Agenda Item #: 3L4

PALM BEACH COUNTY
BOARD OF COUNTY COMMISSIONERS

AGENDA ITEM SUMMARY

Meeting Date: May 1, 2012 (X) Consent ( ) Regular ( ) Workshop ( ) Public Hearing

Department

Submitted By: Environmental Resources Management
Submitted For: Environmental Resources Management

I. EXECUTIVE BRIEF

Motion and Title: Staff recommends motion to approve: Task Order No. 1434-08 to a continuing Contract (R2010-1434) with Coast & Harbor Engineering, Inc. (CHE) in the amount of $134,054.17 for seagrass monitoring services in association with the Lake Worth Lagoon Partnership Grant Program (LWLPGP), and to acquire 2012 seagrass aerial imagery of the entire Lake Worth Lagoon (LWL) and Intracoastal Waterway (ICW) throughout Palm Beach County, and provide data analysis for the seagrass monitoring associated with this Task Order.

Summary: The BCC approved the Contract with CHE, a Palm Beach County company, on September 14, 2010 (R2010-1434). This Task Order No. 1434-08 authorizes CHE to acquire seagrass aerial imagery for 2012. There is 17% Small Business Enterprise (SBE) and 21% Woman Business Enterprise (WBE) sub-consultant participation on the Task Order. CHE committed to an overall 32.0% SBE-M/WBE participation in the Contract. CHE has achieved 40.4% cumulative SBE-M/WBE participation on the Contract including this Task Order. The work is funded by the LWLPGP and the Manatee Protection Program. District: Countywide (JM)

Background and Justification: The scope of work associated with this project is part of the State Department of Environmental Protection (DEP) Grant Agreement No. LP6046 (R2006-0583) for the LWLPGP. This Agreement is part of the State Legislature's disbursement of funds for restoring, protecting and monitor the surface waters of the State. Approximately 75% of the total Task Order cost will be eligible for cost sharing from the DEP, under the existing funding contract.

Attachments:
1. Task Order No. 1434-08 with Contract History
2. Contract (pages 1, 19, Exhibit B Fee Schedule)

Recommended by: _____ 4/12/12
Department Director **Date**

Approved by: _____ 4/13/12
County Administrator **Date**

II. FISCAL IMPACT ANALYSIS

A. Five Year Summary of Fiscal Impact:

Fiscal Years	2012	2013	2014	2015	2016
Capital Expenditures	$134,054				
Operating Costs					
External Revenues	($100,000)				
Program Income (County)					
In-Kind Match (County)					
NET FISCAL IMPACT	$34,054				
# ADDITIONAL FTE POSITIONS (Cumulative)					

Is Item Included in Current Budget? Yes X No ____

Budget Account No.: Fund ____ Department ____ Unit ____ Object ____
Program ____

B. Recommended Sources of Funds/Summary of Fiscal Impact:

Lake Worth Lagoon Partnership Grant Program $100,000 (1229-380-3057)
Manatee Protection Program $34,054 (1226-380-3252)

C. Department Fiscal Review:

III. REVIEW COMMENTS

A. OFMB Fiscal and /or Contract Dev. and Control Comments:

OFMB 4/10/12 JB 4/10/12

Contract Development and Control 4/19/12 4-19-12

B. Legal Sufficiency:

This item complies with current County policies.

4/20/12

Assistant County Attorney

C. Other Department Review:

Department Director

TASK ORDER

TASK ORDER: 1434-08 CONSULTANT: Coast & Harbor Engineering, Inc.

ACCOUNT: various CONTRACT: R2010-1434

[Fiscal approval of Budget Availability: see attached BAS]

PROJECT MANAGER: Alessandra Medri PHONE: 561-233-2446

CONTRACT MANAGER: Juan Cueto PHONE: 561-233-2431

PROJECT NAME: 2012 Aerial Seagrass Mapping

LOCATION/DISTRICT #: Countywide

TASK DESCRIPTION (use additional pages if necessary): The consultant shall provide professional services for mapping of seagrasses in the Lake Worth Lagoon and Intracoastal Waterway, as described in the scope of work dated April 4, 2012.

DELIVERABLES: See scope of work.

TASK ORDER TYPE: FIXED PRICE $120,608.76
NOT-TO-EXCEED $13,445.41

DUE DATE: 3/15/2013

*TOTAL AMOUNT $ 134,054.17

*See attached proposal dated 4/4/2012

(Check where appropriate)
for Contract and Subcontract Amounts:

	Black	Hispanic	Women	Other (specify)	White Male
M/WBE (State) ☒	$	$	$ 28,494.40	$	
SBE-M/WBE* ☐	$	$	$	$	
SBE ☒	$	$	$	$	$22,725.00

*certified as both an SBE and a State M/WBE

TOTAL SBE-M/WBE PARTICIPATION: $51,219.40

CONSULTANT REP: _____ DATE: 4/9/2012

APPROVED AS TO TERMS AND CONDITIONS:

ERM DIRECTOR/DEPUTY: _____ DATE: 4-11-12

APPROVED AS TO FORM AND LEGAL SUFFICIENCY:

ASSISTANT COUNTY ATTORNEY: _____ DATE: 4/20/12

BOARD OF COUNTY COMMISSIONERS: _____ DATE: _____
Shelley Vana, Chair

COAST & HARBOR ENGINEERING

Proposal and Scope of Work for 2012 Aerial Seagrass Mapping

Introduction

Palm Beach County Department of Environmental Resources Management (PBC ERM) has requested Coast & Harbor Engineering, Inc. (CHE) to provide a scope of work for the collection of aerial photography and delineation of seagrass beds in the Lake Worth Lagoon (LWL). This work also includes ground truthing of aerial seagrass delinations and development of a summary report documenting the findings. All work is detailed in the attached Statement of Work. This Statement of Work was developed in coordination with PBC ERM.

Approach

All technical work in this scope of work will be completed by subconsultants under contract to CHE. CHE's primary role in this task will be project management and coordination of the individual subconsultants performing the work.

The following team members will be utilized under this task order:

Team Member	Abbreviation	Technical Role Summary	Contract Status	Cost
Coast & Harbor Engineering	CHE	Project Coordination	Prime	$12,741.07
Coastal EcoGroup	CEG	Ground truthing of seagrass beds	On existing CHE contract roster. (WBE)	$28,494.40
Sea Diversified Inc	SDI	Professional surveying services, field equipment/vessel	On existing CHE contract roster (SBE)	$22,725.00
Aerial Cartographics of America	ACA	Aerial photography and triangulation	Not on CHE contract roster – to be added for this task order only	$34,151.70
Nova Southeastern University	NSU	Aerial interpretation and delineation of seagrass beds.	Not on CHE contract roster – to be added for this task order only	$35,942.00
TOTAL (Including Optional Tasks 2A and 5A)				$134,054.17

COAST & HARBOR
ENGINEERING

A more detailed breakdown of each subconsultant's role responsibility and associated costs is included in the included Statement of Work.

Should you have any questions, please do not hesitate to contact us at your convenience.

Sincerely,

Shane Phillips, PE

STATEMENT OF WORK

Palm Beach County 2012 SEAGRASS MAPS

1.0 INTRODUCTION

A primary objective of the Lake Worth Lagoon Management Plan (LWLMP) and PBC Comp Land Use Plan is to protect and restore seagrasses. Seagrass beds are highly productive and ecologically important habitats within South Florida's estuaries and coastal lagoons. In 2001 and 2007, seagrass beds were mapped throughout the lagoon using color aerial photography interpreted with an analytical stereoplotter and field checks. These maps serve as important management tools for obtaining a current inventory of this resource, identifying areas that may deserve special protection efforts, and identifying potential "problem" areas that require further investigation. These large scale maps can also document significant trends in the status of this resource.

2.0 OBJECTIVES

The overall objective of this contract is for the consultant to: A) acquire 2012 time appropriate aerial imagery of the entire Lake Worth Lagoon (LWL) and Intracoastal Waterway (ICW) throughout Palm Beach County captured directly in digital format by a photogrammetric pushbroom scanner or a frame based Digital Mapping Camera (DMC); B) produce a complete 2012 seagarass map primarily by photo-interpreting this newly acquired aerial imagery in ArcInfo 10 GIS; C)collect quantitative and ancillary ground truth data in segments of concern for algal blooms, outer boundaries of beds, and isolated seagrass patches; D) deliver the processed aerial imagery along with all files used in establishing the blocks in orthorectification and other processes; and E) provide a final report with narrative and tabular summary of findings.

Appropriate Geographic Information Systems (GIS) and photogrammetric software shall be used to ensure that all maps will be fully compatible with the data presently in the County's ArcGIS library.

3.0 SCOPE OF WORK

The intent of the study is to prepare 2012 seagrass maps of Palm Beach County's Intracoastal Waterway (ICW) and LWL. There are eight main tasks for completion (see timeline below), beginning with (1) generation of a Study Plan after the contract start-up conference; and (2) acquiring digital aerial photography of the entire Palm Beach County ICW and LWL system (Project Boundary – Figure 1), which includes responsibility for flight planning and mission management,(3) ground-truthing field work; (4) aerial triangulation using block-bundle adjustment and orthophotography production; (5) spatial accuracy assessment; (6) photo-interpretation using ArcInfo, (7) production of draft and final maps (County approved ArcGIS geodatabase); and (8) final report including a survey report sealed by a Florida Professional Surveyor and Mapper, a narrative and tabular summary of findings by reach, and an analysis of change compared to 2007.

PBC General Distribution Segments

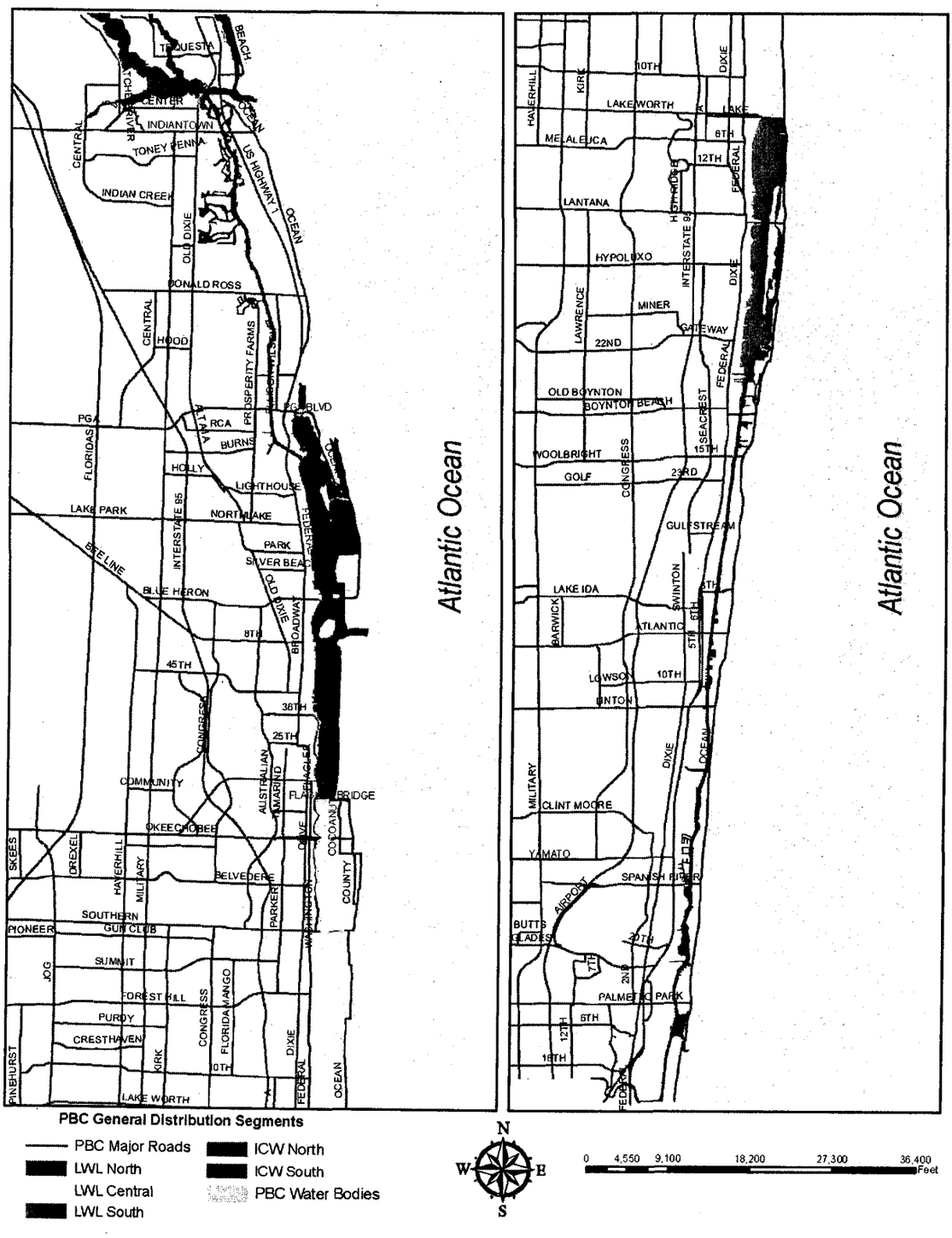


Figure 1. Project Boundary.

The County will be responsible for providing the following items:

1. ArcGIS digital files of the 2007 shoreline. Mapping will be restricted and if necessary adjusted to this boundary.
2. Project boundary shapefile.
3. Data from the most recent seagrass transect monitoring. Transect data includes percent cover of algae and each seagrass species – generally every 10 m from shore to the deep edge of the grass bed, plus total distance from shore to the edge of the grass bed.
4. The 2007 Lagoon-wide mapping data as ArcGIS shapefiles or geodatabase.
5. Ground control coordinates and documentation utilized for the 2007 maps.
6. Lagoon segments of "concern" where algae cover is known to interfere with photointerpretation.
7. Ancillary SAV data from other smaller scale mapping projects to augment ground truthing data and strengthen interpretation.
8. Bathymetry data.

4.0 TASK IDENTIFICATION

The work to be performed under this project is set forth below. Each of the eight tasks referred to earlier is described separately below. **All work shall be completed by March, 2013**. Monthly status reports shall be provided to the County via e-mail.

Task 1: Preliminary Conference

Within two weeks of receipt of a fully executed contract (in conjunction with the receipt of the County provided items) from the County, a kick-off meeting will be held with representatives of the County at the County's office. A thorough review of the existing map and imagery products, selection of suitable airborne sensor systems such as Leica ADS80, Intergraph's DMC, etc., classification and photo-interpretation strategies, mapping and GIS techniques, project work flow and scheduling, deliverables, and other related topics will be discussed at this meeting in order to reaffirm the scope of work, deliverables, and schedule. The Consultant shall submit to the County a letter report of the meeting minutes, which summarizes all conclusions and action items from the meeting.

Deliverable:

- Letter report (may be submitted via e-mail) within four (4) working days after the preliminary conference, that includes a Study Plan for execution of all tasks and tentative dates for deliverables (to be revised in the monthly status report following photo acquisition), using May 1st as the assumed photo date.
- Flight window matrix.

Task 1 Consultant Work Breakdown

CHE, CEG, SDI, ACA and NSU will participate in a 2 hour teleconference . CHE will be responsible for developing the post meeting letter report summarizing the meeting minutes, study plan as well as conclusions and action items from the meeting. ACA will provide the flight matrix and proposed flight line map for preliminary conference.

Task 1 Cost: $1,151.01

Task 2: Acquisition of Lagoon-wide Digital Aerial Photos

Project Area:

New digital camera imagery will be acquired for the entire project based on the **Project Boundary** (Figure 1) shapefile provided by the County. The entire project includes the entire LWL system and the Atlantic Intracoastal Waterway (ICW) throughout Palm Beach County, including the Loxahatchee River extending north to the County line to the west, and the ICW north of Jupiter Inlet extending north to the County line, excluding only the canals off the main water bodies. The project study area will be divided into 6 general categories:

- ICW North Segment: begins at northern county line and continues south to the line where the ICW meets the LWL at the US 1 Bridge in North Palm Beach
- LWL: begins at the line where the ICW meets the LWL at US 1 Bridge, includes Little Lake Worth, and continues south to the Ocean Ave Bridge in Boynton Beach.
    - LWL North Segment: begins at the US 1 Bridge in North Palm Beach, includes Little Lake Worth and continues south to the Flagler Memorial Bridge in West Palm Beach.
    - LWL Central Segment: begins at the Flagler Memorial Bridge in West Palm Beach and continues south to the Lake Worth Bridge in Lake Worth .
    - LWL South Segment: begins at the Ocean Lake Worth Bridge in Lake Worth and continues south to the Ocean Ave. Bridge in Boynton Beach.
- ICW South Segment: begins at the Ocean Ave. Bridge in Boynton Beach and continues south to the county line.

Imagery:

A. Digital aerial photography captured with a photogrammetric pushbroom scanner (such as Leica ADS80) or a frame based sensor (such as Vexcel's Ultracam or Integraph's Z/I DMC). This will be decided by County Project Manager at kick-off meeting.

B. Ground Sample Distance: GSD shall be 0.3 meters (1 foot) Maximum variation = 2%.

C. Radiometric resolution: 16 bit or higher. All photointerpretation conducted at the highest radiometric resolution.

D. Tip, tilt, and swing of the camera for each frame shall be less than 3 degrees, usually achieved by the use of an intertial stabilization system.

E. Imagery shall be calibrated to capture the best exposure of submerged bottom features. Forward Motion Compensator (FMC) should be used depending on the selection of the sensor system.

F. Flight Stability and Airspeed: Average tilt shall not exceed 1 degree (maximum not to exceed 3 degrees). Crab shall not affect more than 5 percent of photo width. Resolution loss due to blurring shall be avoided by sufficiently low airspeed or by a forward image motion compensation system.

G. Other Criteria: The final imagery shall be free of sun glint and washout. No submerged features shall be obscured by sun glint, clouds, cloud shadows, haze or smoke. When acquiring digital photography airborne GPS and IMU data will be acquired to be utilized for aerotriangulation and bundle adjustments.

Mission Constraints:

The Consultant assumes the responsibility of determining when conditions are acceptable. If aerials are not acceptable for seagrass interpretation and all mission criteria A through E have been met, an additional flight (Optional Task 2A) may be authorized by the County.

All defective photographs that are a result of the Consultant's negligence or lack of compliance with the mission constraints shall be re-taken at the Consultant's expense.

A. Water Clarity: The major constraint, besides air clarity and weather, is water clarity. Water is expected to be clearest either (a) a few days after the passage of a dry front, when water temperatures are at a minimum and after winds have been slight or in a direction perpendicular to the main north-south axis of the Lagoon, or (b) after a few weeks of low rainfall and moderate to calm wind conditions. A list of four locations for water clarity observation monitoring will be provided to CHE. The stations located between West Palm Beach and Boynton Beach along Lake Worth Lagoon will be monitored for water clarity prior to conducting the aerials to provide a qualitative assessment of water clarity prior to aerial photography flights. It is understood that a secchi disk water clarity measurement of 4 feet is generally indicative of acceptable water clarity conditions although the final decision to authorize the aerial photography flights will be made by CHE considering all the available weather and water quality information regarding Lake Worth conditions.

B. Sun Angle: Photography shall be acquired when surface reflection from sun glint does not cover more than 10% of the frame. Surface water roughness will also affect sun glint. Sun angle generally between 15 degrees and 30 degrees should minimize surface water glitter.

C. Weather Conditions: Clear skies with no haze and visibility of at least 10 miles. Sea state calm, minimal waves, no white caps. Winds less than 5 knots across the E/W axis of the Lagoon are not expected to affect surface transparency, but may affect sun glint. Because winds are generally calmer early in the day, mornings are considered preferable to afternoons.

D. Tide Constraints: The aerial shall be flown at mean low tide, plus or minus 1.5 hours. The tide station located at Okeechobee Boulevard, State Road 704 Bridge and Flagler Drive in West Palm Beach will be used to determine low tide. Consultant is free to propose alternatives based upon their professional experience.

The Consultant acknowledges that windows of opportunity for completing the work may be quite brief – lasting only a few days – and shall be able to mobilize quickly to take advantage of the acceptable windows.

E. Date: Based on anticipated weather and water clarity conditions, the most probable window for the photography is expected to be May to June. **Therefore, the "time to photo" shall be done during the first available date-window beginning on May 1st that meets the above criteria/constraints**. All photographs shall be taken during a single 14-day period, if possible, and preferably on the same day or adjacent days.

Deliverables:

- Actual flight line map.
- Draft samples of un-rectified, raw imagery, prior to subsequent aerial triangulation and orthorectification within two weeks after acquisition. **These samples shall be used to determine the acceptability of the imagery prior to commencing with other tasks.**
- Sensor/system processed raw digital image files in a format compatible to County's data.
- All intermediate camera files including the airborne GPS/IMU data needed for aerotriangulation.
- Flight log (mission log with dates of acquisition) and ABGPS control documentation within the survey report delivery by a Florida Professional Surveyor and Mapper.

Task 2 Consultant Work Breakdown

ACA will conduct all work in this Task, except for monitoring of water clarity/quality conditions within Lake Worth Lagoon. Water clarity/quality condition monitoring will be conducted by Sea Diversified on a Not-To-Exceed basis. Up to 15 days of water clarity observations are included in this work assuming 2 hours per day of field work for water clarity observations.

Task 2 Cost: $15,699.27

Optional Task 2A: Reflight of Lagoon-wide Digital Aerial Photos
This optional task includes the cost of re- flying the lagoon-wide digital aerial photos. This Task would only be authorized by the County in the event that digital aerial photography from Task 2 do not provide sufficient image quality due to poor water clarity. This also includes water clarity observations by the Consultant team for purposes of selecting target flight dates that will provide adequate water clarity for delineation of seagrass beds.

Optional Task 2A Consultant Work Breakdown
ACA will conduct all work in this Task, except for monitoring of water clarity/quality conditions within Lake Worth Lagoon. Water clarity/quality condition monitoring will be conducted by Sea Diversified on a Not-To Exceed basis. Up to 15 more days of water clarity observations are included in this work assuming 2 hours per day of field work for water clarity observations.

Optional Task 2A Cost (Not to Exceed): $11,643.43

Task 3: Ground-truthing Field Work

Project Area:
Ground-truthing field work shall be done for Project Boundary-Figure 1:

3.1a Pre-Photointerpretation Field Work. The field crew(s) shall visit the County-provided segments of "concern" to verify seagrass/algae occurrence. All pre-interpretation field work shall be done as close as possible to aerial acquisition, preferably within one month, so as to minimize any changes in growth and distribution of seagrass and macroalgae. Data collected shall include field personnel, date, coordinate location using GPS, reason for inspection, pre-trip and post-trip classifications, and a detailed description of seagrass plant communities and densities. Once in-field analysis is completed at a particular site/GPS point, a classification code shall be applied to that GPS point and and ArcGIS shapefile created containing the field collected information. Fieldwork documentation shall be contained within the project's geodatabase in a separate feature class.

The Consultant shall be responsible for providing a boat for all ground-truthing. The Consultant shall notify the County well in advance of the field dates so that the County can plan to visit the sites with the Consultant, if desired.

Area of concern ground-truthing field work shall include four (4) days pre-photointerpretation field work. Field work will include in-water field observations of 120 stations. Observations will include seagrass density based upon 0.5 m2. Species ID shall also be included.
Deliverables:

- ArcGIS feature class containing pre-interpretation field work documentation.
- A report including ground-truthing methodology and dates of field work.

3.1b During-Photointerpretation Field Work. During photo-interpretation, sample locations should be visited including areas that are difficult to distinguish on aerial images due to water depth or clarity, and presence of seagrass/macroalgae confirmed by field checks. Data collected shall include field personnel, date, coordinate location using differential GPS, reason for inspection, pre-trip and post-trip classifications, detailed description of seagrass plant communities and densities, and a discussion of photo-interpretation problems. Once in-field analysis is completed at a particular site, a classification code shall be applied to the site and and ArcGIS shapefile created containing the field collected information. Fieldwork documentation shall be contained within the project's geodatabase within a separate feature class.

The Consultant shall be responsible for providing a boat for all ground-truthing. The Consultant shall notify the County well in advance of the field dates so that the County can plan to visit the sites with the Consultant, if desired.

Ground-truthing field work shall include four (4) days of field work during-photointerpretation. Field work will include in-water field observations of 120 stations. Observations will include seagrass density based upon 0.5 m2. Species ID shall also be included.

Deliverables:

- ArcGIS feature class containing during-interpretation field work documentation.
- A report including ground-truthing methodology and dates of field work.

3.2 Photointerpretation Key. The photo-interpreter(s) shall analyze thoroughly the selected ground-truthing points, ancillary SAV data provided by the County, or transects to verify seagrass/algae photographic signatures. The Consultant shall develop a Photointerpretation Key to be used during seagrass photo-interpretation. The key shall include samples of the delineated aerial photos used for this mapping project and shall identify specific portions of the photographs that represent the four (4) classification types (see Task 4). This key shall provide the photo-interpreter(s) with verified references for the Florida Land Use and Cover Classification System (FLUCCS) classes used for this project and shall be developed to reduce errors and omissions in the subsequent photo-interpretation effort.

Deliverable: A report including Photointerpretation Key.

Task 3 Consultant Work Breakdown

CEG will conduct eight (8) days of photointerpretation and ground truthing field work as described in this Task. Four (4) days will be designated to pre-photointerpretation field work and four (4) days will be designated to during-photointerpretation field work.

SDI will provide field support to CEG, including vessel and vessel operator for a total of eight (8) days.

NSU will support CEG in field site selection and GIS support as well as identification of areas that required ground truthing. NSU will also be responsible for development of the photointerpretation key report.

Task 3 Cost: $37,426.18

Task 4: Triangulation and Orthophotography

Project Area:

Triangulation and orthophotography shall be done for Project Boundary-Figure 1: the entire LWL system and the Atlantic Intracoastal Waterway (ICW) throughout Palm Beach County, including the Loxahatchee River extending north to the County line to the west, and the ICW north of Jupiter Inlet extending north to the County line, excluding only the canals off the main water bodies.

4.1 Aerial Triangulation Specifications. The County will provide the entire set of ground control points used for the 2007 mapping effort. These will be provided in a spreadsheet format and ArcGIS shapefiles indicating detailed site locations. Any additional ground control points collected by the Consultant shall be measured with sub-meter differential GPS.

Aerotriangulation accuracy shall be designed to ensure that the triangulated imagery and associated digital

orthophotography shall meet USGS National Map Accuracy Standards for 1:24,000-scale map products.

Airborne GPS/IMU data will be used for aerial triangulation along with any necessary ground control points.

Checkpoints shall be utilized to test the spatial accuracy of the aerial triangulation solution. The results of the comparison between checkpoints and the adjusted imagery will be reported within the Aerial Triangulation Report which will be part of the PSM Survey Report. The number of checkpoints to be utilized for the project will be decided during negotiations.

Deliverables:

- An Aerial Triangulation Report within the PSM Survey Report describing the aerial triangulation process and results. ABGPS/IMU procedures, ground control point documentation, spatial accuracy assessment, residuals, etc. will be detailed and compliant to Florida's Minimum Technical Standards.
- Aerial triangulation files

4.2 Digital Orthophotography Specifications. Digital orthophotography will be generated and delivered for the project based on the following specifications:

Orthophotos will be delivered as 4-band stacked RGB images

The final ground sample distance and pixel size of all digital orthophotography shall be one (1) foot.

The file format of the digital orthophotography shall be .tiff with associated .tfw files.

The digital orthophotos shall be delivered and projected to
NAD_1983_HARN_StatePlane_Florida_East_FIPS_0901_Feet for Project Boundary Figure 1.
The digital orthophotography will be tiled based on Florida's 5000ft x 5000ft tiling scheme. A tile shapefile will be provided by the County.

The digital orthophotos shall be delivered on a portable hard drive to the County. The digital orthophotographs will be mosaiced and provided in TIFF format. Mosaiced files should be to no larger than 500 mb so that ERM can compress them using Desktop Mr. Sid software. If the files exceed 500 mb, then the consultant shall also provide compressed files in Sid format.

The Digital Elevation Model (DEM) used for orthorectification will be decided upon during the preliminary conference or during contract negotiations. The PBC DEM is preferred for greater accuracy.

NOTE: The digital orthophotos to be delivered are intended to be used as the source for photointerpretation.

Deliverables:

- 4-band stacked digital orthophotography tiles based on Florida's 5000ft x 5000ft tiling scheme.
- FDGC-compliant metadata

Task 4 Consultant Work Breakdown
ACA will provide aerial triangulation report, aerial triangulation files and all orthophotography.

SDI will assist ACA in collection of ground control points and reporting of ground control point collection methodology.

Task 4 Cost: $16,963.14

Task 5: Positional Accuracy Assessment

The Consultant shall also conduct a positional accuracy assessment. Points used for this assessment shall not be those used as control for aero-triangulation. Several tests shall be performed during the aerotriangulation task in order to ensure a positionally accurate project that meets the project specifications.

The Consultant shall select a new subset of known control points that were not used within the aerotriangulation solution. A total sample of 50 points shall be used and shall be uniformly distributed to cover the Project Boundary-Figure 1.

The selected coordinates shall be identifiable on the seagrass coverages and be visible in the field or on other map products that contain a better positional accuracy.

The positions of known control shall be gathered from:
1) Field work. While in the field during Task 3, the Consultant shall record the coordinates of the edges of distinct seagrass beds and distinct shoreline features for later comparison to the seagrass ArcGIS coverages.
2) The existing previous year's LWL coverage.
3) 2012 orthophotography relative to 2007 collected orthophotography.
4) If necessary, additional survey data will be provided by the County. If the data is not sufficient to assess accuracy, additionally surveying by the Consultant of up to 50 points may be authorized as an optional task. This task does not include the collection of any new field data or ground control points.
5) Based on the above processes, the Consultant shall assess whether or not the positional accuracy was accomplished.

Deliverables:

- The positional accuracy sampling strategy; and
- A positional accuracy assessment report.

Task 5 Consultant Work Breakdown
ACA will conduct the positional accuracy sampling strategy and assessment report.

Task 5 Cost: $4,207.34

Optional Task 5a: Additional Surveying for Positional Accuracy Assessment
If the ACA positional accuracy assessment report indicates accuracy problems or if the data gathered in Task 5 are not sufficient to perform an assessment, the Consultant shall gather a new subset of known control points that were not used within the aerotriangulation solution and are different from those provided by the County in Task 5. This optional task shall be authorized on a per day basis to collect additional ground

control points for the accuracy assessment report. Depending on the locations of the points, it is estimated that 10-15 points can be collected per day.

Optional Task 5a Consultant Work Breakdown
SDI will assist ACA in collection of additional positional accuracy ground control points on a per day basis.

Optional Task 5a Cost (Not to Exceed): $1,801.98

Task 6: Photo-Interpretation

Project Area:

Photo-interpretation shall be done for Project Boundary-Figure 1:
All photo-interpretation shall be conducted using the orthorectified imagery loaded into an ArcInfo GIS workstation in order to maximize signature identification and the accuracy of delineation and classification. Previous efforts have used stereoscopy to delineate lagoon habitats. Stereoscopy has advantages in areas of increased topographic relief to allow for 3 dimensional visualization; however, it is not necessary in this project due to the flat nature of the lagoon bottom. Photo-interpretation of aerial photography in ArcGIS has been completed in other local mapping studies at a high level of accuracy. For example in the 2009 study "Benthic Habitat Mapping of Miami-Dade County: Visual Interpretation of LADS Bathymetry and Aerial Photography", 100% of polygons mapped as seagrass were verified as correct in an independent accuracy assessment.

The following guidelines are provided as a means of standardizing the photo-interpretation for this task:

A. The Consultant shall exercise extra care especially on the deep edge of seagrass beds. "Real" changes should be made regardless of the minimum mapping unit.

B. Outer boundaries of beds are more important than density categorization within beds.

C. The minimum mapping unit is 0.25 acres (0.1 ha). It is more important to map individual small isolated patches than similar sized patches that are part of a large matrix. Care shall be taken in mapping small areas of seagrass when only a small amount of seagrass is present, e.g., around a spoil island.

   (1) When deciding whether an area with patches of seagrass is one polygon of patchy seagrass or individual seagrass polygons, apply guideline C above with a minimum mapping unit of 0.25 acres. Err on the side of lumping except in areas where small patches are the only seagrass present.

   (2) If an area has only a few patches, each <0.25 acres: include the polygon of patchy seagrass if the total seagrass area is >0.25 acres. Err on the side of including these rather than excluding them.

D. The 2007 shoreline shall be used unchanged during delineation. The new 2012 line work shall be snapped to the shoreline where appropriate. If the shoreline bisects any of the photo-interpreted seagrass beds during this process, the County shall be consulted for problem resolution, including the possibility of editing the shoreline, but the shoreline base map shall <u>not</u> be changed unless approved, in writing or by e-mail, by the County.

E. Significant change to be mapped shall follow similar criteria as mapping original seagrass polygons – only changes larger than the minimum mapping unit of 0.25 acres (0.1 ha) are mapped, except where the changes less than the minimum mapping unit either are completely new (not present in the

previously mapped year) or have completely disappeared and except for changes in the deep edge of seagrass beds.

The new undelineated aerial photography shall be compared to the photography from the previous mapped year and seagrass vector data to ensure changes are mapped accurately.

Significant change to be mapped shall follow similar criteria used for mapping original seagrass polygons – only changes larger than the minimum mapping unit (MMU) of 0.25 acres (0.1 ha) are mapped, except where the changes less than the MMU either are completely new (not present in the previously mapped year) to the surrounding region, such as a spoil island, or have completely disappeared from the region.

The 2007 vector data shall be edited and used for this project so that all the seagrass line work does not have to be recompiled in areas where it has not changed since 2007. The Consultant shall ensure that differences between the 2007 and 2012 coverages represent only true seagrass changes and not positional inaccuracies (slivers) or photo-interpretation differences.

If uncertainties occur during photo-interpretation, the photo-interpreter(s) shall: 1) delineate the problem area; 2) code it as a 9000 attribute; 3) produce a shapefile with GPS location and the photo-interpretation question; and 4) revisit the problem area in the field so that the problem can be resolved. When possible, the County will help provide these field checks.

The minimum mapping unit for all categories is 0.25 acres (= 0.1 hectares).

Polygons shall be annotated using the mapping categories described below. Ensure that coverage is labeled using a modification of the Florida Land Use and Cover Classification System (FLUCCS). The categories to be used are listed and described below:

1. **Seagrass, continuous** – FLUCCS code 9116. The dominant feature of these seagrass beds is that they are continuous in nature, with interconnected areas of seagrass. These beds may contain many small interspersed patches of sparsely vegetated or unvegetated bottom. The dense aspect means that the area should contain more vegetated bottom than unvegetated bottom, and thus at least 50-60% of the area with this FLUCCS code should contain seagrass. Only sand patches greater than 0.25 acres should be distinguished within a continuous bed. Species composition is not mapped. A density hierarchy will be provided within this FLUCCS code that distinguishes areas that are generally greater than 50% continuous cover (dense seagrass: 9116-dsg) and areas with less than 50% continuous cover (sparse seagrass: 9116-ssg).

2. **Seagrass, patchy** – FLUCCS code **9113**. Areas 0.25 acres or greater in size that consist of primarily (greater than 50%) bare bottom in which many small patches (each less than 0.25 acres) of seagrass are scattered, and where the seagrass patches are not interconnected. (For this study, the lower limit of what constitutes a seagrass bed is approximately 10% cover; areas with <10% cover are considered "unvegetated bottom.")

3. **Unvegetated bottom** – FLUCCS code **5400**. Barren substrate with little or no perceptible seagrass (< 10%) or algae.

4. **Algae beds** – FLUCCS code **9121**. In a few cases, beds of algae may be distinguishable from seagrass. Where these areas are identifiable on the photography AND field checked during the field trips conducted for seagrass mapping they should be mapped (if >10% cover), although this is not a high priority and there is no intent to accurately map all algae beds as part of this project. (In some cases, drift algae will accumulate in seagrass beds. In these cases, the area should be mapped as seagrass, and the density should be based on seagrass density only, not algae density.)

Deliverables:

- Monthly status reports and documentation of progress on photo-interpretation (may be submitted via e-mail).

Task 6 Consultant Work Breakdown
NSU will conduct the photo-intepretation of the aerial imagery.

CEG will coordinate with Nova and discuss all uncertain areas during this Task. CEG will revisit problem areas in the field to resolve uncertainties, if needed.

Task 6 Cost: $26,347.02

Task 7: Draft and Final Coverages

At the conclusion of the photo-interpretation task, all files shall be submitted as ArcGIS files. Resultant ArcGIS files will have valid and correct topology and be free from errors such as slivers, dangling arcs, and label errors. Selected features to be checked within the digital data include edgematching, point duplication, line quality and polygon closure. Quality assurance shall check for errors, such as missing polygon label points, label points with no attributes, invalid attribute codes, and two adjacent polygons with the same attributes.

7.1 Draft Coverage. The Consultant shall provide the County with a single County-wide seagrass ESRI Shapefile and File Geo-database for Project Boundary Fig. 2 derived from the aerial photography. The ESRI Shapefile and File Geo-database will be considered as a Draft for County review. The County will have a total of twenty (20) days to review and comment on the ESRI Shapefile and File Geo-database. Review comments will be submitted to the Consultant who will have a total of thirty (30) days to edit according to the County's comments and submit a Final ESRI Shapefile and File Geo-database to the County.

Deliverable:

- *Draft* seagrass ESRI Shapefile and File Geo-database of Project Boundary-Figure 1.

7.2. Final Coverage. The Consultant shall provide the County with a single ArcGIS seagrass ESRI Shapefile and File Geo-database for Project Boundary derived from the aerial photography.

Deliverable:

- Seagrass ESRI Shapefile and File Geo-database of the above defined project area.

The ESRI Shapefile and File Geo-database delivered to the County shall conform to the following characteristics:
- Double precision;
- Full arc and polygon topology;
- No unnecessary pseudo nodes;
- Dangle length of 0, verified;
- Projected to North American Datum (NAD)_1983_HARN_StatePlane_Florida_East_FIPS_0901_Feet
- Polygon Attribute Tables shall conform to the County's format:
- Arc Attribute Tables shall be constructed to the County's format;

- One attribute per polygon; and
- Unique covername – IDs.

All seagrass/algae cover data developed through this contract shall meet minimum National Map Accuracy Standards for maps at 1:24,000 map scale. The minimum acceptable error in positional accuracy is that no more than 10% of the line work shall be in error by more than forty (40) feet from their correct geographical location.

Analysis by sub-basin of SAV with bathymetry data to produce a frequency distribution table and graph. Example will be provided by the County.

Deliverable:

- Excel graph and table in NAVD

Task 7 Consultant Work Breakdown

NSU will conduct all technical work and deliverables in this task.

Task 7 Cost: $5,183.92

Task 8: Final Report

The project summary report shall include:

1. A description of the mapping techniques used;
2. A copy of the classification key developed in Task 3;
3. A description of any problems encountered and their solutions;
4. Metadata documentation, compliant with the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata, filled out as completely as possible. To view or download the standard, consult: http://www.fgdc.gov/metadata/metadata.html;
5. Recommended future modifications; and
6. A hard copy of the final map (fold out inserts of 11" x 17") including countywide and sub-basin maps
7. Hard copy 11" x 17" maps indicating changes in SAV extents between 2007 and 2012. (For the purposes of comparing 2007 results to 2012, the 2007 data classification for Tidal Flats (FLUCCS code 6510) shall be converted to Unvegetated Bottom (FLUCCS cod 5400).)
8. Narrative and tabular summary of 2012 data by sub-basin reach and analysis compared to 2007. The report will discuss the seagrass objectives of the Lake Worth Lagoon Management Plan, evaluate trends in seagrass extents over time, discuss County seagrass restoration accomplishments, and offer recommendations for future monitoring and restoration objectives,

All geographic data provided to the County under this project shall be included in the metadata documentation of the final report. Geographic data shall include the following:

1. Ground control points;
2. Seagrass polygon coverage;
3. Positional Accuracy assessment data;
4. Field observations.

Deliverable:

- The Draft and Final Report submitted via e-mail
- Final Report on CD or DVD, including all final and supporting GIS, Excel, Word and PDF files.
- Two Final Report hard copies

Task 8 Consultant Work Breakdown

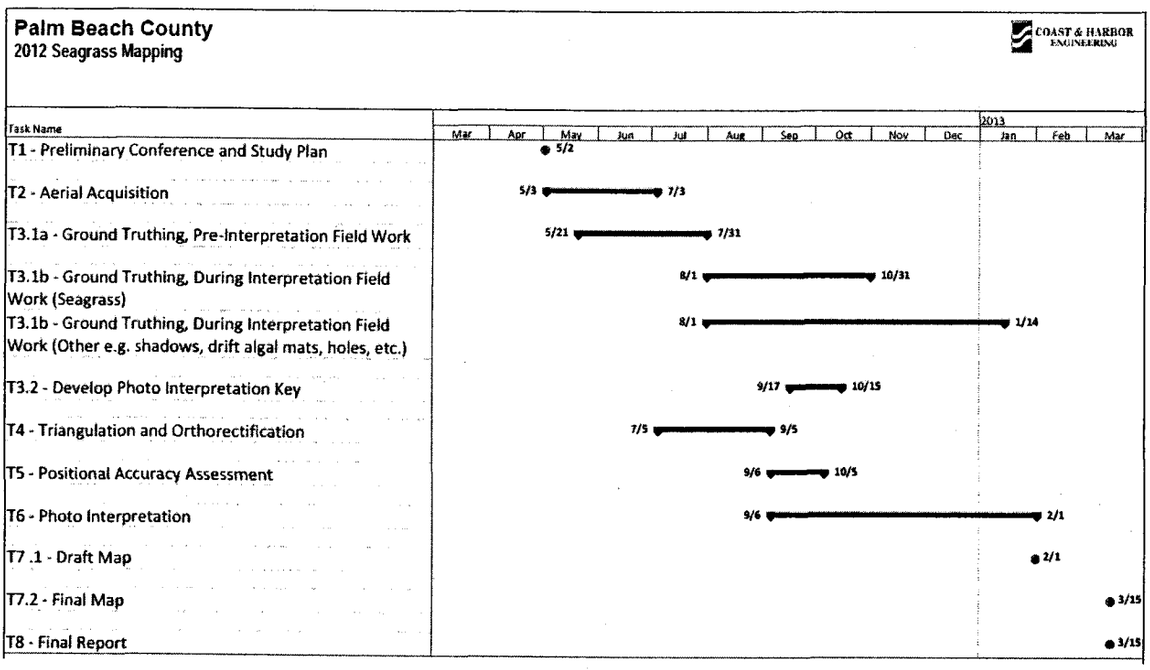
CEG will compile the data provided by mapping/GIS Tasks under Items through 1 through 4 and 6 above, and summarize and synthesize the ground-truthing data and field observations into a Draft Report for review by Palm Beach County. NSU will assist CEG and will provide information as necessary for completion of the report. CEG will address County comments on the Draft Report and prepare a Final Report

Task 8 Cost: $13,630.88

DELIVERABLE SCHEDULE

Summary Table – Deliverables

DELIVERY SCHEDULE FOR 2012 SEAGRASS MAPS



Note: Deliverable dates represented in the above schedule are approximate.

Cost (not including Optional Tasks 2A and 5A): $120,608.76

Not-to-Exceed Cost (Optional Tasks 2A and 5A): $13,445.41

Total Project Cost (including Optional Tasks): $134,054.17

Coast & Harbor Engineering, Inc
Lake Worth Lagoon Fixed Transect Seagrass Monitoring

Prepared by: S. Hicks

COAST & HARBOR ENGINEERING

CHE - Staff Hour Summary

Item	Senior Principal Engineer	Senior Coastal Engineer	Principal Coastal Engineer	Coastal Scientist	Coastal Engineer	Engineer V - Project Manager	Engineer V	Engineer IV	Engineer III	Engineer I	Junior Engineer	CAD Designer	CAD Technician	Administrative	Total Hours	Reimbursable Expenses	Task Labor Cost	Subtotal Cost	Task Total Cost
	$170.18	$156.23	$138.89	$103.27	$117.62	$106.49	$105.88	$98.05	$89.54	$78.44	$65.26	$79.72	$76.49	$50.30					
TASK 1 Preliminary Conference																			$1,151.01
1 CHE - Kick Off Meeting and Project Management		1				2									3	$0.00	$373.21	$373.21	
2 SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$212.80	$0.00	$212.80	
3 SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$240.00	$0.00	$240.00	
4 SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$220.00	$0.00	$220.00	
5 SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$105.00	$0.00	$105.00	
TASK 2 - Acquisition of Lagoon-wide Digitial Aerial Photos																			$15,699.27
1 CHE - Contract and Project Management (2 hr/wk for 8 wks). Plus 7 hrs for water clarity observations coordination						23									23	$0.00	$2,495.27	$2,495.27	
2 SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$0.00	$0.00	$0.00	
3 SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$2,700.00	$0.00	$2,700.00	
4 SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$10,504.00	$0.00	$10,504.00	
5 SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$0.00	$0.00	$0.00	
OPTIONAL TASK 2A - Reflight of Lagoon-wide Digitial Aerial Photos																			$11,643.43
1 Water Clarity Observations (Assume Project Management for duration is included in Task 2)						7									7	$0.00	$759.43	$759.43	
2 SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$0.00	$0.00	$0.00	
3 SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$2,700.00	$0.00	$2,700.00	
4 SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$8,184.00	$0.00	$8,184.00	
5 SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$0.00	$0.00	$0.00	
TASK 3 - Ground Truthing Field Work																			$37,426.18
1 CHE - Contract and Project Management (1 hr/wk for 22 wks)						22									22	$0.00	$2,386.78	$2,386.78	
2 SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$17,978.40	$0.00	$17,978.40	
3 SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$11,960.00	$0.00	$11,960.00	
4 SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$0.00	$0.00	$0.00	
5 SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$5,101.00	$0.00	$5,101.00	
TASK 4 - Triangulation and Orthophotography																			$16,963.14
1 CHE - Contract and Project Management (2 hrs/wk for 8 wks)						16									16	$0.00	$1,735.84	$1,735.84	
2 SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$0.00	$0.00	$0.00	
3 SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$3,540.00	$0.00	$3,540.00	
4 SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$11,687.30	$0.00	$11,687.30	
5 SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$0.00	$0.00	$0.00	

Coast & Harbor Engineering, Inc
Lake Worth Lagoon Fixed Transect Seagrass Monitoring

Prepared by: S. Hicks

COAST & HARBOR ENGINEERING

CHE - Staff Hour Summary

	Item	Senior Principal Engineer $170.18	Senior Coastal Engineer $156.23	Principal Coastal Engineer $138.89	Coastal Scientist $103.27	Coastal Engineer $117.62	Engineer V - Project Manager $108.49	Engineer V $105.88	Engineer IV $98.05	Engineer III $89.54	Engineer I $78.44	Junior Engineer $65.26	CAD Designer $79.72	CAD Technician $76.49	Administrative $50.30	Total Hours	Reimbursable Expenses	Task Labor Cost	Subtotal Cost	Task Total Cost
TASK 5 - Positional Accuracy Assessment																				$4,207.34
1	CHE - Contract and Project Management (2 hrs/wk for 3 wks)						6									6	$0.00	$650.94	$650.94	
2	SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$0.00	$0.00	$0.00	
3	SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$0.00	$0.00	$0.00	
4	SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$3,556.40	$0.00	$3,556.40	
5	SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$0.00	$0.00	$0.00	
TASK 5A - Positional Accuracy Assessment - GCP Collection																				$1,801.98
1	CHE - Contract and Project Management (2 hrs/wk for 1 wks)						2									2	$0.00	$216.98	$216.98	
2	SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$0.00	$0.00	$0.00	
3	SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$1,585.00	$0.00	$1,585.00	
4	SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$0.00	$0.00	$0.00	
5	SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$0.00	$0.00	$0.00	
TASK 6 - Photo-Interpretation																				$26,347.02
1	CHE - Contract and Project Management (1 hr/wk for 18 wks)						18									18	$0.00	$1,952.82	$1,952.82	
2	SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$851.20	$0.00	$851.20	
3	SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$0.00	$0.00	$0.00	
4	SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$0.00	$0.00	$0.00	
5	SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$23,543.00	$0.00	$23,543.00	
TASK 7 - Draft and Final Coverages																				$5,183.92
1	CHE - Contract and Project Management Submittal Review and Coordination)						8									8	$0.00	$867.92	$867.92	
2	SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$0.00	$0.00	$0.00	
3	SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$0.00	$0.00	$0.00	
4	SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$0.00	$0.00	$0.00	
5	SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$4,316.00	$0.00	$4,316.00	
TASK 8 - Final Report																				$13,630.88
1	CHE - Contract and Project Management Submittal Review and Coordination)						12									12	$0.00	$1,301.88	$1,301.88	
2	SUBCONSULTANT Coastal-Eco Group - See Attached Proposal															0	$9,452.00	$0.00	$9,452.00	
3	SUBCONSULTANT Sea Diversified Inc - See Attached Proposal															0	$0.00	$0.00	$0.00	
4	SUBCONSULTANT Aerial Cartographics of America - See Attached Proposal															0	$0.00	$0.00	$0.00	
5	SUBCONSULTANT Nova Southeastern - See Attached Proposal															0	$2,877.00	$0.00	$2,877.00	
	Total Hours	0	1	0	0	0	116	0	0	0	0	0	0	0	0	117				
	Labor Cost	$0.00	$156.23	$0.00	$0.00	$0.00	$12,584.84	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00					
	note: Labor rates include overhead + profit) Reimbursable Costs																$121,313	$12,741.07		
	Subtotal Costs	$0	$156	$0	$0	$0	$12,585	$0	$0	$0	$0	$0	$0	$0	$0		$121,313			
	Total Project Costs																			$134,054.17

Total Cost (Not Including Optional Task 2A and 5A) $120,608.76
Total Cost (Including Optional Task 2A and 5A) $134,054.17

Coastal Eco-Group Inc.
810 SE 8th Avenue, Suite C
Deerfield Beach, FL 33441
954.591.1219 Phone 954-653-2981 Fax

March 27, 2012

Mr. Scott Hicks, P.E.
Coast and Harbor Engineering, Inc
745 US Hwy 1, Suite 208
North Palm Beach, FL 33408

RE: Proposal for Professional Services for the 2012 Lake Worth Lagoon Seagrass Mapping Project

Dear Mr. Hicks:

Coastal Eco-Group, Inc. (CEG) is pleased to provide the following scope of services and associated costs in support of four major tasks for the proposed 2012 Lake Worth Lagoon Seagrass Mapping Project. The four tasks according to the CHE Statement of Work for the project are: Task 1) Preliminary Work Teleconference; Task 3: Groundtruthing Fieldwork; Task 6) PhotoInterpretation; and Task 8) Final Report Preparation. Detailed descriptions of CEG's proposed services under each task are provided below.

Task 1 – Preliminary Conference

Ms. Cheryl Miller of CEG will attend the pre-work conference to ensure that the objectives, procedures, and final deliverables of the project are understood prior to commencement of the pre-photointerpretation field work. The meeting will occur either at the County offices or via teleconference.

Task 1 Total Cost: $212.80

Task 3: Ground-truthing Field Work

3a. Pre-Photointerpretation Field Work.
The CEG field team shall visit the County-provided segments of "concern" to verify seagrass/algae occurrence. All pre-interpretation field work shall be done as close as possible to aerial acquisition, preferably within one month, so as to minimize any changes in growth and distribution of seagrass and macroalgae. Four (4) days pre-photointerpretation field work will be conducted under Task 3a. In-water field observations will be performed at a minimum of 120 stations; observations will include seagrass density based upon 0.5 m^2 and species identification. CEG shall notify the County well in advance of the field dates so that the County can plan to visit the sites with the field team if desired.

3b. During-Photointerpretation Field Work. During photo-interpretation, sample locations to be visited include areas that are difficult to distinguish on aerial images due to water depth or clarity, algal blooms, outer boundaries of beds, and isolated seagrass patches. Four (4) days of during-photointerpretation field work will be conducted under Task 3b. In-water field observations will be performed at a minimum of 120 stations; observations will include seagrass density based upon 0.5 m^2 and species identification. CEG shall notify the County well in advance of the field dates so that the County can plan to visit the sites with the field team if desired.

Survey vessel/captain services are not a component of this scope of work. A separate consultant will be responsible for providing the eight days of survey vessel and boat captain in support of CEG for Tasks 3a and 3b.

Task 3 Deliverables: Data collected shall include field personnel, date, coordinate location using GPS, reason for inspection, pre-trip and post-trip classifications, and a detailed description of seagrass communities and densities. Once in-field analysis is completed at a particular site/GPS point, a classification code shall be applied to that GPS point and an ArcGIS shapefile will be created containing the field verification information. Deliverables include ArcGIS feature class containing pre-interpretation and during-interpretation field work documentation and a brief report including ground-truthing methodology and dates of field work.

Task 3a Fieldwork Total Cost: $8,804.40
Task 3b Fieldwork Total Cost: $8,804.40
Task 3a/3b Field Reporting Total Cost: $369.60

Task 6 – Photo-Interpretation

CEG will coordinate with and support the aerial photointerpretation sub-consultant, Nova Southeastern University, during their photointerpretation work and discuss the findings of the groundtruthing fieldwork and uncertain areas during this task. If needed, CEG will revisit problem areas in the field to resolve uncertainties.

Task 6 Total Cost: $851.20

Task 8 – Final Report

CEG will compile the data provided by the tasks performed by others under the CHE statement of work (Mapping/GIS Tasks 2, 4, 5, 6, and 7), and summarize and synthesize the ground-truthing data and field observations into a Draft Report. The Draft Report will be submitted via email for review by Palm Beach County. CEG will address County comments on the Draft Report and prepare a Final Report to be submitted via email to the County. Two hard copies of the Final Report and one electronic copy on CD/DVD will be provided to the County.

The project Final Report shall include:

1. A description of the mapping techniques used;
2. A copy of the classification key developed in Task 3 (provided by NSU);

3. A description of any problems encountered and their solutions;
4. Metadata documentation, compliant with the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata, filled out as completely as possible. To view or download the standard, consult: http://www.fgdc.gov/metadata/metadata.html (provided by NSU);
5. Recommended future modifications; and
6. A hard copy of the final map (fold out inserts of 11" x 17") including countywide and sub-basin maps *(Note: Electronic copy of the map to be provided to CEG by NSU for inclusion in the final hard copy of the report).*
7. Hard copy 11" x 17" maps indicating changes in SAV extents between 2007 and 2012. (For the purposes of comparing 2007 results to 2012, the 2007 data classification for Tidal Flats (FLUCCS code 6510) shall be converted to Unvegetated Bottom (FLUCCS code 5400). *(Electronic copy of the map to be provided to CEG by NSU for inclusion in the final hard copy of the report).*
8. Narrative and tabular summary of 2012 data by sub-basin reach and analysis compared to 2007. The report will discuss the seagrass objectives of the Lake Worth Lagoon Management Plan, evaluate trends in seagrass extents over time, discuss County seagrass restoration accomplishments, and offer recommendations for future monitoring and restoration objectives,

Task 6 Total Cost: $9,452

The total cost to conduct the work described in this scope of services is **$28,494.40**, and includes all labor, equipment costs, and map/report preparation costs.

Thank you for the opportunity to provide this scope of services and cost estimate. Please let me know if you have any questions. We look forward to working with you on this project.

Sincerely,

Cheryl L. Miller

Cheryl L. Miller
President, Coastal Eco-Group Inc.

2012 PALM BEACH COUNTY
2012 SEAGRASS MAPS LAKE WORTH LAGOON

COASTAL ECO-GROUP INC.
COST ESTIMATE

TASK #	DESCRIPTION	COST
TASK 1	KICK OFF TELECONFERENCE	$212.80
TASK 3A	Pre-Aerial Groundtruthing- 4 days	$8,804.40
TASK 3B	Post-Aerial Groundtruthing- 4 days	$8,804.40
TASK 3C	Field Updates to County Staff	$369.60
TASK 6	COORDINATION WITH PHOTOINTERPRETATION/GIS	$851.20
TASK 8	FINAL REPORT	$9,452.00
	TOTAL COST:	$28,494.40

PALM BEACH COUNTY
2012 SEAGRASS MAPS LAKE WORTH LAGOON

	LABOR COST			DIRECT COSTS				
	Principal Scientist (Hours)	Senior Scientist (Hours)	Staff Scientist (Hours)	Underwater Video (Day)	Underwater Still Camera (Day)	Diver Supplies (Days)	SCUBA Tanks (Number)	Dive Equipment (Days)
TASK 1 - PRE-WORK PROJECT MEETING WITH COUNTY STAFF	2							
TASK 3- GROUND-TRUTHING FIELDWORK								
A. Pre-Aerial Groundtruthing	22	44	22	4	4	4	16	8
B. Post-Aerial Groundtruthing	22	44	22	4	4	4	16	8
C Field Updates to County Staff		4						
TASK 6 - COORDINATION WITH PHOTOINTERPRETATION/GIS	8							
TASK 8 - FINAL REPORT	40	40	20					
Total =	94	132	64	8	8	8	32	16
Rate =	$106.40	$92.40	$75.00	$50.00	$30.00	$25.00	$8.00	$25.00
Cost =	$10,001.60	$12,196.80	$4,800.00	$400.00	$240.00	$200.00	$256.00	$400.00
TOTAL LABOR COST =		$26,998.40						
TOTAL DIRECT COST =		$1,496.00						
TOTAL COST =		**$28,494.40**						

SEA Diversified, Inc.
310 North Swinton Avenue
Delray Beach, Florida 33444
Phone: 561-243-4920
Facsimile: 561-243-4957

4640 Lipscomb Street, Suite 12
Palm Bay, Florida 32905
Phone: 321-984-7268
Facsimile: 321-984-7270

April 2, 2012

Scott Hicks, PE
Coast & Harbor Engineering, Inc.
745 U.S. Hwy, Suite 208
North Palm Beach, FL 33408

RE: Agreement for Professional Surveying Services – Revision Four
Survey and Vessel Support for Palm Beach County 2012
Lake Worth Lagoon Seagrass Mapping
Sea Diversified Inc. Project Number 12-1894

Dear Scott:

In accordance with your request, Sea Diversified, Inc. (SDI) is pleased to submit the following proposal for professional services. The scope of work shall include aerial mapping ground control along with vessel support pertaining to diver groundtruthing activities. Services shall be conducted in accordance with the Statement of Work (SOW) prepared by the County as provided by Coast & Harbor Engineering, Inc. on February 24, 2012. This proposal will specifically pertain to Tasks One through Five of the SOW prepared by the County. Details are as follows:

General:
Sea Diversified, Inc. shall provide supervision, field / office support staff and equipment to perform the scope of work described, herewith. All work shall be conducted to the highest level of industry standards and under the responsible charge of a Professional Surveyor and Mapper registered in the State of Florida. All work shall meet or exceed the Minimal Technical Standards set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 5J-17, Florida Administrative Code, pursuant to Section 472.027, Florida Statutes.

Task One: Preliminary Conference
SDI shall participate in a project kick-off conference call with representatives of the County along with other Consultants involved with the project.

Task Two: Acquisition of Lagoon-wide Digital Aerial Photos

Water Clarity / Quality
Water clarity conditions are critical to the success of the aerial mission. SDI will assist ACA with determining the clarity of the lagoon in advance of each flight window. This will consist of water clarity / quality measurements at four (4) stations dictated by the County (Two Georges Fuel Dock, Lantana Boat Ramp, Bryant Park Ramp and Southern Boulevard Bridge). The measurements will be taken the day before each scheduled flight during the tide window dictated by ACA. Measurements will be obtained using a secchi disk with minimum disk visibility criteria of four (4) feet below the water surface, as established by the County. For staff hour and cost purposes, it is assumed that SDI will monitor the stations on fifteen (15) separate events with an average of two (2) hours per event.

Task Two (Optional): Re-Flight Water Clarity / Quality Testing
In the event of a required re-flight of the aerial photography, SDI will redeploy technicians to assist in determining the clarity of the lagoon in advance of each flight window. Similar to that described above, this will consist of water clarity / quality measurements at four (4) stations dictated by the County (Two Georges Fuel Dock, Lantana Boat Ramp, Bryant Park Ramp and

Southern Boulevard Bridge). The measurements will be taken the day before each scheduled flight during the tide window dictated by ACA. Measurements will be obtained using a secchi disk with minimum disk visibility criteria of four (4) feet below the water surface, as established by the County. For staff hour and cost purposes, it is assumed that SDI will monitor the stations on fifteen (15) separate events with an average of two (2) hours per event.

Task Three: Groundtruthing Field Work
To assist in the diver groundtruthing effort, SDI shall provide a suitable dive platform or survey launch along with an operator and positioning / navigation system. A marine-grade sounder shall additionally be provided if requested by the Biological Team. Cost shall be based on a total of eight (8), ten (10) hour field days, which includes mobilization /demobilization and travel time. This shall encompass four (4) pre-photointerpretation work days and four (4) post-photointerpretation work days.

Task Four: Photo ID Ground Control
SDI shall determine the X,Y and Z positions of nineteen(19) aerial photo ground control points. The ground control points were reportedly those used to control the 2007 aerial mapping efforts and shall be provided to SDI by the County. RTK GPS positioning shall be employed to measure the positions at each location. Positional calibrations shall be performed throughout the survey to ensure horizontal and vertical site calibration accuracies. ACA will be provided with a tabulation of coordinates, digital photographs of each point along with a sealed survey report.

Task Five A (Optional): Additional Surveying for Positional Accuracy Assessment
As an option, SDI shall obtain additional aerial photo ground control points as necessary for aerial triangulation. The ground control points will be equally distributed around the County as dictated by ACA. Cost for this optional service shall be based on one day of field data collection and an estimated fifteen (15) to twenty (20) additional ground control points. The points, considered check points, will be used for positional accuracy assessment. RTK GPS positioning shall be employed to measure the positions at each location. Positional calibrations shall be performed throughout the survey to ensure adequate horizontal accuracy levels are achieved. ACA will be provided with a tabulation of coordinates, digital photographs of each point along with a sealed survey report.

Cost:
The cost for the above described services in accordance with the attached staff hour projections and cost estimates shall be as follows:

Task One:	Preliminary Conference	$ 240.00
Task Two:	Acquisition of Lagoon-wide Digital Aerial Photos	$ 2,700.00
Task Two (Optional):	Re-Flight Water Clarity / Quality Testing	$ 2,700.00
Task Three:	Groundtruthing Field Work	$ 11,960.00
Task Four:	Photo ID Ground Control	$ 3,540.00
Task Five A: (Optional)	Positional Accuracy Assessment	$ 1,585.00
Total:		**$22,725.00**

Should you have questions or require additional information please do not hesitate to contact us at your convenience. We appreciate this opportunity to assist you with this project and look forward to hearing from you soon.

Sincerely,

William T. Sadler Jr., P.E., P.S.M.
President

WTS/dq

Cost Breakdown - Revision Three
Sea Diversified, Inc.
2012 Seagrass Mapping
SDI P.N. 12-1894
March 30, 2012

Task One: Preliminary Conference

Description	Reg Hours	Reg Rate	OT Hours	OT Rate	Unit	Total
Professional Surveyor and Mapper	2	$120.00		$180.00	PH	$240.00
Total Cost:						**$240.00**

Task Two: Acquisition of Lagoon-wide Digital Aerial Photos

Description	Reg Hours	Reg Rate	OT Hours	OT Rate	Unit	Total
Engineering Technician	30	$90.00		$135.00	CH	$2,700.00
Total Cost:						**$2,700.00**

Task Two Optional: Re-Flight Water Clarity / Quality Testing

Description	Reg Hours	Reg Rate	OT Hours	OT Rate	Unit	Total
Engineering Technician	30	$90.00		$135.00	CH	$2,700.00
Total Cost:						**$2,700.00**

Task Three: Groundtruthing Field Work

Description	Reg Hours	Reg Rate	OT Hours	OT Rate	Unit	Total
Survey / Dive Platform w/ Operator and Positioning	64	$175.00		$262.50	CH	$11,200.00
Survey Manager	8	$95.00		$142.50	PH	$760.00
Total Cost:						**$11,960.00**

Task Four: Photo ID Ground Control

Description	Reg Hours	Reg Rate	OT Hours	OT Rate	Unit	Total
2-Person GPS Survey Crew	16	$160.00		$240.00	CH	$2,560.00
Computer / CADD Operator	4	$90.00		$135.00	PH	$360.00
Survey Manager	4	$95.00		$142.50	PH	$380.00
Professional Surveyor and Mapper	2	$120.00		$180.00	PH	$240.00
Total Cost:						**$3,540.00**

Task Five A (Optional): Additional Surveying for Positional Accuracy Assessment

Description	Reg Hours	Reg Rate	OT Hours	OT Rate	Unit	Total
2-Person GPS Survey Crew	8	$160.00		$240.00	CH	$1,280.00
Computer / CADD Operator	1	$90.00		$135.00	PH	$90.00
Survey Manager	1	$95.00		$142.50	PH	$95.00
Professional Surveyor and Mapper	1	$120.00		$180.00	PH	$120.00
Total Cost:						**$1,585.00**

Notes:
1. GPS crew rates include High Order GPS equipment (Trimble or equivalent) and vehicle.
2. All labor rates include labor multiplier (overhead and fringe) and operating margin.

Aerial Cartographics of America, Inc.
DIGITAL MAPPING - LAMP - LIDAR - GIS - PHOTOGRAPHY - ORTHOS

April 4, 2012

Mr. Scott Hicks, PE
Coast and Harbor Engineering, Inc.
745 US Hwy, Suite 208
North Palm Beach, FL 33408

Subject: **Lake Worth Lagoon Project**
ACA Proposal # 16072.5

Dear Mr. Hicks

Our firm greatly appreciates this opportunity to provide you with our proposal to perform professional photogrammetric services as requested. The following proposal is based on our understanding of the scope of work. This proposal can be individually modified to meet your requirements, upon request.

Our proposed Scope of Work is as follows:

Project Area

The project area is calculated to total approximately 45 linear miles in length. The entire project includes the entire LWL system and the Atlantic Intracoastal Waterway (ICW) throughout Palm Beach County, including the Loxahatchee River extending north to the County line to the west, and the ICW north of Jupiter Inlet extending north to the County line, excluding only the canals off the main water bodies. The project study area will be divided into 6 general categories:

1. ICW North Segment: begins at northern county line and continues south to the line where the ICW meets the LWL at the US 1 Bridge in North Palm Beach
2. LWL: begins at the line where the ICW meets the LWL at US 1 Bridge, includes Little Lake Worth, and continues south to the Ocean Ave Bridge in Boynton Beach.
3. LWL North Segment: begins at the US 1 Bridge in North Palm Beach, includes Little Lake Worth and continues south to the Flagler Memorial Bridge in West Palm Beach.
4. LWL Central Segment: begins at the Flagler Memorial Bridge in West Palm Beach and continues south to the Lake Worth Bridge in Lake Worth .
5. LWL South Segment: begins at the Ocean Lake Worth Bridge in Lake Worth and continues south to the Ocean Ave. Bridge in Boynton Beach.
6. ICW South Segment: begins at the Ocean Ave. Bridge in Boynton Beach and continues south to the county line.

Digital Imagery Acquisition

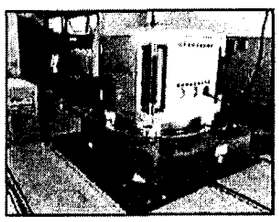
All aerial imagery for this project will be collected using a UCX digital sensor. The UCX will collect aerial imagery at a 9 inch pixel resolution in panchromatic, red, green, blue, and near-infrared spectral bands. However, only a true color version of the digital imagery is proposed for this project. Near-infrared bands can be processed and delivered for an additional fee if required.

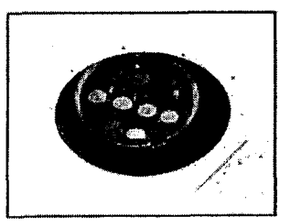
This UCX system is operated in aircraft that are each permanently equipped with geodetic grade GPS antennas and receivers to conduct airborne GPS operations. The UCX, equipped with FMC and an Applanix POS 510AV inertial measurement unit, which is mounted on a PAV30 gyro-stabilized platform. The simultaneous collection of airborne GPS and IMU data with the aerial imagery ensures an exceptional level of accuracy in the final product.

UCX Sensor Specifications and Capabilities

The UCX digital camera system incorporates optics, electronics, data transfer, and storage. The viewing angles and characteristics of the sensor are as follows:

- Image Frame Size: 216 MB, largest digital frame mapping system available today
- Pixel size 7.2 microns
- 13 CCD sensors
- Panchromatic band: 4 arrays
- R,G,B and NIR bands 4 arrays
- Dynamic Range of CCD: 12-bits all arrays
- IMU POS AV 510





for

The digital imagery, GPS, and IMU position and orientation data are recorded during each sortie and are written to the Flight Data Storage (D-X) that is part of the UCX sensor control unit. On completion of a mission the hard disk drive system is removed and the data is offloaded onto a storage system at a base of operation / production facility. The D-X can store 1.7 terabytes of data which represents approximately 8 hours of collection time.

The UCX sensors are calibrated by the manufacturer prior to shipment and a report is provided in the form of a calibration certificate for each sensor.

Conditions During Aerial Imagery Acquisition

Water Clarity: The major constraint, besides air clarity and weather, is water clarity. Water is expected to be clearest either (a) a few days after the passage of a dry front, when water temperatures are at a minimum and after winds have been slight or in a direction perpendicular to the main north-south axis of the Lagoon, or (b) after a few weeks of low rainfall and moderate to calm wind conditions.

Sun Angle: Photography shall be acquired when surface reflection from sun glint does not cover more than 10% of the frame. Surface water roughness will also affect sun glint. Sun angle generally between 15 degrees and 30 degrees should minimize surface water glitter.

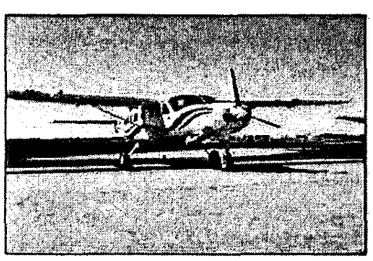
Weather Conditions: Clear skies with no haze and visibility of at least 10 miles. Sea state calm, minimal waves, no white caps. Winds less than 5 knots across the E/W axis of the Lagoon are not expected to affect surface transparency, but may affect sun glint. Because winds are generally calmer early in the day, mornings are considered preferable to afternoons.

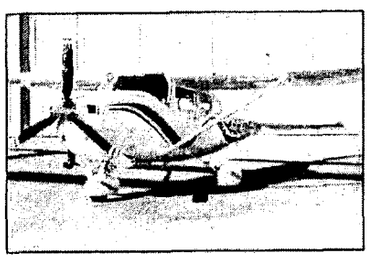
Tide Constraints: The aerial shall be flown at mean low tide, plus or minus 1.5 hours. The tide station located at Okeechobee Boulevard, State Road 704 Bridge and Flagler Drive in West Palm Beach will be used to determine low tide. Consultant is free to propose alternatives based upon their professional experience.

Date: All photographs shall be taken during a single 14-day period, if possible, and preferably on the same day or adjacent days. The Consultant is encouraged to consider using two flight teams in order to take all photos on a single day.

Deliverables

- Pre-acquisition flight line plan map.
- Draft samples of un-rectified, raw imagery, prior to subsequent aerial triangulation and orthorectification within two weeks after acquisition. *These samples shall be used to determine the acceptability of the imagery prior to commencing with other tasks.*
- Sensor/system processed raw digital image files in a format compatible to County's data.
- All intermediate camera files including the airborne GPS/IMU data needed for aerotriangulation.
- Flight log (mission log with dates of acquisition) and ABGPS control documentation within the survey report delivery by a Florida Professional Surveyor and Mapper.





EQUIPMENT	TYPE	QUANTITY
Aircraft (turbo-engine)	Cessna 208 Grand Caravan	1
	Cessna 206 Turbo Stationair	1

Flight Planning QC

Successful collection of aerial photography is a critical part of the production chain because all other phases depend on this data. Since so much depends on successful completion of aerial imagery, each phase of planning and acquisition has quality control steps to ensure that photography is acquired correctly.

QUALITY CONTROL ELEMENT	SPECIFICATION
Criteria for Remedial Action	Insufficient coverage or data gaps Lack of visible ground control Incorrect scale and/or resolution Cloud cover Sun angle, site suitability conditions for snow, flooding, dust, haze, or smoke Sensor malfunction Sidelap Tilt Crab Data corruption
Frequency for Evaluation	Ongoing, inspection of data ASAP in the Orlando production facility
Timeframe for Mitigation	Immediate; re-flights ordered as soon as issue is detected, normally within 2 to 3 days
Verification of Mitigation	Immediate inspection of re-flight data
Notification	Via email and telephone as soon as problem is detected and resolved

Flight Planning & Airborne Data Acquisition

During the development of the aerial acquisition plan, flight maps are independently inspected by the mission planner and the aircraft sensor operation specialist to ensure that the coverage is sufficient, the altitude and sidelap is correct, and that there are no errors in the geographic reference of the plan. Prior to commencement of aerial acquisition, the flight operations manager will prepare an acquisition plan that is based on the approved flight plans and will provide each flight crew with the acquisition plan for their area of responsibility, flight log forms, sensor log forms, GPS PDOP tables and a copy of specifications.

Once flight maps are approved, the coordinate values for the flight line start and stop points are loaded into the Track Air flight management system which is used to control all aspects of the actual mission. The tolerances for deviation from altitude and side lap are preset into the flight management parameters. During the aerial collection mission, if the aircraft starts to deviate from the prescribed plan, a visual alert appears on the pilot and sensor operator's console. If the aircraft continues to deviate and exceeds the tolerance, the sensor system is shut down and the line is aborted and re-flown. The flight crews will monitor weather conditions and will launch based on a favorable forecast and accompanying GPS constellation.

The aircrew will obtain the necessary clearances for the areas to be acquired and will set up, or coordinate with the ground crews, the needed GPS base stations.

Flight logs are completed using an internet accessible database located at the Orlando production & operations facility.

Sample raw imagery files will be provided to Coast & Harbor Engineering to approve image quality prior to ortho processing.

Triangulation and Orthophotography

Project Area: Triangulation and orthophotography shall be done for Project Boundary-Figure 1: the entire LWL system and the Atlantic Intracoastal Waterway (ICW) throughout Palm Beach County, including the Loxahatchee River extending north to the County line to the west, and the ICW north of Jupiter Inlet extending north to the County line, excluding only the canals off the main water bodies.

Aerial Triangulation Specifications: ACA understands the County will provide the entire set of ground control points used for the 2007 mapping effort. These will be provided in a spreadsheet format and ArcGIS shapefiles indicating detailed site locations. Any additional ground control points collected by the Consultant shall be measured with sub-meter differential GPS.

Aerotriangulation accuracy shall be designed to ensure that the triangulated imagery and associated digital orthophotography shall meet USGS National Map Accuracy Standards for 1:24,000-scale map products.

Airborne GPS/IMU data will be used for aerial triangulation along with any necessary ground control points.

Checkpoints shall be utilized to test the spatial accuracy of the aerial triangulation solution. The results of the comparison between checkpoints and the adjusted imagery will be reported within the Aerial Triangulation Report which will be part of the PSM Survey Report. The number of checkpoints to be utilized for the project will be decided during negotiations.

Deliverables:

- An Aerial Triangulation Report within the PSM Survey Report describing the aerial triangulation process and results. ABGPS/IMU procedures, ground control point documentation, spatial accuracy assessment, residuals, etc. will be detailed and compliant to Florida's Minimum Technical Standards.
- Aerial triangulation files

Digital Orthophotography Specifications: Digital orthophotography will be generated and delivered for the project based on the following specifications:

Orthophotos will be delivered as 4-band stacked RGB images

The final ground sample distance and pixel size of all digital orthophotography shall be one (1) foot. The file format of the digital orthophotography shall be mosaiced and provided .tiff with associated .tfw files.

The digital orthophotos shall delivered on a portable hard drive to the County. Mosaiced files will be to no larger than 500 mb so that ERM can compress them using Desktop Mr. Sid software. If the files exceed 500 mb, then ACA will also provide compressed files in Mr. Sid format.

The digital orthophotos shall be delivered and projected to NAD_1983_HARN_StatePlane_Florida_East_FIPS_0901_Feet for Project Boundary Figure 1. The digital orthophotography will be tiled based on Florida's 5000ft x 5000ft tiling scheme. A tile shapefile will be provided by the County.

The digital orthophotos shall be delivered on a portable hard drive to the County.

The Digital Elevation Model (DEM) used for orthorectification will be decided upon during the preliminary conference or during contact negotiations.

Deliverables:

- Sample image for quality approval
- 4-band stacked digital orthophotography tiles based on Florida's 5000ft x 5000ft tiling scheme.
- FDGC-compliant metadata

The ortho rectification will be performed on a pixel-by-pixel basis utilizing the cubic convolution re-sampling method.

Quality Control Procedures

The success of this project will be realized through a combination of comprehensive planning and a highly structured approach to quality control. Our approach is designed to prevent the occurrence of errors, omissions, or blunders that will disrupt the production workflow and potentially impact the quality of the final geospatial products that will be produced by Aerial Cartographics of America, Inc. The quality management system provides clients with an added level of assurance in the mission planning, data acquisition imagery production, and delivery processes. The quality control procedure maintains product quality standards through evaluation, inspection, and verification of deliverables at all stages of production.

The media is then inspected to confirm that there is no corruption of the data files and to confirm that all of the needed data files are on the designated media.

ACA has extensive experience dealing with the production of large-scale projects. We have tailored quality control routines for efficiency of throughput and combined them with a comprehensive review of digital ortho imagery data to verify the quality of the data over multiple days of image collection and varying types of terrain and land cover.

- ACA has successfully utilized quality control criteria to complete digital imagery in multiple countywide projects.
- ACA has integrated quality control processes for digital imagery production, mosaicing, and radiometric correction into a single efficient workflow.

Positional Accuracy Assessment

ACA shall also conduct a positional accuracy assessment. Points used for this assessment will not be those used as control for aero-triangulation. Several tests shall be performed during the aero triangulation task in order to ensure a positionally accurate project that meets the project specifications.

Sea Diversified will gather a new subset of known control points that were not used within the aero triangulation solution. A total sample of 50 points identified by ACA will be uniformly distributed to cover the Project Boundary described on Figure 1.

The selected coordinates shall be identifiable on the seagrass coverage's and be visible in the field or on other map products that contain a better positional accuracy.

Deliverable:

A positional accuracy assessment report.

Metadata

The completed digital ortho imagery will be documented through the development of file and project level metadata that is fully compliant with FGDC requirements. Compliance will be verified through the use of validation tools recognized by FGDC.

ACA Responsibilities for Statement of Work

1. Attend Task 1 meeting $220.00
2. Complete Task 2 with help from SDI on Water and wind conditions $10,504.00
3. Complete Task 4 (with additional Mr.SID files $11,687.30
4. Positional accuracy assessment as described (not entire assessment) $3,556.40

The completed digital ortho imagery will be documented through the development of file and project level metadata that is fully compliant with FGDC requirements. Compliance will be verified through the use of validation tools recognized by FGDC.

Fee

Twenty-five thousand nine hundred sixty-seven dollars and 70/100 ..... $25,967.70

If water conditions affect the quality of imagery and a new acquisition is required, the cost would be:

Eight thousand one hundred eighty-four dollars $8,184.00

Payment Terms:

ACA will invoice monthly in accordance with percent complete. Payment terms are 30 days. It is understood that this agreement is between ACA and the addressee and payment is not contingent on payment from a third party unless other written agreements or guarantees are agreed to by both parties and attached hereto.

If ACA incurs any expense, including but not limited to, attorney's fees and court costs, in connection with actions or proceedings brought or joined by ACA to enforce any provision, duty or obligation of Coast & Harbor Engineering, Inc. under this Agreement, Coast & Harbor Engineering, Inc. shall compensate ACA for attorney's fees, damages, losses, costs or expenses of enforcement.

We appreciate the opportunity of submitting this proposal and look forward to working with you on this project. If acceptable, a space is provided for an authorized signature. We will consider the return of the signed original letter as our legal contract and Notice to Proceed.

By signing below I APPROVED AND ACCEPT this letter as a legal contract and I have read and agree to the payment terms as set forth above.

By: _____ Date: _____
(Authorized Signature)

_____ Title: _____
(Typed or printed name)

Very truly yours,

AERIAL CARTOGRAPHICS OF AMERICA, INC.

Steven Kuda, PSM, PHO
Senior Vice President

DRAFT

ACA

Labor Category	Hourly Rate	Labor Hours	Total	Percent
Level 1	$ 66.00	0.0	$ -	0.0%
Level 2	$ 80.00	34.0	$ 2,720.00	8.0%
Level 3	$ 93.00	145.0	$ 13,485.00	39.5%
Level 4	$ 110.00	34.0	$ 3,740.00	11.0%
Level 5	$ 126.00	0.0	$ -	0.0%
Level 6	$ 143.00	0.0	$ -	0.0%
Survey Crew - 2 Man	$ 91.14	0.0	$ -	0.0%
Survey Crew - 3 Man	$ 118.34	0.0	$ -	0.0%
Survey Crew - 4 Man	$ 145.53	0.0	$ -	0.0%
Labor Subtotal:		**213.0**	**$ 19,945.00**	**58.4%**

Expense Type	Total	Percent
Media	$ 4.50	0.0%
Printing	$ -	0.0%
Reproduction	$ -	0.0%
Shipping	$ 13.00	0.0%
Technology	$ 14,189.20	41.5%
Telecom	$ -	0.0%
Travel	$ -	0.0%
Expense Subtotal:	**$ 14,206.70**	**41.6%**
Total Fee:	**$ 34,151.70**	**100.0%**

DRAFT

Task #	Task Description	Level 1 $66.00	Level 2 $80.00	Level 3 $93.00	Level 4 $110.00	Level 5 $126.00	Level 6 $143.00	Survey 2-Man $91.14	Survey 3-Man $118.34	Survey 4-Man $145.53	Total Labor Cost	Total task cost with expences	
1	flight planning	$ -	$ 480.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 480.00	**$480.00**	
2	aerial data acquisition	$ -	$ 1,280.00	$ 1,488.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,768.00	**$16,368.00**	Includes 2 flights
3	image data processing	$ -	$ 960.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 960.00	**$960.00**	Includes sample image
4	ABGPS/IMU processing	$ -	$ -	$ -	$ 880.00	$ -	$ -	$ -	$ -	$ -	$ 880.00	**$880.00**	
5	analytical triangulation	$ -	$ -	$ 1,860.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,860.00	**$1,860.00**	
6	DEM processing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
7	autocorrelation / DEM QC	$ -	$ -	$ 558.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 558.00	**$558.00**	
8	image data processing for ortho's	$ -	$ -	$ 6,417.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,417.00	**$7,023.70**	
9	metadata	$ -	$ -	$ 558.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 558.00	**$558.00**	
10	QA/QC	$ -	$ -	$ -	$ 880.00	$ -	$ -	$ -	$ -	$ -	$ 880.00	**$880.00**	
11	Meetings, Reports & ESRI submittals	$ -	$ -	$ 2,604.00	$ 1,980.00	$ -	$ -	$ -	$ -	$ -	$ 4,584.00	**$4,584.00**	
12		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
13		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
14		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
15		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
	Labor Cost Subtotals:	**$ -**	**$ 2,720.00**	**$13,485.00**	**$ 3,740.00**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 19,945.00**	**$34,151.70**	

DRAFT

Task #	Task Description	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Survey 2-Man	Survey 3-Man	Survey 4-Man	Total Labor	Total Survey
1	flight planning	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0
2	aerial data acquisition	0.0	16.0	16.0	0.0	0.0	0.0	0.0	0.0	0.0	32.0	0.0
3	image data processing	0.0	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0
4	ABGPS/IMU processing	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0
5	analytical triangulation	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0
6	DEM processing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	autocorrelation / DEM QC	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0
8	image data processing for orthos	0.0	0.0	69.0	0.0	0.0	0.0	0.0	0.0	0.0	69.0	0.0
9	metadata	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0
10	QA/QC	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0
11	Meetings,Reports & ESRI submittals	0.0	0.0	28.0	18.0	0.0	0.0	0.0	0.0	0.0	46.0	0.0
12		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Labor Hour Subtotals:	**0.0**	**34.0**	**145.0**	**34.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**213.0**	**0.0**

Notes: 1
2
3

DRAFT

Task #	Task Description	L1 Admin	L1 MapTech	L1 Lab Tech	L1 Photogrm	L2 MapTech	L2 Lab Tech	L2 Photogrm	L3 GIS	L3 Photogrm	L3 Pilot	L4 PSM	Total Labor
1	flight planning							6.0					6.0
2	aerial data acquisition					16.0					16.0		32.0
3	image data processing						12.0						12.0
4	ABGPS/IMU processing											8.0	8.0
5	analytical triangulation									20.0			20.0
6	DEM processing												0.0
7	autocorrelation / DEM QC									6.0			6.0
8	image data processing for orthos									69.0			69.0
9	metadata									6.0			6.0
10	QA/QC											8.0	8.0
11	Meetings,Reports & ESRI submittals									28.0		18.0	46.0
12													0.0
13													0.0
14													0.0
15													0.0
	ACA Labor Subtotals	**0.0**	**0.0**	**0.0**	**0.0**	**16.0**	**12.0**	**6.0**	**0.0**	**129.0**	**16.0**	**34.0**	**213.0**

Notes: 1
2
3

DRAFT

Expense Type	Expense Item	Unit Cost	# Units	Total
Media	External Hard Drive	$ -	0	$ -
Media	CD or DVD Disk	$ 1.50	3	$ 4.50
Media Total		$ -		**$ 4.50**
Printing	Plotting - Color Inkjet, $1.00 Per Square Foot	$ -	0	$ -
Printing	Plotting - Color Laser, Legal	$ -	0	$ -
Printing	Plotting - Color Laser, Letter	$ -	0	$ -
Printing	Plotting - Color Laser, Tabloid	$ -	0	$ -
Printing	Printing - Letter, B&W	$ -	0	$ -
Printing	Printing - Tabloid, B&W	$ -	0	$ -
Printing Total		$ -		**$ -**
Reproduction	Dry Mount Foamboard, $4.00 Per Square Foot	$ -	0	$ -
Reproduction	Laminating, $1.98 per 8.5" x 11" page	$ -	0	$ -
Reproduction	Photocopies - Letter, B&W	$ -	0	$ -
Reproduction	Photocopies - Letter, Color (Includes $1.00 Setup Charge)	$ -	0	$ -
Reproduction	Photocopies - Tabloid, B&W	$ -	0	$ -
Reproduction	Photocopies - Tabloid, Color (Includes $1.00 Setup Charge)	$ -	0	$ -
Reproduction	Presentation Board, $254.40 Per Board	$ -	0	$ -
Reproduction Total		$ -		**$ -**
Shipping	Shipping & Postage - Courier	$ 13.00	1	$ 13.00
Shipping	Shipping & Postage - Overnight	$ -	0	$ -
Shipping	Shipping & Postage - US Postal Service	$ -	0	$ -
Shipping Total		$ -		**$ 13.00**
Technology	GPS, Sokkia Stratus, Per Day	$ -	0	$ -
Technology	GPS, Trimble GeoXT, Per Day	$ -	0	$ -
Technology	Lizardtech (MRSID) file compression	$ 589.20	1.00	$ 589.20
Technology	Contact Prints	$ -	0	$ -
Technology	Diapositives	$ -	0	$ -
Technology	Microsoft Vexcel UCX aerial sensor	$ 350.00	16	$ 5,600.00
Technology	Aircraft	$ 500.00	16	$ 8,000.00
Technology	Computer Technology Charge, $4.10 Per Staff Hour	$ 4.10	0	$ -
Technology Total		$ -		**$ 14,189.20**
Telecom	Telephone, Long Distance, Per Minute	$ -	0	$ -
Telecom Total		$ -		**$ -**
Travel	Airfare, Coach/Economy Class, Per Round Trip	$ -	0	$ -
Travel	Car Rental, Mid-Size, Per Day	$ -	0	$ -
Travel	Class A - $12.50, Per Quarter Travel Day	$ -	0	$ -
Travel	Class B - $12.50, Per Quarter Travel Day	$ -	0	$ -
Travel	Class C - Breakfast $6, Lunch, $11, Dinner $19, Per Day	$ -	0	$ -
Travel	Hotel, Per Day	$ -	0	$ -
Travel	Mileage, Personally Owned Vehicle, $0.29 Per Mile	$ -	0	$ -
Travel Total		$ -		**$ -**
Grand Total		$ -		**$ 14,206.70**

NOVA SOUTHEASTERN UNIVERSITY

April 2, 2012

Coast & Harbor Engineering, Inc.
745 U.S. Hwy, Suite 208
North Palm Beach, FL 33408

Re: Palm Beach County 2012 seagrass mapping project

To Coast and Harbor Engineering:

This letter outlines the work Nova Southeastern University (NSU) intends to perform as part of the upcoming Palm Beach County seagrass mapping project as defined in the latest (March 28, 2012) draft scope of work. The overall objective of project is for the consultant (Coast & Harbor Engineering) to: A) acquire 2012 time appropriate aerial imagery of the entire Lake Worth Lagoon (LWL) and Intracoastal Waterway (ICW) throughout Palm Beach County captured directly in digital format by a photogrammetric pushbroom scanner or a frame based Digital Mapping Camera (DMC); B) produce a complete 2012 seagarass map primarily by photo-interpreting this newly acquired aerial imagery in ArcInfo 10 GIS; C) collect quantitative and ancillary ground truth data in segments of concern for algal blooms, outer boundaries of beds, and isolated seagrass patches; D) deliver the processed aerial imagery along with all files used in establishing the blocks in orthorectification and other processes; and E) provide a final report with narrative and tabular summary of findings.

This work has been divided up into 8 tasks; each having different levels of contribution of effort by each subconsultant. Below, each task is listed with the expected effort for Nova Southeastern University and the estimated number of hours it will take.

Task 1: Preliminary Conference

NSU will participate in a 2 hour teleconference.

Estimated hours: 2; Cost: $105

Task 2: Acquisition of Lagoon-wide Digital Aerial Photos

NSU will provide consultation where needed.

Estimated hours: 0; Cost: $0

Task 3: Ground-truthing Field Work

NSU will support Coastal Eco Group (CEG) in field site selection and GIS support as well as identification of areas that required ground truthing. NSU will also be responsible for development of the photointerpretation key report.

Estimated hours: 97.5; Cost: $5,101

Oceanographic Center
8000 North Ocean Drive • Dania Beach, Florida 33004-3078
(954) 262-3600 • Fax: (954) 262-4098

Task 4: Triangulation and Orthophotography

NSU will provide consultation where needed.

Estimated hours: 0; Cost: $0

Task 5: Positional Accuracy Assessment

NSU will provide consultation where needed.

Estimated hours: 0; Cost: $0

Task 6: Photo-Interpretation

NSU will conduct the photo-intepretation of the aerial imagery.

CEG will coordinate with NSU and discuss all uncertain areas during this Task. CEG will revisit problem areas in the field to resolve uncertainties, if needed.

Estimated hours: 450; Cost: $23,543

Task 7: Draft and Final Coverages

NSU will conduct all technical work and deliverables in this task.

Estimated hours: 82.5; Cost: $4,316

Task 8: Final Report

CEG will compile the data provided by mapping/GIS Tasks under Items through 1 through 4 and 6 above, and summarize and synthesize the ground-truthing data and field observations into a Draft Report for review by Palm Beach County. NSU will assist CEG and will provide information as necessary for completion of the report.

Estimated hours: 55; Cost: $2,877

The estimated total number of hours of effort by NSU for this project is 687 at a total cost of $35,942. I will be the NSU principle investigator for the habitat delineation; however Coast and Harbor engineering must subcontract NSU for me to perform those duties. Once the statement of work is finalized, please work with our grants and contracts office for subcontracting.

Thank you for having me as part of your team and I look forward to working with you.

Sincerely,

Dr. Brian K. Walker
Research Scientist
Nova Southeastern University

Nova Southeastern University

2012 Palm Beach County Seagrass Mapping

Prepared by: B. Walker

**All time is budgeted as overtime at regular wage rate.

NSU - PI Hour Summary - 7.5 hrs = 1 day

Item	Principal Investigator $34.53	Total Hours	Task Labor Cost	Fringe (26.5%)	Overhead (25%)	Subtotal Cost	**Task Total Cost**
TASK 1 Preliminary Conference and Study Plan	2	2	$69	$18	$17	$105	$105
TASK 2 Acquisition of Digital Aerial Photos and Sample Imagery	0	0	$0	$0	$0	$0	$0
TASK 3 Ground-truthing Field Work			$0				$5,101
Task 3.1a Pre-interpretation field work	30	30	$1,036	$275	$259	$1,570	
Task 3.2 Develop Photo-interpretation Key	30	30	$1,036	$275	$259	$1,570	
Task 3.1b During-interpretation field work	37.5	37.5	$1,295	$343	$324	$1,962	
TASK 4 Triangulation and Orthophotography	0	0	$0	$0	$0	$0	$0
TASK 5 Positional Accuracy Assessment	0	0	$0	$0	$0	$0	$0
TASK 6 Photo-Interpretation	450	450	$15,540	$4,118	$3,885	$23,543	$23,543
TASK 7 Draft and Final Map							$4,316
Task 7.1 Draft map	37.5	37.5	$1,295	$343	$324	$1,962	
Task 7.2 Final map	7.5	7.5	$259	$69	$65	$392	
Task 7.3 Bathymetry Analysis	37.5	37.5	$1,295	$343	$324	$1,962	
TASK 8 Final Report	55	55	$1,899	$503	$475	$2,877	$2,877
Total Hours:	687	687	$23,724	$6,287	$5,931	$35,942	
Total Project Costs							**$35,942**

BUDGET AVAILABILITY STATEMENT
Palm Beach County
Environmental Resources Management

REQUEST DATE: 04/12/2012 **Task Order:** 1434-08

REQUESTED BY: Alessandra Medri **PHONE:** 233-2512

PROJECT TITLE: Seagrass monitoring **PROJECT NO:** E031

SITE: Lake Worth Lagoon **ACTIVITY:** Monitoring

CONTRACTOR/CONSULTANT NAME: Coast & Harbor Engineering, Inc.

SCOPE OF SERVICES: Seagrass monitoring and aerial imagery of the Lake Worth Lagoon.

BCC RESOLUTION #: R2010-1434 **TASK ORDER AGNDA DATE:** 5/1/2012

CHANGE ORDER #: _____ **REQUESTED AMOUNT:** $134,054.17

BUDGET ACCOUNT NUMBER(S):

Fund	Dept	Unit	Obj	SObj	Program	PPC	(Proj) Task	(Site) Sub Task	(Activity) Task Ord	Amount
1229	380	3057	3401		3057EX		E031	ILWL	014	$100,000.00
1226	380	3252	3401		3057EX		E031	ILWL	014	$34,054.17

BAS APPROVED BY: Liz Pluvi **DATE:** 4/12/12

ENCUMBRANCE NUMBER: TBD

Coast & Harbor Engineering, Inc.
Continuing Contract for Coastal and Marine Engineering

Contract R2010-1434 dated September 14, 2010 for period of two years expires on September 13, 2012.
Contract Amendment No. 1 (R2011-0061) dated 1-11-11 changes IG Lanuage and Period of Service clause.
SBE-M/WBE Goal 32.0% (15% SBE/White; 5% SBE/Asian; 2% SBE/Woman; 10% MBE/Woman)

Task order summary:

TASK NUMBER	TOTAL/ SBE and/or MWBE AMOUNT	TASK DUE DATE	TASK DESCRIPTION	APPROVED BY/DATE
1434-01	11,712.31 9,520.00	12/31/2010	SLWI Sand Transfer Plant Production Surveys	ERM 11/8/2010
AMENDMENT NUMBER 1			Inspector General language and Period of Service clause changes	BCC 1/11/2011
1434-02	21,094.00 20,009.00	11/1/2011	2011 Lake Worth Lagoon Fixed Transect Seagrass Monitoring	ERM 3/10/2011
1434-03	4,427.00 4,210.00	3/15/2011	South Cove Bathymetry Survey	ERM 3/10/2011
1434-04	4,787.00 4,570.00	5/3/2011	Ibis Isle & Lake Worth Lagoon Dredge Sites Bathymetric Surveys	ERM 4/20/2011
1434-05	10,391.00 0.00	1/2/2012	SLWI Sand Transfer Plant Performance Report	ERM 11/10/2011
1434-06	5,488.00 0.00	12/30/2011	Central PBC Comprehensive Erosion Control Project - Hardbottom Mapping	ERM 11/20/2011
1434-06A	0.00 1,064.00	3/15/2012	Central PBC Comprehensive Erosion Control Project - Hardbottom Mapping	ERM 3/9/2012
1434-07	32,084.00 0.00	7/15/2012	Turtle Cove Restoration Project - Hydrodynamic Sedimentation Analysis	ERM
1434-08	134,054.17 51,219.40	3/15/2013	2012 Aerial Seagrass Mapping	BCC

Total: 224,037.48
SBE-MBE: 90,592.40
SBE-MBE Participation: 40.4%
Report Date & Filename: 04/04/12 T:\eer\engser\Consultants\Coast & Harbor\[history_1434.xls]Sheet1

JC

R2010 1434

CONTRACT FOR PROFESSIONAL CONSULTANT SERVICES
BETWEEN PALM BEACH COUNTY AND
COAST & HARBOR ENGINEERING, INC.

This Contract is made as of SEP 14 2010, by and between Palm Beach County, a Political Subdivision of the State of Florida, by and through its Board of County Commissioners, hereinafter referred to as the COUNTY, and Coast & Harbor Engineering, Inc., 745 U.S. Highway 1, Suite 208, North Palm Beach, FL 33408, an engineering firm, a corporation, authorized to do business in the State of Florida, hereinafter referred to as the CONSULTANT, whose Federal I.D. Number is 20-0501110.

In consideration of the mutual promises contained herein, the COUNTY and the CONSULTANT agree as follows:

ARTICLE 1 - SERVICES

The CONSULTANT's responsibility under this Contract is to provide professional coastal and marine engineering services and incidental services as more specifically set forth in the Scope of Work attached hereto as Exhibit "A". In the event services are required to be performed that are not described in Exhibit "A", but are within the general scope of services, the COUNTY and the CONSULTANT hereby reserve the right to negotiate task orders covering the desired services.

The CONSULTANT shall conduct professional services in accordance with Chapters 471 and 472, Florida Statutes and other applicable local, state and federal standards. The CONSULTANT shall conduct topographic and hydrographic survey work in compliance with the most current U.S. Army Corps of Engineers "Technical Requirements for Surveying, Mapping and Photogrammetric Services", the most current U.S. Army Corps of Engineers "Engineering Design: Hydrographic Surveying," EM 1110-2-1003, and the most current Florida Department of Environmental Protection specifications for topographic (section 02000) and bathymetric (section 02100) surveying.

ARTICLE 2 - PERIODS OF SERVICE AND SCHEDULES

This Contract commences on the day and year first written above and ends two years later. At the option of the COUNTY, the Contract can be renewed for an additional one-year period.

Reports and other work items shall be delivered or completed according to schedules established in each task order.

ARTICLE 3 - ASSIGNMENT OF WORK

The CONSULTANT shall provide professional services on a task order basis. A copy of the Task Order form and Task Change Order form are attached hereto as Exhibit "C" and Exhibit "D". The COUNTY reserves the right to modify these forms during the term of the Contract. The

IN WITNESS WHEREOF, the Board of County Commissioners of Palm Beach County, Florida has made and executed this Contract on behalf of the COUNTY and CONSULTANT has hereunto set its hand the day and year above written. R2010 1434

SEP 14 2010

ATTEST:
Sharon R. Bock, Clerk & Comptroller

By: _____
Deputy Clerk

PALM BEACH COUNTY
BOARD OF COUNTY COMMISSIONERS:

By: _____
Burt Aaronson, Chair

WITNESS:

_____
Signature

NANCY J. EVANS
Name (type or print)

CONSULTANT:

Coast & Harbor Engineering, Inc.
Company Name

_____
Signature

R. Shane Phillips, P.E.
Typed Name

Principal
Title

(corporate seal)

APPROVED AS TO FORM
AND LEGAL SUFFICIENCY

By _____
Assistant County Attorney

APPROVED AS TO TERMS
AND CONDITIONS

By _____
Richard E. Walesky, Director
Dept. of Environmental Resources Mgmt.

Coast & Harbor Engineering, Inc.

Salary and Billing Rates Table
Submitted July 21, 2010

EXHIBIT B

Labor Category	Hourly Rate 100%	Gross Multiplier 171.90%	Billing Rate 271.90%
Senior Principal Engineer	$ 62.59	$ 107.59	$ 170.18
Senior Coastal Engineer	$ 57.46	$ 98.77	$ 156.23
Principal Engineer	$ 51.08	$ 87.81	$ 138.89
Coastal Scientist	$ 37.98	$ 65.29	$ 103.27
Coastal Engineer	$ 43.26	$ 74.36	$ 117.62
Engineer V - Project Manager	$ 39.90	$ 68.59	$ 108.49
Engineer V	$ 38.94	$ 66.94	$ 105.88
Engineer IV	$ 36.06	$ 61.99	$ 98.05
Engineer III	$ 32.93	$ 56.61	$ 89.54
Engineer I	$ 28.85	$ 49.59	$ 78.44
Junior Engineer	$ 24.00	$ 41.26	$ 65.26
CAD Designer	$ 29.32	$ 50.40	$ 79.72
CAD Technician	$ 28.13	$ 48.36	$ 76.49
Administrative	$ 18.50	$ 31.80	$ 50.30

Multiplier = 2.719