers	No Habitat
Ursus americanus luteous	Louisiana black bear	State and Federal Threatened	Jefferson and Chambers	No Habitat
Spilogale putorius interrupta	Plains Spotted Skunk	Rare	Jefferson and Chambers	Potential
Corynorthinus rafinesquii	Rafinesque's big-eared bat	State Threatened	Jefferson	No Habitat
Canis rufus	Red Wolf	State and Federal Endangered	Jefferson and Chambers	Extirpated within the Region
Myotis austroriparius	Southeastern Myotis bat	Rare	Jefferson and Chambers	No Habitat
Mollusks				
Strophitus undulatus	Creeper (Squawfoot)	Rare	Jefferson	No Habitat
Truncilla donaciformis	Common Fawnsfoot	Rare	Jefferson	No Habitat
Villosa lienosa	Little spectaclecase	Rare	Jefferson	No Habitat
Pleurobema riddellii	Louisiana Pigtoe	Rare	Jefferson and Chambers	No Habitat
Tritogonia verrucosa	Pistolgrip	Rare	Jefferson	No Habitat
Acridens confragosus	Rock-pocketbook	Rare	Jefferson	No Habitat
Lampsilis satura	Sandbank pocketbook	Rare	Jefferson	No Habitat
Obovaria jacksoniana	Southern hickorynut	Rare	Jefferson	No Habitat
Potamilus amphichaenus	Texas heelsplitter	Rare	Jefferson	No Habitat
Fusconaia askewi	Texas pigtoe	Rare	Jefferson	No Habitat
Fusconaia flava	Wabash Pigtoe	Rare	Jefferson	No Habitat
Quadrula nodulata	Wartyback	Rare	Jefferson	No Habitat
Reptiles				
Macrochelys temminckii	Alligator Snapping turtle	State Threatened	Jefferson	Known
Dermochelys coriacea	Leatherback sea turtle	State and Federal Endangered	Jefferson and Chambers	Potential
Eretmochelys imbricata	Hawksbill sea turtle	State and Federal Endangered	Jefferson and Chambers	Potential
Lepidochelys kempii	Kemp's Ridley sea turtle	State and Federal Endangered	Jefferson and Chambers	Potential
Caretta caretta	Loggerhead sea turtle	State and Federal Threatened	Jefferson and Chambers	Potential
Chelonia mydas	Green sea turtle	State and Federal Threatened	Jefferson and Chambers	Potential
Nerodia clarkii	Gulf saltmarsh snake	Rare	Jefferson and Chambers	Known
Liochlorophis vernal/s	Smooth green snake	State Threatened	Chambers	Known
Cemophora coccinnea	Northern Scarlet snake	State Threatened	Jeffersom	No Habitat

Table 11. Federally and State Listed Threatened and Endangered Species and Species of Concern, Which Occur In Jefferson and Chambers Counties, TX				
Scientific Name	**Common Name**	**Federal Status**	**County**	**Occurrence in Refuge Complex**
Malaclemys terrapin littoralis	Texas diamondback terrapin	Rare	Jefferson and Chambers	Known
Phrynosoma cornutum	Texas horned lizard	State Threatened	Jefferson and Chambers	Known
Crotalus horridus	Timber/canebreak rattlesnake	State Threatened	Jefferson and Chambers	No habitat
Plants				
Platanthera chapmanii	Chapman's Orchid	Rare	Jefferson	No habitat
Chloris texensis	Texas windmill grass	Rare	Chambers	Potential

Federally-Listed Threatened or Endangered Species Known to Occur or with Potential for Occurrence within the Refuge Complex

Sea Turtles

Three species of endangered sea turtles, Kemp's Ridley, Leatherback, and Hawksbill, and two species of threatened sea turtles, Loggerhead and Green, are known to occur in the Gulf of Mexico. The Kemp's Ridley, also known as the Atlantic Ridley, is the most endangered sea turtle. The Kemp's Ridley sea turtles are known to use shallow-water bays over its entire range to feed on blue crab, by-catch of shrimpers, algae, and grass beds.

Historically, all five of these sea turtles nested on the Texas Gulf Coast. The number of Kemp's Ridley sea turtles nesting in Texas appears to be increasing, and this species is now nesting again in parts of its historic range, including on the upper Texas Gulf Coast. To date, nesting has not been documented on the Refuges, but has been documented as far north as the west end of Galveston Island in recent years. Strandings of dead and wounded turtles occur occasionally on the beaches of the Refuge.

Brown Pelican

Brown pelicans along the Texas coast experienced a population decline from the first part of the century until the mid 1970's. From numbers in the range of 5,000 at the turn of the century to less than *50* individuals in the early 1970's, the brown pelican's population decreased until the elimination of organochlorine pesticides, and the species was listed as endangered. Population increases have been documented since the late 1970's. Brown Pelicans do not nest within the Refuges, but Campbell (1995) lists Jefferson County as a migratory range and potential nesting range. They are now commonly present year-round along the Gulf shoreline and the GIWW, and are frequently observed flying over the Refuge.

Bald Eagle

Like the brown pelican, bald eagle populations were affected by the use of organochiorine pesticides. Bald eagles, especially juveniles, are seen occasionally flying over the Refuge during the winter but do not nest in the area. They are generally associated with large concentrations of wintering waterfowl.

Piping Plovers
The piping plover, listed as threatened, overwinters on the Texas Gulf Coast. This species occurs along the Gulf beaches and other exposed mudflats within the Refuge Complex, primarily during fall migration and winter. They begin to arrive in the northern sections of the Gulf as early as mid-July and continue to arrive through October. Most move further south as the winter approaches. Piping plover do not nest on the Refuge Complex. The piping plover feeds on invertebrates found along tidal mudflats, sandflats, and algal fiats.

American Alligator
The American alligator is federally-listed as threatened due to similarity of appearance with the endangered American crocodile.

State of Texas-Listed Threatened, Endangered, or Rare Species Known to Occur or with Potential for Occurrence within the Refuge Complex

Arctic Peregrine Falcon
The Arctic peregrine falcon is state-listed as threatened. Due to similarity of appearance, the TPWD also affords protection to the American peregrine falcon. The Artic peregrine falcon's wintering range includes all of the Texas Gulf Coast. The American and Arctic peregrine falcons are attracted to large concentrations of ducks and other birds during the winter. The southern coast of Texas appears to be a major spring migration staging area, and most falcons are observed on the Refuge during the spring and fall migration, usually along the Gulf of Mexico shoreline.

Bachman's Sparrow
The Bachman's sparrow is state-listed as threatened. The breeding range of the Bachman's sparrow includes the Texas Gulf Coast. However, this species has not been documented on the Refuge Complex. Its distribution over the region as a whole is uncommon and local, and most observations are of wintering birds and those seen during the fall and spring migration. A ground nester, the Bachman's sparrow prefers habitat consisting of open pine stands with grassy ground cover and dense herbaceous cover.

Reddish Egret
The reddish egret is state-listed as threatened. Reddish egrets are observed on the brackish and intermediate marshes of the Anahuac NWR, especially large flats found on the Roberts-Mueller and Pace tracts. Preferred habitats include shores, lagoons, salt marshes and salt flats where they primarily forage on fish. Breeding activity generally occurs on coastal islands where they will nest in colonies, although rarely east of Galveston, Texas (Collins, 1981). There is no documentation of nesting activity by Reddish Egrets within the Refuge Complex.

Wood Stork
Currently, the TPWD lists the Wood Stork as threatened. Wood storks are federally-listed as endangered, but this status only applies to populations in Alabama, Florida, Georgia, and South Carolina. Some of the latest nesting records in Texas come from Chambers and Jefferson counties (1930 and 1960, respectively) (Oberholser, 1974 and DeGraaf et. al., 1991). The wood stork generally nests in colonies in trees bordering swamps, marshes, or ponds. Wood storks

typically utilize brackish marsh habitats on the Anahuac and McFaddin NWRs during late summer. It is believed that these birds are dispersing post-breeding from Mexico, where nesting populations occur.

White-Faced Ibis
The white-faced ibis is state-listed as threatened. This species is a colonial nester that is commonly observed throughout the year on the Refuge Complex. White-faced ibis have nested on the Refuge Complex within the McFaddin NWR. Populations of this species in the Chenier Plain region are believed to have been negatively-impacted by the use of pesticides and herbicides used in rice production (DeGraaf et. al., 1991). Preferred habitats include freshwater marshes, sloughs, and ponds with emergent vegetation.

Interior Least Tern
Currently, the TPWD lists the interior least tern as endangered. The entire Texas Gulf Coast, including the Refuge Complex and the entire seismic survey project area, is included within the wintering range of the interior least tern. Interior least terns nest inland of the coast, and are considered a separate population than the coastal least tern, which is a common nester in the project area. The interior least tern is observed on the Refuge Complex only rarely during spring and fall migration.

American Swallow-Tailed Kite
The American swallow-tailed kite is state-listed as threatened. Preferred habitats consist of river bottom forests where they nest in the tree tops near habitat edges and other openings. In recent years, nesting has been documented just north of the Refuge Complex in bottomland forests along the Trinity River (TPWD, unpublished data). They have been observed on the North Unit of the McFaddin NWR.

White-Tailed Hawk
The white-tailed hawk is state-listed as threatened. White-tailed hawks are a southern species that just makes it to the Upper Texas Coast. They are uncommon permanent residents of the coastal prairies. This species in not known to occur within the Refuge Complex, however, potential suitable habitat exists.

Alligator Snapping Turtle, Smooth Green Snake, Texas Horned Lizard
The alligator snapping turtle, smooth green snake and Texas horned lizard are state-listed as threatened. The smooth green snake is found in disjointed populations in Chambers County and other parts of southeast Texas. The preferred habitats include grassy fields, meadows, low brush, and bog sites. These species have been documented on the Refuge Complex, but their distribution and abundance are currently not known.

State of Texas Listed Species of Concern

Several species listed by the State of Texas as rare species of concern are known to occur within the Refuge Complex. These include the Texas diamondback terrapin, Gulf saltmarsh snake, black rail, snowy plover and Henslow's sparrow.

The State of Texas also lists two types of bird-related habitat as rare in Jefferson County. These habitats include colonial waterbird nesting areas and migratory songbird fallout areas. Many rookeries are active annually in coastal Texas; therefore, there may be active rookeries present within the project area during the coarse of operations. Song bird fallout areas are defined as oak mottes and other woods/thickets that provide foraging/roosting sites for neotropical migratory songbirds. Habitat of this nature is potentially present within the project area.

The applicant and their consultants have pursued consultation with the Texas Parks and Wildlife, Wildlife Diversity Branch and with the USFWS Ecological Services (Clear Lake Field Office) to determine the potential for other threatened and endangered species to occur within the project area.

4.7 HISTORICAL AND ARCHEOLOGICAL RESOURCES

Brazos Valley Research Associates was contracted (by DESCO) to conduct a cultural resources file search through the Texas Archaeological Research Laboratory (TARL). This file search, concerning known cultural resources within the boundary of the proposed 3-D survey, revealed that there were eight recorded archaeological sites and one recorded cemetery within the portions of the project area that overlap the McFaddin and Anahuac NWRs. All of these sites will be identified in the field and flagged for avoidance by the project crews.

4.8 LAND USE AND SOCIOECONOMIC RESOURCES

4.8.1 Land Use

The McFaddin NWR was established on February 20, 1980 under authority of the Migratory Bird Conservation Act of 1929. The Anahuac NWR was established on February 27, 1963 to provide wintering and migration habitat for ducks and geese of the Central Flyway, as well as other migratory bird species.

Approximately 100,000 visitors came to the McFaddin NWR in 2000 for recreational and educational activities including fishing, waterfowl hunting, wildlife observation and photography, environmental education and interpretation, and beach-related recreation. Annual visitation to the Anahuac NWR exceeds 72,000 visitors for wildlife observation and photography, waterfowl hunting, recreational fishing and crabbing, hiking, canoeing and kayaking.

Waterfowl hunting is permitted on the Refuges in designated Public Hunting Areas during state specified seasons, and includes the September teal season, youth-only hunts, regular waterfowl season, and currently a Special Conservation Order season for white geese. Saltwater fishing and crabbing is popular year-round on Salt Bayou.

Management activities to enhance, restore, and protect habitats for migratory birds and other native fish and wildlife species on McFaddin and Anahuac NWRs include water level salinity management, prescribed burning, cooperative rice farming, and controlled grazing. Water management infrastructure includes numerous water control structures, levees ditches, and

canals. Cool season cattle grazing takes place on Anahuac NWR and McFaddin NWR from October to April/May, using local ranchers under Refuge Special Permit. Prescribed burning occurs primarily from September through November. Summer grazing also occurs on Anahuac NWR. Rice farming is conducted by local farmers under Cooperative Agreements on the Anahuac NWR. Rice farming activities including field preparation, planting, irrigation and harvest are conducted from February through October. Harvested rice fields are flooded to provide wetland habitat for waterfowl during the winter months. Control of several exotic plant species which negatively impact native fish and wildlife, including Chinese tallow in terrestrial habitats and water hyacinth in aquatic habitats, is also ongoing.

4.8.2 Socioeconomic Resources

The population of Jefferson County was estimated to be 241,332 in 1999, an increase of 1,935 people over the 1990 census of 239,397. The largest population centers in Jefferson County are Beaumont and Port Arthur with populations of 114,323 and 58,724 respectively in 1990.

The labor force in the metropolitan statistical area in Jefferson County was estimated at 120,439, approximately 109,880 of which are employed, leaving a 9.6% unemployment rate in 2003. The major employment industries in the county include manufacturing, construction, services, trade, and government. The major employers in Port Arthur include the correctional facilities, school district, Huntsman Corp. (petrochemical manufacturing), St. Mary hospital, Tenet Mid-Jefferson/Park Place (medical service), and Star Enterprise (petroleum refining).

The 1999 estimated median household income for Jefferson County was $34,706 (U.S. Census Bureau 2001).

The population of Chambers County was estimated to be 26,031 in 2000, an increase of 5,143 people over the 1990 census of 20,088. The largest population centers in Chambers County are Anahuac and Beach City, the seat of government, with populations of 2,210 and 1,645 respectively in 2000.

The labor force in the metropolitan statistical area in Chambers County was estimated at 13,294, approximately 12,503 of which are employed, leaving a 6.3% unemployment rate in 2003. The major employment industries in the county include oil and gas extraction, agribusiness, petroleum refining, and the manufacturing of plastics and resins. The major employers in Anahuac include the Exxon-Mobil, school districts, Beacon Construction, and Houston Light and Power.

The 1999 estimated median household income for Chambers County was $47,964 (U.S. Census Bureau 2001).

The population of Galveston County was estimated to be 250,158 in 2000, an increase of *32,759* people over the 1990 census of 217,399. The largest population centers in Galveston County are Galveston and Texas City, the seat of government, with populations of 56,600 and 43,200 respectively in 2000.

The labor force in the metropolitan statistical area in Galveston County was estimated at 124,505, approximately 114,327 of which are employed, leaving an 8.9% unemployment rate in 2003. The major employment industries in the county include petrochemical, manufacturing, and tourism. The major employers in Galveston County include BP Amoco Refinery, Dow Chemicals, Texas City ISD, Sterling Chemicals, Mainland Medical Center, and Valero Refining Co.

The 1999 estimated median household income for Galveston County was $42,419 (U.S. Census Bureau 2001).

5.0 PROVISIONS AND STIPULATIONS OF THE USFWS SPECIAL USE PERMIT

Under the USFWS Special Use Permit, several management and operational procedures will be required throughout the seismic survey to eliminate avoidable impacts to natural and cultural resources and infrastructure on McFaddin and Anahuac NWRs, and to control, reduce, and correct unavoidable adverse impacts. These required management and operational procedures are defined through the provisions and stipulations, which are the Special Conditions of the SUP. Administration of the SUP will include active monitoring of all seismic operations to provide the Refuge Manager with high-quality current information throughout the course of the seismic survey and allow the Refuge Manager to, if necessary, modify the course of the survey to protect Refuge resources.

The Refuge Manager and environmental monitors will retain the right to "stop work" in any situation that imperils a threatened or endangered species or its habitat, that causes significant harm to Refuge resources, that threatens cultural or historic resources, or that endangers public safety. Any sightings of cultural features or artifacts or sightings of threatened or endangered species by employees of Suemaur or Veritas will be immediately reported to the Refuge Manager.

As per regulations specified in 50 CFR 29.32 regarding oil and gas exploration activities on USFWS lands, the following stipulations apply:

- Suemaur and Veritas will to the greatest extent practicable, conduct all exploration in such a manner as to minimize damage, erosion, pollution or contamination to the lands, waters, facilities and vegetation of the area.

- So far as is practicable, seismic operations must be conducted without interference with the operation of the Refuge or disturbance to the wildlife thereon.

- The physical occupancy of the area must be kept to the minimum space compatible with the conduct of efficient mineral operations.

- Upon the cessation of operations, the area shall be restored as nearly as possible to its condition prior to the commencement of seismic operations.

A third-party environmental monitor(s) will be hired at Suemaur' expense to ensure compliance with Refuge regulations and Special Conditions of the Special Use Permit. Suemaur will pay reasonable total cost of this requirement, as mutually agreed with the Refuge Manager prior to the hiring of the environmental monitors. The environmental monitor(s) will be hired with prior approval of the Refuge Manager, and will report directly to the Refuge Manager. The environmental monitors will be provided a radio and a cell phone for communications with crews. Monitors will also have access to an airboat and airboat operator, when work is being done in marsh conditions, and access to an ATV for work in other areas.

Suemaur is responsible for any damage caused by Veritas or any other subcontractor hired by Suemaur or Veritas or involved in the seismic survey, and for restoring impacted areas as closely as possible to original conditions prior to the end of seismic operations. Suemaur will be responsible for restoration of and/or mitigation for all damages to Refuge habitats, and for repairing any damages to Refuge facilities and infrastructure including roads, parking areas, levees, fences, and water control structures.

The USFWS will enforce all applicable Federal statutes and regulations, including all Refuge specific regulations.

5.1 GENERAL PROVISIONS AND OPERATIONAL METHODS

- Monitoring Program: One or more environmental monitors will be on duty at all times. Additional monitors will be on duty when determined necessary by the Refuge Manager. Daily operations logs shall be kept by the environmental monitors and the seismic survey project manager. These logs should document all daily activities as well as any damages to habitats or infrastructure. Daily updated logs will be made available to the Refuge Manager, Suemaur and Veritas each morning and a final composite log will be given to the Refuge Manager, Suemaur and Veritas upon completion of the program.

- The shot line and receiver line pattern will be designed and operations conducted so as to minimize mechanized equipment traffic along the line and lessen the overall time required to conduct drilling and recording operations.

- The seismic program will be initiated in the eastern portion of the Refuge and will progress from east to west.

- Training Program: Training of all seismic program personnel will be conducted prior to commencing seismic activities through orientation meetings. Training will include review of the provisions and stipulations of the Special Use Permit and review of Refuge specific and general regulations applicable to National Wildlife Refuges. Training will be repeated periodically throughout the program prior to each phase of the operations and/or as new personnel begin work within Refuge areas.

- In the event of adverse weather conditions, the Refuge Manager may halt all seismic operations. Should work be delayed for this reason the Refuge Manager is authorized to extend the period of operation up to an additional thirty (30) days.

5.2 STIPULATIONS TO PROTECT CULTURAL RESOURCES

- A file search will be performed, at Suemaur's expense, by an archaeologist to identify any known cultural sites. The archaeologist will also identify and map high probability areas within the area of the seismic survey, and map buffer zones around all known sites and high probability areas. A cultural resource avoidance plan, including low impact

methodology is being prepared for the protection of cultural resources, and all stipulations and recommendations describing operations and avoidance measures around cultural/historical features will be adhered to.

- All cultural resources identified in the file search and all high probability areas will be mapped and/or flagged in the field by the archaeologist prior to beginning seismic operations, and such sites will be avoided by seismic field crews during all phases of the seismic survey. No seismic survey activities will occur in buffer zones within 100 ft. radius around identified sites and high probability areas.

- The seismic survey will only use the low-impact seismic survey methodology specified in the "Seismic Methodology And Sensitive Area Avoidance Plan".

- Staging areas for the seismic survey will only be sited in low probability areas.

- Any discovery of cultural artifacts or features during the course of the seismic survey will be immediately reported to the USFWS and SHPO. The Refuge Manager and the environmental monitor(s) will have "stop work" authority for any activity that may threaten a cultural artifact or feature.

5.3 STIPULATIONS TO PROTECT MIGRATORY BIRDS, OTHER WILDLIFE, AND HABITATS

- The timeframe for conducting the seismic survey will be June 1, 2006 to October 15, 2006, to reduce disturbance impacts to migrating/wintering migratory birds including waterfowl, shorebirds, and wading birds and to avoid the peak nesting season for mottled ducks. Suemaur understands that an earlier completion date is preferable to reduce potential disturbance impacts to blue-winged teal and other early migrating species, and will strive to complete the survey at the earliest possible date.

- Shifting of the seismic source or receiver lines and subsequent operations will be required to avoid active migratory bird nests, alligator nests, muskrat dens, wildlife concentrations, and other sensitive wildlife features.

- Killing or harassing all wildlife on the Refuge is prohibited; this includes snakes, turtles, frogs, or other wildlife. Only monitor(s) and Refuge personnel will remove poisonous snakes from work areas. Spotlighting of wildlife by crews is prohibited.

- Fishing by seismic survey personnel while on duty is prohibited.

- Lightweight aluminum marsh buggies (tracked vehicles) will be used for drilling in emergent wetlands which are too dry for airboat use, and in salty prairie habitats whenever possible. Use of terra-tired drilling and water vehicles must be approved by the Refuge Manager, and these vehicles will only be used if water availability restricts use of lightweight tracked vehicles.

- Airboat drills will be used in shallow water habitats. The boundary between the tracked vehicle operations and the airboat operations will be determined with the input of the environmental monitor(s). Airboat drills may be used as the preferred drilling apparatus wherever conditions permit.

- Equipment used to haul water to the drills must be consistent with the drilling vehicles used in a particular habitat. On-site determinations will be made by USFWS and the environmental monitor(s) at the time of drilling as to whether water will be hauled to the drills or will be obtained at the drilling sites by digging with a small bucket or backhoe. If holes are dug, they will be immediately refilled, leveled and repaired to original condition. Wherever possible, water available at the drill sites will be utilized, including laying hose and pumping from nearby water sources.

- Potential vegetation damage and soil compaction/rutting along shot and receiver lines will be reduced by: 1) restricting the number of vehicle and airboat passes along the lines to the absolute minimum required. Veritas will limit receiver line checks to the absolute minimum possible. Wherever possible, laying and servicing receiver equipment will be accomplished by walking. Natural and man-made travel lanes (bayous and other waterways, roads and trails) will be utilized whenever possible; 2) using helicopters to transport equipment to the lines within marshes to the maximum extent possible; 3) using lightweight aluminum tracked vehicles and four-wheelers where necessary in uplands and drier transitional sites; 4) minimizing turning by tracked vehicles (no locking tracks); 5) prohibiting the transportation of equipment by sleds; and 6) prohibiting all "cross country travel" by mechanized vehicles.

- Damage to levees, ditches, and other waterway banks and shorelines will be minimized to the extent possible by: 1) conducting drilling activities on one side of a waterway in a portion of the project area before proceeding to the opposite side, thereby minimizing crossings; 2) utilizing plywood, pvc pipes or other appropriate materials at crossing locations; and 3) avoiding lateral travel along banks and shorelines.

- All beach access will be limited to a Refuge Manager approved access point from which personnel will be transported via ATV to areas in which walking to work sites along the beach ridges will be possible.

- Veritas will pressure wash all vehicles and receiving equipment prior to deployment on Refuge lands to avoid introducing any foreign plants or animals. Boats, vehicles, and receiving equipment will be inspected by the environmental monitor(s) prior to entering Refuge areas.

- Work, with the exception of trouble-shooting operations, will be conducted during daylight hours within the Refuges. Air gun operations in the Gulf of Mexico will be conducted for 12-24 hours per day. Trouble-shooting operations within the Refuges will be permitted 24 hours per day in support of air gun operations.

- Staging areas, boat launch sites, and vehicle/boat travel lanes will be approved by the Refuge Manager following a coordinated field review with Veritas.

- Areas such as boat launches and access points, if disturbed by seismic survey activities, will be restored according to USFWS specifications.

- Sensitive habitats, including small stands of native prairie and coastal woodlots will be identified and avoided by shifting shot and receiver lines and subsequent operations. No tree cutting or brush clearing will occur, other than the removal of Chinese tallow trees as necessary.

- Drilling will not occur within bayous and other navigable waterways.

- All vegetation damage and soil compaction/rutting will be restored by Veritas as nearly as possible to its condition prior to commencement of seismic operations, or will be mitigated for as specified by the USFWS.

5.4 STIPULATIONS TO MINIMIZE INTERFERENCE WITH PUBLIC USE OF THE REFUGE

- Should seismic survey operations of the Refuges not be completed before the September teal hunting season, operations will be modified. During the September teal season, Veritas will not begin work on the McFaddin NWR and Anahuac NWR until 12:30 PM.

- Veritas will provide adequate signage to inform the public of the program at specified locations. Signs advising the public regarding seismic activities, or signs addressing public safety, will be approved by the Refuge Manager before being posted.

- Veritas will confine vehicle and equipment movements to the designated access routes at all times during travel to and from work. While on the job site, Veritas will confine all activities to the designated work areas.

- Laying out of shot and receiver lines and subsequent operations will avoid USFWS monitoring and research activities including vegetation monitoring transects, SET tables, water quality monitoring devices, weather stations, and other scientific equipment.

5.5 OTHER STIPULATIONS

- Veritas will establish and identify to the USFWS a designated point of contact who will be available at all times for communication and coordination with the USFWS.

- All water control structures, wells, and water gauges will be avoided.

- The USFWS and Veritas will cooperatively develop a Contingency Plan to cover the potential occurrence of project-related or other incidences of wildfire during the seismic survey. Survey crews will carry basic fire suppression equipment (shovels, fire extinguishers, etc.). Crews will report any occurrence of wildfire to Refuge management.

- Possession of firearms is prohibited by Refuge regulation. Possession of firearms is also prohibited by Veritas' policy and is enforceable by dismissal from employment.

- In the event that any roads, trails, parking areas, levees, and other infrastructure are impacted by the seismic survey, these resources will be immediately repaired at Suemaur's expense. Suemaur will be required to maintain all Refuge facilities used during the seismic survey, and repair any damages caused by Veritas' or its subcontractors' use of these facilities.

- All fences (barbed and electric) breached by the seismic survey will be repaired at Suemaur's expense in a timely manner, and in a manner agreed upon by the Refuge Manager.

- Cattle grazing and rice farming operations being conducted by cooperators under Refuge Special Use Permit, which are impacted by seismic survey activities (for example, impacting infrastructure including gates and fences, cattle losses, crop losses), will be compensated, directly to the Refuge permittee, in accordance with the fair market value of losses incurred. All Refuge grazing and farming permittees will be contacted by Suemaur and provided information on the 3-D seismic survey and its impact to them before any survey activities occur.

- On-Refuge storage of explosives must be approved in advance by the Refuge Manager. Explosives will be stored in secured locations in accordance with Bureau of Alcohol, Tobacco, and Firearms regulations as approved by the Refuge Manager.

- Field oil or fluid changes will be permitted on the Refuge in selected areas determined by the Refuge Manager. Any spilled oil will require immediate cleanup. Therefore, oil absorbent pads will be required on site at all times as a precautionary measure.

- Suemaur will provide the Refuge Manager with proof of environmental liability insurance or post a bond prior to the initiation of the seismic survey.

- Strict adherence to Veritas' Drug and Alcohol Policy (**Appendix A**) will be enforced for all Veritas employees, contractors, and subcontractors. Violation of this policy will be grounds for immediate dismissal.

- All cans, bottles, paper, and other trash generated by the seismic crew will be removed from the Refuge daily or placed in designated trash receptacles. Trash receptacles must be emptied and trash removed from the Refuge on an as-needed basis.

- All equipment and debris incidental to the survey, such as flagging, wires, poles, etc., will be removed following the cessation of activities on each line.

- Veritas will advise the Refuge Manager at least 72 hours in advance of the initial survey activities and shall coordinate all activities during the seismic survey on the Refuge with the Refuge Manager.

- The Refuge Manager will be provided detailed maps showing the exact locations of all seismic survey lines and shot holes promptly after survey completion.

- Suemaur will provide the USFWS with aerial photographs of the area surveyed within McFaddin and Anahuac NWRs. These aerial photographs will be taken prior to and within 6 months of completion of seismic survey activities on the Refuges. The Refuge Manager will provide input for the aerial photography specifications.

- An Office of Aircraft Safety (OAS) approved and carded helicopter and pilot will be made available to the Refuge Manager for aerial reconnaissance before and after completion of seismic activities on Refuge lands.

- All applicable Federal and State regulations, including all Refuge-specific regulations, whether or not specified in this Special Use Permit, shall be in force and adhered to by all seismic personnel at all times, except where explicitly exempted by the Refuge Manager. Seismic personnel shall comply with all applicable ordinances, laws, decrees, statutes, rules, and regulations of all Federal and State entities.

- The USFWS can add to or modify stipulations of the Special Use Permit during the seismic survey should additional or modified stipulations be needed to protect Refuge resources or public safety.

6.0 IMPACTS ASSESSMENT

The following description of potential impacts of seismic operations and how avoidable impacts are eliminated and unavoidable impacts minimized, restored, and/or mitigated through USFWS management of seismic operations through the issuance of the SUP is derived primarily from USFWS management of previous seismic operations on coastal national wildlife refuges in Texas and Louisiana.

For purposes of the impact assessment for the "No Action Alternative" (USFWS Not issuing a SUP for the seismic survey), the USFWS assumes that Suemaur would elect to proceed with its 3-D seismic survey without a SUP, relying upon the property rights of the underlying mineral interest owners to make reasonable and necessary use of the surface to explore for and develop their mineral interests.

6.1 SOILS

The McFaddin and Anahuac NWRs consist primarily of wetland areas. Soil compaction and/or rutting that might result from the movement of heavy equipment in sensitive wetland and transitional upland habitats on the Refuges is a primary concern due to the fact that even slight changes in ground elevation can result in habitat changes in a coastal marsh. For example, water ponding in depressions resulting from soil compaction could change species composition of the vegetation within these depressions. Additionally, rutting could lead to more rapid drainage and drying of marsh soils. Hydrological impacts, specifically those that might cause saltwater intrusion and increased tidal energies, can in extreme situations result in marsh loss (conversion of vegetated marsh to open water). These potential impacts are discussed in Section 6.3. It is likely that some degree of soil compaction and/or rutting in wetland and transitional upland habitats from normal seismic operations will be unavoidable, a nd some damages would occur in locations where restoration will not be possible.

Hydrogeological impacts resulting from soil compaction, specifically impeding the recharge of near surface water tables, would likely be minimal or non-existent on the Refuges.

In uplands or dry land drilling, excess cuttings from the drilling may exist at some shothole locations. The excess soil remaining varies but averages less than two cubic feet per shothole. Normal procedure is to backfill the shotholes with the drill cuttings, but the degree to which the immediate shot hole area is restored is operator-dependent. (In sandy soils, where there may not be enough cuttings to fill the hole, Statewide Rule 100 requirements apply). Bare ground or un-vegetated topsoil created by the excess soil cuttings can provide favorable conditions for seed set and growth of invasive species such as the exotic Chinese tallow.

6.1.1 Alternative A. No Action. The USFWS Would Not Issue a SUP for the 3-D Seismic Survey

Under this Alternative, it is expected that impacts to soils and subsequent hydrological impacts would be greater than the Proposed Action as a consequence of the lack of specific guidance on

mitigative measures to minimize impacts to soils, which would be stipulated in the SUP and strictly adhered to by Suemaur and Veritas. Examples of normal seismic operations and subsequent impacts to soils, which could be reasonably anticipated through project activities not governed by a SUP include:

1 - Not using trained environmental monitors to serve as daily liaisons with Refuge staff, to ensure provisions and stipulations of a SUP are adhered to, and to provide timely on-site guidance to seismic survey personnel would likely increase avoidable impacts to soils.

2 - Increased use of terra-tired drilling and water rigs in wetland and transitional upland habitats. This would increase rutting and soil compaction.

3 – Increased digging of pits to obtain water at the drilling sites rather than utilizing pumps and hose lays. This would result in increased soil disturbances.

4 – Increased passes of mechanized equipment on shot and receiver lines, more frequent instances of repeated passes over the same areas, cross-country travel by mechanized equipment, and increased use of mechanized equipment to distribute and retrieve receiving equipment. This would result in increased soil compaction affecting larger areas.

5 – Not restoring soil surface elevations at shot holes and water pits by leaving drilling and pit cuttings as is, resulting in increased soil disturbance.

6 – Not taking special precautions to prevent rutting and subsequent erosion at particularly susceptible locations, including the shorelines of waterways and ponds.

6.1.2 Alternative B. Proposed Action. The USFWS Would Issue a SUP for the 3-D Seismic Survey

Under this Alternative, impacts to soils and subsequent hydrological impacts would be less than under Alternative A, because of the USFWS' management of the seismic operations through the SUP, including monitoring of the seismic operations to ensure strict adherence by Suemaur and Veritas to the SUP's provisions and stipulations. This includes the requirement for restoration of and/or mitigation for any unavoidable damages. Examples include:

1 – Required use of trained environmental monitors to serve as daily liaisons with Refuge staff, to ensure provisions and stipulations of a SUP are adhered to, and to provide timely on-site guidance to seismic survey personnel would likely increase avoidance of impacts to soils.

2 – Required use of airboat and lightweight tracked vehicles to the maximum extent possible for shot hole drilling to minimize rutting and soil compaction in sensitive wetland and transitional upland habitats.

3 – Required use of pumps and hose lays to provide water to the drilling site from suitable surface water sources to the maximum extent possible to reduce soil disturbance from digging pits.

4 – Restricting passes of mechanized equipment along shot and receiver lines to the absolute minimum necessary, required offsetting of vehicular passes along lines when necessary, prohibition of cross-country travel by mechanized equipment, required use of existing waterways, levees, and roads by mechanized equipment to enter and exit seismic lines, and required distribution and retrieval of receiving equipment by foot whenever possible will minimize soil compaction, rutting, and vegetation damage.

5 – Required site restoration and shot hole and pit locations by completely leveling displaced soils to pre-existing surface elevations will minimize soil disturbance.

6 – Required use of special precautions when crossing waterway and pond shorelines with mechanized equipment will minimize soil compaction, rutting, and subsequent erosional loss of marsh soils.

7 – Required restoration of all soil damages as nearly as possible to original conditions and/or mitigation for damages resulting from seismic operations. This includes required restoration of and mitigation for rutting and compaction of soils, which without restoration could impact plant communities. Where direct restoration is not possible, required mitigation will include implementation of projects, which will preclude long-term hydrological alterations (especially increased saltwater intrusion) that could result from unavoidable soil and/or vegetation damages. Examples of restoration/mitigation projects which would prevent increased saltwater intrusion include hydrologic restoration projects restore existing waterways to historic dimensions through construction of passive or active water control structures, restoring shorelines along existing waterways, and erosion-abatement projects along the Gulf Intracoastal Waterway and Gulf of Mexico shoreline.

6.2 WATER

The impacts of the proposed seismic survey upon water can be categorized as effects on quality of surface water, effects on quality of groundwater, and effects upon water quantity used in shot hole drilling operations.

Generally, the quality of surface water in the vicinity of the seismic survey will not be impaired by the seismic activity. However, shallow or ephemeral ponds may have increased turbidity due to the passage of heavy equipment. The surface waters of the ponds and marshes may have increased turbidity due to the activity of airboats in the vicinity of the drills and the activities of the drills themselves. This effect will be short-term and localized. However, increased water turbidities during the growing season could reduce production of submerged aquatic vegetation in those wetlands impacted. Some species, like water-shield, are extremely sensitive to increased turbidity.

The groundwater protection depth for Jefferson and Chambers counties varies depending on location. The stated depth of shot holes for the proposed project will be 80-100 feet; shot hole depth will be adjusted, as necessary, to eliminate any potential impacts to groundwater. No shot holes will be drilled in excess of 100 feet within McFaddin and Anahuac NWRs. Suemaur has submitted a request for water quality certification from the Texas Council on Environmental Quality. Suemaur will comply with recommendations contained in the water quality certification.

The seismic survey will require moderate quantities of water for the drilling of shot holes. The amount required will have minimal or no impact to surface water quantities within the Refuges.

6.2.1 Alternative A. No Action. The USFWS Would Not Issue a SUP for the 3-D Seismic Survey

Under this Alternative, it is expected that impacts to surface and groundwater quality would be greater than the Proposed Action as a consequence of the lack of specific guidance on mitigative measures to minimize impacts to water resources, which would be stipulated in the SUP and strictly adhered to by Suemaur and Veritas. Examples of normal seismic operations and subsequent impacts to water resources that could be reasonably anticipated through project activities not governed by a SUP include:

> 1 - Not using trained environmental monitors to serve as daily liaisons with Refuge staff, to ensure provisions and stipulations of a SUP are adhered to, and to provide timely on-site guidance to seismic survey personnel would likely increase avoidance of impacts to surface and ground water quality.
>
> 2 - Laying out shot and receiver lines and subsequent conduct of operations along lines without full consideration of possibilities to avoid sensitive habitat, wildlife, or other natural resource features would likely increase impacts to surface water quality. For example, increased travel of airboats and mechanized equipment and increased drilling activity would occur in open water wetland habitats, resulting in increased water turbidities in those wetlands with subsequent impacts to submerged aquatic vegetation.

6.2.2 Alternative B. Proposed Action. The USFWS Would Issue a SUP for the 3-D Seismic Survey

Under this Alternative, impacts to water resources would be less than under Alternative A, because of the USFWS' management of the seismic operations through the SUP, including monitoring of the seismic operations to ensure strict adherence by Suemaur and Veritas to the SUP's provisions and stipulations. This includes the requirement for restoration of and/or mitigation for any unavoidable damages. Examples include:

> 1 – Required use of trained environmental monitors to serve as daily liaisons with Refuge staff, to ensure provisions and stipulations of a SUP are adhered to, and to provide timely on-site guidance to seismic survey personnel, will eliminate or at least reduce avoidable impacts to water resources.

2 – Required full consideration of possibilities to avoid sensitive habitat, wildlife, or other natural resources in the laying out of shot and receiver lines and subsequent conduct of operations along lines, and avoidance of sensitive features discovered during the course of seismic operations by shifting lines and operations will eliminate or minimize avoidable impacts to surface water quality. For example, required avoidance by mechanized equipment of small open water wetland habitats supporting high production of submerged aquatic vegetation along shot and receiver lines will minimize impacts on water turbidities and subsequent impacts to submerged aquatic vegetation.

6.3 VEGETATION

Vegetation in the project area will be affected primarily by mechanized vehicular traffic along the shot and receiver lines, and locally at each shot hole location. Some vegetation will be cleared or crushed by vehicle access, drilling, and pit digging.

Some unavoidable soil compaction and rutting from equipment passes along shot and receiver lines can reasonably be expected to occur due to seismic operations in wetland and transitional upland habitats within the project area. These impacts can in turn affect marsh hydrology and plant communities. Increases in water depths and inundation periods along compacted lines would likely cause changes in plant species composition. In cases of severe compaction or rutting, altered hydrological conditions could favor establishment of invasive plants like cattail and common reed. In tidally influenced marshes, compacted lines could increase the potential for saltwater intrusion. Such impacts would likely cause plant community changes in affected areas by reducing the abundance of less salt-tolerant plant species. Severe compaction or rutting could increase saltwater intrusion by leading to the creation of new channels over time. Any such impacts from seismic survey activities would likely be manifested over a long-term period of several years after the survey is completed. Saltwater intrusion into coastal freshwater marsh systems (like those within the project area) can cause extensive plant mortality and erosion of highly organic marsh soils, leading to marsh loss (the conversion of vegetated emergent marsh to open water). Marsh loss resulting from saltwater intrusion, land subsidence, sea level rise, and other factors is a major problem affecting coastal marsh ecosystems along the upper Gulf Coast of Texas (Moulton *et al.* 1997). Tidal marshes in the eastern and western portions of McFaddin NWR and southeastern portions of Anahuac NWR are particularly sensitive and susceptible to marsh loss.

6.3.1 Alternative A. No Action. The USFWS Would Not Issue a SUP for the 3-D Seismic Survey

Under this Alternative, it is expected that impacts to habitats and vegetation would be greater than the Proposed Action as a consequence of the lack of specific guidance on mitigative measures to minimize impacts to water resources, which would be stipulated in the SUP and strictly adhered to by Suemaur and Veritas. Examples of normal seismic operations and subsequent impacts to vegetation that could be reasonably anticipated through project activities not governed by a SUP include:

1 - Not using trained environmental monitors to serve as daily liaisons with Refuge staff, to ensure provisions and stipulations of a SUP are adhered to, and to provide timely on-site guidance to seismic survey personnel would likely increase avoidable impacts to vegetation.

2 - Laying out shot and receiver lines and subsequent conduct of operations along lines without full consideration of possibilities to avoid sensitive habitat, wildlife, or other natural resource features would likely increase avoidable impacts to vegetation.

3 – Increased use of terra-tired drilling and water rigs in wetland and transitional upland habitats. This would increase impacts to vegetation along the shot lines, and increase rutting and soil compaction, which would increase the potential for impacts to hydrological conditions and subsequent impacts to vegetation.

4 – Increased digging pits to obtain water at the drilling sites rather than utilizing pumps and hose layouts to obtain water from available surface water resources. This would result in increased soil disturbances, increased potential for invasion from undesirable invasive plant species, and increased plant mortality at the shot hole locations.

5 – Increased passes of mechanized equipment on shot and receiver lines, more frequent instances of repeated passes over the same areas, cross-country travel by mechanized equipment, and increased use of mechanized equipment to distribute and retrieve receiving equipment. This would result in increased mortality of plants along the shot and receiver lines, and increased soil compaction affecting larger areas, which could increase the potential for altering hydrological conditions with subsequent impacts to vegetation.

6 – Not restoring soil surface elevations at shot holes and water pits by leaving drilling and pit cuttings as is, resulting in increased soil disturbance. This would result in increased potential for invasion by undesirable invasive/exotic plant species.

7 – Not taking special precautions to prevent rutting and subsequent erosion at particularly susceptible locations including the shorelines of waterways and ponds. This would result in increased plant mortality and vegetation damage at these locations.

8 – Not taking special precautions to prevent the spread and/or introduction of undesirable invasive/exotic aquatic and terrestrial plant species, which could result in additional infestations and subsequent negative impacts to native vegetation and wildlife.

6.3.2 Alternative B. Proposed Action. The USFWS Would Issue a SUP for the 3-D Seismic Survey

Under this Alternative, impacts to vegetation and habitats would be less than under Alternative A, because of the USFWS' management of the seismic operations through the SUP, including monitoring of the seismic operations to ensure strict adherence by Suemaur and Veritas to the

SUP's provisions and stipulations. This includes the requirement for restoration of and/or mitigation for any unavoidable damages. Examples include:

1 – Required use of trained environmental monitors to serve as daily liaison with Refuge staff, to ensure provisions and stipulations of a SUP are adhered to, and to provide timely on-site guidance to seismic survey personnel will eliminate or at least reduce avoidable impacts to vegetation.

2 – Required full consideration of possibilities to avoid sensitive habitat, wildlife, or other natural resources in the laying out of shot and receiver lines and subsequent conduct of operations along lines, and avoidance of sensitive features discovered during the course of seismic operations by shifting lines and operations will eliminate or minimize avoidable impacts to vegetation. For example, lines and operations would be shifted to avoid small stands of vegetation containing rare plant communities such as remnant stands of native prairie and coastal woodlots.

3 – Required use of airboat and lightweight tracked vehicles to the maximum extent possible for shot hole drilling to minimize vegetation damage along the shot lines, and decreased rutting and soil compaction in sensitive wetland and transitional upland habitats, which will decrease the potential for hydrological impacts and subsequent impacts to vegetation.

4 – Required use of pumps and hose layouts to provide water to the drilling sites from suitable nearby surface water sources (to the maximum extent possible) will reduce plant mortality and soil disturbance from digging pits.

5 – Restricting passes of mechanized equipment along shot and receiver lines to the absolute minimum necessary, required offsetting of vehicular passes along lines when necessary, prohibition of cross-country travel by mechanized equipment, required use of existing waterways, levees, and roads by mechanized equipment to enter and exit seismic lines, and required distribution and retrieval of receiving equipment by foot whenever possible will minimize vegetation damages, soil compaction, and rutting.

6 – Required site restoration of shot hole and pit locations by completely leveling displaced soils to pre-existing surface elevations will minimize soil disturbance and the potential for invasion by nuisance invasive/exotic plant species.

7 – Restricting crossings of waterway and wetland shorelines to the absolute minimum needed and required use of special precautions when crossing waterway and pond shorelines with mechanized equipment will minimize vegetation damage and soil compaction, rutting, and subsequent erosional loss of marsh soils.

8 – Required avoidance of small natural and managed open water wetland habitats by mechanized equipment along shot and receiver lines, which will minimize impacts on water turbidities and subsequent impacts on submerged aquatic vegetation.

9 – Required special precautions to prevent the spread and/or introduction of nuisance/invasive/exotic and terrestrial plant species, including thorough inspection and cleaning of vehicles.

10 – Required restoration of vegetation damages as nearly as possible to original conditions and/or mitigation for vegetation damages resulting from seismic operations. This includes required restoration of and mitigation for rutting and compaction of soils, which without restoration could impact plant communities. Restoration of vegetation damages will include revegetation and control of invasive/exotic plant species. Where direct restoration is not possible, required mitigation will include implementation of projects, which will preclude long-term hydrological alterations (especially increased saltwater intrusion) that could result from unavoidable soil and/or vegetation damages. Examples of restoration/mitigation projects which would prevent increased saltwater intrusion include hydrologic restoration projects restore existing waterways to historic dimensions through construction of passive or active water control structures, restoring shorelines along existing waterways, and erosion-abatement projects along the Gulf Intracoastal Waterway and Gulf of Mexico shoreline.

6.4 WILDLIFE

Seismic survey activities are of a degree of intensity such that it is likely that use of Refuge habitats by migratory birds, including waterfowl, shorebirds, wading birds, and songbirds would be reduced within the project area, especially in the immediate area of seismic activities during the drilling of shot holes, laying out and picking up of receiving equipment, and shooting activities that involve concentrated periods of mechanized equipment use in localized areas. These disturbances could displace migratory birds, at least temporarily, to adjacent habitats, but in some cases, the quality of these habitats may be lower. It is expected that these disturbance impacts would be short-term and temporary.

The proposed seismic survey could overlap with the fall migration of early migrating waterfowl, primarily Blue-winged teal, and several shorebird species, which can be present in large numbers on the Refuges during this period. However, seismic survey activities at this time will be occurring only in the western reaches of the project area, and large areas of suitable, undisturbed habitats will be available in other Refuge portions. Disturbances caused by seismic survey activities conducted later in the fall or winter could alter use patterns by much larger concentrations of migratory waterfowl and other wetland-dependent birds, over a larger area and for a longer period of time.

The initial and final phases of the proposed seismic survey will overlap with spring and fall migration of several species of raptors including the Arctic Peregrine Falcon. Peregrine falcons migrate through McFaddin and Anahuac NWRs during these periods, and are occasionally present within the Refuges in low numbers during winter. This species may be displaced by seismic survey activities, but is highly mobile and displacement would likely be only temporary.

The mottled duck is a resident waterfowl species which nests and rears young on the McFaddin and Anahuac NWRs. Peak nesting of this species in the region occurs in March, April, and May

(Stutzenbaker 1988), but later nesting and re-nesting does occur throughout the summer. In some cases, disturbance from seismic survey activities could result in reduced nesting success for mottled ducks and other nesting birds (through possible nest abandonment or increased susceptibility to nest predation). Adult mottled ducks generally complete their molt by late August. During their molt, they are flightless and more susceptible to disturbance. Immature or flightless birds could be disturbed and displaced by seismic survey operations, which could make them more susceptible to predation and other sources of mortality.

The 3-D seismic survey's impact on resident wildlife in the project area will primarily be short-term. In general, habitat exists for wildlife to emigrate from the immediate vicinity of the proposed operations to similar adjacent habitats, which will be unaffected by project operations. Small mammal, amphibian, and reptile populations may experience some local loss of individuals and change in species composition for a short time. These local losses are not expected to affect population size or stability, and individual losses will be replaced over several generations of each population. Larger mammals are more highly mobile, and will be capable of avoiding the seismic survey operations.

6.4.1 Alternative A. No Action. The USFWS Would Not Issue a SUP for the 3-D Seismic Survey

Under this Alternative, it is expected that impacts to migratory birds and other wildlife would be greater than the Proposed Action as a consequence of the lack of specific guidance on mitigative measures to minimize impacts to habitats and wildlife resources, which would be stipulated in the SUP and strictly adhered to by Suemaur and Veritas. Examples of normal seismic operations and subsequent impacts to wildlife that could be reasonably anticipated through project activities not governed by a SUP include:

> 1 – Conduct of the seismic survey outside of the seasonal timeframes specified by the USFWS, which could be during the periods of highest migratory bird use (fall and spring migrations and wintering periods). Conducting seismic operations during migrational or wintering periods would result in greater overall disturbance impacts to migratory waterfowl, shorebirds, wading birds, and other wetland-dependent migratory birds than operations conducted during the April 15 to October 15 seasonal timeframe specified by the USFWS.
>
> 2 – Not using environmental monitors to serve as daily liaison with Refuge staff, to ensure provisions and stipulations of the SUP are adhered to, and to provide timely onsite guidance to seismic survey personnel would likely increase avoidable disturbance impacts to migratory birds and other wildlife.
>
> 3 – Not laying out shot and receiver lines and conducting subsequent operations with full consideration of possibilities to avoid sensitive habitat, wildlife or other natural resource features, and not shifting operations to avoid sensitive features encountered during the course of operations, could increase avoidable disturbance impacts to migratory birds and other wildlife.

6.4.2 Alternative B. Proposed Action. The USFWS Would Issue a SUP for the 3-D Seismic Survey

Under this Alternative, impacts to migratory birds and other wildlife would be less than under Alternative A, because of the SUP's provisions and specific stipulations aimed at protecting migratory birds and other wildlife and strict adherence by Suemaur and Veritas to the SUP's provisions and stipulations. Examples include:

1 – Restricting the seismic operations to the timeframe from April 15 to October 15. This timeframe results in the avoidance of operations during peak periods of migratory bird utilization on the Refuges. Peak concentrations of migrating and wintering waterfowl, shorebirds, wading birds and other wetland-dependent migratory birds on the Refuges occur during spring and fall migrations and through winter. This seasonal timeframe also avoids most of the peak nesting period for mottled ducks for those activities of the seismic operations with the greatest potential for disturbance impacts, i.e., the drilling, laying of receiver equipment, and shooting portions of the seismic operations. Restricting the seismic survey to this timeframe would result in minimizing potential disturbance impacts to migratory birds.

2 – Required east to west movement of the seismic survey operations will minimize potential disturbance impact to nesting mottled ducks by ensuring that drilling, shooting, and recording operations do no occur in portions of the Refuge containing most mottled duck nest habitat (located in the central and western portions of the McFaddin National Wildlife Refuge) until after the peak nesting period.

3 – Required use of trained environmental monitors to serve as daily liaison with Refuge staff, to ensure provisions and stipulations of the SUP are adhered to, and to provide timely onsite guidance to seismic survey personnel would likely increase avoidance of disturbance impacts to migratory birds and other wildlife.

4 – Required full consideration of possibilities to avoid sensitive habitat, wildlife, or other natural resource features in laying out of shot and receiver lines and subsequent operations along lines, and avoidance of sensitive features discovered during the course of seismic operations by shifting lines and operations will eliminate or minimize avoidable disturbance impacts to migratory birds and other wildlife. For example, lines and operations would be shifted to avoid active bird and alligator nests, muskrat dens, wading bird rookeries and wildlife concentrations of immature and molting mottled ducks.

6.5 THREATENED AND ENDANGERED SPECIES

Bald Eagles (federally listed as threatened) have historically occurred in Jefferson and the surrounding counties, particularly Liberty County, but are not likely to be present on the Refuges during the proposed seismic survey.

Brown Pelicans (federally listed as endangered) may be found within the project area throughout the year. Pelican roosting or foraging along the Gulf shoreline or GIWW will be displaced by survey activities, but this species is highly mobile and displacement will be temporary and should not have measurable impacts on the species. Most seismic survey activities will occur in inland wetland habitats away from the coast and GIWW, the Brown Pelican would not be adversely impacted.

The occurrence of a small number of piping plovers (federally listed as threatened) within the seismic survey area is a possibility along bayous and mudflats and the Gulf Shoreline. Piping Plovers would be displaced by seismic survey activities. This temporary displacement may have some negative effects on the plover's time and energy budgets, however, this species is also highly mobile, will easily avoid seismic activities, and would not be adversely impacted. The environmental monitors will be alert for the possible presence of these birds; the environmental monitors will then work with the MNWR and ANWR Managers and the seismic crews to minimize disturbance, as much as feasible, to these birds.

Threatened or endangered sea turtles (listed in Section 4.6.6) occur only in the Gulf of Mexico and in larger coastal bays and lagoons, some of which are within the immediate area of influence of the proposed seismic program. Sightings of stranded turtles along the Gulf shoreline will be immediately reported to the environmental monitors and Refuge Manager.

As seismic survey activities are not expected to adversely impact any threatened or endangered species, potential impacts to threatened or endangered species would not differ between the two alternatives. However, conduct of the seismic survey under the USFWS SUP would result in a greater probability that the presence of a T&E species on the Refuge during the seismic survey operations would be documented, and provide an opportunity to alter operations to avoid even short term disturbance and displacement of these rare species.

6.6 HISTORICAL AND ARCHEOLOGICAL RESOURCES

Most of the impact from the proposed seismic survey will be related to surface disturbance. This disturbance on the Refuges will be limited to low ground-pressure tracked vehicles, airboats, limited use of terra tire drill and water vehicles, and drilling of seismic shot holes. All other vehicular traffic will be limited to existing roads and levees. Subsurface disturbance from the drills will be limited to the approximately four-inch hole drilled at each shot hole location.

A cultural resource avoidance plan, including low impact methodology will be prepared that identifies the proposed low impact seismic methodology, buffer zones of 100' radius around all known cultural/historical sites and high probability areas, and procedures that will be followed in the case of inadvertent discoveries. These measures will be followed throughout the entire seismic survey area, both on and off the Refuges; therefore, impacts to cultural and historic resources should not differ between the two alternatives. However, the daily oversight of seismic program activities provided by the USFWS and environmental monitors under the Proposed Action should provide a higher level of protection of known sites, high probability areas, and more timely reporting and protection of any inadvertent discoveries of cultural or historic artifacts or other resources.

6.7 LAND USE AND SOCIOECONOMIC RESOURCES

6.7.1 Land Use

There will be no permanent land use changes resulting from the proposed seismic survey. Changes of vegetative cover type are expected to be temporary and are discussed in Section 6.3. The project is scheduled for completion in October 2006, before the beginning of both goose and general waterfowl hunting seasons. The extent to which the proposed project will disturb and displace waterfowl and thus decrease the quality of hunting during the early goose and general waterfowl seasons is currently unknown. The seismic survey activities will be modified or suspended within designated Teal hunting areas during the "Early Teal Hunting Season" tentatively scheduled for 16 days in September, if determined to be in conflict with the hunt by the NWR Manager.

USFWS management activities occurring on the Refuge during the timeframe of the seismic survey could include prescribed burning, invasive plant species control, wildlife and vegetation surveys and monitoring, and scientific research. Cattle grazing operations, generally occurring on the refuge from October to April/May, will not be affected by the seismic program. All alterations to fence lines will be repaired to their original condition before termination of seismic operations. Other infrastructure such as levees and cattlewalks damaged by the seismic operations will be repaired to their original condition.

6.7.1.1 Alternative A. No Action. The USFWS Would Not Issue a SUP for the 3-D Seismic Survey

Under this Alternative, it is expected that increased conflicts with Refuge public use and management programs including prescribed burning, invasive plant species control, controlled grazing, wildlife and vegetation surveys and monitoring, and scientific research would occur as a consequence of the lack of specific guidance on mitigative measures to minimize these conflicts that would be stipulated in the SUP.

6.7.1.2 Alternative B: Proposed Action. The USFWS Would Issue a SUP for the 3-D Seismic Survey.

Under this Alternative, conflicts with Refuge public use and other management programs including prescribed burning, invasive plant species control, controlled grazing, wildlife and vegetation surveys and monitoring, and scientific research would be less than under Alternative A because of the USFWS management of the seismic activities through the SUP and Suemaur's and Veritas' commitment to conduct the 3-D seismic survey according to all conditions and stipulations of the SUP.

6.7.2 Socioeconomic Resources

The proposed seismic exploration program will provide the local communities closest to the Refuges (High Island, Winnie, Anahuac) with short-term positive economic benefits. These

benefits will result from local spending of crew per diem, local purchase of some supplies and fuel and, potentially, local leasing or contracting of auxiliary services.

The total seismic crew will reach a maximum of 50 to 70 employees. Approximately 50 percent of the crew will be technically skilled; the remainder will be semi-skilled to unskilled labor. The technical staff will average $10.00 to $12.00 per hour and the labor staff will average $5.50 to $7.50 per hour. The crew will typically work 80 to 90 hours per week. Effective per diem will be in the range of $25.00 to $35.00 per day per crew member to cover food and accommodations. Crew accommodations will probably be in the vicinity of Winnie, Texas. Weekly spending by the crew, including both personal and project-related expenditures, should range from $150,000 to $200,000. Local lodging, fuel stations, and food establishments will benefit from the presence of workers in the cities of Winnie, Anahuac, High Island and surrounding areas.

The seismic crew will typically be fully staffed from Veritas's operations center. However, routine turnover is expected in the unskilled labor group. These laborers may be replaced locally, if available. Thus, a small short-term source of employment may accrue to the local communities. All newly hired laborers will be given appropriate safety and environmental awareness training prior to startup of work duties. It is estimated that 10 to 15 employees could come from the local communities. These jobs might potentially result in a local payroll of $6,000 to $10,000 for the project, depending on how many people apply and are qualified for the positions offered. Any turnover in the technical staff is usually replaced by trained personnel from Veritas's operations center.

There would be no difference in impacts to socioeconomic resources between Alternatives A and B.

7.0 REGULATORY FRAMEWORK

7.1 TEXAS COASTAL MANAGEMENT PROGRAM

Coastal Zone Management Act of 1972—The Texas Coastal Management Program (TCMP), which is administered by the Texas Coastal Coordination Council (TCCC), is under the Texas General Land Office. The Final Environmental Impact Statement (FEIS) for the TCMP was released in August 1996. The federal consistency requirement of the TCCC for the project was met through the U.S. Army Corps of Engineers Nationwide Permit #6 process.

7.2 FLOODPLAIN MANAGEMENT

Executive Order (EO) 11988, Floodplain Management—The project is situated in a floodplain. The activities associated with the proposed action must be located in the floodplains of McFaddin and Anahuac NWRs to make the geophysical prospecting feasible. The proposed action will not induce increased flooding in developed areas and will not contribute to increased future flood damage.

7.3 PROTECTION OF WETLANDS

Executive Order (EO) 11990, Protection of Wetlands—The proposed action has been analyzed for compliance with EO 11990. Every attempt has been made to minimize impacts and preserve the value of wetland areas. Impacts to wetlands from the proposed action have been identified in the assessment. Special actions, including the use of airboats and specially designed tracked vehicles, have been developed to mitigate impacts on wetlands.

7.4 ENDANGERED SPECIES ACT CONSULTATION

Endangered Species Act of 1973, as amended—Interagency consultation procedures under Section 7 of the Act were conducted with the Clear Lake Ecological Services Field office of the USFWS.

7.5 U.S. ARMY CORPS OF ENGINEERS— NATIONWIDE PERMIT

The applicant requested implementation of Nationwide Permit #6, which covers the activities of seismic programs. Nationwide Permit #6, "Survey Activities" covers "seismic exploration operations, and plugging of seismic shotholes...." The applicant will comply with the terms and conditions and all requirements of the U.S. Army Corps of Engineers permit (**SWG-06-06-002**, **applied for**), which includes compliance with the Nationwide General/Regional Conditions, and the Texas Commission on Environmental Quality's Best Management Practice Guidelines for Nationwide Permit # 6.

7.6 NATIONAL HISTORIC PRESERVATION ACT – STATE HISTORIC PRESERVATION OFFICER NOTIFICATION

The applicant hired Brazos Valley Research Associates to complete a file search of known cultural and historic resources within the project area. This assessment is based on a search of the site files at the Texas Archaeology Research Laboratory (TARL). This file search revealed 8 sites and one cemetary within the McFaddin NWR and Anahuac NWR portions of the project area. Several cultural sites were identified outside of Refuge boundaries, but within the seismic survey area. In addition, high probability areas were identified. A cultural resource avoidance plan, including low impact methodology, is being prepared by a State-certified archaeologist. This document will describe low impact methodology, avoidance measures for known sites and high probability areas, and procedures to be followed in the event of inadvertent discovery. The USFWS has notified the State Historic Preservation Officer under Section 106 of the National Historic Preservation Act.

7.7 TEXAS COUNCIL ON ENVIRONMENTAL QUALITY – WATER QUALITY CERTIFICATION

Suemaur has submitted a request for water quality certification from the Texas Council on Environmental Quality. Suemaur will comply with recommendations contained in the water quality certification.

7.8 TEXAS GENERAL LAND OFFICE

Some submerged tracts of land, Permanent School Fund tracts and/or Relinquishment Act tracts, within or adjacent to the vicinity of the Refuge are owned by the State of Texas and administered by the Texas General Land Office (GLO). An application for a permit to perform seismic work on state-owned lands was submitted directly by the applicant or the seismic contractor to the Minerals Leasing Division of the GLO.

7.9 NATIONAL MARINE FISHERIES SERVICE

The USFWS has consulted with the National Marine Fisheries Service on impacts to Essential Fish Habitat to satisfy the consultation procedures outlined in 50 CFR Section 600.290 of the regulation to implement the essential fish habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

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APPENDIX A

Veritas' Drug and Alcohol Policy

DRUG AND ALCOHOL POLICY OVERVIEW

Veritas DGC Land has a comprehensive drug and alcohol policy in place to create a safer work place for its employees. All applicants selected for possible employment will be subject to a drug and alcohol screening to determine if they qualify for employment. Veritas DGC Land utilizes a random selection process to screen personnel already working on site. The crew will test 10 % of the personnel, on the crew, per week for drugs and alcohol. Any integrity critical classified personnel will be taken to the approved lab/clinic for testing.

All personnel will have been drug and alcohol tested within 6 months prior to job start.

The drug and alcohol policy is reviewed with all employees and all potential new employees. All personnel are made aware of the consequences of violating this company policy. If an employee tests positive for any of the five drugs tested, the individual is subject to immediate termination. If an employee tests .04% or higher on an alcohol test then the individual is subject to immediate termination.

If an employee challenges the positive test results, he/she is then taken to a certified clinic/lab to take another drug and/or alcohol test to verify the results of the first test. If the lab tests prove negative he/she returns to work without suspension and receives full compensation for time away from work while awaiting the test results. If he/she tests positive then he/she is subject to immediate termination.

Testing Equipment

A ROCHE Diagnostics Test Kit is used to conduct the drug screening, which tests lower than DOT on some of the drugs. The kit has a $\pm$ 4 margin of error on the results.

A Q.E.D. saliva alcohol test will be used for alcohol testing. It's set to test from .01 % or higher alcohol levels in the employee's system. For the remainder of this document these two items will be referred to as the "testing equipment".

Any positive results will be dealt with according to Veritas DGC Land company policy and/or contractual requirements.

Safety Sensitive

For pre-access Drug and Alcohol screening, all safety sensitive personnel will have been tested (documentation required) within 6 months prior to starting work on the project or a pre-job test will be performed at orientation per contractual requirements. If selected in random test, they will submit a specimen for test using the Roche diagnostics testing kits. Alcohol testing will be performed at the crew office using the device mentioned above or its equivalent. The following personnel are considered Safety Sensitive personnel.

- Senior Observer
- Survey Crew Manager
- Vibrator Operators
- Drill Push
- Powder man
- Drillers
- Driller Helpers
- Line Clearance Foreman
- Shooters
- All drivers (Including sub-contractors)

Integrity Critical Personnel

For pre-access Drug and Alcohol screening, all integrity critical personnel will be taken to a testing facility (lab) to conduct a non-DOT drug test prior to starting work on a project and once annually as per contractual requirements. If selected in random test, they will be escorted to the nearest testing facility (lab) where the drug screen will be performed and analyzed. Alcohol testing will be performed at the crew office using the device mentioned above or its equivalent. The following personnel are considered ICP's.

- Helicopter Pilots
- Helicopter Engineers
- Project Manager
- HSE Advisor
- Recording Crew Manager

CDL Drivers

Veritas DGC Land already adheres to DOT regulations by testing its DOT drivers once per year, but will do additional testing when personnel are selected in a random drug/alcohol test using the testing equipment at the crew level. If a positive result occurs on the drug screen and the individual does not agree with the results, then that individual will be escorted to the nearest testing facility (lab) where the test will be performed and analyzed. Alcohol testing will be performed at the crew office using the testing equipment mentioned above. Any positive results will be dealt with according to Veritas DGC Land company policy and/or contractual requirements.

Other Personnel/Contactors

Pre-access Drug and Alcohol screening for all other personnel will consist of using the crew level testing equipment mentioned above or at an approved clinic/lab. If selected in a random drug/alcohol test, the test will be performed at crew level using the testing equipment available on crew. If a positive result occurs on the drug screen and the individual does not agree with the results, then that individual will be escorted to the nearest testing facility (lab) where the test will be performed and analyzed. Alcohol testing will be performed at the crew office using the testing equipment mentioned above. Any positive results will be dealt with according to Veritas DGC Land company policy and/or contractual requirements.

Post Incident Testing

Post-incident drug and alcohol testing will be conducted by the medical facility the victim is taken to for medical attention (if required). If the victim does not require medical attention at a clinic or hospital offsite and is not a CDL driver he/she will be tested on site with crew's testing equipment. If a positive result occurs on the drug screen and the individual does not agree with the results, then that individual will be escorted to the nearest testing facility (lab) where the test will be performed and analyzed. Alcohol testing will be performed at the crew office using the testing equipment mentioned above. Any positive results will be dealt with according to Veritas DGC Land company policy and/or contractual requirements.

Reasonable Suspicion/For Cause

If any individual involved with a Veritas project is thought to be under the influence of alcohol or a controlled substance that person is subject to a controlled substance or alcohol test. Individuals classified as Safety Sensitive or Integrity Critical personnel will be tested at a certified lab/clinic. All other employees will be tested on crew with the above, mentioned testing equipment. Any positive results will be dealt with according to Veritas DGC Land company policy and/or contractual requirements.