SIDA/Hilton Head Dredging and Open Water Placement

General Dredging Plan

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1. Background

The South Island Dredging Association (SIDA) is seeking a permit to dredge about 300,000 cubic yds. of environmentally suitable sandy silty/clay sediment from several navigation channels and berthing locations on Hilton Head Island, SC. Hydraulic dredging by cutter head pipeline is proposed with transport by pipeline and submerged placement in inland waters near the mouth of Calibogue Sound. This report presents the "General Dredging Plan" for "stakeholder" review and comment. Detailed dredging plans and specifications for contractor use will be developed on the basis of this report. Related monitoring is described in the monitoring report.

Maintenance dredging is required for 6 marinas and marina entrance channels to achieve navigable depths of 5-8 ft. Mean Low Water (MLW) for recreational and commercial navigation. All are located in the lower Calibogue Sound on Hilton Head Island. Figure 1 shows the entire project area for the areas to be dredged. Table 1-1 describes the dredging areas and depth requirements. Open water placement, permitted pursuant to and regulated by Section 404(b)1 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, is planned at a site in the lower sound near the entrance to the sound. The placement site is in Waters of the U.S. and is regulated pursuant to the Clean Water Act.

Hydraulic dredging is planned, and a dredged material transport pipe ranging from 2 to 3.5 miles is necessary to move the material to the preferred aquatic placement site. Anticipated dredging volume is about 300,000 cu. yds. A submerged release will be 3 ft. above the bottom in about 28 ft. of water. Table 1-2 describes the physical properties of the sediments to be dredged. Figures 2, 3, 4, and 5 present the individual dredging locations and expected dredging area.

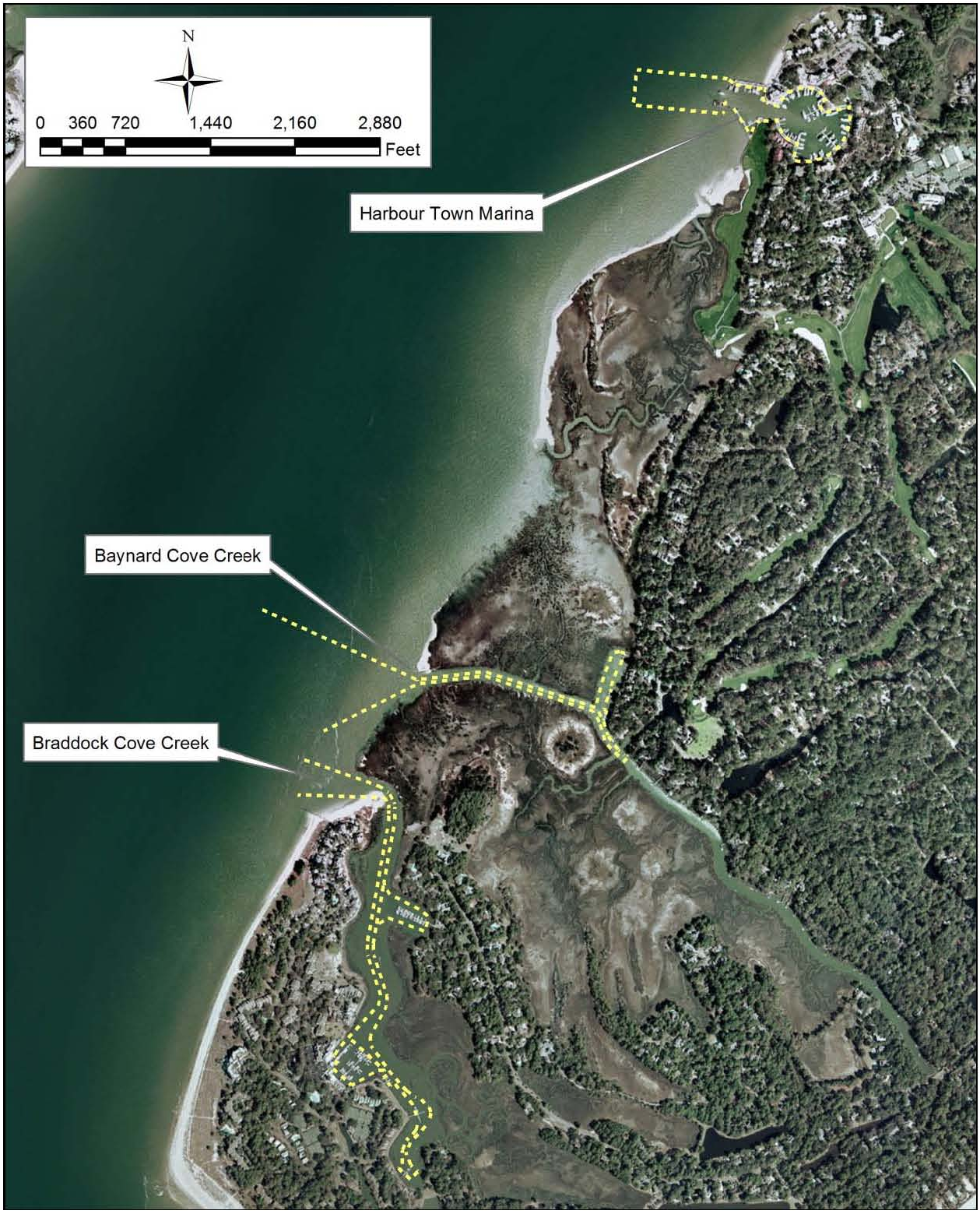

Figure 1-1: Overview of Proposed Areas to be Dredged

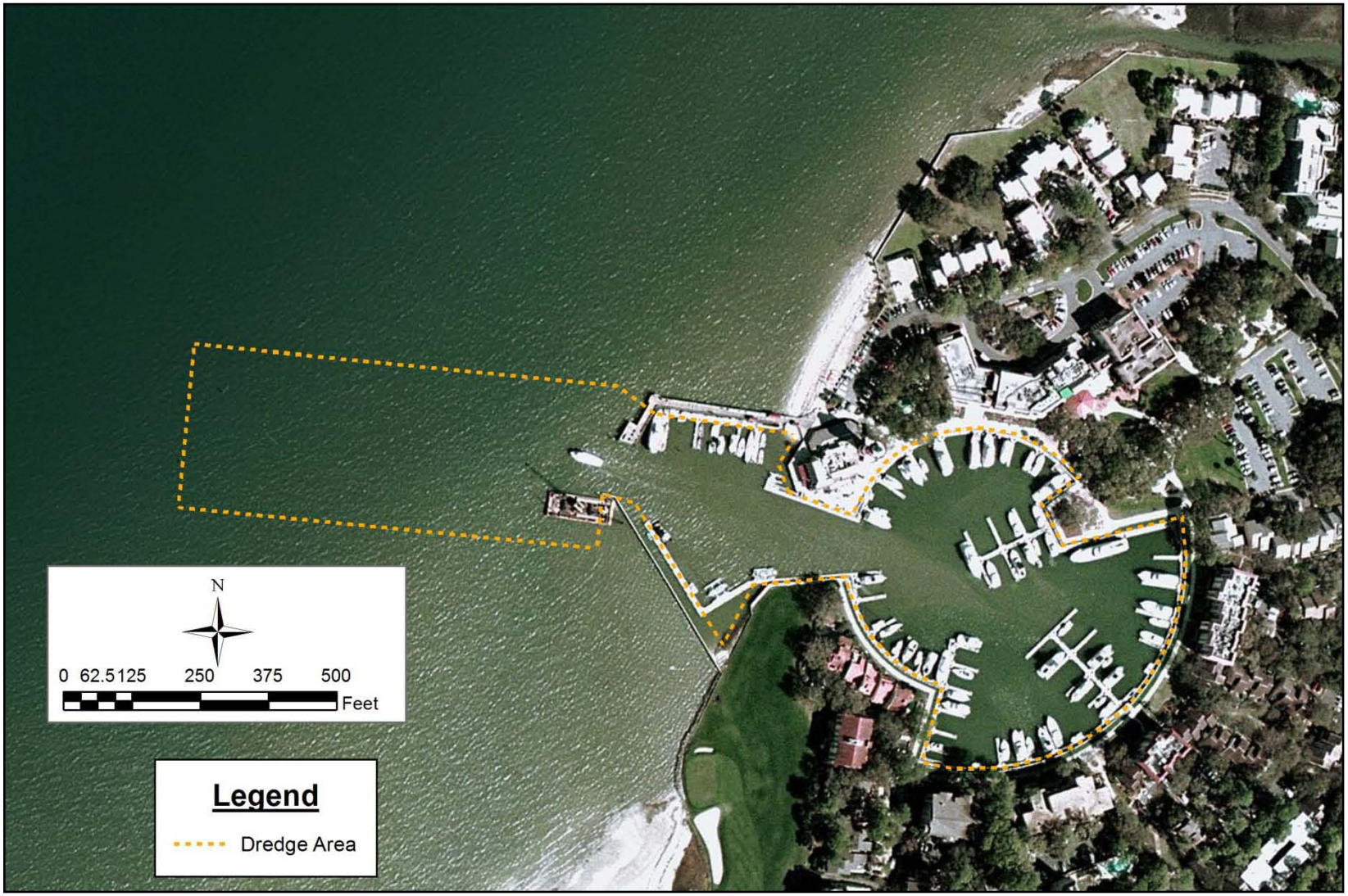

Figure 1-2 Harbour Town Marina Dredge Area

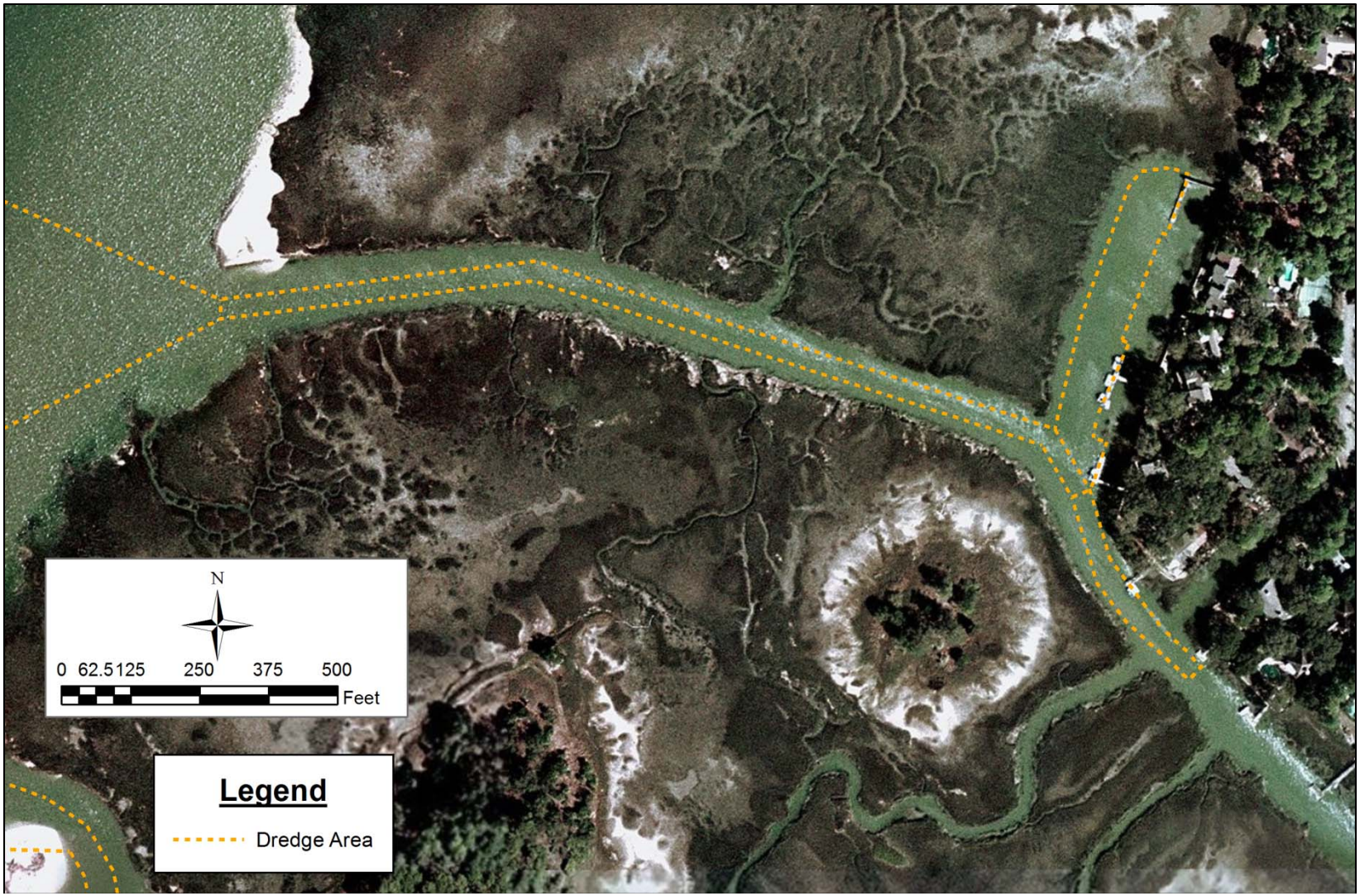

Figure 1-3: Baynard Cove Creek Dredge Area

Figure 1-4: Braddock Cove Creek Mouth and Gull Point Marina Areas to be Dredged

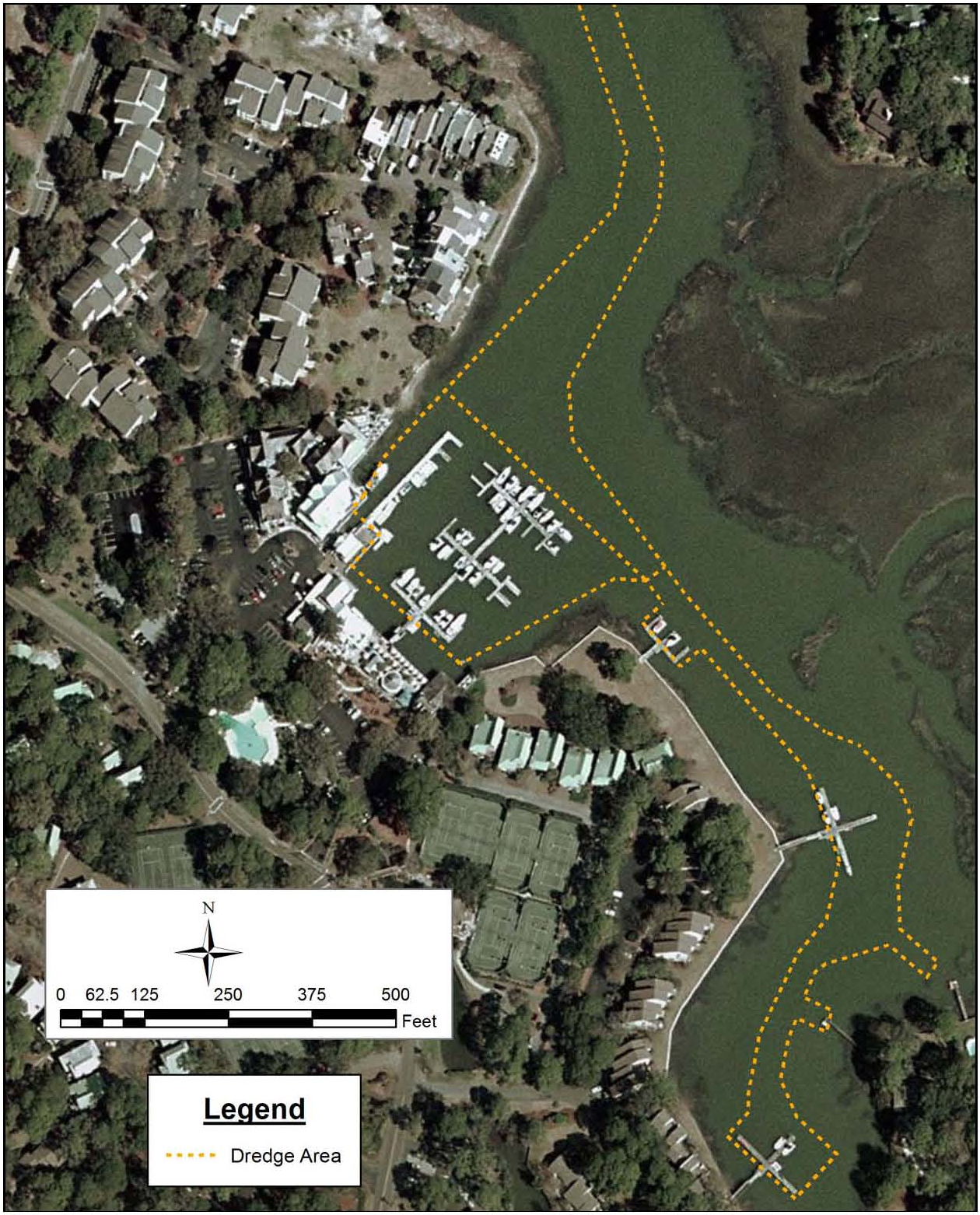

Figure 1-5: Braddock Cove Creek and South Beach Marina Areas to be Dredged

Table 1-1. Dredge areas and depth for each site

Location	Acres	Depth ft. (MLW)
Harbour Town Marina		
Entrance Channel	6.5	-8
Marina	8.3	-8
Braddock Cove Creek		
Entrance Channel to South Beach Marina, including Gull Point Marina	12.6	-8
South Beach Marina	2.1	-8
Upcreek of S. Beach Marina to Point Villas	2.6	-6
Baynard Cove Creek		
Entrance Channel	13.6	-8
Community Dock	1.5	-5
Creek	3.3	-6
TOTAL	50.5	

Because of the quantity of material to be dredged, and the fact that only a shallow draft small dredge can navigate the creeks and docking areas to excavate the material (which limits the production rate of the dredge), the project will require up to 6 months to complete. The proposed project will be performed during the allowable work season, and is expected to start in the month of November and continue through the winter and spring months, ending as late as the end of April. Dredging would be conducted continuously (24/7), except when repositioning the dredge, conducting equipment repair or maintenance, or during weather delays. The duration of the dredging will be significantly less in the tidal creeks than in the marinas and mouths of the creeks.

Based on a review of geotechnical data collected by Applied Technology and Management (ATM. 1999) and by GEL Engineering (GEL 2008), the maintenance material is mostly silt and clay with a variable fraction of sand. Material composition and sediment grain size depends upon the location from which it is extracted. Table 1-2 summarizes the 2008 grain size analysis data for the dredge sites.

Table 1-2 Summary of Grain Size Distribution at Dredge Sites

		Percentage in each grain size class			
Sample	**Location**	**Sand**	**Coarse silt**	**Fine silt**	**Clay**
HT-2	Harbour Town Marina - entrance	8	12	38	42
HT-3	Harbour Town Marina - center of basin	22	16	28	34
Gull PT-1	Gull Point Marina in Braddock Cove Creek	5	15	38	42
S. Beach-1	South Beach Marina in Braddock Cove Creek	5	21	46	28
Brad-2	Middle of Braddock Cove Creek	8	18	34	40
Bay-2	Middle of Baynard Cove Creek	6	26	30	38
CD-1	Community dock in Baynard Cove Creek	7	25	31	37
Average		9	19	35	37
Standard Deviation		6.0	5.2	6.2	5.0

The project proposes to use a small hydraulic dredge with a maximum intake diameter of 10-12 inches to transport the material via a pipe to Placement Site 5 (Fig. 6), a distance of 2 to 3.5 miles depending on dredge location. A booster station will be placed in the pipeline as needed to provide sufficient additional power to transport the material to the placement site. Site 5 is located in an area with rippled sand bottom habitat. The location of the proposed pipeline discharge at Placement Site 5 is approximately 4,600 feet from the shoreline of Hilton Head Island and approximately 8,100 feet from the shoreline of Daufuskie Island.

The discharge pipeline corridor shown in Fig. 7 will lead from the dredge site along the shoreline in water depths sufficient for it to remain off the bottom and convey materials to the chosen site for placement. The pipeline would be floated at the surface except when crossing channels, where it would need to be submerged and anchored (using heavy chains with weights on the ends) so that it does not create a navigation impediment.

For the purposes of this report, the Project Action Area includes the marina and creek dredge areas (listed in Table 1, and shown in Figures 2-5), the pipeline corridor to the placement area, and the Site 5 placement area included in Figure 7 with an expanded view in Figure 8.

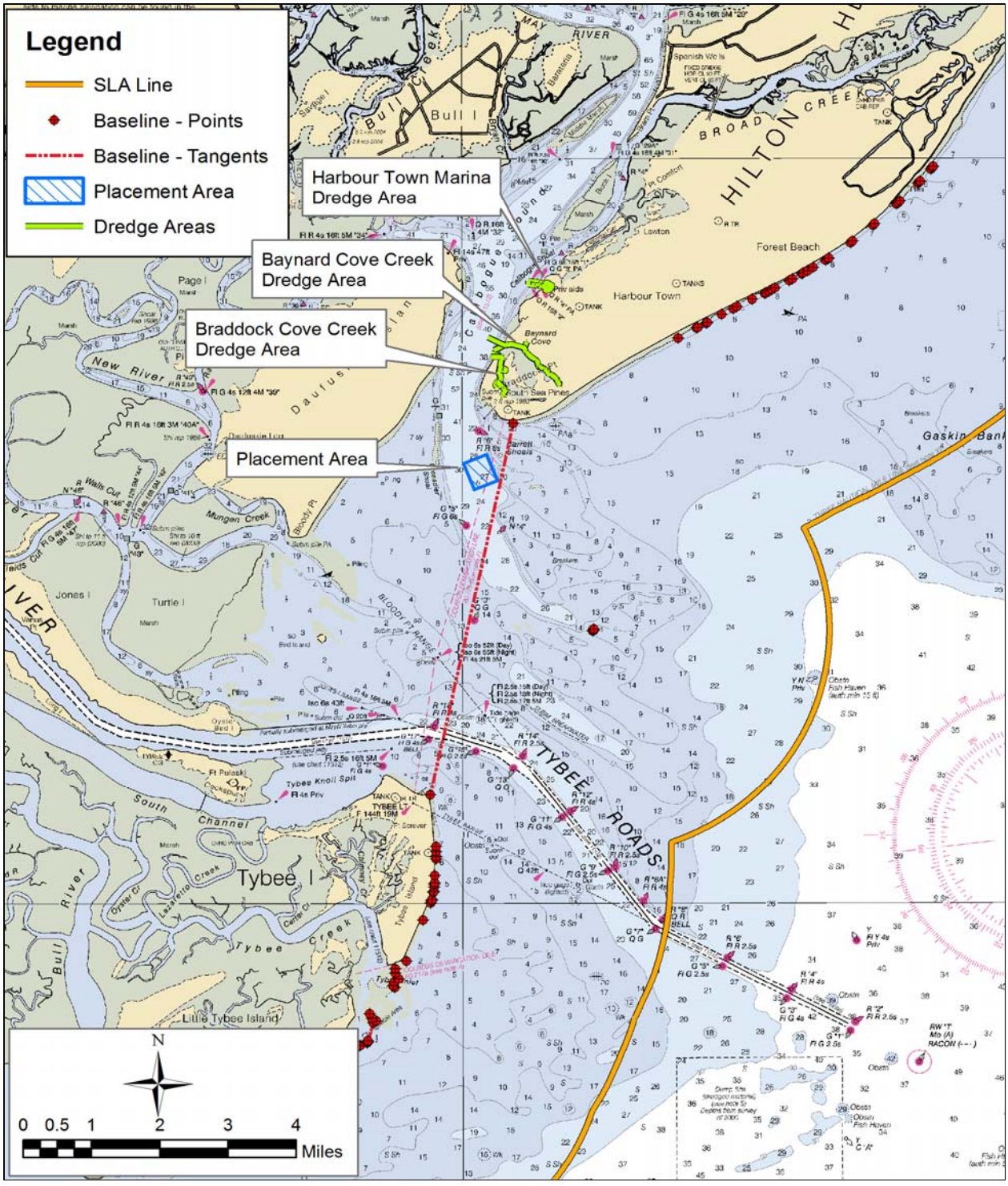

Figure 1-6: Project Location Map

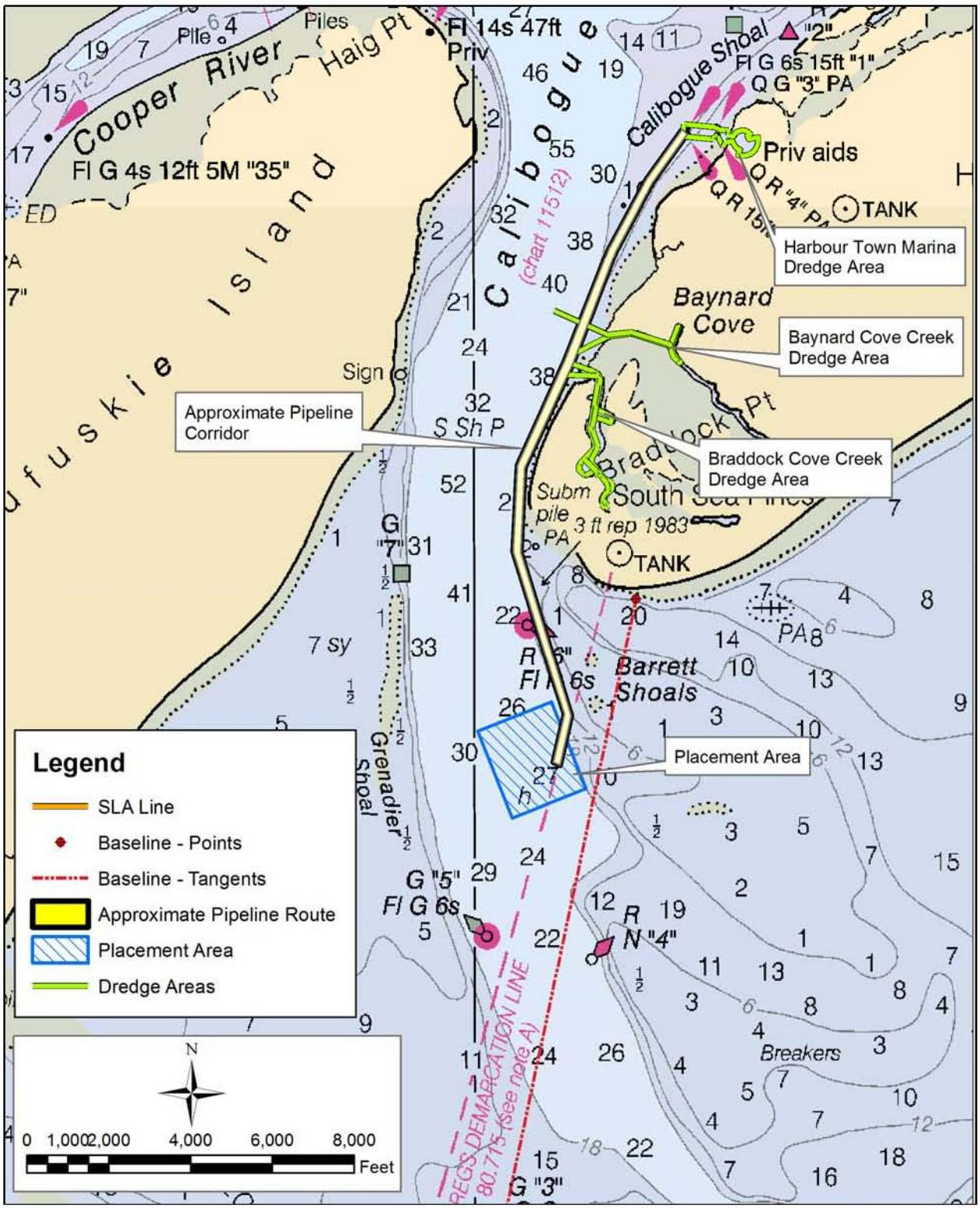

Figure 1-7: Location of Dredge Areas, Pipeline Route and Placement Area

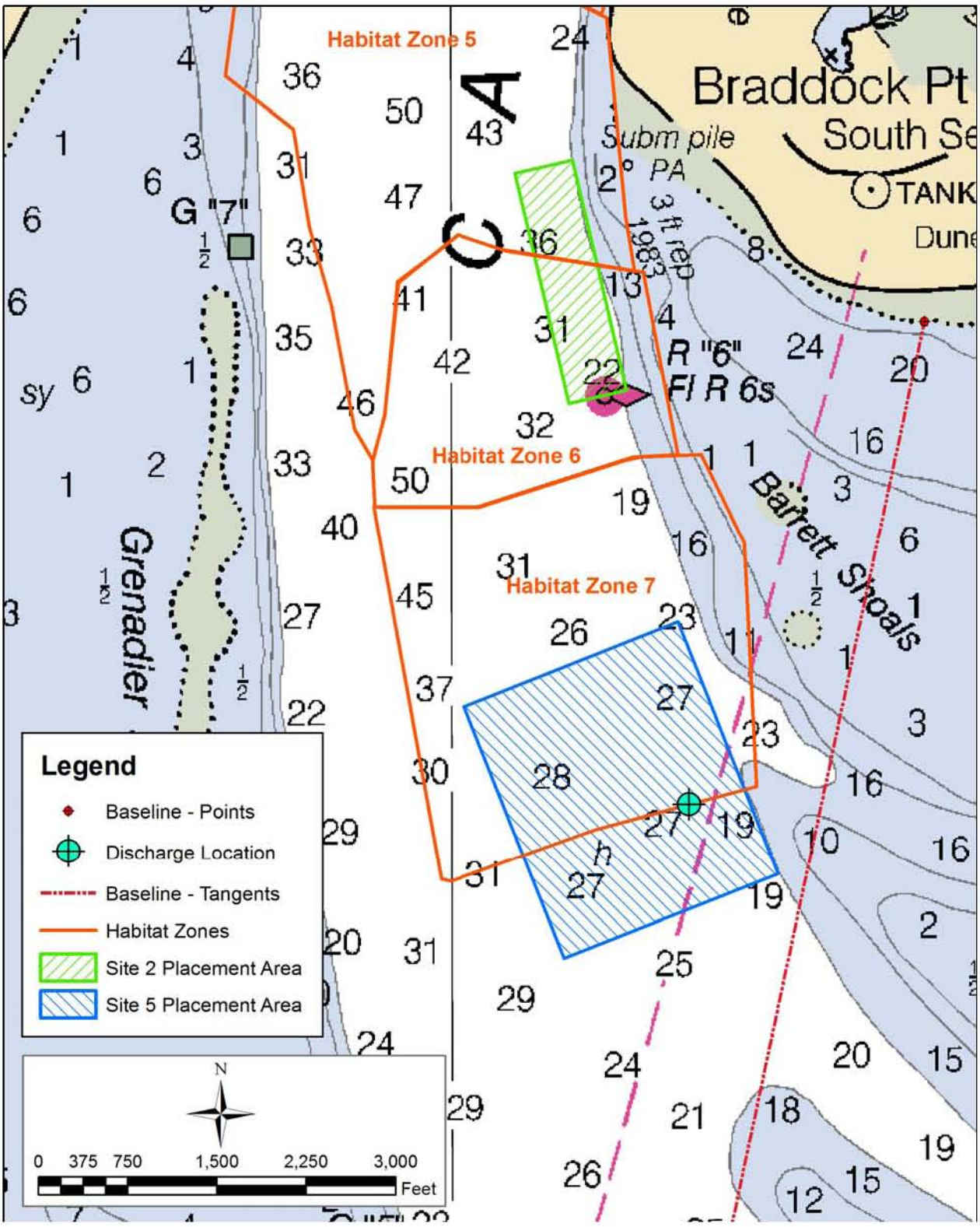

Figure 1-8: Hilton Head Island Features and Dredged Material Placement Alternatives, Including Proposed Sites 5 and Earlier Alternative Site 2. Included are Habitat Zones Identified by ATM

2. Dredging and Placement Guidelines

2.1. Dredge and related equipment

A shallow draft 10-12-inch self-propelled cutter head pipeline dredge typical to marina dredging that is capable of dredging to 8 ft. (MLW) marina navigation depths is required. A single operator is usually required for the dredging and a part time engineer may be required. GPS location device and dredge tracking software to document dredged areas and elevations are required. A pre- and post-dredge bathometric survey is required for the dredging site and the placement site for documentation of completion and pay purposes and to ensure all material has been placed within the permitted site boundaries. Routine surveys of the placement site will be conducted at certain times throughout the project to ensure accurate placement and minimal mounding. Pumping capacity will be capable of handling a discharge pipe for about 2 to 3.5 miles to the placement site. Fig. 7 depicts the dredging and pipeline corridor to the placement site. Where a booster pump is necessary for longer distances, it will include an anchored platform with fuel storage and docking features. It is anticipated that a cutter head pipeline dredge will be selected with enough power and size to provide for production of up to 2,000 cu. yds. per day, 24 hours and 7 day per week production. The dredging season is about 180 days, 1 Nov – 30 April, with about 150 days of actual production and 30 days of dredge transport, mechanical maintenance, and weather contingency.

2.2. Transport and Discharge Equipment

The sediment slurry transport pipe diameter will match that of the dredge discharge pipe (i.e., 10-12-inches). The transport distance will be about 2-3.5 miles following the route shown at Fig. 7 and accounting for movement up the creeks as needed. Proper anchorage will be required for the floating and submerged pipeline and will result in minimal physical impact to the environment and other uses of the water body. The discharge platform (barge) will be anchored in such a manner to allow movement of the discharge pipe within the boundaries of the placement site to minimize bottom mounding. As noted above, a booster pump may be necessary to ensure slurry pumping and transport requirements. This will require appropriate fuel storage and navigation markings.

2.3. Placement Site

The placement site is shown at Fig. 6. Site 5 is the preferred alternative (GEL 2012, Alternative Analysis Report). The placement site depth is about 27-28 ft. (MLW). Tidal dominated currents at the disposal site range from a maximum ebb velocity of 1.0m/s (meters per second) 3.3 ft/s (feet per second) and a maximum flood velocity of 0.8 m/s 2.6 ft/s. Currents will move suspended sediments as related to tidal cycle and longer term river flow with dominant sediment movement seaward. The tidal range is about 8 ft. The current regime should pose no problem to floating pipe, discharge platform placement and maintenance, and submerged discharge.

An analysis was completed by MG Associates (2012) to evaluate the spreading of material on the bottom after the mud is discharged from the pipeline. As described by MGA (2012), the discharged material will flow along the bottom in a downhill direction as a fluid mud underflow. The predicted distance covered by the fluid mud underflow varies depending on the coefficients used for the rheological properties of the mud. Spreading of the mud as a thin flat layer covering 56 acres is the most conservative estimate of bottom coverage. For this scenario, the fluid mud spreads along the bottom as far as 1,350 ft. (410 meters) from the discharge location. However, if the mud is more viscous, the fluid mud will spread less than 330 ft. (100 meters) from the discharge location. For this scenario, the deposited material will have a steeper slope.

Placement of dredged material will be adjusted as necessary to maintain minimal mounding of the material on the bottom. Dredged material placement will start on the shallow side (i.e., eastern side) of the permitted placement footprint. The discharge will be moved no more than 1,000 ft. from the initial discharge location in order to spread the material. The deposited material will be monitored to ensure that the material spreading on the bottom does not go beyond the placement area limits.

2.4. Booster Pump Barge

A small barge (disposal/discharge barge) is necessary to precisely control the movement of the discharge pipe during hydraulic dredging. The discharge pipe is placed over the deck of the barge, allowing the outlet end to be configured downward at about a 45 ^{o}

angle, reaching 3 ft. above the bottom. A 90 ^{o} angle may also be considered. The dredged material is placed underwater in a more deliberate fashion to reduce water column turbidity. As an example, the discharge pipeline from the dredge is connected to a heavy flexible rubber pipe anchored to the barge and bending at 45^{o} to direct the material downward. A steel or rigid plastic pipe is connected to the rubber pipe for the direct discharge about 3 ft. from the bottom. A baffle plate at a 45^{o} angle could be attached at the end of the discharge pipe to direct the flow downward to reduce flow velocity and encourage settlement. The barge is moved within the site boundaries to disperse the sediment bottom placement and maintain minimal mounding of material.

2.5. Submerged Disposal

The dredged material will be discharged through a Tremie pipe at a 45^{o} bend in the transport pipe, as shown in Fig. 9, to proceed vertically through the water column and place the dredged material at about 3 ft. above the sediment surface. A baffle plate is attached at the end of the Tremie pipe at a 45^{o} angle to ensure even bottom spreading. This discharge is used to ensure minimum water column impact

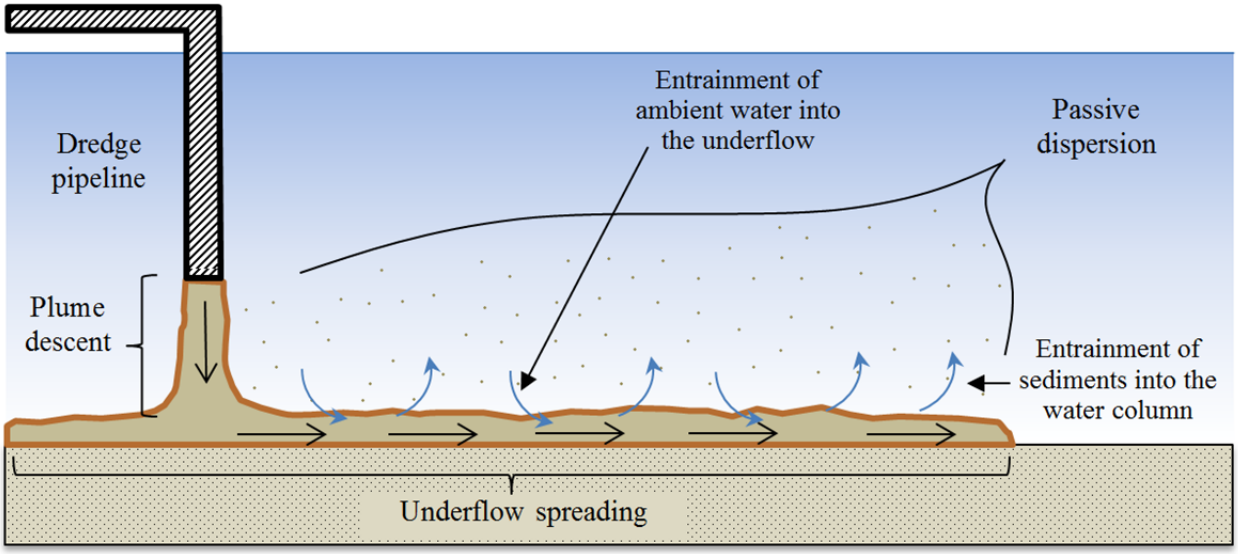

Figure 1-9: Dispersion phases of discharge from a pipeline (adapted from Teeter, in Thovenot et al., 1992).

or turbidity at the placement site. The submerged disposal will not only minimize water column impact, but will allow for bottom placement in thin lifts within the permitted

footprint to minimize benthic impact, enhance transport seaward, and allow for rapid benthic re-colonization. The discharge platform will be moved at select time intervals across the permitted placement site from the landward edge of the site towards the deeper channel edge. The dredged material placement mound will be maintained at an approximate elevation of no more than 2 ft. above the sediment surface. As referenced in MG Associates (2012), mounding will be minimal and is expected to completely erode weeks after project completion. Based on our experience, it is not likely that a sediment diffuser attachment is needed at the end of the Tremie pipe as justified by the Discharge Modeling Report. All appropriate U. S. Coast Guard markings and signals will be placed on the barge and over the 2 mile length of the disposal pipeline.

2.6. Inspection

Continuous dredging inspections by full time inspectors are required to ensure that the dredge remains within the permitted area using GPS coordinates. Safety briefings and inspection are required for all operations and for boaters and pedestrians. The entire length of the discharge pipeline will be routinely inspected for any leakage and anchoring/mooring stability. Monitoring requirements at the dredging and placement sites are discussed more thoroughly in the Monitoring Report.

2.7. Dredging Plans and Specifications (P&S)

Detailed engineering P&S will be developed showing precise boundaries, elevations and GPS coordinates and all aspects will be shown in certified drawings. All technical and appropriate permitting requirements will be discussed in detail as part of the contractual process and in advertising for and contracting a competent dredging company.

3. References:

Applied Technology and Management. 1999.
Sampling and Analysis Plan – South Island Dredging Association Long Term Management Strategy. For South Island Dredging Association.

GEL Engineering. 2008. Sediment Testing Report. For South Island Dredging Association.

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Thevenot, M.M., T.L. Prickett, and Kraus, N.C. 1992. “Tylers Beach, Virginia, dredged material plume monitoring project: 27 September to 4 October 1991," Technical Report DRP-92-7, U.S.Army Engineer Waterways Experiment Station, Vicksburg, MS.