**Attachment C**

# Sediment QA/QC Plan
# Bathtub Beach Restoration Project

Prepared for

Florida Department of Environmental Protection
Joint Coastal Permit Application RAI
JCP File Number: 0163447-002-JC

by

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**Bathtub Beach Restoration Project**
**Martin County, FL**
**JCP #0163447-002-JC**

**Sediment Quality Assurance and Quality Control Plan**
**Gahagan & Bryant Associates, Inc.**

## Project Description

The Bathtub Beach Restoration Project is to dredge, as needed, approximately 25,000 cubic yards of sand from St. Lucie Inlet flood shoal using a cutterhead dredge and place the beach-quality sand along 1,250 linear feet between R34.5 and R36 at Bathtub Beach, Martin County, to protect essential infrastructure from erosion. This nourishment is to be conducted in coordination with activities at the adjacent Sailfish Point and will temporarily impound sediment behind geotubes that will be cut and removed at the end of the project. Work is projected to begin in spring 2009 and occur periodically thereafter, as needed.

The purpose of the Sediment Quality Assurance and Quality Control (QA/QC) Plan, is to ensure that the sediment dredged from the permitted borrow area and placed within the beach fill template will meet the standards outlined in Section 62B-41.007(2)(j), Florida Administrative Code (FA C.) and the conditions in the Joint Coastal Permit issued by the Bureau of Beaches and Coastal Systems, Florida Department of Environmental Protection (DEP).

## Native Beach Sand Characteristics

Based on previous studies of the area's native beach sand, prior to artificial renourishment activities, mean grain sizes ranged from 0.32mm to 0.54mm in the beach berm and swash zone, with very little material less than 0.125mm. Shell fragments comprised a considerable part of the beach material. The average percent of carbonate found within the native samples is approximately 58% consisting of shell hash material. The color of the native beach was generally light yellowish brown. Renourishment projects have created an existing beach with a grayish tone.

## Borrow Area Sediment Characteristics

The borrow site sediment consisted of a mean grain size of 0.93 phi, (0.52mm) with a standard deviation of 1.47. The large standard deviation can be attributed to the quantity of medium to large shell hash mixed with an abundant amount of medium to fine-grained quartz sand. The proposed borrow site is

comprised of 1.1% organic material, 54.0% carbonate and 44.9% siliciclastic grains. The carbonate content present within the borrow site is indicative of a large quantity of shell fragments and/or eroded reef material within the sediment. Using the Munsell Color palate, the average color for the borrow material is 10YR 6/2, or verbally, a light brownish gray.

**Acceptable Borrow Material Criteria**

The following table summarizes the acceptable beach sediment characteristics to be determined from sieve analysis and visual inspection of the constructed beach berm sediment samples. Materials which differ from the specifications provided in this table will be considered unacceptable materials. Unacceptable materials also include debris, trash, and rocks or rubble larger than three-fourths (3/4) inch in diameter. Note that silt is defined as any material finer than the #230 sieve (0.0625 mm).

| Sediment Parameter | Acceptable Borrow Material Limits |
|---|---|
| Mean Grain Size (mm) | 0.30mm to 0.70mm |
| Maximum Silt Content (%) | 5% |
| Moist Munsell Color Range | 7 or lighter |

If rocks or other non-specified materials appear on the surface of the filled beach in excess of 50% of background in any 10,000 square foot area, then surface rock should be removed from those areas. These areas shall also be tested for subsurface rock percentage and remediated as required.

**Quality Assurance**

The Quality Assurance Plan describes the activities to be performed by the County and its Engineer to monitor construction operations and to observe, sample and test the placed sediments to determine if the sediments are in compliance with the criteria presented in this Sediment QA/QC Plan.

The following level of construction observation is proposed to reasonably assure that the Contractor's work will be in conformance with the required contract and permit conditions. Construction observation and contract administration will be performed 7 days a week, typically 10 hours a day. Inspections will occur mostly during daytime hours, however, random nighttime inspections may be conducted.

1. The Engineer shall provide onsite observation by a Site Inspector with training or experience in beach nourishment and construction inspection and testing. The Site Inspector shall be knowledgeable of the project design and permit conditions. The Engineer, a qualified Coastal Engineer, shall actively manage the site inspector who is responsible for the daily field observations.

2. The Engineer and the Site Inspector shall be continuously on call during the period of construction for purposes of making decisions regarding issues that involve Sediment QA/QC Plan compliance. Communications will take place between the Engineer and his on-site inspector daily.

3. Any addendum or change order to the Contract between the County and the Contractor shall determine whether or not the change in scope will potentially affect this Sediment QA/QC Plan.

4. The Contractor's Quality Control Program shall be discussed at the Pre-construction meeting. The Contractor shall acknowledge the requirements of this Sediment QA/QC Plan prior to issuance of the Notice to Proceed.

5. The Engineer shall review the Contractor's Daily Reports, and shall monitor the dredge position and discharge location on a daily basis.

6. During beach fill construction, the placed sand will be assessed by the Engineer, or Site Inspector, to ensure compliance with the permit and this Sediment QA/QC Plan, and will include the following:

a) One representative grab sample will be collected from every 200 linear feet of beach fill placed. The sample will be collected 12 inches below the surface and located in the center of the newly constructed berm.

b) The grab sample will be visually compared to the acceptable sand criteria outlined in this plan. The grab sample will be assessed for grain size, moist Munsell color, shell and carbonate content, gravel content and silt content. Each grab sample will be archived with the date, time, and location of the sample, and shall be stored until project completion.

c) The results of these sample assessments shall be documented on the Engineer's Daily Observation Reports, which shall be submitted to DEP with the Final Certification.

d) Prior to completion and acceptance of a beach fill section, the Project Engineer will collect a representative sand sample at each DEP beach profile line to quantitatively assess the grain size distribution, moist and dry Munsell color, shell content, and silt content for compliance. Samples shall be collected 6-12 inches below the surface of the newly constructed berm.

e) The Engineer shall note the existence of any layering or rocks encountered while collecting the samples. One replicate sample (a minimum of one half (1/2) pound sample) shall be collected at each sample location.

f) One of the sediment samples collected at each sample location shall be sent for laboratory analysis while the other sample shall be archived.

g) All samples and laboratory test results shall be labeled with the Project Name, location relative to the DEP Monument profile line, State Plane Northing and Easting coordinate location, date the sample was collected, and "Construction Berm Sample."

h) All samples shall be evaluated for visual attributes and sieved in accordance with the applicable sections of ASTM D422-63 (Standard Test Method for Particle-Size Analysis of Soils), ASTM D1140 (Standard Test Method for Amount of Material in Soils Finer than No. 200 Sieve), and ASTM D2487 (Classification of Soils for Engineering Purposes). The samples shall be sieved using the following U.S. Standard Sieve Numbers: 3/4", 5/8", 3.5, 4, 5, 7, 10, 14, 18, 25, 35, 45, 60, 80, 120, 170, and 230.

i) The results shall be tabulated and each parameter averaged to keep a running total average. Each sample results shall state whether the sample "PASSED"or "FAILED" the compatible sand criteria found in this Sediment QA/QC Plan. The County will submit the sediment testing results to the DEP following project completion.

j) In the unlikely event that the sediment within a beach fill section is not in compliance with the permit and/or this Plan, then the DEP will be notified within 24-hours. Notification will indicate the volume, aerial extent (area), and location of any un-suitable beach fill material and the proposed remediation plan. Additional sediment quality testing may be required to delineate the area of un-suitable material and following any remediation efforts. Remediation efforts, subject to approval by DEP, may include beach tilling or blending of n125on-compatible beach fill material with adjacent material or moving the non-compatible material seaward of the mean high

water. The results of any remediation will be reported to DEP following project completion.

**Quality Control**

The Quality Control Plan describes the means and methods used for dredge monitoring and beach fill monitoring. The Contractor shall complete the following requirements to ensure the work will be in conformance with the required contract and permit conditions. The County and the Engineer will enforce these requirements during the prosecution of work.

1. The Construction Specifications will require the Contractor to continuously operate and accurately monitor the horizontal and vertical position of the lowest portion of the excavation device with on-board electronic positioning equipment. To maintain vertical accuracy near real-time tide corrections should be applied to the vertical position measurements. The positioning equipment shall have horizontal accuracy of +/-3 feet and a vertical accuracy of +/-0.25 feet.
2. The Contractor shall be responsible for establishing adequate positioning control to insure the allowable excavation depths and horizontal limits are not exceeded.
3. The horizontal and vertical positions shall be recorded at intervals of fifteen (15) minutes or less. Tide elevations shall also be recorded at the same intervals.
4. The Contractor shall excavate within the borrow areas in a uniform and continuous manner. No dredging shall take place outside of the permitted borrow area limits (horizontal and vertical limits) as shown on the Construction Drawings. DEP will be notified as soon as possible of any violations of the dredging plan.
5. On a daily basis, the Contractor shall prepare a plot of the excavation device positions referenced to Florida State Plane Coordinates (NAD, 1983). The plot of the data shall include the Florida State Plane Coordinate grid system, position of the excavation device and dredge area limits with actual and maximum authorized dredge cut depth. The monitored depths shall be corrected for tide elevation and referenced to NAVD 1988. A hardcopy plot and file (both raw and corrected data) of the position data shall be included with the Daily Quality Control Reports. Dredge position data will be provided to **DEP** following the completion of the project, or at any time during construction, if requested.
6. The Contractor shall submit a proposed Daily Quality Control Report to the Project Engineer at the pre-construction meeting for the Engineer's review and approval. The report shall include, at a minimum, the horizontal and vertical data and information listed above. In

addition, the Contractor's reports will characterize the sediments placed within the beach fill limits with specific reference to the occurrence of rock, rubble, shell, silt or debris. The Contractor's Daily Quality Control Report shall be due by 4:00 p.m. the following day for the documented activity and will be collected by the Engineer from the Contractor's designated Field Representative.

**Remediation**

The following are the procedures and methods that will be implemented during the placement of sand within the permitted beach fill limits if the placed sand is deemed "unacceptable" through the daily sediment monitoring or post-construction sediment monitoring outlined in this Sediment QA/QC Plan.

1. The Contractor shall continuously visually monitor the material discharged from the end of the pipeline and placed within the beach fill limits. Specifically, non-acceptable materials such as rock debris, and very silty materials shall be noted. If occasional non-acceptable materials appear on the beach during dredging operations, these materials shall be removed by the Contractor after contacting the Engineer. The Contractor shall survey and document the location (in Florida State Plane Coordinates), area and volume of non-compatible material removed. The Contractor shall document the occurrence on the Daily Quality Control Report.
2. If the Engineer or the Contractor determines that the material discharged from the end of the pipeline or placed within the beach fill limits does not comply with the Acceptable Borrow Material Criteria outlined in this Sediment QA/QC Plan, the Contractor will immediately cease all dredging operations. The Contractor shall take whatever actions necessary to avoid further discharge of unacceptable material within the beach fill limits.
3. The Engineer shall use the dredge positioning records, plans, and vibracore descriptions to determine the portion of the borrow area containing unacceptable materials. The Engineer will instruct the Contractor to adjust the construction operation to avoid the unacceptable material.
4. If during the daily sediment monitoring or post-construction sediment monitoring the Engineer determines the fill placed is unacceptable based on the criteria in this Sediment QA/QC Plan, and has an area of 10,000 square feet or greater, the Engineer shall immediately contact DEP. Remediation actions, on which DEP may be consulted, may include: beach tilling or blending of unacceptable beach fill material with adjacent acceptable material; or, moving the unacceptable material seaward of the mean high water line.

Additional sediment testing shall be conducted following any remediation effort. The results of the sediment testing shall be reported to DEP. If material from the beach berm and/or dune is pushed below MLLW, the adjacent beach berm and/or dune may need to be graded to remove any escarpments, ruts or significant non-conformities in elevation.