



VILLAGE OF KEY BISCAYNE

Office of the Village Manager

Village Council

Robert L. Vernon, *Mayor*
Jorge E. Mendia, *Vice Mayor*
Michael Davey
Enrique Garcia
Steve Liedman
Thomas Thornton
Patricia Weinman

Village Manager

Genaro "Chip" Iglesias

DATE: July 8, 2008
TO: Honorable Mayor and Members of the Village Council
FROM: Genaro "Chip" Iglesias, Village Manager
RE: Beach Nourishment Seagrass Mitigation

RECOMMENDATION

It is recommended that the Village Council approve the contract for Continental Shelf Associates (CSA) to complete the seagrass mitigation required as part of the beach nourishment permit conditions. The Village Beach consultant, Coastal Systems International, has been coordinating the efforts of CSA to map the areas for mitigation and to prepare a mitigation plan with estimated budgets as follows:

Donor Site Survey:	\$ 31,192
Seagrass Mitigation (1.33 ac):	\$ 450,130
Baseline Monitoring Survey:	\$ 37,504
Offshore Site Mitigation (if required):	\$ 34,503
TOTAL:	\$ 553,329

Funding will be obtained from the capital outlay beach renourishment line item.

BACKGROUND

The seagrass mitigation is required for impacts to the seagrass beds in the corridor from the dredge pipeline placed at the south end of Key Biscayne for the 2002 Beach Nourishment. The completion of this mitigation is also required as a condition of the recently obtained dune permit in April. The dune permit required the 1.33 acres of mitigation to commence this summer, with seagrass transplanting in most of the areas complete by August 31. The mitigation is also required prior to applying for environmental permits for the next beach nourishment.

Coastal Systems has been coordinating with CSA for the last two months to map and field-verify suitable locations for seagrass mitigation in Biscayne Bay. Seagrass mitigation is a very specialized field of marine biology, and CSA has an established reputation with successful restoration projects throughout South Florida including nearby Biscayne National Park. Since the mitigation project will be monitored for 5 years, it is essential to have an experienced consultant with demonstrated experience complete the work. The mitigation will consist of transplanting seagrass from suitable donor areas to prop scars mapped for restoration to complete the 1.33 acres in 192 sites at 4 separate locations in Biscayne Bay. Up to 4,000 seagrass planting units will be harvested from 75 donor sites to complete the mitigation. In addition, bird stakes will be deployed to facilitate fertilizing the prop scars to promote seagrass growth. Approximately 3,000 bird stakes will be deployed throughout the mitigation areas.

CSA prioritized prop scars that do not require sand fill to restore elevations, and therefore only seagrass transplantation and bird stake placement is required to complete the mitigation. This technical approach significantly reduced the budget and schedule for implementation. Recent seagrass mitigation projects have been on the order of \$1.2M/acre, based on the most recent seagrass mitigation project planned for the Oleta River State Park.

A line item is included for off-site mitigation of approximately 0.07 acres within the pipeline corridor. Coastal Systems is recommending to the agencies that this acreage be mitigated with the prop scar restoration as currently proposed in the mitigation plan since the next beach nourishment is being planned which may further impact the corridor.

In addition, as a permit requirement, Department of Environmental Protection (DEP) mandates five years of monitoring; four monitoring events for the first year and then biannual monitoring events for the following 4 years totaling 12 events. Biological Reports will be prepared and processed through the agencies. The estimated cost for five years of monitoring with a total of 12 events is \$ 432,000.

This is to be completed by Coastal Systems International, Inc. under their existing contract with the Village.

cc: Randy White, Village Finance Director
Stephen Helfman, Esq., Village Attorney

RESOLUTION NO. 2008 - _____

A RESOLUTION OF THE VILLAGE COUNCIL OF THE VILLAGE OF KEY BISCAVNE, FLORIDA, APPROVING AGREEMENT FOR PROFESSIONAL SERVICES BETWEEN CSA INTERNATIONAL, INC. AND THE VILLAGE OF KEY BISCAVNE CONCERNING SEAGRASS RESTORATION AND MITIGATION SERVICES; PROVIDING FOR IMPLEMENTATION; PROVIDING FOR AN EFFECTIVE DATE.

WHEREAS, the Village Council of the Village of Key Biscayne desires to retain the services of CSA International, Inc. ("CSA") to perform seagrass restoration and mitigation services in accordance with that certain plan entitled "Seagrass Restoration and Mitigation Plan: Village of Key Biscayne" and dated _____, 2008; and

WHEREAS, the Village Council finds, upon advice from the Village Attorney, that the Village Council is authorized to waive competitive bidding for the proposed work pursuant to Section 2-85 of the Village Code, upon the Village Council hereby finding that it is impractical to apply competitive bidding procedures in light of the need to expeditiously proceed with the work; and

WHEREAS, the Village Council finds that the attached approval of the Agreement for Professional Services between CSA and the Village (the "Agreement") is in the best interest of the Village.

NOW, THEREFORE, BE IT RESOLVED BY THE COUNCIL OF THE VILLAGE OF KEY BISCAVNE, FLORIDA, AS FOLLOWS:

Section 1. Recitals Adopted. That each of the recitals stated above is hereby adopted and confirmed.

Section 2. Authorization. That the Agreement is hereby approved and the Village

Manager is authorized to execute the Agreement on behalf of the Village, once approved by the Village Attorney as to form and legal sufficiency.

Section 3. Implementation. That the Village Manager is hereby authorized to take any necessary action to implement the purposes of this resolution and the Agreement.

Section 4. Effective Date. That this Resolution shall be effective immediately upon adoption hereof.

PASSED AND ADOPTED this _____ day of July, 2008.

ROBERT VERNON, MAYOR

ATTEST:

CONCHITA H. ALVAREZ, CMC, VILLAGE CLERK

APPROVED AS TO FORM AND LEGAL SUFFICIENCY

Village Attorney

**PROFESSIONAL SERVICES AGREEMENT
BETWEEN
THE VILLAGE OF KEY BISCAYNE
AND
CSA INTERNATIONAL, INC.**

THIS AGREEMENT (this "Agreement") is made effective as of the ____ day of _____, 2008 (the "Effective Date"), by and between the **VILLAGE OF KEY BISCAYNE, FLORIDA**, a Florida municipal corporation (hereinafter the "Village"), and **CSA INTERNATIONAL, INC.**, a Florida corporation (hereinafter the "Consultant").

WHEREAS, the Consultant and Village, through mutual negotiation, have agreed upon a scope of services, schedule, and fee for certain seagrass restoration services within the Biscayne Bay Aquatic Preserve (the "Project"); and

WHEREAS, the Village desires to engage the Consultant to perform the services and provide the deliverables as specified below.

NOW, THEREFORE, in consideration of the mutual covenants and conditions contained herein, the Consultant and the Village agree as follows:

1. **Scope of Services.**

1.1. The Consultant shall furnish such professional services and provide deliverables (the "Services") as described in the Seagrass Restoration and Mitigation Plan attached hereto and made a part hereof as Exhibit "A" (the "Plan") and the proposal attached hereto and made a part hereof as Exhibit "B" (the "Proposal").

2. **Term/Commencement Date.**

2.1 This Agreement shall become effective upon the Effective Date and shall remain in effect until Consultant completes the Services described herein, which Services are scheduled to be complete on October 15, 2008, unless earlier terminated in accordance with Paragraph 8.

2.2 Consultant agrees that time is of the essence and Consultant shall complete the Services within the timeframes set forth in the Plan and the Proposal, unless extended by the Village Manager.

3. **Compensation and Payment.**

3.1 Compensation for Services provided by Consultant shall be in accordance with the following fee schedule:

Task 1 – Seagrass Donor Site Survey	\$31,192
Task 2 – Seagrass Restoration and Mitigation	\$450,130
Task 3 – Offshore Site Restoration	\$34,503
Task 4 – Baseline (Time Zero) Monitoring Survey	\$37,504

3.2 Consultant shall deliver an invoice to Village no more often than once per month detailing Services completed and the amount due to Consultant under this Agreement. Fees shall be paid in arrears each month, pursuant to Consultant's invoice, which shall be based upon the percentage of work completed for each task invoiced. The Village shall pay the Consultant in accordance with the Florida Prompt Payment Act after approval and acceptance of the Services by the Village Manager.

4. **Subconsultants.**

- 4.1 The Consultant shall be responsible for all payments to any subconsultants and shall maintain responsibility for all work related to the Project.
- 4.2 Consultant may only utilize the services of a particular subconsultant with the prior written approval of the Village Manager, which approval may be granted or withheld in Village Manager's sole discretion.

5. **Village's Responsibilities**

- 5.1 Village shall make available any maps, plans, existing studies, reports and other data pertinent to the Services and in possession of the Village.
- 5.2 Upon Consultant's request, Village shall reasonably cooperate in arranging for access to any real property as required for Consultant to perform the Services.

6. **Consultant's Responsibilities**

- 6.1 The Consultant shall exercise the same degree of care, skill and diligence in the performance of the Services for the Project as is ordinarily provided by a consultant under similar circumstances. If at any time during the term of this Agreement or within two (2) years from the completion of the Project, it is determined that the Consultant's deliverables or services are incorrect, not properly rendered, defective, or fail to conform to the Services for the Project, upon written notification from the Village Manager, the Consultant shall at Consultant's sole expense, immediately correct the work.
- 6.2 The Consultant hereby warrants and represents that at all times during the term of this Agreement it shall maintain in good standing all required licenses, certifications and permits required under Federal, State and local

laws applicable to and necessary to perform the Services for Village as an independent contractor of the Village.

7. **Conflict of Interest.**

7.1 To avoid any conflict of interest or any appearance thereof, Consultant shall not, for the term of this Agreement, provide any consulting services to any private sector entities (developers, corporations, real estate investors, etc.), with any adversarial issues in the Village. For the purposes of this section “adversarial” shall mean any development application where staff is recommending denial or denied an application, or an administrative appeal or court action wherein the Village is a party.

8. **Termination.**

8.1 The Village Manager, without cause, may terminate this Agreement upon thirty (30) days written notice to the Consultant, or immediately with cause.

8.2 Upon receipt of the Village's written notice of termination, Consultant shall immediately stop work on the Project unless directed otherwise by the Village Manager.

8.3 In the event of termination by the Village, the Consultant shall be paid for all work accepted by the Village Manager up to the date of termination, provided that the Consultant has first complied with the provisions of Paragraph 8.4.

8.4 The Consultant shall transfer all books, records, reports, working drafts, documents, maps, and data pertaining to the Services and the Project to the Village, in a hard copy and electronic format within fourteen (14) days from the date of the written notice of termination or the date of expiration of this Agreement.

9. **Insurance.**

9.1 Consultant shall secure and maintain throughout the duration of this Agreement, insurance of such type and in such amounts necessary to protect its interest and the interest of the Village against hazards or risks of loss as specified below. The underwriter of such insurance shall be qualified to do business in Florida, be rated AB or better, and have agents upon whom service of process may be made in the State of Florida. The insurance coverage shall be primary insurance with respect to the Village, its officials, employees, agents and volunteers. Any insurance maintained by the Village shall be in excess of the Consultant’s insurance and shall

not contribute to the Consultant's insurance. The insurance coverages shall include a minimum of the amounts set forth in this Section 9.

- 9.2 **Worker's Compensation and Employer's Liability Insurance.** Coverage to apply for all employees for statutory limits as required by applicable State and Federal laws. The policy(ies) must include Employer's Liability with minimum limits of \$500,000.00 each accident.
- 9.3 **Comprehensive Automobile and Vehicle Liability Insurance.** This insurance shall be written in comprehensive form and shall protect the Consultant and the Village against claims for injuries to members of the public and/or damages to property of others arising from the Consultant's use of motor vehicles or any other equipment and shall cover operation with respect to onsite and offsite operations and insurance coverage shall extend to any motor vehicles or other equipment irrespective of whether the same is owned, non-owned, or hired. The limit of liability shall not be less than \$1,000,000.00 per occurrence, combined single limit for Bodily Injury Liability and Property Damage Liability. Coverage must be afforded on a form no more restrictive than the latest edition of the Business Automobile Liability Policy, without restrictive endorsement, as filed by the Insurance Services Office.
- 9.4 **Commercial General Liability.** This insurance shall be written in comprehensive form and shall protect the Consultant and the Village against claims arising from injuries to members of the public or damage to property of others arising out of any act or omission to act of the Consultant or any of its agents, employees, or subcontractors. The limit of liability shall not be less than \$1,000,000.00 per occurrence, combined single limit for Bodily Injury Liability and Property Damage Liability. Coverage must be afforded on a form no more restrictive than the latest edition of the Commercial General Liability Policy, without restrictive endorsements, as filed by the Insurance Services Office, and must include: (1) Premises and/or Operations; (2) Independent contractors and Products and/or completed Operations; (3) Broad Form Property Damage, Personal Injury and a Contractual Liability Endorsement, including any hold harmless and/or indemnification agreement.
- 9.5 **Certificate of Insurance.** Consultant shall provide the Village Manager with Certificates of Insurance for all required policies. The Certificates of Insurance shall not only name the types of policy(ies) provided, but also shall refer specifically to this Agreement and shall state that such insurance is as required by this Agreement. The Village reserves the right to require the Consultant to provide a certified copy of such policies, upon written request by the Village. If a policy is due to expire prior to the completion of the Services, renewal Certificates of Insurance or policies shall be furnished thirty (30) calendar days prior to the date of their policy

expiration. Each policy certificate shall be endorsed with a provision that not less than thirty (30) calendar days' written notice shall be provided to the Village before any policy or coverage is cancelled or restricted. Acceptance of the Certificate(s) is subject to approval of the Village Manager.

9.6 **Additional Insured.** The Village is to be specifically included as an Additional Insured for the liability of the Village resulting from operations performed by or on behalf of Consultant in performance of this Agreement. Consultant's insurance, including that applicable to the Village as an Additional Insured, shall apply on a primary basis and any other insurance maintained by the Village shall be in excess of and shall not contribute to Consultant's insurance. Consultant's insurance shall contain a severability of interest provision providing that, except with respect to the total limits of liability, the insurance shall apply to each Insured or Additional Insured in the same manner as if separate policies had been issued to each.

9.7 **Deductibles.** All deductibles or self-insured retentions must be declared to and be approved by the Village Manager. The Consultant shall be responsible for the payment of any deductible or self-insured retentions in the event of any claim.

10. **Nondiscrimination.**

10.1 During the term of this Agreement, Consultant shall not discriminate against any of its employees or applicants for employment because of their race, color, religion, sex, or national origin, and to abide by all Federal and State laws regarding nondiscrimination

11. **Attorneys Fees and Waiver of Jury Trial.**

11.1 In the event of any litigation arising out of this Agreement, the prevailing party shall be entitled to recover its attorneys' fees and costs, including the fees and expenses of any paralegals, law clerks and legal assistants, and including fees and expenses charged for representation at both the trial and appellate levels.

11.2 In the event of any litigation arising out of this Agreement, each party hereby knowingly, irrevocably, voluntarily and intentionally waives its right to trial by jury.

12. **Indemnification.**

12.1 Consultant shall defend, indemnify, and hold harmless the Village, its officers, agents and employees, from and against any and all demands,

claims, losses, suits, liabilities, causes of action, judgment or damages, arising out of, related to, or any way connected with Consultant's performance or non-performance of any provision of this Agreement, including, but not limited to, liabilities arising from contracts between the Consultant and third parties made pursuant to this Agreement. Consultant shall reimburse the Village for all its expenses including reasonable attorneys fees and costs incurred in and about the defense of any such claim or investigation and for any judgment or damages arising out of, related to, or in any way connected with Consultant's performance or non-performance of this Agreement.

12.2 The provisions of this section shall survive termination of this Agreement.

13. **Notices/Authorized Representatives.**

13.1 Any notices required by this Agreement shall be in writing and shall be deemed to have been properly given if transmitted by hand-delivery, by registered or certified mail with postage prepaid return receipt requested, or by a private postal service, addressed to the parties (or their successors) at the following addresses:

For the Village: Genaro "Chip" Inglesias
Village Manager
Village of Key Biscayne
88 West McIntyre Street
Key Biscayne, FL 33149

With a copy to: Stephen J. Helfman, Esq.
Village Attorney
Weiss Serota Helfman Pastoriza Cole & Boniske, P.L.
2525 Ponce de Leon Blvd.
Coral Gables, Florida 33134

For The Consultant: CSA International, Inc.
8502 S.W. Kansas Avenue
Stuart, Florida 34997

14. **Governing Law.**

14.1 This Agreement shall be construed in accordance with and governed by the laws of the State of Florida. Venue for any litigation arising out of this Agreement shall be proper exclusively in Miami-Dade County, Florida.

15. **Entire Agreement/Modification/Amendment.**

- 15.1 This writing contains the entire Agreement of the parties and supercedes any prior oral or written representations. No representations were made or relied upon by either party, other than those that are expressly set forth herein.
- 15.2 No agent, employee, or other representative of either party is empowered to modify or amend the terms of this Agreement, unless executed with the same formality as this document.
- 15.3 Consultant represents that is an entity validly existing and in good standing under the laws of Florida. The execution, delivery and performance of this Agreement by Consultant have been duly authorized, and this Agreement is binding on Consultant and enforceable against Consultant in accordance with its terms. No consent of any other person or entity to such execution, delivery and performance is required.

16. **Ownership and Access to Records and Audits.**

- 16.1 Consultant acknowledges that all inventions, innovations, improvements, developments, methods, designs, analyses, drawings, reports and all similar or related information (whether patentable or not) which relate to Services to the Village which are conceived, developed or made by Consultant during the term of this Agreement (“Work Product”) belong to the Village. Consultant shall promptly disclose such Work Product to the Village and perform all actions reasonably requested by the Village (whether during or after the term of this Agreement) to establish and confirm such ownership (including, without limitation, assignments, powers of attorney and other instruments).
- 16.2 All records, books, documents, maps, data, deliverables, papers and financial information (the “Records”) that result from the Consultant providing the Services to the Village under this Agreement shall be the property of the Village.
- 16.3 The Village Manager or his designee shall, during the term of this Agreement and for a period of three (3) years from the date of termination of this Agreement, have access to and the right to examine and audit any Records of the Consultant involving transactions related to this Agreement.
- 16.4 The Village may cancel and terminate this Agreement immediately for refusal by the Consultant to allow access by the Village Manager or his designee to any Records pertaining to work performed under this

Agreement that are subject to the provisions of Chapter 119, Florida Statutes.

17. **Nonassignability.**

17.1 This Agreement shall not be assignable by Consultant unless such assignment is first approved by the Village Manager. The Village is relying upon the apparent qualifications and expertise of the Consultant, and such firm's familiarity with the Village's area, circumstances and desires.

18. **Severability.**

18.1 If any term or provision of this Agreement shall to any extent be held invalid or unenforceable, the remainder of this Agreement shall not be affected thereby, and each remaining term and provision of this Agreement shall be valid and be enforceable to the fullest extent permitted by law.

19. **Independent Contractor.**

19.1 The Consultant and its employees, volunteers and agents shall be and remain an independent contractor and not an agent or employee of the Village with respect to all of the acts and services performed by and under the terms of this Agreement. This Agreement shall not in any way be construed to create a partnership, association or any other kind of joint undertaking, enterprise or venture between the parties.

20. **Compliance with Laws.**

20.1 The Consultant shall comply with all applicable laws, ordinances, rules, regulations, and lawful orders of public authorities in carrying out Services under this Agreement, and in particular shall obtain all permits from all jurisdictional agencies to perform the Services under this Agreement.

21. **Waiver**

21.1 The failure of either party to this Agreement to object to or to take affirmative action with respect to any conduct of the other which is in violation of the terms of this Agreement shall not be construed as a waiver of the violation or breach, or of any future violation, breach or wrongful conduct.

22. **Survival of Provisions**

22.1 Any terms or conditions of either this Agreement that require acts beyond the date of the term of the Agreement, shall survive termination of the Agreement, shall remain in full force and effect unless and until the terms or conditions are completed and shall be fully enforceable by either party.

23. **Prohibition of Contingency Fees.**

23.1 The Consultant warrants that it has not employed or retained any company or person, other than a bona fide employee working solely for the Consultant, to solicit or secure this Agreement, and that it has not paid or agreed to pay any person(s), company, corporation, individual or firm, other than a bona fide employee working solely for the Consultant, any fee, commission, percentage, gift, or any other consideration, contingent upon or resulting from the award or making of this Agreement.

24. **Public Entity Crimes Affidavit**

24.1 Consultant shall comply with Section 287.133, Florida Statutes (Public Entity Crimes Statute), notification of which is hereby incorporated herein by reference, including execution of any required affidavit.

25. **Counterparts**

25.1 This Agreement may be executed in several counterparts, each of which shall be deemed an original and such counterparts shall constitute one and the same instrument.

[Remainder of page intentionally left blank]

IN WITNESS WHEREOF the parties hereto have executed this Agreement on the day and date first above written.

VILLAGE:

VILLAGE OF KEY BISCAWAYNE

By: _____
Genaro "Chip" Inglesias, Village Manager

Attest: _____
Conchita Alvarez, Village Clerk

Approved as to Form and Legal Sufficiency:

Village Attorney

CONSULTANT:

CSA INTERNATIONAL, INC., a Florida corporation

By: _____
Name: _____
Title: _____

EXHIBIT "A"

THE PLAN

EXHIBIT "B"

THE PROPOSAL

Seagrass Restoration and Mitigation Plan: Village of Key Biscayne

June 2008



Submitted to:



Ms. Penny Cutt
Environmental/Permitting Regional Manager
Coastal Systems International, Inc.
2047 Vista Parkway, Suite 101
West Palm Beach, Florida 33411

Submitted by:



CSA International, Inc.
8502 SW Kansas Avenue
Stuart, Florida 34997
Telephone: 772-219-3000

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1.0 INTRODUCTION

Beach nourishment projects have been conducted on Key Biscayne Beaches since 1987 under authorization of the State of Florida. Permitted and un-permitted impacts to seagrass communities have occurred as a result of these projects. In June 2000, Florida Department of Environmental Protection (FDEP) Permit No. 0160846-001-JC regarding additional nourishment authorized impacts to seagrass communities within a pipeline corridor and called for 0.28 acres of mitigation to offset those impacts. To date, the mitigation has not been completed. In February 2008, the FDEP issued Permit Modification No. 0160846-010-EM for the construction of a dune restoration project and increased the acreage of required seagrass mitigation under Permit No. 0160846-001-JC from 0.28 acres to 1.26 acres due to the delay in implementation. Additionally, special permit conditions also were added to the Permit Modification that stipulate timelines and other requirements to ensure the mitigation is conducted in a timely manner.

Prior to the February 2008 increase in required seagrass mitigation, Coastal Systems International, Inc. (CSI) developed a Seagrass Restoration and Mitigation Plan (revised 6 December 2007) proposing an off-site mitigation location and restoration methods for both on-site and off-site locations. As a result of the increase in mitigation requirements, additional off-site areas for mitigation needed to be located and proposed and the mitigation plan required updating and revision.

This updated mitigation plan will address proposed sites, methods and scheduling for implementing the full 1.26 acres of off-site seagrass mitigation per FDEP Permit Modification No. 0160846-010-EM, and an additional 0.07 acres of off-site mitigation recommended in lieu of on-site mitigation within the pipeline corridor. Based on recent surveys completed by CSI in January 2008 and CSA International, Inc. (CSA) in June 2008, it is recommended that the on-site impacts within the offshore pipeline corridor be left to recover naturally. Although the scars remain visible in certain areas, the sediment gradation between the scars (0 to 10 cm [0 to 4.0 in.] [avg. 2.5 cm (1.0 in.)] based on CSI's January 2008 survey) and surrounding seabed is less than the ≥ 20 cm (7.8 in.) gradation guideline recommended for filling based on standard methodologies and guidelines developed by the National Oceanic and Atmospheric Administration (NOAA) and FDEP as presented in the "Final Programmatic Environmental Impact Statement for Seagrass Restoration in the Florida Keys National Marine Sanctuary" (herein after referred to as the FPEIS) (NOAA and FDEP, 2004). Additionally, natural recovery is occurring, as evidenced by the in-growth of seagrass runners into barren areas of the scars. Sediment placement and/or disturbance within this area could potentially reduce the natural recovery process currently happening. This offshore area is a high-energy coastal environment with distinct environmental characteristics. Sand movement and wave action are common and could contribute to the shifting of any placed sediment and/or seagrass transplants, causing further secondary damage.

All recommended approaches and procedures within this updated mitigation plan are structured to meet FDEP permit requirements and conform to guidelines and methodologies in the FPEIS. Consultation has been sought from the appropriate resource managers within Biscayne Bay Aquatic Preserve and the Florida Keys National Marine Sanctuary (FKNMS) for additional guidance relating to procedures, authorization, donor bed selection, and other relevant details.

2.0 PROPOSED OFF-SITE MITIGATION SITES

Using aerial photographs, CSI initially identified approximately 0.33 acres of seagrass impacts on the northwestern portion of Key Biscayne as a potential area for the implementation of off-site mitigation efforts. In response to the increase in required mitigation, another desktop analysis was performed by CSA through a subcontract to CSI in order to locate more areas within Miami-Dade County and in close proximity to Key Biscayne that were suitable based on the likelihood of success and current viability for mitigation. An additional 1.722 acres of seagrass were identified using 2006 digital geo-rectified aerial photographs flown by the South Florida Water Management District and obtained through the National Park Service. To verify the viability of the sites for mitigation, a ground truth survey was recommended to eliminate impacts that may have recovered and locate recent impacts (post-2006 aerials) for inclusion into the revised mitigation plan. **Figure 1** shows the following four general areas targeted for the surveys:

- Area A – South of Biscayne National Park (BNP) boundary within Miami-Dade County, the FKNMS, and the Card Sound portion of Biscayne Bay Aquatic Preserve (BBAP);
- Area B – North of BNP boundary within Miami-Dade County, southwest of Key Biscayne, and within BBAP;
- Area C – Northwest side of Key Biscayne, south of the Rickenbacker Causeway and Crandon Marina within BBAP; and
- Area D – West side of Key Biscayne within BBAP.

2.1 SURVEY METHODS

From 4 to 10 June 2008, CSA performed ground truthing surveys of the four areas, mapped seagrass impacts (“sites”) currently suitable for off-site mitigation, and visited the on-site mitigation site (“deep scar”) to assess existing conditions. A combination of methods was used to locate, document, and map the seagrass impacts, including direct measurements of depths and widths and a telemetric buoy system interfaced with Hypack navigational software. Each site was visually assessed by an on-site biologist and, according to depth and width measurements, assigned proposed restoration action(s) that would help facilitate long-term recovery. Several restoration options were considered, including seagrass transplants, bird stakes, fertilizer spikes, sediment fill, and sediment tubes, as outlined in the FPEIS. Digital video and photographs were collected of impacts and surrounding unimpacted areas; community composition and percent cover data for seagrass were collected within each area proposed for mitigation using a modified Braun-Blanquet technique (Fourqurean et al., 2001). Seagrass scars and blowholes exhibiting recoveries such that restoration actions would not be justifiable were not mapped.

2.2 RECOMMENDED OFF-SITE MITIGATION SITES

In total, 236 sites within Areas A, B, C, and D covering an area of 1.642 acres were mapped during CSA’s June 2008 survey. Only those seagrass impact sites presently viable for restoration were mapped. The on-site impacts within the offshore pipeline corridor were not mapped as they had been recently assessed by CSI in February 2008; both CSA and CSI recommend conducting additional off-site mitigation to offset these impacts.

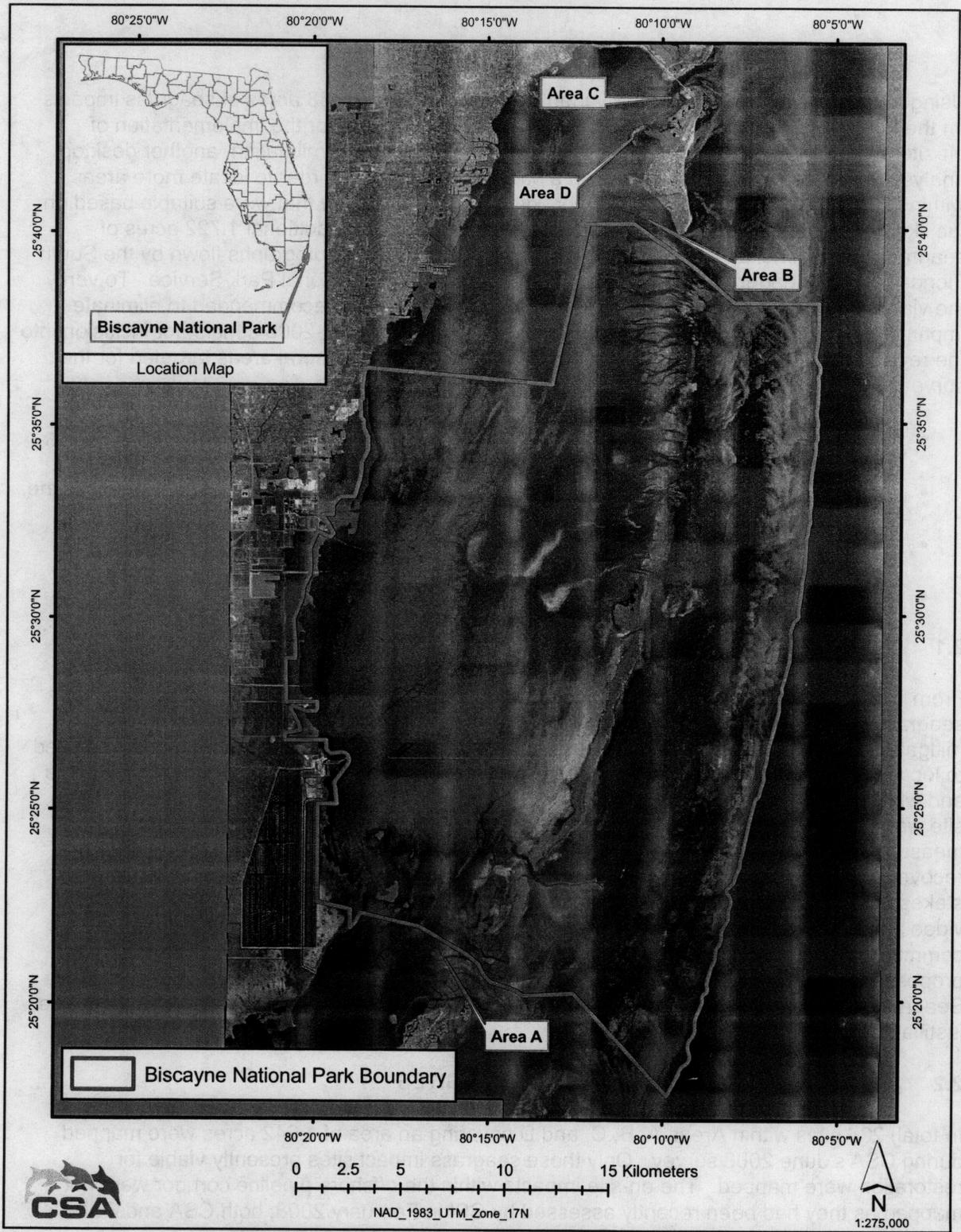


Figure 1. General site locations for seagrass mitigation project.

After careful review of each site and the recommended restoration options as well as consideration of the geographic location of the areas, the current condition, and timeline of the project, it is recommended that 192 of the 235 sites (approximately 1,338 acres) be restored as off-site mitigation (see **Appendix A**) to comply with FDEP requirements, meet the 1.26-acre mitigation requirement, and provide an additional 0.07 acres of off-site mitigation as compensation for the on-site offshore pipeline impacts. The proposed restoration actions include seagrass planting at 75 sites (0.7 acres) (52% of the total area) and installation of bird stakes at each proposed site using standard restoration techniques. **Figures 2** through **6** present the specific locations within Areas A, B, C, and D proposed for off-site mitigation. The recommended sites were chosen based on the following general criteria:

- Located in Miami-Dade County and outside BNP;
- Located on banks marked with navigational aids within established managed areas (BBAP and/or FKNMS) with a likelihood of success;
- Present condition does not exhibit significant signs of natural recovery;
- Recommended for seagrass transplanting and bird staking, which only can be completed within the FDEP deadline; and
- Would benefit from restoration actions to stabilize sediments and/or encourage re-growth of seagrass.

Within each proposed off-site mitigation area (Areas A, B, and D), *Thalassia testudinum* (turtle grass) was the dominant seagrass species, with average coverage ranging from 26% to 52%. Manatee grass (*Syringodium filiforme*) and shoal grass (*Halodule wrightii*) were found in Areas B, C, and D ranging from 1% to 5% cover, but were not observed in Area A (see Braun-Blanquet data in **Appendix B**). Water depths in the areas were shallow and ranged from 0 m (0 ft) (emergent) at Mean Low Low Water to approximately 1.2 m (4 ft) at Mean High Water.

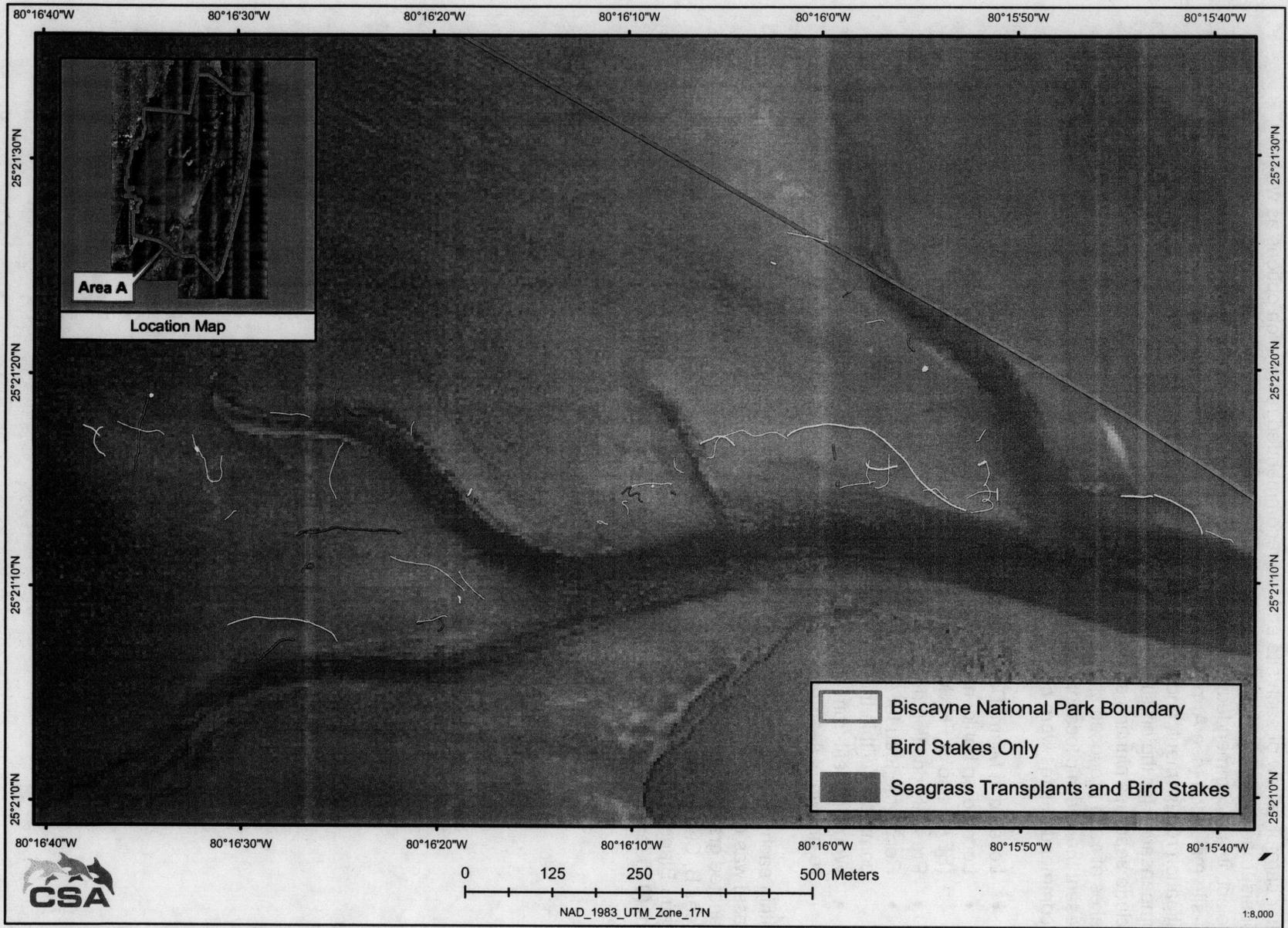


Figure 2. Area A mitigation sites.

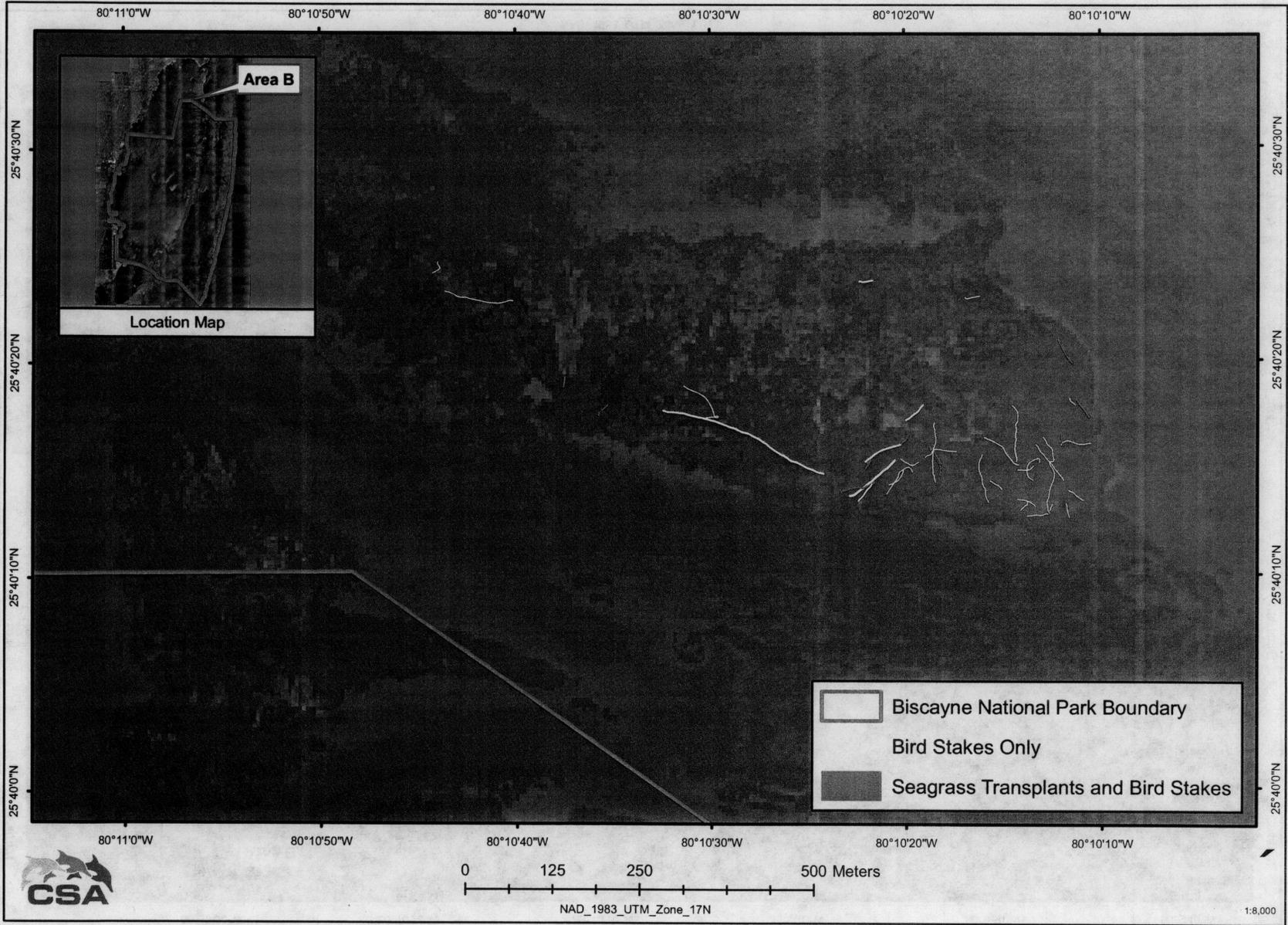


Figure 3. Area B northern bank mitigation sites.

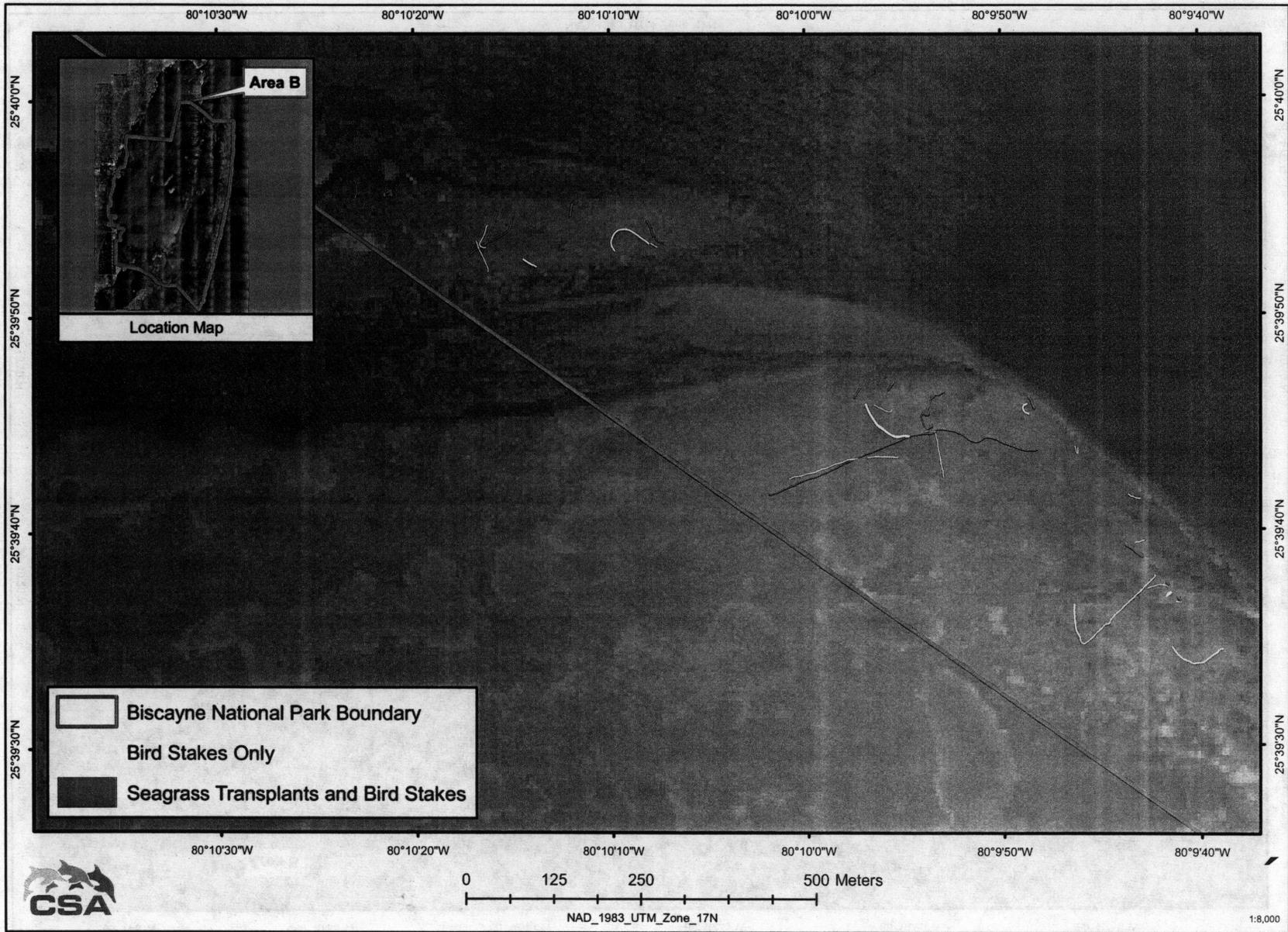


Figure 4. Area B southern bank mitigation sites.



Figure 5. Area C mitigation sites.

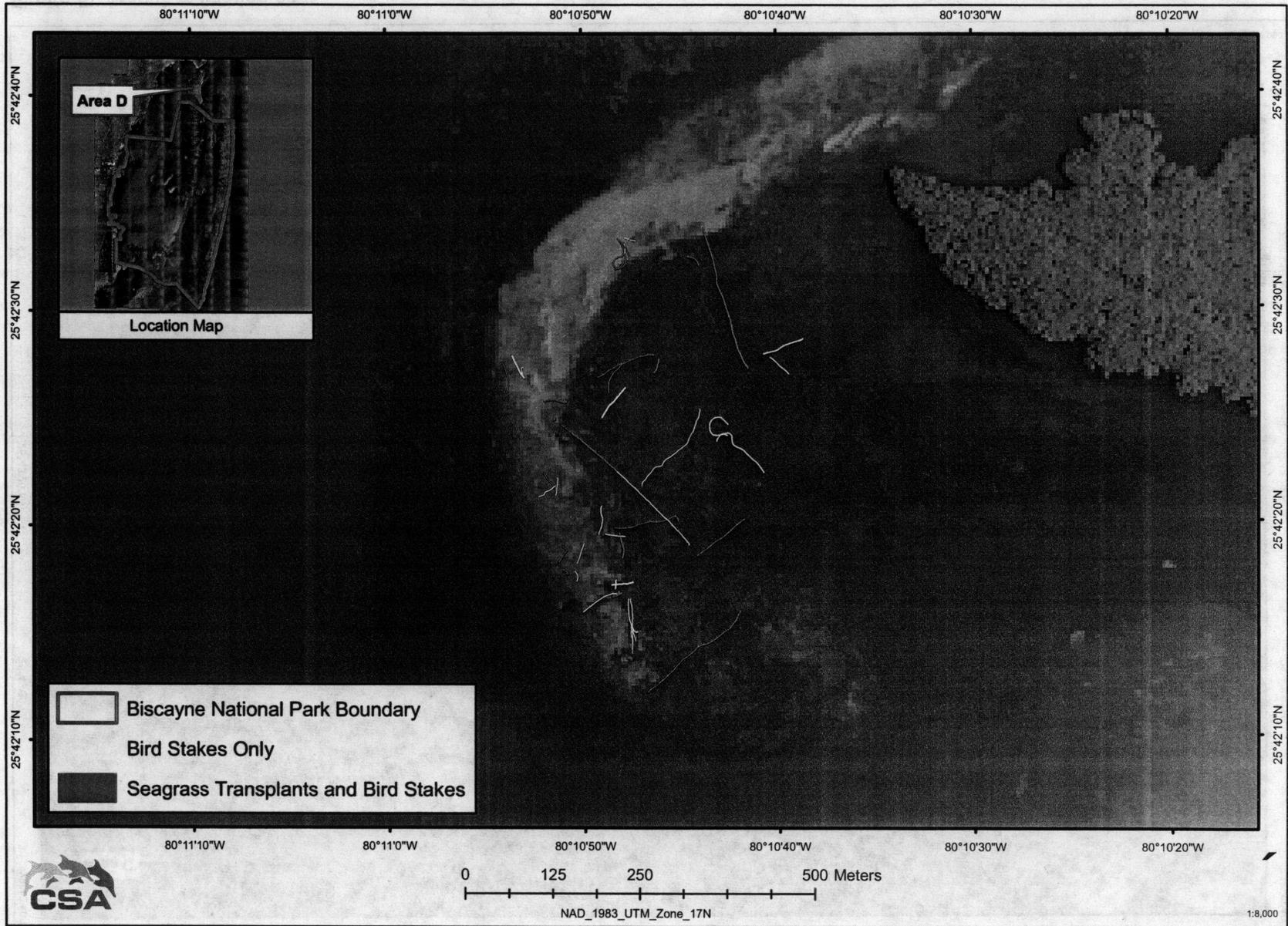


Figure 6. Area D mitigation sites.

3.0 RESTORATION METHODS

The proposed methods discussed in this restoration and mitigation plan were developed using the FPEIS guidelines and methodologies for seagrass restoration and mitigation efforts. Final recommendations for each site are based on field observations and processed (post-survey) spatial data confirming width, depth, and area of each site. A greater acreage of seagrass impacts was mapped (1.642 acres) than necessary for mitigation to fulfill the mitigation requirements (1.26 off-site and 0.07 on-site). Therefore, certain sites within the four areas were eliminated from consideration, as discussed in **Section 2.2**.

A summary of the recommended restoration for each area is provided in **Table 1**. Of the 192 sites (1.338 acres) proposed for mitigation, no sites are recommended for filling, 75 sites (0.7 acres) are recommended for seagrass transplanting and bird staking, and 117 sites (0.638 acres) are recommended for bird staking only. Bird staking and seagrass transplantation will be the primary restoration methods used at the selected mitigation sites; sediment fill is not recommended due to the time lag (60 days per the FPEIS) between filling activities and seagrass transplantation activities. According to the FPEIS and FKNMS restoration planning guidance, approximately 60 days are needed after filling occurs to allow the sediment to settle before any other restoration action (e.g., staking or planting) is taken. If sites that require fill and planting were recommended, this would delay planting until peak hurricane season, which the FPEIS recommends against. Additionally, FDEP Permit No. 0160846-001-JC requires planting be done prior to 31 August 2008, and planting of fill sites would extend the project well beyond this deadline.

Table 1. Summary of recommended restoration actions for proposed off-site mitigation sites in Areas A, B, C, and D.

Restoration Area	Total			Restoration Action					
				Transplant and Bird Stake			Bird Stake Only		
	Number of Sites	Area (m ²)	Acre	Number of Sites	Area (m ²)	Acre	Number of Sites	Area (m ²)	Acre
Area A	55	1,820.86	0.450	14	457.88	0.113	41	1,362.99	0.337
Area B	86	2,388.37	0.590	34	1,590.47	0.393	52	797.99	0.197
Area C	1	59.56	0.015	1	59.56	0.015	0	0.00	0.000
Area D	50	1,145.71	0.283	26	724.38	0.179	24	421.34	0.104
Total	192	5,354.94	1.338	75	2,832.29	0.700	117	2,582.32	0.638

3.1 SEAGRASS TRANSPLANTATION

Injury sites in low to moderate energy environments that have minimal change in grade with the surrounding areas were selected for seagrass transplanting due to a higher probability of transplant success from a lack of high water velocities (NOAA and FDEP, 2004). Planting seagrass in injured areas is proven to be successful in the stabilization of sediment, thereby promoting seagrass recovery by reducing injury recovery time (Fonseca et al., 1998). Faster-growing opportunistic seagrass species such as *H. wrightii* can serve as temporary substitutes for slower-growing climax species such as *T. testudinum* during the initial phase of transplantation selection. Up to approximately 4,000 planting units (PUs) of *H. wrightii* are anticipated to be harvested and transplanted within the 75 proposed sites, for a total area of

0.7 acres (equal to 52% of the total mitigation area [1.338 acres]). This estimate is based on a general assumption of 1.5 PUs/m² (1.5 PUs/10.8 ft²) although site conditions and sporadic in-growth within the injury sites will dictate the final number of PUs required per site.

3.1.1 Seagrass Donor Sites

H. wrightii transplants will be selectively taken from healthy seagrass “donor” communities/sites to be determined following discussions and/or field site visits with key personnel from the FDEP and FKNMS. All donor sites will be approved by the appropriate agencies prior to plan implementation. Donor sites located near the impact sites are recommended in order to minimize differences in environmental conditions, genetic populations, and/or resiliency and changes between the resident seagrass and the transplanted seagrass, thereby increasing the chance of successful coalescence.

3.1.2 Seagrass Harvesting and Transplanting

Seagrass transplants will be collected from donor sites in accordance with all regulating permits and in a manner that ensures the donor bed is not degraded as a result of harvesting. PUs of *H. wrightii* will be collected at a rate of one plug/m² (one plug/10.8 ft²) of healthy donor material using a 15-cm (6-in.) diameter polyethylene core (Fonseca et al., 1998). Using this method, it is anticipated that each PU will contain stems from several individual plants and the associated sediment. Removed PUs immediately will be placed in containers to minimize washout during transport to the restoration site. PUs will be stored in containers *in situ* until enough material has been collected for the day. The containers and PUs will be placed in a survey vessel for transport to the mitigation area, with a maximum holding down of approximately 30 minutes out of the water. The containers and PUs will be placed *in situ* adjacent to the injury sites and transported to each area by a shallow-draft pontoon vessel traveling along a predetermined tract with appropriate depths to allow ingress and egress of the vessel without threatening restoration activities or causing additional impact to designated restoration sites.

Seagrass PUs will be transplanted manually by snorkelers using buoyancy control vests and/or snow shoes to minimize disturbance of the below-ground rhizomes and roots and physical contact with the restoration site and the surrounding area. Following the general guidelines in the FPEIS, prop scars less than 2 m (6.5 ft) wide will be planted with a single row of PUs down the center of the scar at distances of 0.5, 1.0, and 1.5 m (1.6, 3.3, and 4.9 ft) between rows of bird stakes (see **Section 3.2.1** for a description of bird stake placement). For scars and blowhole (non-fill) features greater than 2 m (6.5 ft) wide, subsequent rows of bird stakes and PUs will be placed approximately 2 m (6.5 ft) apart, depending on the width of the shortest axis. A divot or hole will be made for insertion of a seagrass plug using a hand trowel, post hole digger, or corer; any sediment removed during the process will be placed around the seagrass plug to help secure it.

3.2 FERTILIZER USE

The ability of seagrasses to recolonize is more difficult in nutrient-limited areas due to the disturbance of the sediment nutrient reservoir by vessel injuries. Fourqurean et al. (1992) suggested that the use of slow-release supplemental nutrients stimulates the growth and reproduction of seagrasses as well as the nutrient content of their tissue. Fertilizers can be used to augment seagrass transplantation or as a stand-alone activity to aid in the natural recolonization of an injury.

Two methods of fertilization have been considered for restoration activities: natural fertilization using bird stakes and commercial fertilizer spikes. Natural fertilization using bird stakes will be used at the selected off-site mitigation sites. Fertilizer spikes only will be used if it is deemed necessary for on-site mitigation.

3.2.1 Natural Fertilization Using Bird Stakes

Many successful seagrass mitigation projects in BNP and FKNMS have benefited from a natural fertilization method that utilizes the repeated deposition of bird feces from birds roosting on stakes ("bird stakes"). Bird staking has been documented to be an effective treatment to encourage re-growth of seagrasses in impacted areas and/or faster growth of seagrass transplants (Fourqurean et al., 1995; Kenworthy et al., 2000) by ensuring a regular release of fertilizer below each stake over an area of approximately 3 m² (32 ft²). Water depths of 1.5 m (4.9 ft) or less at mean high tide are generally considered ideal for bird feces to reach the seafloor in concentrated doses as long as the stakes are in place (NOAA and FDEP, 2004). Therefore, utilized bird stakes will compensate for water depth and tide fluctuations while maintaining an approximate height of 0.25 m (0.8 ft) above the high water level.

The bird stakes will be placed just inside the immediate rim and throughout the interior at 2-m intervals immediately following the completion of seagrass transplantation. For prop scars less than 2 m (6.5 ft) wide, only a single row of stakes will be placed down the center of the scar. Up to approximately 3,000 bird stakes will be constructed and installed following the guidelines provided in the FPEIS. This estimate is based on a general assumption of one bird stake/m² (one bird stake/10.8 ft²), although site conditions and sporadic in-growth within the injury sites will dictate the final number of bird stakes required per site. Bird stakes will be removed after a 75% survival rate is reached.

3.2.2 Fertilizer Spikes

The use of chemical fertilizer spikes is recommended to enhance seagrass colonization at impacted locations where water depths are greater than 1.5 m (4.9 ft) (NOAA and FDEP, 2004); therefore, fertilizer spikes only will be used if on-site mitigation is required by the governing agencies. Spikes will be placed in rows at 2-m (6.5-ft) intervals within the scar. For scars less than 2 m (6.5 ft) wide, only a single row of spikes will be planted down the center of the scar.

3.3 MITIGATION MEASURES

During the proposed restoration, the following mitigative measures will be undertaken to minimize the potential long-term and short-term adverse effects that could result from restoration activities:

- All restoration activities will be conducted off of a shallow-draft vessel;
- Predetermined vessel tracts with appropriate depths will be utilized to allow ingress and egress of the vessel to the site; and
- Buoyancy control vests and/or snow shoes will be used to minimize physical contact with the restoration site and the surrounding area.

3.4 INSTALLATION OF MANATEE PROTECTION AND RESTORATION SIGNS

One manatee protection sign (**Photo 1**) will be placed during restoration activities to caution vessel operators of the potential presence of manatees. The manatee awareness signs will be 0.9 m x 1.2 m (3 ft x 4 ft) in size and Florida Fish and Wildlife Conservation Commission-approved. Restoration-in-progress signs (**Photo 2**) will be installed in multiple locations within each mitigation area (Areas A, B, and D) to inform boaters of the activities and minimize the possibility of vessel groundings and additional propeller scarring while the site is under active restoration. The aluminum restoration-in-progress signs will be approximately 46 cm wide x 36 cm tall (18 in. wide x 14 in. tall) with a white reflective background. The signs will be framed with orange reflective vinyl, and letters will be black vinyl. Both types of signs will be attached to 3-m (10-ft) sections of Schedule 80 polyvinyl chloride (PVC) and oriented with the message board facing opposite of the restoration area toward deeper water of the seagrass banks.



Photo 1. Florida Fish and Wildlife Conservation Commission-approved manatee awareness sign.



Photo 2. Restoration-in-progress sign.

4.0 RECOMMENDED MONITORING

The recommended monitoring program will examine the success of transplantation efforts and natural re-colonization of seagrass at approximately 5% of the mitigation sites and the offshore pipeline corridor impact area. Reference areas will be considered as adjacent, undisturbed seagrass habitat and will serve to evaluate the success of the mitigation efforts. Quarterly monitoring is proposed for the first year post-restoration (0, 3, 6, and 9 months) and bi-annually during the spring and fall thereafter, for a minimum of 5 years (12, 18, 24, 30, 36, 42, 48, 54, and 60 months). Monitoring reports will be submitted within 45 days of each monitoring event, and a final summary will be completed at the end of the 5-year monitoring period. Monitoring activities and reports will be conducted by CSI and/or a qualified subconsultant.

At each site, the following monitoring parameters will be observed and/or measured:

- PU survival at off-site mitigation sites (initial and throughout the monitoring period);
- Seagrass abundance and community composition within the offshore pipeline corridor impact area, off-site mitigation sites, and surrounding “reference” areas;
- Qualitative observations of re-colonization, coalescence, and overall site conditions; and
- Physical stability of bird stakes and PUs (off-site mitigation areas only).

During each monitoring survey, the community composition and percent cover of seagrass within the offshore pipeline corridor impact area, off-site mitigation sites, and reference areas will be assessed using a modified Braun-Blanquet technique (Braun-Blanquet, 1932; Fourqurean et al., 2001; Kenworthy and Schwarzchild, 1997). With this method, the seagrass within a 0.25-m² quadrat (divided into 5 cm x 5 cm grids) will be identified and assigned a cover-abundance scale value as shown in **Table 2**. The percent cover per individual species and the total seagrass cover will be determined by averaging the Braun-Blanquet scores by species and total cover over all quadrats assessed within each injured and reference area. Additionally, qualitative digital photos and video data will be collected to document the site conditions and seagrass recovery. Success of the mitigation efforts will be evaluated by PU survival, abundance of seagrass within the mitigation sites in comparison to reference areas, and general observations of the restoration actions and site conditions. To be considered successful at the end of the 5-year monitoring period, the off-site mitigation areas will exhibit 65% coverage of seagrass and PU survival rate will be 75% at the end of Year 1 of monitoring.

Table 2. Braun-Blanquet community composition and percent cover scale values.

Scale Value	Percent Cover
0.0	Not present
0.1	Solitary specimen
0.5	Few with small cover
1	<5%
2	5% to 25%
3	25% to 50%
4	50% to 75%
5	75% to 100%

5.0 PROPOSED PROJECT SCHEDULE

To implement the mitigation plan within the FDEP stipulated timeframe and avoid conducting activities during the height of hurricane season, an abbreviated schedule is proposed in **Table 3**. The dates and timeframes are subject to change based on feedback from relevant regulatory and resource management representatives.

Table 3. Proposed mitigation schedule.

Task	Proposed Date	Note
Submit Draft Mitigation Plan	24 June 2008	Current submittal
Submit Final Mitigation Plan	8 July 2008	To include regulatory and operational comments
Identify donor sites	15 July 2008	To be scheduled with relevant regulatory and/or resource management representatives
Begin off-site mitigation in Areas B and D	29 July 2008	Subject to Plan approval
Begin off-site mitigation in Area A	19 August 2008	Subject to Plan approval
Conduct baseline monitoring	26 August 2008	Subject to Plan approval
Submit mitigation completion report	15 October 2008	N/A
Submit baseline monitoring report	15 October 2008	N/A

N/A = not available.

NOTIFICATIONS AND COMMUNICATIONS PLAN

Prior to project implementation, the U.S. Coast Guard will be notified of project initiation as necessary. A Notice to Mariners also may be required to alert boat operators and the general public of the scope and location of field work, including restoration activities such as the installation of bird stakes and other applicable warning signs. Additional communication and coordination will be undertaken throughout the project to facilitate project success and inform project sponsors and regulators of progress.

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APPENDICES

APPENDIX A

**RECOMMENDED RESTORATION ACTIONS WITHIN
PROPOSED OFF-SITE MITIGATION SITES IN AREAS A, B, C, AND D**

Table A1. Area A.

Site	Restoration Action				
	Area (ft ²)	Area (m ²)	Acre	Transplant and Bird Stake	Bird Stake Only
AP01	309.20	28.73	0.007	X	
AP03	184.65	17.15	0.004	X	
AP07	98.03	9.11	0.002	X	
AP08	102.33	9.51	0.002	X	
AP11	284.74	26.45	0.007	X	
AS01	894.72	83.12	0.021		X
AS02	505.97	47.01	0.012		X
AS03	286.68	26.63	0.007		X
AS04	509.20	47.31	0.012		X
AS05	406.15	37.73	0.009		X
AS06	746.20	69.32	0.017		X
AS07	235.46	21.88	0.005		X
AS08	1,107.79	102.92	0.025		X
AS09	651.49	60.53	0.015	X	
AS09A	382.56	35.54	0.009		X
AS10	69.34	6.44	0.002		X
AS11	397.22	36.90	0.009		X
AS12	561.97	52.21	0.013		X
AS13	180.43	16.76	0.004		X
AS14	378.57	35.17	0.009	X	
AS15	150.57	13.99	0.003		X
AS16	1,212.57	112.65	0.028	X	
AS17	305.98	28.43	0.007		X
AS18	561.80	52.19	0.013	X	
AS21	142.27	13.22	0.003		X
AS25	172.01	15.98	0.004		X
AS26	136.02	12.64	0.003	X	
AS27A	100.69	9.35	0.002		X
AS27B	71.08	6.60	0.002		X
AS28	127.84	11.88	0.003		X
AS29	189.73	17.63	0.004		X
AS30	64.47	5.99	0.001		X
AS33	79.80	7.41	0.002	X	
AS34	95.20	8.84	0.002		X
AS35	195.07	18.12	0.004		X
AS36	194.10	18.03	0.004		X
AS38	470.22	43.68	0.011		X
AS39	92.97	8.64	0.002		X
AS40	729.74	67.80	0.017		X
AS41	188.64	17.53	0.004		X
AS42	89.70	8.33	0.002		X
AS43	813.42	75.57	0.019		X
AS43a	44.83	4.16	0.001		X

Table A1. (Continued).

Site	Restoration Action				
	Area (ft ²)	Area (m ²)	Acre	Transplant and Bird Stake	Bird Stake Only
AS44	212.75	19.77	0.005		X
AS44a	149.01	13.84	0.003		X
AS45a	464.87	43.19	0.011	X	
AS45b	57.13	5.31	0.001	X	
AS46	74.64	6.93	0.002		X
AS47	2,003.90	186.17	0.046		X
AS49	407.34	37.84	0.009	X	
AS49a	527.12	48.97	0.012		X
AS51	118.07	10.97	0.003		X
AS52	146.87	13.65	0.003		X
AS53	621.70	57.76	0.014		X
AS54	294.79	27.39	0.007		X
Total	19,599.59	1,820.86	0.45	14	41

Table A2. Area B.

Site	Restoration Action				
	Area (ft ²)	Area (m ²)	Acre	Transplant and Bird Stake	Bird Stake Only
BP01	271.45	25.22	0.006	X	
BP02	256.93	23.87	0.006		X
BP03	201.63	18.73	0.005	X	
BP05	1,089.45	101.21	0.025	X	
BP06	212.95	19.78	0.005	X	
BP07	660.69	61.38	0.015	X	
BP08	167.72	15.58	0.004	X	
BP09	173.98	16.16	0.004	X	
BP11	166.76	15.49	0.004	X	
BP13	278.07	25.83	0.006	X	
BP15	519.01	48.22	0.012	X	
BP17	531.42	49.37	0.012	X	
BP20	239.50	22.25	0.005	X	
BP21	291.79	27.11	0.007	X	
BP22	536.69	49.86	0.012	X	
BP23B	790.67	73.46	0.018	X	
BS01	407.44	37.85	0.009		X
BS03	200.30	18.61	0.005		X
BS04	1,176.83	109.33	0.027	X	
BS05	496.73	46.15	0.011	X	
BS06	45.71	4.25	0.001		X
BS07	95.80	8.90	0.002	X	
BS08	46.65	4.33	0.001		X
BS09	351.27	32.63	0.008		X
BS10	99.13	9.21	0.002	X	
BS11	151.42	14.07	0.003		X
BS12	43.11	4.00	0.001		X
BS13	71.52	6.64	0.002		X
BS14	179.67	16.69	0.004		X
BS15	135.75	12.61	0.003	X	
BS16	54.02	5.02	0.001		X
BS17	67.68	6.29	0.002		X
BS18	1,338.77	124.38	0.031	X	
BS19	337.95	31.40	0.008		X
BS20	199.76	18.56	0.005	X	
BS21	756.10	70.24	0.017	X	
BS22	49.27	4.58	0.001		X
BS23	36.76	3.41	0.001		X
BS24	555.88	51.64	0.013		X
BS25	240.47	22.34	0.006	X	
BS26	176.40	16.39	0.004	X	
BS27	323.04	30.01	0.007	X	
BS28	249.31	23.16	0.006		X
BS29	158.59	14.73	0.004		X
BS30	134.80	12.52	0.003		X
BS31	79.65	7.40	0.002		X
BS32	39.75	3.69	0.001		X
BS33	32.46	3.02	0.001		X
BS34	69.56	6.46	0.002		X

Table A2. (Continued.)

Site	Restoration Action				
	Area (ft ²)	Area (m ²)	Acre	Transplant and Bird Stake	Bird Stake Only
BS35	32.96	3.06	0.001		X
BS36	398.95	37.06	0.009		X
BS37	213.13	19.80	0.005		X
BS38	85.56	7.95	0.002		X
BS39	102.95	9.56	0.002		X
BS40	52.77	4.90	0.001		X
BS41	93.04	8.64	0.002		X
BS43	476.00	44.22	0.011	X	
BS44	279.22	25.94	0.006	X	
BS45	166.29	15.45	0.004		X
BS46	83.28	7.74	0.002		X
BS47	155.23	14.42	0.004		X
BS48	52.94	4.92	0.001		X
BS49	347.84	32.32	0.008	X	
BS50	68.27	6.34	0.002	X	
BS51	71.76	6.67	0.002		X
BS52	240.44	22.34	0.006		X
BS53	160.33	14.90	0.004		X
BS54	205.11	19.06	0.005		X
BS55	163.54	15.19	0.004		X
BS56	101.98	9.47	0.002		X
BS57	200.58	18.63	0.005		X
BS58	102.77	9.55	0.002		X
BS59	718.48	66.75	0.016	X	
BS60	834.09	77.49	0.019		X
BS61	146.89	13.65	0.003		X
BS62	271.36	25.21	0.006		X
BS63	3,314.03	307.88	0.076	X	
BS64	455.35	42.30	0.010	X	
BS65	245.49	22.81	0.006		X
BS66	68.15	6.33	0.002		X
BS67	104.37	9.70	0.002		X
BS68	331.46	30.79	0.008		X
BS70	74.99	6.97	0.002		X
BS71	135.20	12.56	0.003		X
BS72	73.21	6.80	0.002		X
BS73	289.87	26.93	0.007	X	
Total	25,708.17	2,388.37	0.590	34	52

Table A3. Area C.

Site	Restoration Action				
	Area (ft ²)	Area (m ²)	Acre	Transplant and Bird Stake	Bird Stake Only
CS12	641.14	59.56	0.015	X	
Total	641.14	59.56	0.015	1	0

Table A4. Area D.

Site	Restoration Action				
	Area (ft ²)	Area (m ²)	Acre	Transplant and Bird Stake	Bird Stake Only
DS04	106.97	9.94	0.002	X	
DS05	99.29	9.22	0.002	X	
DS06	439.86	40.86	0.010		X
DS07	276.60	25.70	0.006	X	
DS08	166.40	15.46	0.004		X
DS09	84.38	7.84	0.002		X
DS10	28.34	2.63	0.001		X
DS11	18.65	1.73	0.000		X
DS12	181.73	16.88	0.004		X
DS13	315.80	29.34	0.007	X	
DS14	528.61	49.11	0.012	X	
DS15	490.87	45.60	0.011		X
DS16	618.37	57.45	0.014		X
DS17	116.99	10.87	0.003	X	
DS18	182.04	16.91	0.004	X	
DS19	99.29	9.22	0.002		X
DS20	54.47	5.06	0.001		X
DS21	87.18	8.10	0.002	X	
DS22	140.44	13.05	0.003	X	
DS23	118.00	10.96	0.003	X	
DS24	93.09	8.65	0.002	X	
DS25	48.57	4.51	0.001		X
DS26	83.32	7.74	0.002	X	
DS27	391.72	36.39	0.009	X	
DS28	50.34	4.68	0.001		X
DS29	199.45	18.53	0.005	X	
DS30	271.29	25.20	0.006	X	
DS31	86.94	8.08	0.002	X	
DS32	40.38	3.75	0.001		X
DS33	46.81	4.35	0.001		X
DS34	29.88	2.78	0.001		X
DS35	44.61	4.14	0.001		X
DS36	19.46	1.81	0.000		X
DS37	140.59	13.06	0.003	X	
DS38	1,256.00	116.69	0.029	X	
DS39	482.30	44.81	0.011	X	
DS40	105.92	9.84	0.002		X
DS41	751.93	69.86	0.017	X	
DS42	439.59	40.84	0.010	X	
DS43	189.76	17.63	0.004		X
DS44	293.83	27.30	0.007		X
DS46	140.25	13.03	0.003		X
DS48	266.88	24.79	0.006		X

Table A4. (Continued.)

Site	Restoration Action				
	Area (ft ²)	Area (m ²)	Acre	Transplant and Bird Stake	Bird Stake Only
DS49	594.98	55.28	0.014		X
DS50	481.21	44.71	0.011		X
DP01	274.26	25.48	0.006	X	
DP02	105.93	9.84	0.002	X	
DP03	530.39	49.28	0.012	X	
DP04	86.68	8.05	0.002	X	
DP05	631.76	58.69	0.015	X	
Total	12,332.40	1,145.71	0.283	26	24

APPENDIX B

**BRAUN-BLANQUET SCORES AND
PERCENT COVER CONVERSIONS FOR AREAS A, B, C, AND D**

Table B1. Area A.

Braun-Blanquet Cover (%)							
Quadrat #	T.t (%)	S.f. (%)	H.w. (%)	TMA (%)	Total Grass (%)	Coral (%)	Sediment
1	37.5	0.0	0.0	37.5	37.5	0.0	SM/FL
2	37.5	0.0	0.0	37.5	37.5	0.0	SM/FL
3	37.5	0.0	0.0	15.0	37.5	0.0	SM/FL
4	15.0	0.0	0.0	62.5	15.0	0.0	SM/FL
5	0.0	0.0	0.0	37.5	0.0	0.0	SM/FL
6	37.5	0.0	0.0	15.0	37.5	0.0	SM/FL
7	37.5	0.0	0.0	62.5	37.5	0.0	SM/FL
8	37.5	0.0	0.0	62.5	37.5	0.1	SM/FL
9	37.5	0.0	0.0	62.5	37.5	0.1	SM/FL
10	37.5	0.0	0.0	62.5	37.5	0.1	SM/FL
Average	31.5	0	0	45.5	31.5	0.03	

T.t. = *Thalassia testudinum*S.f. = *Syringodium filiforme*H.w. = *Halodule wrightii*

TMA = Total macroalgae

SM = Sandy mud

FL = Flocculent sediment

Table B2. Area B.

Braun-Blanquet Cover (%)							
Quadrat #	T.t. (%)	S.f. (%)	H.w. (%)	TMA (%)	Total Grass (%)	Coral (%)	Sediment
North							
1	37.5	15.0	0.0	37.5	37.5	0.0	SM/FL
2	62.5	1.0	0.0	15.0	62.5	0.0	SM/FL
3	37.5	15.0	1.0	15.0	62.5	0.0	SM/FL
4	15.0	0.0	0.0	1.0	15.0	0.0	SM/FL
5	0.0	0.0	0.0	1.0	0.0	0.0	SM/FL
6	62.5	0.0	0.0	1.0	62.5	0.0	SM/FL
7	87.5	0.0	1.0	1.0	87.5	0.0	SM/FL
8	37.5	0.0	0.0	0.0	37.5	0.0	SM/FL
9	62.5	0.0	0.0	0.0	62.5	0.0	SM/FL
10	87.5	0.0	0.0	0.0	87.5	0.0	SM/FL
Average	49.0	3.10	0.20	7.15	51.50	0.00	
Middle							
1	15.0	15.0	0.0	15.0	37.5	0.5	MS/CR
2	37.5	15.0	0.0	62.5	37.5	0.1	MS
3	37.5	15.0	0.0	37.5	37.5	0.1	MS
4	37.5	15.0	0.0	15.0	37.5	0.5	MS
5	62.5	15.0	0.0	37.5	62.5	0.5	MS/FL
6	37.5	15.0	0.0	37.5	37.5	0.0	MS
7	62.5	0.0	0.0	15.0	62.5	0.0	MS
8	87.5	0.0	0.0	15.0	87.5	0.0	MS
9	87.5	0.0	0.0	15.0	87.5	0.0	MS/FL
10	62.5	0.0	0.5	37.5	62.5	0.0	MS
Average	52.75	9	0.05	28.75	55	0.17	
South							
1	1.0	1.0	0.0	15.0	15.0	1.0	CS
2	37.5	0.0	0.0	15.0	37.5	0.0	SM
3	37.5	0.5	0.0	15.0	62.5	0.0	FL
4	62.5	1.0	0.0	1.0	62.5	0.0	SM/HH
5	15.0	1.0	0.0	1.0	15.0	0.0	MS
6	37.5	15.0	0.0	37.5	62.5	0.0	MS
7	62.5	1.0	0.0	37.5	62.5	0.0	MS
8	15.0	1.0	0.0	15.0	15.0	0.5	MS
9	15.0	0.0	0.0	37.5	15.0	0.1	MS
10	37.5	0.0	1.0	37.5	37.5	0.0	MS
Average	32.1	2.05	0.1	21.2	38.5	0.16	

T.t. = *Thalassia testudinum*S.f. = *Syringodium filiforme*H.w. = *Halodule wrightii*

TMA = Total macroalgae

MS = Muddy sand

SM = Sandy mud

CS = Coarse shell

HH = Halimeda hash

FL = Flocculent sediment

CR = Coral rubble

Table B3. Area C.

Braun-Blanquet Cover (%)							
Quadrat #	T.t. (%)	S.f. (%)	H.w. (%)	TMA (%)	Total Grass (%)	Coral (%)	Sediment
1	15.0	0.0	0.0	1.0	15.0	0.0	MS
2	15.0	0.0	0.0	1.0	15.0	0.0	MS
3	62.5	0.0	0.0	15.0	62.5	0.0	SM/FL
4	37.5	0.0	0.0	15.0	37.5	0.0	SM/FL
5	37.5	0.0	0.0	37.5	37.5	0.0	FL
6	15.0	0.0	0.0	15.0	15.0	0.0	FL
7	15.0	0.0	0.0	15.0	15.0	0.0	MS
8	15.0	37.5	0.0	1.0	62.5	0.0	FL
9	15.0	15.0	0.0	15.0	15.0	0.0	FL
10	37.5	15.0	0.0	15.0	37.5	0.0	FL
Average	26.5	6.75	0	13.05	31.25	0	

T.t. = *Thalassia testudinum*
 S.f. = *Syringodium filiforme*
 H.w. = *Halodule wrightii*
 TMA = Total macroalgae
 MS = Muddy sand
 SM = Sandy mud
 FL = Flocculent sediment

Table B4. Area D.

Braun-Blanquet Cover (%)							
Quadrat #	T.t. (%)	S.f. (%)	H.w. (%)	TMA (%)	Total Grass (%)	Coral (%)	Sediment
1	37.5	0.5	0.0	15.0	37.5	0.0	MS
2	62.5	0.0	0.0	37.5	62.5	0.0	MS
3	15.0	0.0	1.0	15.0	37.5	0.0	MS
4	62.5	0.0	0.0	15.0	62.5	0.0	MS
5	62.5	0.0	0.0	1.0	62.5	0.0	FL
6	62.5	0.0	0.0	1.0	62.5	0.0	FL
7	37.5	0.0	0.0	37.5	37.5	0.0	FL
8	62.5	0.0	0.0	37.5	62.5	0.0	FL
9	37.5	0.0	0.5	62.5	37.5	0.0	MS
10	62.5	0.0	0.5	15.0	62.5	0.0	MS
Average	50.25	0.05	0.2	23.7	52.5	0	

T.t. = *Thalassia testudinum*
 S.f. = *Syringodium filiforme*
 H.w. = *Halodule wrightii*
 TMA = Total macroalgae
 MS = Muddy sand
 FL = Flocculent sediment

Table B5. Braun-Blanquet Mid-Point Interpolation.

Interpolation of the Mid-Point of BB Scores			
BB Score	% Cover	BB Score	% Cover
0.00	0.00	2.60	28.50
0.10	1.00	2.70	30.75
0.20	1.00	2.80	33.00
0.30	1.00	2.90	35.25
0.40	1.00	3.00	37.50
0.50	1.00	3.10	40.00
0.60	1.00	3.20	42.50
0.70	1.00	3.30	45.00
0.80	1.00	3.40	47.50
0.90	1.00	3.50	50.00
1.00	3.00	3.60	52.50
1.10	4.20	3.70	55.00
1.20	5.40	3.80	57.50
1.30	6.60	3.90	60.00
1.40	7.80	4.00	62.50
1.50	9.00	4.10	65.00
1.60	10.20	4.20	67.50
1.70	11.40	4.30	70.00
1.80	12.60	4.40	72.50
1.90	13.80	4.50	75.00
2.00	15.00	4.60	77.50
2.10	17.25	4.70	80.00
2.20	19.50	4.80	82.50
2.30	21.75	4.90	85.00
2.40	24.00	5.00	87.50
2.50	26.25		

<u>BB Score</u>	<u>Mid-Point Range</u>
<1 = <1	<1 = 1
1 = 1 to 5	1 = 2.5
2 = 5 to 25	2 = 15
3 = 25 to 50	3 = 37.5
4 = 50 to 75	4 = 62.5
5 = 75 to 100	5 = 87.5