

7 February 2001

TO: All Potential Proposers

FROM: Barataria-Terrebonne National Estuary Program
Scientific-Technical Committee

SUBJECT: Request For Submission of Scope of Services for Marsh Dieback and Nutria Control Emergency Response

During the spring and summer of 2000 in coastal Louisiana, an unusually extensive and rapidly spreading dieback of the normally lush green saltwater marsh grass *Spartina alterniflora* was discovered. Approximately 20,000 acres of marsh grass have already converted from dense vegetation to open mud flats with little or no vegetation and approximately 260,000 acres of marsh have been identified as being moderately or severely impacted. The Saltwater Marsh Dieback was declared an emergency by Louisiana Governor Mike Foster in the form of Executive Proclamation #55-MJF-2000 issued on October 23, 2000.

The Scientific-Technical Committee of the Barataria-Terrebonne National Estuary Program (BTNEP STC) invites you to submit a scope of services to conduct research on projects related to the *Spartina alterniflora* dieback and nutria control as described below. Scopes of services shall be prepared according to the instructions and information provided. Consideration of scope of services shall be limited to those proposers who meet the prerequisites listed. Submission of scope of services with associated funding greater than \$50,000 by private sector entities would have to go through the formal RFP process. The typical formal RFP process takes approximately four months, which exceeds the time constraints of this emergency response. Therefore, submission of scope of services greater than \$50,000 shall be limited to Louisiana state agencies, accredited Louisiana public universities and colleges, and federal institutions.

Scope of services shall provide a straightforward and concise presentation, adequate to satisfy the requirements of the request for scope of services. Elaborate scope of services are neither required nor desired. The BTNEP STC reserves the right, without qualification, to select any scope of services, to reject any or all scope of services, and to exercise its discretion and apply its judgement with respect to any scope of services submitted. The BTNEP STC may select a scope of services, based on initial offers received, without discussion of such offers. Proposers are, therefore, advised to submit their initial offers on the most favorable terms possible. Once the BTNEP STC selects a scope of services, this selection shall be recommended to the Louisiana Wetlands Conservation and Restoration Authority (SWA). If the recommended selection is provisionally approved by the SWA, it shall be forwarded to the Secretary of the Louisiana Department of Natural Resources. This request

for scope of services is not intended and shall not be construed to commit either the BTNEP, the SWA or the LDNR to pay any costs incurred in connection with any proposal or to procure or contract for any services.

It is not intended that a proposer's conference be held. Any questions regarding this scope of services shall be submitted in writing to the BTNEP Director. Replies to such questions shall be posted on the BTNEP website (www.btnep.org) and the Brown Marsh website (www.lacoast.gov/brownmarsh/index.htm).

Please note that any or all proposers may be required to make an oral presentation of their proposed scope of services prior to final selection of the Contracting Party. If the BTNEP STC chooses to require oral presentations, those proposers selected to make such presentations shall be so notified by the BTNEP STC via telephone and presentations shall be made by proposers at a time and date assigned by the BTNEP STC.

Scope of Services Format

The format for the submission of scope of services for the Marsh Dieback and Nutria Control research tasks shall conform to the following requirements.

Proposals shall have 2.5 cm margins at the top, bottom and on each side. The type size shall be clear and readily legible, and conform to the following requirements: 1) the height of letters shall not be smaller than 10 point; 2) type density shall be no more than 15 characters per 2.5 cm.; (for proportional spacing, the average for any representative section of text shall not exceed 15 characters per 2.5 cm.); and 3) no more than 6 lines shall be within a vertical space of 2.5 cm. The type size used throughout the proposal shall conform to all three requirements. While line spacing (single-spaced, double-spaced, etc.) is at the discretion of the proposer, established page limits shall be followed. While the guidelines specified establish the minimum type size requirements, readability is of paramount importance and shall take precedence in selection of an appropriate font.

Scope of services shall be limited to a maximum of ten pages, including text and figures. Supplemental information regarding the qualifications of Principal Investigators, Project Directors, co-Principal investigators, co-Project directors or other staff shall be limited to a maximum of 10 pages per proposal with no more than two pages per individual. A supplement budget page shall be submitted including a cumulative task budget, subaward budgets and up to three pages of budget justification. Budgets shall clearly identify any personnel, fringe benefit, equipment purchased (all equipment purchased as part of contracts resulting from the scopes of services will be property of the state and shall be turned over to the state following completion of work), travel, supplies (including equipment rental) and indirect costs associated with completing the tasks described in the proposed scope of services.

There shall be a limit of 18% modified total indirect costs associated with the proposed Marsh Dieback and Nutria Control research projects. The contracts for Marsh Dieback and Nutria Control research projects shall be a payment upon task contract not to exceed the dollar amount proposed and a contract period of number months is scheduled with initiation of the contract period.

Ten (10) completed, signed paper copies and one electronic copy (submit in Adobe Acrobat version 4 - see Marsh Dieback and Nutria Control Information Format Standards) of the scope of services shall be received by Mr. Kerry St. Pe, Program Director, Barataria-Terrebonne National Estuary Program, Nicholls State University Campus, 320 Audubon Street, North Babington Hall, Room 105, Thibodaux, La. 70301 or P.O. Box 2663, Thibodaux, 70310, **no later than Wednesday, February 28, 2001, 4:00 p.m.**

Review and Selection

The Louisiana Wetlands Conservation and Restoration Authority and the Louisiana Department of Natural Resources Secretary under advisement from the BTNEP STC are ultimately responsible for selection of a Contracting Party to perform the work. The BTNEP STC shall evaluate and rank scope of services according to the following criteria and associated percentage weight:

- 1) Scope of services explains in detail how the contractor intends to accomplish the Task and give a description of what work shall be accomplished, who shall be responsible for the work, how the work shall be accomplished within the defined time frame. Describe collaborative efforts with other parties conducting associated tasks, as appropriate (Proposers are encouraged to make suggestions, drawing from their expertise, of alternate approaches that could be executed to make the product better).....50%
- 2) Qualifications of the personnel assigned to this project. (Relevant experience of the individuals actually conducting the work).....20%
- 3) When can the proposer begin working on the project, what is the proposed schedule of work and when is the anticipated completion date of the project. Clearly demonstrate that you have the capability of accomplishing the work defined in the scope of services within the time frame that is proposed. (Do you currently have the equipment or staff necessary to conduct the work, if not how do you plan to acquire them? What percentage of the total proposed work shall be accomplished by existing personnel?).....15%
- 4) Cost (Although cost will not be the overriding criterion for selection, the level of qualitative and quantitative effort to be made by the contractor and the cost thereof shall be considered).....15%

A separate scope of services shall be submitted for the completion of an entire task. Each scope of services shall address all aspects of that task. Sixteen tasks are listed in the four research areas of Causes, Status and Trends, Data Management and Synthesis, and Nutria Control. Scope of services for completion of only part of a task will not be considered.

Marsh Dieback and Nutria Control Research Information Format Standards

The goal of the information format standards is to make all data and information immediately

available and useable to the Marsh Dieback and Nutria Control Investigators and, within a set period of time, to the public. It is important that potential responders to the request for scope of services understand the final data formats and account for any additional time necessary to meet the format requirements. Use of trade names is not an endorsement by the government.

To increase efficiency all information and data shall be transferred and stored in a digital format. This includes scientific proposal, quarterly and final reports, raw and processed data (both spatial and temporal), and informational products. All datasets shall have updated metadata records and GPS coordinators for all data gathering areas. All spatial data shall be collected in World Geodetic Survey 84 and projected to Universe Transverse Mercator (UTM) and North American Datum (NAD) 83.

Reports (proposals, draft reports, progress reports, final reports, etc.)

Adobe Acrobat version 4

For more information: <http://www.adobe.com/products/acrobat/main.html>

Data (satellite imagery, hydrological, model output, etc.)

Temporal (i.e. data logging)

Microsoft Excel 2000

For more information: <http://www.microsoft.com/>

Spatial (i.e. map)

All spatial data will be collected in World Geodetic Survey 84 and projected to Universe Transverse Mercator (UTM) and North American Datum (NAD) 83.

Raster

Geo tiff

Vector

Arc Info Export File Format

For more information: <http://www.esri.com/>

Meta Data

Meta Data shall be written for all data gathering activities. The minimal Federal guidelines shall be used for spatial and temporal datasets. Spatial data shall follow the Federal Geographic Data Committee Meta Data standards <http://www.fgdc.gov/>
For more information on the Executive Order for Meta data creation for all Federal Funded projects: <http://sdms.nwrc.gov/pub/refinfo/exo12906.txt>

Information Synthesis (presentation, fact sheets, brochures, etc)

Brochures - Adobe Acrobat version 4

Information Approval Policies

The STC, shall review and approve the progress reports. Data or reports submitted in formats not described above shall not be accepted and request for payments shall be denied until submitted in proper formats. Included with those reports shall be any data that has been collected (pending QA/QC, not to exceed 3 months time) and the appropriate meta data. Once the report is accepted by the reviewer; the report, data, and meta data shall be posted to the Brown Marsh Web site. The progress report shall be made available immediately to the public. The data shall be made available, immediately following the QA/QC review, to the Marsh Dieback and Nutria Control Investigators for a period of two years. After two years, the data shall be made available to the public.

Following selection and approval of the investigators for each task, a kickoff meeting for the research team will convene in Baton Rouge to review contracting procedures with LDNR personnel and to coordinate collaboration between research activities. A mid-term workshop will be held in the fall of 2001 for the purpose of tracking and reporting on the progress of investigations. Proposal shall understand these meeting requirements and account for these in their scope of services.

MARSH DIEBACK AND NUTRIA CONTROL RESEARCH TASKS

A. STATUS AND TRENDS

Background

Attached you will find tasks descriptions to support the Status and Trends effort for 2000 Marsh Dieback. These tasks include a variety of methods to track brown marsh spread/recovery: fixed wing transects, helicopter transects, aerial photography, and LANDSAT imagery. Fixed wing and helicopter surveys are key in locating and determining the extent of marsh dieback. Aerial photography is important to provide high-resolution imagery for studying marsh dieback in relation to adjacent wetland areas. Satellite imagery can be used to monitor of large areas of wetlands across different salinity regimes.

Task I.1. Photointerpret, using stereo techniques and ground truthing, aerial infrared photographs of twelve 1:24,000 quadrangle maps of highly stressed saline marsh taken in the Barataria Terrebonne Estuary in the fall of 2000. The photographs are available at the lacoast.gov website. See Attachment A for list of quadrangles. Map these photographs to depict brown marsh location and stress severity using the brown marsh photointerpretation classification system in Attachment B. Compare the 2000 maps with 1998 aerial infrared photographs of the same quadrangles to indicate change from marsh to brown marsh.

Objective: Develop comprehensive baseline data and comparisons for the above areas, selected for their high brown marsh stress and restoration potential.

Rationale: The resulting GIS maps and digital data generated from the aerial photointerpretation and comparisons will provide the spatial data that is necessary for an assessment of the areas of potential brown marsh restoration and remediation, and future change detection.

Milestones: Quarterly Reports submitted to BTNEP office every three months. Completion of mapping and analysis within twelve months from funding. Draft of report and data sets submitted to BTNEP Scientific Technical Committee within 45 days thereafter. Final Report and Executive Summary submitted within 45 days of submission of draft report. Draft maps and data made available on the brown marsh website (www.lacoast.gov) as individual quadrangles are completed.

Anticipated Recommended Funding: \$75,600

Products: 1:24,000 scale format hardcopy maps (blue line copy), and ArcInfo export files of the brown marsh photointerpretation will be available via brown marsh website (<http://www.lacoast.gov/>). Quarterly, Draft and Final Reports, Executive Summary, data sets and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

Task I.2 Characterize brown marsh progression and/or recovery in brackish and saline marshes across the entire coast of Louisiana using Landsat imagery for two dates: one in the late summer/early fall of 2000 and the next in late summer/early fall of 2001.

Objective: Use satellite remote sensing technology for brown marsh monitoring and tracking to provide a full statewide perspective on the overall problem facing the state as well as the recovery of marshes from die-back.

Rationale: Remote sensing technology can be used to create detailed maps, and when combined within a Geographic Information System (GIS), remote sensing can be used to create a history of landscape changes. Products derivable from satellite time series will aid in defining the marsh dieback problem; its extent, selective associations, and rate of spread.

Milestones: Regional trend analysis for the 2000 imagery due three months from funding. Draft maps and data made available on the brown marsh website (www.lacoast.gov). Draft report and data sets on the 2000 image analysis due at the BTNEP office within four months of funding. For the 2001 imagery, maps and data due on the website within 3 months of the flight date. Draft Report and data sets due to BTNEP Scientific Technical Committee within four months of 2001 flight date. Final

Report and Executive Summary due to BTNEP Office within 30 days of submission of draft report.

Anticipated Recommended Funding: \$56,250

Products: Digital trend analysis geotiff files from late summer/early fall 2000 and late summer/early fall 2001 that measure and assess recovery. Draft and Final Reports, Executive Summary, data and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response published in the dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

Tasks 1.3: Characterize localized brown marsh areas using multi-resolution imagery and aerial photography to accurately map occurrence of marsh dieback

Objective: Relate field measurements of site specific canopy leaf optical properties, canopy density, and background to spectral signatures in the October 2000 aerial photos and September 2000 and late summer/early fall 2001 satellite imagery to accurately map occurrence and recovery of marsh dieback and to predict future occurrences.

Rationale: Ultimately, an effective method of confirming diebacks and predicting dieback onset may require the use of higher definition remote sensing systems, in conjunction with, aerial photography and field measurements. This is not only necessary for confirming the time series of marsh dieback, but it is also important for determining the spatial extent of contiguous dieback and mitigation appraisal, and to reduce costs for future mapping and delineations.

Milestones: Analysis for the 2000 aerial photos and imagery due three months from funding. Draft maps and data made available on the brown marsh website (<http://www.lacoast.gov/>). Draft report and data sets on the 2000 analysis results due at the BTNEP office within four months of funding. For the 2001 analysis, maps and data due on the website within 3 months of the flight date. Draft Report and data sets due to BTNEP Scientific Technical Committee within four months of 2001 flight date. Final Report and Executive Summary due to BTNEP Office within 45 days of submission of draft report.

Anticipated Recommended Funding: \$58,500

Products: Digital geotiff's that compare impacts of historical spectral signature from September 2000-Landsat imagery with impacts defined from October 2000 aerial photographs. Geotiff data which compares late summer/early fall 2001 Landsat imagery for healthy marshes with data from 2000 Landsat imagery and aerial photography. Digital data and a report analyzing the possibility of detecting future dieoff from various types of satellite imagery, aerial photography, and field investigations using models developed

from spectral plant stress and canopy reflectance data. Draft and Final Reports, Executive Summary, data and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

Task I.4 Obtain late summer/early fall 2001 aerial infrared photography covering the 12 quadrangle maps chosen in Task I.1. Rectify photography to produce a contiguous mosaic that will show the extent of the effected areas. Compare this to data generated from the fall 2000 aerial infrared photography to conduct change analyses for the quadrangle maps chosen in Task 1.1.

Objective: To obtain and interpret 2001 aerial infrared photography and conduct change analysis comparing 2000 and 2001 photography for 12 quadrangles in Barataria/Terrebonne.

Rationale: With the addition of a second flight, researchers will have the ability to track and monitor brown marsh movement and map trends that may help narrow possible causes of this phenomenon. The photography will also indicate the status of any remediation.

Milestones: A late summer/early fall flight with scanned photography available on the brown marsh website (<http://www.lacoast.gov/>) two months after flight. Rectification and change analysis available on the website nine months after flight. Draft Report and data sets due to BTNEP Scientific Technical Committee within 10 months of flight date. Final Report and Executive Summary due to BTNEP Office within 45 days of submission of draft report.

Anticipated Recommended Funding: \$123,000

Products: 1:24,000 scale color infrared aerial photography in digital tiff format will be available for downloading from web. Retified photo-mosaic of aerial photography in geotiff format, hardcopy and digital Arc export files of change analysis data will be developed and made available on the web. Draft and Final Reports, Executive Summary, data and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

Task I.5 During 2001, use standardized soil classification parameters to characterize soils to a minimum depth of 90 cm across dead, impacted and healthy zones of salt marsh at ten of the 20 study sites established in the fall of 2000. Use this characterization information to refine existing soil mapping units throughout the affected salt marsh area.

Objective: Determine whether there are differences in soil characterization parameters among the following zones: the non-affected perimeter on the gulf side, the transition where the dieback first becomes evident, the center of the dieback area, the transition on the inland side of the dieback, and the non-affected area on the inland side.

Rationale: Other scientists are proposing randomized, small plot studies in portions of the dieback areas. These studies are being designed assuming that the soils at all the sites are uniform. This soil study will establish whether or not the soils are, in fact, uniform. The existing soil surveys of the coastal zone were completed prior to the occurrence of the salt marsh dieback crisis. Soil survey mapping units, although based on site-specific data, do not describe soils in a manner that would account for the differentiation from unaffected areas, to impacted areas, to dead areas. Research conducted during 2000 sampled soils only at shallow depths and descriptions of the materials sampled were not recorded according to the standards of the national soil classification system.

Milestones: Quarterly Reports due to BTNEP Office every three months. Draft Report and data sets due to BTNEP Scientific Technical Committee within 11 months of funding. Final Report and Executive Summary due to BTNEP Office within 45 days of submission of Draft Report.

Anticipated recommended funding: \$71,000

Product: Lab data and a report of the soil classification variability across dieback zones and among sampled sites available on the brown marsh website (<http://www.lacoast.gov/>) as work is completed. Quarterly, Draft and Final Reports, Executive Summary, data and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

TASK I.6. Perform ground assessments of plant recovery and soil conditions during spring and fall of 2001 at the multiple field sites throughout the Barataria and Terrebonne Basins that were established in 2000.

Objective: Determine the recovery trajectories of specific established dieback sites located throughout the Barataria and Terrebonne Basins and identify changes in hydro-edaphic conditions responsible for recovery or the absence of recovery.

Rationale: Remote sensing, although essential for large spatial-scale tracking of recovery, must be supplemented with site-specific, ground-based evaluations to best characterize the environmental and biotic processes that allow recovery to occur or that may prevent any further recovery. This task will provide ground-based assessments of recovery that can be used as verification of remotely sensed recovery estimates. It will also delineate the plant and soil status of recovering or deteriorating sites.

Milestones: Completion of field work in spring and fall of 2001. Quarterly Reports due to BTNEP Office every three months. Draft Report and data sets due to BTNEP Scientific Technical Committee within 11 months of funding. Final Report and Executive Summary due to BTNEP Office within 45 days of submission of Draft Report.

Anticipated recommended funding: \$180,000

Products: Quarterly, Draft and Final Reports, Executive Summary, data and maps be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

B. CAUSES

Background

Task descriptions, objectives and rationales to support the effort to determine the causes of the 2000 marsh dieback are listed below. The purpose of this effort is to determine the unique aspects of the 1999/2000 growing season that caused the spatial and temporal pattern of marsh dieback along coastal Louisiana during summer 2000. No single approach by itself can address the causes. What is needed is an integrated approach that uses a combination of controlled greenhouse and field studies, compilation and analysis of historical data sets of climatic and hydrologic data, modeling, and assessment of patterns of marsh recovery in the field.

All six of the following Tasks are considered an integral part of the proposed effort to determine the causes. This Request for Scope of Services gives some indication as to what factors within any one task might be considered most important. However, each proposer must determine which factors they believe will best address the task. This determination should be discussed in the rationale section of the proposal. Coordination among proposers of different tasks is encouraged prior to submission of proposals. After award, coordination among tasks will be required.

Task II.1 Conduct experimental studies of *Spartina alterniflora* and associated salt marsh plants to determine their tolerance to various environmental stressors and their interactions. Possible stressors may include, but are not limited to, salinity, pH, moisture, metals, and pathogens. Selection of stressors will be coordinated with investigator of Task II.2.

Objective: Determine the level and duration of specific environmental stressors that work singly and in concert to cause mortality of salt marsh plants.

Rationale: Through empirical measurements, some indication of the environmental stressors at the time of the dieback can be ascertained. However, data do not exist in the scientific literature that can be used to assess whether these conditions were of high enough intensity or duration to cause the marsh dieback of 2000. Therefore, the experimental studies proposed in this task are essential in linking the dieback

phenomenon to specific environmental stressors.

Milestones: Quarterly Reports submitted to BTNEP office every three months. Completion of studies within 12 months of funding. Draft of report and data sets submitted to BTNEP Scientific Technical Committee within 45 days thereafter. Final Report and Executive Summary submitted within 45 days of submission of draft report

Anticipated recommended funding: \$225,000.

Products: Quarterly, Draft and Final Reports, Executive Summary, data sets and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

TASK II.2 Conduct experimental studies to determine how different hydrologic drivers and different saline marsh soil types will generate plant stressors evaluated in Task II.1. Studies may also include plant-soil interactions. Possible hydrologic drivers may include, but are not limited to, elevation in relation to tidal inundation, tidal exchange, surface and ground water recharge, location relative to adjacent surface water bodies, precipitation, evapotranspiration, and soil permeability.

Objective: Determine how the plant tolerance studies in Task II.1 are integrated and linked to soil systems, showing how plant stressors in different specific soil types respond to different moisture regimes. Determine how potential plant stressors can be manifested under different hydrologic drivers, depending on soil type.

Rationale: Various plant stressors may respond differently to moisture regimes depending on the specific soil type. There needs to be a link between the tolerance studies in Task II.1 and the physical and hydrologic characteristics of soils that can produce the levels of stressors that can cause marsh plant mortality.

Milestones: Quarterly Reports submitted to BTNEP office every three months. Completion of studies within 12 months of funding. Draft of report and data sets submitted to BTNEP Scientific Technical Committee within 45 days thereafter. Final Report and Executive Summary submitted within 45 days of submission of draft report

Anticipated recommended funding: \$225,000

Products: Quarterly, Draft and Final Reports, Executive Summary, data sets and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

TASK II.3. Conduct field studies to identify site-specific hydrologic drivers and soil characteristics at the salt marsh study sites already established in 2000. Possible hydrologic drivers may include, but are not limited to, elevation in relation to tidal inundation, surface and ground water recharge, location relative to adjacent surface water bodies, precipitation, evapotranspiration, and soil permeability. Possible soil characteristics may include, but are not limited to, soil chemistry, and mineralogy.

Objective: Determine whether site-specific hydrologic and soil characteristics of salt marshes affected their susceptibility to the extensive dieback observed during the 2000 growing season.

Rationale: Most of the environmental stressors potentially implicated in the extensive dieback observed during the 2000 growing season are linked to moisture deficits in the marsh subsurface. Site-specific differences in marsh response to a water deficit may explain why some marshes survived and others did not. Differences may include, but are not limited to elevation in relation to tidal inundation, soil physical characteristics and mineralogy, location relative to adjacent surface water bodies and marsh soil hydrologic parameters. This task will also provide the site-specific hydrologic data necessary for the modeling effort of Task II.5.

Milestones: Quarterly Reports submitted to BTNEP office every three months. Completion of studies within 12 months of funding. Draft of report and data sets submitted to BTNEP Scientific Technical Committee within 45 days thereafter. Final Report and Executive Summary submitted within 45 days of submission of draft report

Anticipated recommended funding: \$270,000

Products: Quarterly, Draft and Final Reports, Executive Summary, data sets and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

TASK II.4. In a subset of the salt marsh study sites already established in 2000 and noted in II.3, conduct monthly in-depth vegetative assessments and analyze selected soil physiochemistry variables. Possible biological variables may include, but are not limited to, live and dead stem densities, growth and survival of tagged shoots, expansion or decline in area of surviving patches, stem heights, stem/leaf stress categories, and production of flowers/seeds. Environmental variables, measured in adjacent waterways and at the surface and various depths in the marsh root zone, may include, but are not limited to, Eh, pH, salinity, sulfides, and nutrients.

Objective: Determine the rates of marsh recovery or continued deterioration relative to changes in certain physical parameters over short time scales during the 2001 growing season. Use data from established sites to link hydrological/soil data gathered in II.3a to

the rates of growth and colonization (or continued decline) of the marsh vegetation. Also, compare with similar data from the summer of 2000 where feasible.

Rationale: Where dieback was intensively monitored in 2000, plant death continued throughout the summer. Size of dieback patches increased dramatically over the course of only a few weeks, and grazing by shredder snails (*Littorina irrorata*) converted some dead areas to bare mudflat over short time scales. As noted in II.3a, many of the environmental stressors that may have caused salt marsh dieback are linked to moisture deficits in the marsh subsurface. The levels, and thus effects, of many of these stressors may also change over relatively short time periods. The nature of these stressors are explored in controlled experiments in Tasks II.1 and II.2, and are tied to actual field conditions of stressors and response of vegetation in Tasks II.3a and b.

Milestones: Quarterly Reports submitted to BTNEP office every three months. Completion of studies within 12 months of funding. Draft of report and data sets submitted to BTNEP Scientific Technical Committee within 45 days thereafter. Final Report and Executive Summary submitted within 45 days of submission of draft report

Anticipated recommended funding: \$55,000

Products: Quarterly, Draft and Final Reports, Executive Summary, data sets and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

TASK II.5 Compile and analyze historical data sets of external environmental drivers potentially contributing to the 2000 marsh dieback. Drivers may include, but are not limited to, climate, riverine discharge, coastal water levels, and salinities.

Objective: Document the external environmental drivers in the time leading up to and during marsh dieback of 2000; relate these to recurrence and other historical patterns.

Rationale: External environmental drivers appeared to be anomalous in the time leading up to and during 2000 marsh dieback. This task will collect, tabulate and analyze the data on such drivers from the past year and the historical record to provide the context in which the extensive marsh dieback observed during the 2000 growing season occurred. Years with similar patterns (e.g. low coastal water levels) will provide external conditions for modeling efforts (Task II.5).

Milestones: Quarterly Reports submitted to BTNEP office every three months. Completion of studies within 12 months of funding. Draft of report and data sets submitted to BTNEP Scientific Technical Committee within 45 days thereafter. Final Report and Executive Summary submitted within 45 days of submission of draft report

Anticipated recommended funding: \$45,000

Products: Quarterly, Draft and Final Reports, Executive Summary, data sets and maps

will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

TASK II.6 Construct a coupled hydrological/ecological model(s) that uses the environmental stressors and hydrologic and climatic drivers identified in Tasks II.1 through II.4 to hindcast marsh soil conditions potentially contributing to marsh dieback and to forecast the potential for future brownmarsh events as a function of environmental conditions. The modeler is required to make a presentation to the STC for approval at critical junctures in model development including: 1) model scheme/development; 2) model setup (grids, boundaries, assumptions and data); 3) model calibration; 4) draft model results.

Objective: Model different scenarios of marsh dieback along coastal Louisiana under conditions of the 2000 growing season. The model should contribute to hypothesis testing and sensitivity analysis of different potential causes of the marsh dieback.

Rationale: Modeling is a powerful tool that can be used to describe, quantify, hindcast and forecast the response of wetland ecosystems to different coastal management strategies. It can contribute to synthesis of experimental research and test specific hypotheses. It is an analytical tool to evaluate “what if” scenarios.

Milestones: Coordinate with the STC as required in the Task above. Quarterly Reports submitted to BTNEP office every three months. Completion of studies within 12 months of funding. Draft of report and data sets submitted to BTNEP Scientific Technical Committee within 45 days thereafter. Final Report and Executive Summary submitted within 45 days of submission of draft report. Achieving the milestones for this task is contingent on receiving data from Tasks II.1 through II.4 in a timely manner.

Anticipated recommended funding: \$135,000

Products: Quarterly, Draft and Final Reports, Executive Summary, data sets and maps will be in format described in Brown Marsh Information Format Standards contained in Request for Submission of Scope of Services for Brown Marsh Emergency Response dated 7 February 2001 from the BTNEP Scientific/Technical Committee.

C. SYNTHESIS AND MANAGEMENT OF DATA GENERATED BY MARSH DIEBACK, REMEDIATION TRIALS AND NUTRIAL CONTROL

Objectives

- 1) To provide a consistent method of analysis for marsh dieback and nutria control data
- 2) To provide a central location for the collection, integration, synthesis, and redistribution of marsh dieback and nutria control data

TASKS

Activities described here cover all aspects of the effort (i.e., Research and Assessment , Nutria, and Remediation Trials). Some tasks may not begin immediately.

Task III.1. Receive and post (on LACOAST website) data, reports and other information related to current and previous studies on marsh dieback and nutria control. Maintain data standards for long-term storage and retrieval that are consistent with National Science Foundation's Long Term Ecological Research standards. Respond to data and information requests related to marsh dieback and nutria control.

Objective: Provide a centralized database and information management system (DIMS) to be located on the LACOAST website for all marsh dieback and nutria control activities. The datasets are to meet the needs of scientists, coastal managers, and the public.

Rationale: A central database documenting salt marsh dieback and nutria control activities allows interested parties to access information on who is studying what and where the data is being collected. This enables different researchers to contact and coordinate with each other.

Note: Format of all products within tasks will conform to the marsh dieback information standards contained in the request for submission of scopes of the services.

Milestone: Initial DIMS operational and data standards developed within 30 days after award of contract. Updates as provided by researchers and program managers.

Anticipated funding level: \$65,000

Products: Centralized database located on LACOAST website that includes statement of data standards.

Task III.2 Provide an assessment and synthesis of the marsh dieback phenomenon within and outside of Louisiana, and a conceptual model describing potential causes and mechanisms of actions. The conceptual model will be developed at a program kickoff meeting and the summary document will be submitted thereafter.

Objectives: To summarize and evaluate what we know and what we do not know about the marsh dieback phenomenon. To construct a conceptual model that describes how climatic drivers, and the stressors they create can potentially cause salt marsh dieback. To host a meeting early within the contract time period to solicit input from various scientists for the development of the conceptual model.

Rationale. Allows conceptualization of how different stressors may interact to control salt marsh dieback. Will help to refine existing hypotheses for the development of new hypotheses that can be tested in the various research tasks.

Milestones

1. Program kickoff meeting within one month of program initiation to develop a conceptual model
2. Synthesis document to be completed by month 4.

Anticipated funding level: \$20,000

Products.

Short Term: A brief document explaining the conceptual model including graphical representations; attendee list of the meeting

Long Term: Synthesis document of studies of marsh dieback and possible causes in the Louisiana situation.

Note: Format of all products within tasks will conform to the marsh dieback information standards contained in the request for submission of scopes of the services.

Task III.3 Project the potential long term impact to coastal wetlands (loss in acres) and the associated plant and animal communities from marsh dieback. Incorporate information from ongoing studies of the Status and Trends and Causation tasks as available and applicable.

Objective: Demonstrate the environmental consequences of the marsh dieback using existing literature and ongoing studies.

Rational: Allows a determination of our state of knowledge at this point on the potential environmental impacts of marsh dieback.

Note: Format of all products within tasks will conform to the marsh dieback information standards contained in the request for submission of scopes of the services.

Milestone: Task to be completed by month 8

Anticipated funding level: \$50,000

Products: A report and a stand-alone executive summary on the environmental impacts of marsh dieback.

Task III.4 Project potential *socioeconomic* impacts from marsh dieback. Incorporate information from ongoing studies of the Status and Trends and Causation tasks as available and the results of task III.3. Socioeconomic considerations include but are not

limited to infrastructure, drinking water supplies, storm and flood protection, living resources, industries, and mineral resource extraction.

Objective: Demonstration of the socioeconomic consequences of the marsh dieback using existing literature and ongoing studies.

Rational: Allows a determination of our state of knowledge at this point on the potential socioeconomic impacts of marsh dieback.

Note: Format of all products within tasks will conform to the marsh dieback information standards contained in the request for submission of scopes of the services.

Milestone: Task to be completed by month 12

Anticipated funding level: \$50,000

Products: A report and a stand-alone executive summary on the projected socioeconomic impacts of marsh dieback.

Task III.5 Convene a workshop of interested parties and researchers to facilitate data exchange, evaluation of remediation progress, refinement of the conceptual model, and refinement of the website, as appropriate.

Objective: To facilitate a workshop during the middle of the study period that allows involved and interested parties to generate a preliminary synthesis of information available to date on marsh dieback.

Rationale: Allows a mid-term tracking and reporting of the progress of remediation and investigation.

Milestone: Workshop needed during months 9-12

Anticipated funding level: \$5,000

Products: A summary of the discussion at the meeting, abstracts, and attendee lists.

Note: Format of all products within tasks will conform to the marsh dieback information standards contained in the request for submission of scopes of the services.

Task III.6 Produce a comprehensive technical characterization and synthesis report that summarizes all work completed in research and remediation trials during the 2001 growing season. Produce a document suitable for distribution to the public.

Objectives: To summarize technical work completed in research and remediation trials on salt marsh dieback during the 2001 growing season in a bound document; the report will be comprehensive and include the revised conceptual model, historical information,

discussion of the marsh dieback initiative, results of research and remediation trials, and other activities related to salt marsh dieback that have taken place. To condense the technical manual into a document that the public can use to understand salt marsh dieback.

Rationale: Demonstrates how we responded to the emergency, what we learned, and how well (or not) prepared we are for such a future occurrence. Provides a complete technical document and a condensed public document that summarizes all of the information collected about marsh dieback before and during 2001.

Milestone: Task to be completed during months 9-18

Anticipated funding level: \$80,000

Products: Ten CD-ROM copies of the characterization and synthesis report. Ten original hard copies of the characterization and synthesis report. Ten CD-ROM copies of the condensed public document. Ten hard copies of the condensed public document.

Note: Draft copies of all products are to be sent to the Scientific Technical Committee for approval.

Note: Format of all products within tasks will conform to the marsh dieback information standards contained in the request for submission of scopes of the services.

D. NUTRIA CONTROL PROGRAM

Background

Nutrias, South America aquatic mammals, were released into the wild in Louisiana in 1940. By the late 1950's they were causing damage in rice and sugarcane as well as some coastal marshes. However, a market for the fur became established and by the 1962-63 season over one million animals were trapped surpassing the annual harvest of muskrats. The annual nutria harvest remained over one million until 1982. During these twenty years the nutria became a valuable renewable resource to coastal trappers, and resulted in the state remaining in the number one position in fur production in the U.S. In the late 1970's the annual nutria harvest was approximately 1.8 million and worth \$15 million to state trappers. During this period nutria damage complaints in agriculture were rare and there were no reports of damage to wetlands. This strong fur market created an economic incentive for trappers sufficient to insure a large harvest and maintain nutria numbers in balance with coastal habitat.

However, this fur market began changing during the mid 1980's with less consistent demand and lower prices to trappers. At the same time several older fur dealers retired or died leaving the local fur business short of capital. This lack of capital, to buy and inventory skins and then sell as demand improved later in the year, further weakened the market. The harvest of nutria continued to decline and by 1988 the La. Department of Wildlife and Fisheries (DWF)

observed damage in wetlands and received the first reports of vegetative damage in coastal wetlands from land managers.

The Fur and Alligator Advisory Council was created in 1986 to educate the public about the role of trapping in wetlands and to enhance and/or create markets for the state's fur and alligators. Even with some successes in market development the trend in harvest of nutria during the 1990's has been down. The attempt to develop a market for nutria meat for human consumption was initiated in 1998 as a result of a CWPPRA demonstration project. Although both of these efforts still have potential to create increased demand, higher prices to trappers, and help control populations and reduce damage, much more is needed.

Aerial surveys of nutria damage, conducted by DWF during the last three years, have indicated severe damage to marshes in the Southeast part of the state, particularly Terrebonne and Lafouche parishes. Extrapolation of data from these surveys results in an estimate of 100,000 acres of marsh visually impacted by nutria. Surveys have indicated only minimal recovery in these damage sites from one year to the next. Other research has shown that the impact of these grazers on coastal wetlands is much greater, actually changing species diversity as well as biomass.

A comprehensive coast wide nutria control program is needed to eliminate or at least dramatically reduce the extent and severity of the wetlands being damaged. The budget approved by congress for addressing brown marsh contained language indicating that a portion of these funds should be used to begin addressing the nutria damage problem. \$200,000 has been recommended for this purpose.

LONG TERM OBJECTIVES

- 1). Eliminate damage to wetlands
- 2). Establish and/or enhance markets resulting in increased price, harvest and control of nutria.

SHORT TERM OBJECTIVES

- 1). Compile, analyze, summarize data that will provide guidance in the development of a nutria control program.
- 2). Provide data to better explain to the public and decision-makers the consequences of this damage and the need for funding a nutria control program. This information will be essential in seeking funding for a comprehensive nutria control program.

Task IV. 1. Conduct a comprehensive search and review of published and unpublished literature, reports and data relating to 1) the biology and natural history of nutria; 2) the chronology and details of their release, population fluctuations, and harvest (as influenced by the fur market) in Louisiana; 3) their interaction with, and affect on, other animal populations in Louisiana; and 4) their interaction with, and affect on, wetland habitats in

Louisiana. Synthesize all available information and produce a final report with a concise and well-written executive summary of those findings most pertinent to a potential nutria control program.

Objective: To produce a single, comprehensive, stand-alone document concerning nutria populations in Louisiana and their interactions with, and affect on, other animal populations and wetland habitats.

Rationale: This report will be used as background information to address the problem of nutria damage and aid in development of a population control program.

Milestone: Completion of review and report writing within 4 months of funding.

Anticipation funding: \$70,000.

Products: Reports in format described in brown marsh information contained in request for submission of scope of services.

Task IV.2 Conduct a comprehensive review of all socioeconomic and cultural information (published and unpublished) on nutria in Louisiana related to historic harvest, value, related jobs, and current wetland damage and loss due to nutria over-population. Predict future impacts of continued over-population on wetland habitat (type, quality, and abundance), wetlands use values, related jobs, and cultural changes. Synthesize available information and predictions and produce a final report with a concise and well-written executive summary.

Objective: To produce a single, comprehensive, stand-alone document concerning the socioeconomic and cultural impacts of nutria, their over-population, and current and future vegetative damage to wetlands.

Rationale: This report will be used as background information to address the problem of nutria damage and aid in development of a population control program.

Milestone: Completion of review, analysis, and report writing within 4 months of funding.

Anticipated funding: \$40,000.

Products: Reports in format described in brown marsh information contained in request for submission of scope of services.

Task IV.3 Conduct a comprehensive review of published and unpublished data related to all appropriate population control methods and analyze their applicability to controlling nutria in Louisiana. Control methods may include, but are not limited to government trapping, poisoning, shooting, chemo-sterilization, and incentive payments to increase

trapper harvest. At a minimum, the analysis should identify potential positive and negative direct and indirect impacts to other animal species (e.g. alligator, small mammals) and rank potential methods relative to efficiency and cost. Prepare a final report summarizing the review, analysis and ranking of the potential nutria control methods; the report shall include a concise and well-written executive summary.

Objective: To produce a single comprehensive, stand-alone document concerning potential population control methods for nutria in Louisiana.

Rationale: This report will provide guidance in development of a nutria control program.

Milestone: Completion of review and report writing within 4 months of funding.

Anticipated funding: \$40,000.

Products: Reports in format described in brown marsh information contained in request for submission of scope of services.

Task IV.4 Based on information provided in Task IV – 1, 2 and 3, develop an information/media packet that 1) explains the significance of historic and projected nutria damage in Louisiana; 2) explains the need for nutria population control; 3) describes the top-ranking options for control (including cost, cost effectiveness, positive and negative impacts, etc.) Additionally, the packet shall describe a comprehensive recommended plan, as developed by LDWF personnel, to control nutria populations and the associated damages. The packet shall include, but is not limited to, a brochure with photos and maps explaining nutria damage, the impact on wetlands, socioeconomic/cultural impacts, the need to control nutria to eliminate or reduce this damage, and the recommended plan for control.

Objective: To produce an information/media packet including a brochure, to describe and promote a nutria population control program in Louisiana.

Rationale: This task will produce materials to educate the public and decision-makers about the impact of nutria on wetlands and the importance of a control program, and describe the recommended control program.

Milestone: Completion of the information/media packet within 1.5 months of funding and based on data availability from Task IV- 1,2 and 3. Presentation of a draft information/media packet within 1 month of funding.

Anticipated funding: \$30,000.

Products: Reports in format described in brown marsh information contained in request for submission of scope of services.

ATTACHMENT A

Highly Stressed Quadrangles in the Barataria/Terrebonne Basins

Bay Courant
Central Isles Dernieres
Cocodrie
Dog Lake
East Bay Junop
Grand Bayou Du Large
Lake Felicity
Lake Tambour
Lake Quitman
Leeville
Oyster Bayou
Pelican Pass

ATTACHMENT B

Brown Marsh Photointerpretation Classification System

Impacted by Brown Marsh:

Brown Marsh	Impacted marsh
Brown Marsh 2	Highly impacted marsh
Unconsolidated Shore/BM	Mudflat with broken brown marsh
Unconsolidated Shore/DM	Mudflat with dead marsh stubble
Impacted Unconsolidated Shore	New mudflat
Impacted Open Water	New open water
Impacted Aquatic Bed	New aquatic vegetation

Non-impacted Areas:

Unconsolidated Shore	Historical mudflat
Open Water	Historical open water
Aquatic Bed	Historical aquatic vegetation
Emergent Marsh	Healthy marsh
Scrub/Shrub	Woody vegetation <20 feet tall
1-Deciduous	
3-Broad-leaved evergreen	
Forest	Woody vegetation > 20 feet tall
1-Deciduous	
3-Broad-leaved evergreen	

Upland Areas:

Upland Barren
Upland Range
Upland Scrub/Shrub
6-Deciduous
7-Evergreen
8-Mixed
Upland Forest
6-Deciduous
7-Evergreen
8-Mixed
Upland Urban
O-Oil

Modified

Excavated
Spoil
Impounded