Planning Division
Environmental Branch

MAR 2 1 2006

Mr. David Bernhart
National Marine Fisheries Service
Southeast Regional Office
Protected Species Resources Division
263 13th Avenue South
St. Petersburg, Florida 33701

Dear Mr. Bernhart:

The U.S. Army Corps of Engineers (Corps), Jacksonville District, proposes to approve the use of a bed-leveling device to perform clean up operations during Operations and Maintenance and Construction activities at Port Everglades in Broward County, Florida.

This letter and enclosed Biological Assessment (BA) serves to initiate consultation under the Section 7 of the Endangered Species Act. After preparing this BA of the impacts of the proposed use of a bed leveling device in Port Everglades, the Corps has determined that the proposed project may affect, but is not likely to adversely affect the green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), Hawksbill sea turtle (*Eretmochelys imbricata*), leatherback turtle (*Dermochelys coriacea*).

Additionally the Corps finds that the use of a bed-leveling device will not effect Johnson's seagrass (*Halophila johnsonii*), blue (*Balenoptera musculus*), humpback, (*Balaenoptera physalus*), sei (*Balaenoptera borealis*), fin (*Balenoptera physalus*), northern right (Eubalaena glacialis) and sperm (*Physeter macrocephalus*) whales and smalltooth sawfish (*Pristis pectinata*), and is not likely to adversely modify designated critical habitat for Johnson's seagrass. We request that you concur with this finding.

If you have any questions, please contact Ms. Terri Jordan at 904-232-1817 or terri.l.jordan@saj02.usace.army.mil.

Sincerely,

Marie G. Burns
Chief, Environmental Branch

Enclosure

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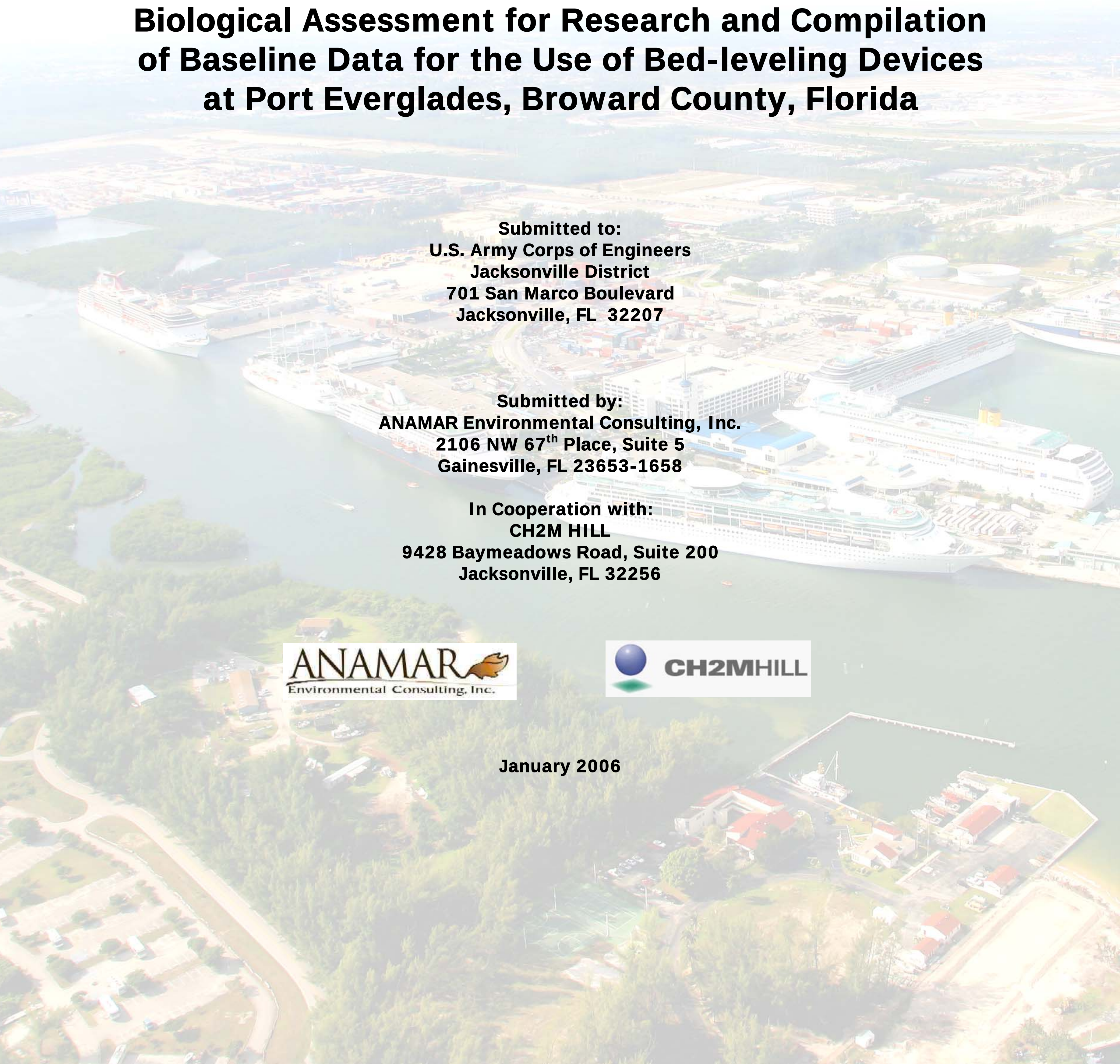
Biological Assessment for Research and Compilation of Baseline Data for the Use of Bed-leveling Devices at Port Everglades, Broward County, Florida



Submitted to:
U.S. Army Corps of Engineers
Jacksonville District
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Jacksonville, FL 32207

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January 2006

Biological Assessment for Research and Compilation of Baseline Data for the Use of Bed-Leveling Devices at Port Everglades Broward County, Florida

PREPARED BY: ANAMAR ENVIRONMENTAL CONSULTING, INC.

IN COOPERATION WITH: CH2M HILL

PREPARED FOR: U.S. ARMY CORPS OF ENGINEERS, JACKSONVILLE DISTRICT

DATE: JANUARY 2006

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Biological Assessment for
Research and Compilation of Baseline Data for the Use of Bed-Leveling Devices at Port Everglades
Broward County, Florida

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LIST OF ACRONYMS AND ABBREVIATIONS

BA	Biological Assessment
ERDC	Engineer Research and Development Center
ESA	Endangered Species Act
FWC	Florida Fish and Wildlife Conservation Commission
GA DNR	Georgia Department of Natural Resources
GRBO	Gulf Regional Biological Opinion
NMFS	National Marine Fisheries Service
NRC	National Research Council
QCR	Quality Control Report
RBO	Regional Biological Opinion
SARBO	South Atlantic Regional Biological Opinion
SAD	South Atlantic Division
SEFSC	Southeast Fisheries Science Center
STSSN	Sea Turtle Stranding and Salvage Network
TED	Turtle Excluder Device
TEWG	Turtle Expert Working Group
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

DESCRIPTION OF PROPOSED ACTION

The U.S. Army Corps of Engineers (USACE), Jacksonville District initiated a review of the use of bed-leveling devices in the major channels and basins within Port Everglades, Broward County, Florida. The purpose of this effort is to research, collect, and compile baseline information through interviews and document and database searches regarding the use of bed-leveling devices and the potential effects on sea turtles during dredging operations in Port Everglades. The data gathered is compiled into a Biological Assessment (BA) to initiate consultation under the Endangered Species Act of 1973. This BA includes results from (1) research of existing documents and data regarding the use of bed-leveling devices and the amount of hopper and bucket dredging conducted in Port Everglades over the last 15 years; (2) compiled stranding reports for turtles stranded within a 4-mile radius of the entrance channel for dates coinciding with dredging projects; and (3) interviews conducted with dredging industry professionals concerning bed-leveling devices used by their companies and how these devices are used.

1.0 INTRODUCTION

A "bed-leveler" is considered to be any type of dragged device used to smooth sediment bottom irregularities left by a dredge. These bed-levelers are suspended from work-barges by winches on A-frames to control the operating depth of the device. A 1,000- to 3,000-hp tug is generally used to push or pull the barge-mounted bed-leveler at towing speeds ranging from 1 to 2 knots. A typical bed-leveler varies from 30 to 50 feet in width and weighs anywhere from 25 to 50 tons. They are frequently used by dredge contractors following new work and maintenance dredging primarily to level out ridges and trenches created by dredging equipment or to reduce the height of dredged material disposal mounds that have reached an excessively high elevation. In various parts of the United States this process is known as "barring" or "knockdown" (Hales *et al.,* 2005). In certain cases, bed-levelers are used to redistribute sediments to maintain navigable depths rather than removing them by dredging with conventional methods. Dredge types using bed-levelers include clamshell (excavator), bucket, hydraulic cutterhead, and hopper dredges. Bed-levelers are not a new dredging technique and can be documented as far back as 1565 (van de Graaf 1987).

Typically, a bed-leveler consists of a large customized plow, I-beam, or old spud that is slowly dragged across the sediment to smooth out peaks and trenches during the final cleanup phase of the dredging activity. Another variant is for the hopper dredge to dig trenches along the channel below the project depth, and then a plow/I-beam bed-leveling device suspended from a barge is dragged along the bottom of the channel by a tugboat to knock material from high spots into deeper trenches dug along the channel bottom in order to achieve final project depth and an even grade. Bed-leveling has also been used by cutterhead dredge contractors for reducing heights of disposal mounds. According to hopper dredge, bucket dredge, and clamshell dredge contractors, bed-leveling is the preferred and least expensive method for achieving the final grade as compared to re-dredging (ERDC 2003).

A barge and workboat performing bed-leveling by trailing where a hopper dredge has been excavating is a relatively inconspicuous activity; accordingly, the utilization of bed-levelers by contractors in U. S. waters has previously received benign neglect (ERDC 2003). Further, since dragging the bottom (bed-leveling) is not a specific pay item, tugs and drag beams for bed-leveling have not previously been included in the plant and equipment lists of contractor's bids. Contract language and dredging company daily operation logs typically do not document specific dates and corresponding locations where this technique is used (Hales *et al.,* 2005). Currently, there is no prohibition on bed-leveler use in Florida or within the boundaries of the Jacksonville District; hence, the District is not required to document that its use is in compliance with any environmental laws or regulations (ERDC 2003). The lack of documentation makes it difficult to assess what affect, if any, bed-leveler use may have on sea turtles. However, it has been determined that bed-leveling has been used periodically (not frequently) during dredging projects throughout the sea turtle's range in the U.S. (Dickerson and Clausner 2003).

Both turtle take data and turtle stranding data was compiled for this BA. A turtle take is defined as a turtle that has been entrained and killed by a hopper dredge. A turtle stranding is defined as a turtle that has been found either washed up on the beach or floating in the water.

2.0 BACKGROUND AND CONSULTATION HISTORY

Bed-leveling was mentioned in passing in some of the early (1984-1987) Canaveral observer reports but has not been an issue of concern until recently. Early in 2003, USACE Division and District personnel became aware that regulatory agencies were concerned about the potential impact of bed-levelers on sea turtles. The question of bed-leveler use and its potential impact on sea turtles was raised during a COE-permitted bed-leveling project in Brunswick Harbor, when the Georgia Department of Natural Resources (GA DNR) reported to the Savannah District that six sea turtle strandings with odd, traumatic injuries were found along the Georgia coast at about the same time a dredging contractor was employing a bed-leveling device (NMFS 2003). All were found in the vicinity of the Brunswick bar channel. The injuries exhibited by the strandings were crushing type injuries that did not appear to be consistent with those produced by hopper dredges (Table 1). Although no conclusive evidence was found to link the bed-leveler with any of the reported sea turtle strandings, it raises the possibility that operation of a bed-leveler at Brunswick Harbor under certain conditions may result in takes of sea turtles (NMFS 2003a). For example, Brunswick Harbor is one of the sites where sea turtles captured by relocation trawlers sometimes show evidence of brumating (burying themselves in the bottom mud with reduced metabolic processes) in the muddy channel bottom, which could explain why, if they were crushed by a bed-leveling dredge, they failed to react quickly enough to avoid the bed-leveler (NMFS 2003b). Therefore, the potential danger to sea turtles from bed-leveler type dredges is that the heavy beam or bar may be dragged over a sea turtle resting or asleep on the channel bottom and crush it (Roy Crabtree 2005, personal correspondence).

After consultation and coordination with NMFS, subsequent bed-leveling at Brunswick Harbor was authorized and conducted in an attempt to corroborate or refute the suspicion that the bed-leveler was causing sea turtle takes. A sea turtle relocation trawler pulling nets was used behind the bed-leveler on all days the bed-leveler worked. This study yielded negative results (i.e., no turtles were captured by the relocation trawler, and no further crushed turtles were stranded on nearby beaches.) (*Bed-leveler Use in the Brunswick Harbor Deepening Project, Brunswick, GA*. Data Summary Report, Savannah District Planning Division Environmental Branch, June 29, 2004).

Subsequently, in November 2003, NMFS issued a hopper dredging opinion (GRBO) to the USACE's Gulf of Mexico Districts stating that, although bed-levelers were suspected of having the potential to take turtles, the use of bed-levelers for cleanup operations is probably preferable to use of hopper dredges, since turtles that are foraging/resting/brumating on irregular bottoms are probably more likely to be entrained by suction dragheads because: (1) sea turtle deflectors on hopper dredge suction dragheads are less effective on uneven bottoms at deflecting sea turtles away from the suction dragheads; (2) hopper dredges operate considerably faster than bed-leveler dredges (5 knots vs. 2 knots); and (3) bed-levelers do not use suction (NMFS 2003b). However, the NMFS (2003b) also acknowledges in the 2003 Opinion that takes by bed-leveler type dredges will be more difficult to ascertain and determine responsibility for because bed-levelers do not entrain turtle parts, and no dredged materials come aboard for observers to monitor; furthermore, turtles impacted by bed-leveling devices may not float ashore for several days, if at all. NMFS goes on to say that if compelling Sea Turtle Stranding and Salvage Network (STSSN) observer reports and evidence indicate that a turtle was killed by a bed-leveler associated with a hopper dredging project covered by this Opinion, that take will be deducted from the Incidental Take Statement's anticipated take level for the USACE District where the take occurred. However, in a June 2005 letter, NMFS revised its opinion to remove the counting of strandings as takes due to the way that the analysis of takes was conducted. If NMFS counts stranded turtles as takes, it results in double counting of taken turtles. In 2005, USACE-South Atlantic Division (SAD) reinitiated consultation with NMFS on the NMFS 2003 Gulf Regional Biological Opinion (GRBO). Results of the re-initiated consultation are pending.

In March 2005, the Navy submitted a letter to NMFS to initiate an informal consultation under the ESA for the use of bed-leveling devices in the Key West Channel. In this letter, the Navy sought NMFS concurrence with the determination that the use of bed-leveling devices (including proposed mitigation measures) in the Key West Channel and Harbor may affect, but is not likely to adversely affect sea turtles that may be present in the project area (R. E. Courtright 2005, personal correspondence). NMFS agreed with the Navy's determination, stating that the Key West situation varies significantly from the Brunswick situation (Roy Crabtree 2005, personal correspondence). The key differences include: (1) warmer water temperatures (i.e., no brumation) compared to Brunswick; thus Key West turtles should be much more active and able to detect and avoid approaching dredging equipment; (2) lack of foraging habitat within the project location; (3) differences in bed-leveling operations which will avoid creating deep furrows that may attract sea turtles; and (4) no land mass obstructions that limit sea turtle's exit and entry routes. The essential difference is that at Key West, turtles can traverse through the harbor without having to go through the dredged channel, which further reduces the turtle-dredge encounter probability.

Prior to the 2003 bed-leveling incident in Brunswick Harbor, resource agencies were apparently unaware of the routine use of bed-levelers during dredging activities, particularly in the cleanup phase (Hales *et al.,* 2005; NMFS 2003a). This constitutes new information not considered in consultations with the SAD, including the 1997 Regional Biological Opinion (SARBO) concerning hopper dredging. Districts within SAD had not previously assessed potential effects of bed-leveler use on sea turtles, and acknowledged that this information would be difficult to ascertain (Hales *et al.*, 2005). The need to better describe the bed-leveling process, including gear types and ranges of applications, was identified as an initial step toward a balanced evaluation of this sediment management practice (Hales *et al.,* 2005).

In March 2003 and February 2005, the USACE Engineer Research and Development Center (ERDC) conducted a survey of Corps Districts within SAD and industry hopper dredge contractors to ascertain the extent of utilization of bed-levelers following dredging activities by hopper and other dredge types. The request arose from questions pertaining to whether bed-leveling activities could adversely impact sea turtles and/or other marine life. USACE ERDC prepared two documents for SAD (ERDC 2003; Hales *et al.*, 2005) summarizing the use of bed-levelers during dredging projects.

This BA is the next step in evaluating potential affects of bed-levelers on sea turtles in Port Everglades Harbor. This BA initiates consultation under the ESA for the use of bed-leveling devices during dredging operations and their potential to affect sea turtles.

3.0 ACTION AREA

3.1 Site Description

Port Everglades, a man-made harbor facility, is located in Broward County on the southeast Atlantic Coast of Florida (Figure 1). The Port is located within the three cities of Fort Lauderdale, Hollywood and Dania Beach, as well as unincorporated Broward County. It is approximately 23 miles north of Miami and 48 miles south of West Palm Beach. Port Everglades was established as a deep water harbor in the mid-1920s in an area formerly known as Lake Mabel. The entrance channel was cut across a low sand ridge that originally separated Lake Mabel and the Atlantic Ocean. The Atlantic Intracoastal Waterway (ICW) has since been dredged to the north and south of Port Everglades and has been maintained for navigational purposes for decades.

Port Everglades is a deepwater port of entry with berthing facilities that support the cruise and cargo industry and petroleum storage and distribution facilities. The average dredged depths range from 30 to 45 feet through the main channel and basins. The Port is bordered to the north by primarily high-density, single-family units and high- and low-rise, multiple-family units. Petroleum storage facilities dominate the western portions of the port facility, and they are bordered to the west by low-rise, multiple-family units and supporting commercial facilities. The Port is bordered on the south by primarily commercial facilities, a beach park, and institutional facilities. Military facilities exist to the east along the ICW and Atlantic coast.

Benthic habitats within the action area include primarily sand- and silt-bottom habitats. Limited fine- to medium-grained sand beaches occur within the immediate action area limits and coarse-grained sand beaches occur along the Atlantic coast. A small area of mangrove swamp is within the immediate action area limits east of the Port along the ICW.

3.2 Environmental Windows, Incidental Takes, and Monitoring

The construction and maintenance of federal navigation channels utilizing hopper dredges has been identified as a source of turtle mortality since turtle takes were first documented in 1980 during hopper dredging operations in Canaveral Channel, Florida. A total of 71 turtle takes by hopper dredge was documented in the Canaveral Channel over the period of July 11 through November 13, 1980 (NMFS 1991). Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore sand mining areas, move relatively rapidly and can entrain and kill sea turtles, presumably as the drag arm of the moving dredge overtakes the slower-moving turtles and sucks them into the hopper.

For several decades, state and federal resource agencies have routinely requested that various aspects of dredging projects be restricted to specified time periods known as environmental windows. Environmental windows are routinely recommended by resource agencies with the intent to protect sensitive biological species or their habitats from potentially detrimental effects of dredging and disposal operations (Reine *et al.,* 1998). Hopper dredging along the southeastern U.S. potentially affects five species of threatened or endangered sea turtles (Dickerson *et al.*, 2004). Three species of sea turtles (loggerhead, green, and Kemp's ridley) have been determined by NMFS to be put at risk by hopper dredging activities (a fact well documented since 1980) (Reine *et al.,* 1998). Generally, the environmental windows for turtle-safe dredging have targeted the winter months since sea turtle abundance is dramatically reduced when water temperatures are below 16°C (Dickerson *et al.,* 2004). As a result, USACE Districts along most of the Atlantic Coast are prohibited from hopper dredging from April through November (when turtle abundance is high). During the hopper dredging window from December through March, 100% observer coverage is required. However, from Titusville to Key West, Florida water temperatures generally do not drop below 16°C; therefore turtles are present year-round. In these areas, year-round windows exist for hopper dredging, but 100% observer coverage is required.

No restrictions related to sea turtles are currently imposed on channel dredging operations if mechanical and/or cutterhead dredge types are used, except when performing projects that place material on nesting beaches like sand bypasses and beach nourishment. These restrictions often prohibit channel dredging between May 1 and October 31 because of the turtle nesting season. Restrictions for beach placement activities are conducted under separate consultations with the US Fish and Wildlife Service and will not be reviewed further.

The 1997 Biological Opinion that covers civil works hopper dredging projects within the boundaries of SAD (Wilmington, Charleston, Savannah and Jacksonville (Atlantic Coast only) Districts), sets current annual incidental take levels for sea turtles at: 35 loggerheads, 7 Kemp's ridleys, 7 greens, and 2 hawksbills (NMFS 1997).

Monitoring for incidental takes of sea turtles began as soon as the earliest incidents were reported from the hopper dredging activities at Canaveral Harbor, Florida in 1980 (Rudloe 1981; Joyce 1982). As a result, the Endangered Species Observer Program was established in 1980 and evolved through consultation between the NMFS and the USACE, as mandated by the ESA. In addition to hopper dredges, monitoring has been conducted periodically over the past 24 years on clamshell and cutterhead dredging projects; however, no incidental takes of sea turtles have been reported from dredges other than from hopper dredges, which use trailing suction dragheads (Dickerson *et al.,* 2004).

Typically, multiple NMFS-approved observers work 8- to 12-hour shifts to cover the 24-hour monitoring. The observers work closely with the dredge crew to record all dredging incidents with endangered species. A reported sea turtle incident represents one sea turtle which was entrained either whole or in parts. Sampling for whole turtles and parts is done through observation and inspection of the hopper, the draghead, and screening of the intake structures or hopper overflow (Dickerson *et al.,* 1990).

4.0 PROTECTED SPECIES INCLUDED IN THIS ASSESSMENT

Of the listed and protected species under NMFS jurisdiction occurring in the action area, the loggerhead sea turtle *(Caretta caretta),* green sea turtle *(Chelonia mydas),* Kemp's ridley sea turtle *(Lepidochelys kempii),* hawksbill sea turtle *(Eretmochelys imbricata),* leatherback sea turtle *(Dermochelys coriacea)*, and olive ridley *(Lepidochelys olivacea)* could potentially be adversely affected by the use of bed-leveling devices. This is the initial consultation in accordance with Section 7 of the Endangered Species Act for marine turtle species. Upon reviewing the biological, status, threats, and distribution information presented in this assessment, it has been determined that these six sea turtle species are likely to be in or near the action area and thus may be affected by bed-leveling activities.

This report has relied heavily upon the Biological Assessment (BA) to NMFS for the Miami Harbor General Reevaluation Report Study that was completed by the USACE, Jacksonville District for the biological information concerning the biology, life history, and status for the five sea turtle species discussed in this assessment (USACE 2003). This BA document was accessed from the USACE Threatened, Endangered, and Sensitive Species Protection and Management System website at: http://www.saj.usace.army.mil/pd/envdocs/Miami-Dade/MiamiHarbor/DEIS.htm

4.1 Loggerhead Sea Turtle *(Caretta caretta)*

Distribution. Loggerhead turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans and are the most abundant species of sea turtle occurring in U.S. waters. Loggerheads concentrate their nesting in the north and south temperate zones and subtropics, but generally avoid nesting in tropical areas of Central America, northern South America, and the Old World (NRC 1990). The largest known nesting aggregation of loggerhead turtles occurs on Masirah and Kuria Muria Islands in Oman (Ross and Barwani 1982). In the western Atlantic, most loggerhead turtles nest from North Carolina to Florida and along the Gulf coast of Florida. The best scientific and commercial data available on the genetics of loggerhead turtles suggest there are four major subpopulations of loggerheads in the northwest Atlantic: (1) a northern nesting subpopulation occurring from North Carolina to northeast Florida, about 29°N (approximately 7,500 nests in 1998); (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast to Sarasota on the west coast (approximately 83,400 nests in 1998); (3) a Florida Panhandle nesting subpopulation occurring at Eglin Air Force Base and the beaches near Panama City (approximately 1,200 nests in 1998); and (4) a Yucatan nesting subpopulation occurring on the eastern Yucatan Peninsula, Mexico (Marquez 1990) (approximately 1,000 nests in 1998, according to TEWG 2000). This biological assessment will focus on the northwest Atlantic subpopulations of loggerhead turtles that occur in the action area. The majority of sea turtle nesting activity occurs during the summer months of June, July, and August, with nesting activity occurring as early as March and as late as September (Miami-Dade County 2000).

Although NMFS and FWS have not completed the administrative processes necessary to formally recognize populations or subpopulations of loggerhead turtles, these sea turtles are generally grouped by nesting locations. Based on the most recent reviews of the best scientific and commercial data on the population genetics of loggerhead sea turtles and analyses of their population trends (TEWG 1998; TEWG 2000), NMFS and FWS treat these loggerhead turtle nesting aggregations as distinct subpopulations whose survival and recovery are critical to the survival and recovery of the species. Further, any action that would appreciably reduce the likelihood that one or more of these nesting aggregations would survive and recover would appreciably reduce the species likelihood of survival and recovery in the wild. Consequently, this biological assessment will focus on the four nesting aggregations of loggerhead turtles identified in the preceding paragraph (which occur in the action area) and treat them as subpopulations for the purposes of this analysis. Natal homing to the nesting beach provides the genetic barrier between these subpopulations, preventing re-colonization from turtles from other nesting beaches. The importance of maintaining these subpopulations in the wild is shown by the many examples of nesting assemblages in the world that have been extirpated. In addition, recent fine-scale analysis of mitochondrial DNA work from Florida rookeries indicates that population separations begin to appear between nesting beaches separated by more than 50-100 km of coastline that does not host nesting (Francisco *et al.,* 2000) and tagging studies are consistent with this result (Richardson 1982; Ehrhart 1979; NMFS SEFSC 2001). Nest site relocations greater than 100 km occur, but generally are rare (Ehrhart 1979; NMFS SEFSC 2001).

Loggerhead turtles in the action area are likely to represent differing proportions of the four western Atlantic subpopulations. Although the northern nesting subpopulation produces about 9% of the loggerhead nests, they comprise more of the loggerhead sea turtles found in foraging areas from the northeastern U.S. to Georgia: between 25% and 59% of the loggerhead turtles in this area are from the northern subpopulation (NMFS SEFSC 2001; Bass *et al.,* 1998; Norrgard 1995; Rankin-Baransky 1997; Sears 1994; Sears *et al.,* 1995). In the Carolinas, the northern subpopulation is estimated to make up from 25% to 28% of the loggerheads (NMFS SEFSC 2001; Bass *et al.,* 1998, 1999). About 10% of the loggerhead turtles in foraging areas off the Atlantic coast of central Florida are from the northern subpopulation (Witzell *et al.,* in prep). In the Gulf of Mexico, most of the loggerhead turtles in foraging areas will be from the South Florida subpopulation, although the northern subpopulation may represent about 10% of the loggerhead sea turtles in the Gulf (Bass, pers. comm.). In the Mediterranean Sea, about 45% to 47% of the pelagic loggerheads are from the South Florida subpopulation and about 2% are from the northern subpopulation, while only about 51% originated from Mediterranean nesting beaches (Laurent *et al.,* 1998). In the vicinity of the Azores and Madiera Archipelagoes, about 19% of the pelagic loggerheads are from the northern subpopulation, about 71% are from the South Florida subpopulation, and about 11% are from the Yucatan subpopulation (Bolten *et al.,* 1998).

<u>Natural History.</u> Loggerhead turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years. Turtles in this life history stage are called "pelagic immatures" and are best known from the eastern Atlantic near the Azores and Madeira and have been reported from the Mediterranean as well as the eastern Caribbean (Bjorndal *et a1.,* in press). Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm SCL, they recruit to coastal inshore and nearshore waters of the Continental Shelf throughout the U.S. Atlantic Coast and the Gulf of Mexico.

Benthic immatures have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico (R. Marquez-M., pers. comm.). Large benthic immature loggerheads (70-91 cm) represent a larger proportion of the strandings and in-water captures (Schroeder *et al.,* 1998) along the south and western coasts of Florida as compared with the rest of the coast, but it is not known whether the larger animals actually are more abundant in these areas or just more abundant within the area relative to the smaller turtles. Benthic immature loggerheads foraging in northeastern U.S. waters are known to migrate southward in the fall as water temperatures cool (Epperly *et al.,* 1995; Keinath 1993; Morreale and Standora 1999; Shoop and Kenney 1992), and migrate northward in the spring. Given an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985; Frazer and Limpus 1998), the benthic immature stage must be at least 10-25 years long. NMFS SEFSC 2001 analyses conclude that juvenile stages have the highest elasticity and maintaining or decreasing current sources of mortality in those stages will have the greatest impact on maintaining or increasing population growth rates.

Like other sea turtles, the movements of loggerheads are influenced by water temperature. Since they are limited by water temperatures, sea turtles do not usually appear on the summer foraging grounds until June, but are found in Virginia as early as April. The large majority leaves the Gulf of Maine by mid-September but may remain in these areas until as late as November and December. Loggerhead sea turtles are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks (Wynne and Schwartz 1999). Under certain conditions they may also scavenge fish, particularly if they are easy to catch (e.g., caught in nets) (NMFS and USFWS 1991).

Adult female loggerheads in the western Atlantic come ashore to nest primarily from North Carolina southward to Florida. Additional nesting assemblages occur in the Florida Panhandle and on the Yucatan Peninsula. Non-nesting adult female loggerheads are reported throughout the U.S. and Caribbean Sea; however, little is known about the distribution of adult males that are seasonally abundant near nesting beaches during the nesting season. Aerial surveys suggest that loggerheads (benthic immatures and adults) in U.S. waters are distributed in the following proportions: 54% in the southeast U.S. Atlantic, 29% in the northeast U.S. Atlantic, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998).

Threats. Loggerhead sea turtles face a number of human-related threats in the marine environment, including oil and gas exploration, development, and transportation; marine pollution; trawl, purse seine, hook and line, gill net, pound net, longline, and trap fisheries (see below); underwater explosions; dredging; offshore artificial lighting; power plant entrapment; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; and poaching.

Although loggerhead turtles are most vulnerable to pelagic longlines during their pelagic, immature life history stage, there is some evidence that benthic immatures may also be captured, injured, or killed by pelagic fishery operations. Recent studies have suggested that not all loggerhead turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic immatures, followed by permanent settlement into benthic environments. Some may not totally circumnavigate the North Atlantic. In addition, some of these turtles may either remain in the pelagic habitat in the North Atlantic longer than hypothesized or they may move back and forth between pelagic and coastal habitats (Witzell, in prep.). Therefore, any loggerhead turtles that follow this developmental model would be adversely affected by shark gill nets and shark bottom longlines set in coastal waters, in addition to pelagic longlines.

On their nesting beaches in the U.S., loggerhead turtles are threatened with beach erosion, armoring, and nourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; exotic dune and beach vegetation; predation by fire ants, raccoons, armadillos, opossums; and poaching. Elimination and control of these threats are especially important because from a global perspective, the southeastern U.S. nesting aggregation is critical to the survival of this species. This aggregation is second in size only to the nesting aggregations in the Arabian Sea off Oman and represents about 35-40% of the nests of this species. The status of the Oman nesting beaches has not been evaluated recently, but they are located in a part of the world that is vulnerable to extremely disruptive events (e.g., political upheavals, wars, and catastrophic oil spills). The resulting risk facing this nesting aggregation and associated nesting beaches is cause for considerable concern (Meylan *et al.,* 1995).

Loggerhead turtles also face numerous threats from weather and coastal processes. For example, there is a significant overlap between hurricane seasons in the Caribbean Sea and northwest Atlantic Ocean (June to November) and loggerhead turtle nesting season (March to November). Therefore, hurricanes can have potentially disastrous effects on the survival of eggs in sea turtle nests. In 1992, Hurricane Andrew affected turtle nests over a 90-mile length of coastal Florida; all of the eggs were destroyed by storm surges on beaches that were closest to the eye of this hurricane (Milton *et al.,* 1992). On Fisher Island near Miami, Florida, 69% of the eggs did not hatch after Hurricane Andrew, probably because they were drowned by the storm surge. Nests from the northern subpopulation were destroyed by hurricanes that made landfall in North Carolina in the mid to late 1990's. Sand accretion and rainfall that result from such storms can appreciably reduce hatchling success. These natural phenomena probably have significant, adverse effects on the size of specific year classes, particularly given the increasing frequency and intensity of hurricanes in the Caribbean Sea and northwest Atlantic Ocean.

Status and Population Trends. The loggerhead turtle was listed as threatened under the ESA on July 28, 1978. The most recent work updating what is known regarding status and trends of loggerhead sea turtles is contained in NMFS SEFSC 2001. The recovery plan for this species (NMFS and USFWS 1991) states that southeastern U.S. loggerheads can be considered for delisting if, over a period of 25 years, adult female populations in Florida are increasing and there is a return to pre-listing annual nest numbers totaling 12,800 for North Carolina, South Carolina, and Georgia combined. This equates to approximately 3,100 nesting females per year at 4.1 nests per female per season. NMFS SEFSC 2001 concludes, "...nesting trends indicate that the numbers of females associated with the South Florida subpopulation are increasing. Likewise, nesting trend analyses indicate potentially increasing nest numbers in the northern subpopulation" (TEWG 2000). However, NMFS SEFSC (2001) also cautions that given the uncertainties in survival rates (of the different life stages, particularly the pelagic immature stage) and the stochastic nature of populations, population trajectories should not be used now to quantitatively assess when the northern subpopulation may achieve 3,100 nesting females.

Several published reports have presented the problems facing long-lived species that delay sexual maturity in a world replete with threats from a modern human population (Crouse *et al.,* 1987; Crowder *et al.,* 1994; Crouse 1999). In general, these reports concluded that animals that delay sexual maturity and reproduction must have high annual survival as juveniles through adults to ensure that enough juveniles survive to reproductive maturity and then reproduce enough times to maintain stable population sizes. This general principle of population ecology originated in studies of sea turtles (Crouse *et al.,* 1987; Crowder *et al.,* 1994; Crouse 1999). Heppell *et al.* (in prep.) specifically showed that the growth of the loggerhead sea turtle population was particularly sensitive to changes in the annual survival of both juvenile and adult sea turtles, and the adverse effects of the pelagic longline fishery on loggerheads from the pelagic immature phase appeared critical to the survival and recovery of the species. Crouse (1999) concluded that relatively small changes in annual survival rates of both juvenile and adult loggerhead sea turtles would adversely affect large segments of the total loggerhead sea turtle population.

The four major subpopulations of loggerhead sea turtles in the northwest Atlantic, northern areas of South Florida, Florida Panhandle, and the Yucatan Peninsula are all subject to fluctuations in the number of young produced annually because of natural phenomena such as hurricanes, as well as human-related activities. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection and probably cause fluctuations in sea turtle nesting success. Sea turtles nesting in the southern and central counties of Florida can be affected by beach armoring, beach renourishment, beach cleaning, artificial lighting, predation, and poaching (NMFS and USFWS 1991).

As discussed previously, the survival of juvenile loggerhead sea turtles is threatened by a completely different set of threats from human activity once they migrate to the ocean. Pelagic immature loggerhead sea turtles from these four subpopulations circumnavigate the North Atlantic over several years (Carr 1987; Bjorndal 1994). During that period, they are exposed to a series of longline fisheries that include an Azorean long-line fleet, a Spanish long-line fleet, and various fleets in the Mediterranean Sea (Aguilar *et al.,* 1995; Bolten *et al.,* 1994; Crouse 1999). Based on their proportional distribution, the capture of immature loggerhead sea turtles in long-line fleets in the Azores and Madiera Archipelagoes and the Mediterranean Sea will have a significant adverse effect on the annual survival rates of juvenile loggerhead sea turtles from the western Atlantic subpopulations, with a disproportionately large effect on the northern subpopulation that may be significant at the population level.

In waters off the coastal U.S., a suite of fisheries in federal and state waters threatens the survival of juvenile loggerhead sea turtles. Loggerhead turtles are captured, injured, or killed in shrimp fisheries off the U.S. Atlantic coast. Along the southeastern Atlantic coast, loggerhead turtle populations are declining where shrimp fishing is intense off the nesting beaches (NRC 1990). Conversely, these nesting populations do not appear to be declining where nearshore shrimping effort is low or absent. The management of shrimp harvest in the Gulf of Mexico demonstrates the correlation between shrimp trawling and impacts to sea turtles. Waters out to 200 nm are closed to shrimp fishing off the Gulf Coast of Texas each year for approximately a three-month period (mid-May through mid-July) to allow shrimp to migrate out of estuarine waters; sea turtle strandings decline dramatically during this period (NMFS, STSSN unpublished data). Loggerhead sea turtles are captured in fixed pound-net gear in the Long Island Sound, in pound-net gear and trawls in summer flounder and other finfish fisheries in the mid-Atlantic and Chesapeake Bay, in gill net fisheries in the mid-Atlantic and elsewhere, in fisheries for monkfish and spiny dogfish, and in northeast sink gillnet fisheries. Witzell (1999) compiled data on capture rates of loggerhead and leatherback turtles in U.S. longline fisheries in the Caribbean and northwest Atlantic; the cumulative takes of these fisheries approach those of the U.S. shrimp fishing fleet (Crouse 1999; NRC 1990).

Based on the data available, it is not possible to estimate the size of the loggerhead population in the U.S. or its territorial waters. There is, however, general agreement that the number of nesting females provides a useful index of the species' population size and stability at this life stage. Nesting data collected on index nesting beaches in the U.S. from 1989-1998 represent the best dataset available to index the population size of loggerhead turtles. However, an important caveat for population trends analysis based on nesting beach data is that this may reflect trends in adult nesting females, but it may not reflect overall population growth rates. Given this, between 1989 and 1998 the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,016 to 89,034 annually, representing, on average, an adult female population of 44,780 [(nests/4.1) * 2.5]. On average, 90.7% of the nests were from the South Florida subpopulation, 8.5% were from the northern subpopulation, and 0.8% were from the Florida Panhandle subpopulation. There is limited nesting throughout the Gulf of Mexico west of Florida, but it is not known to what subpopulation they belong. Based on the above, there are only an estimated 3,800 nesting females in the northern loggerhead subpopulation. The status of this population, based on number of loggerhead nests, has been classified as stable or declining (TEWG 2000). Another consideration adding to the vulnerability of the northern subpopulation is that NMFS scientists estimate, using genetics data from Texas, South Carolina, and North Carolina in combination with juvenile sex ratios from those states, that the northern subpopulation produces 65% males, while the Florida subpopulation is estimated to produce 80% females (NMFS SEFSC 2001, Part I).

Critical Habitat. No critical habitat has been designated for loggerhead turtles.

4.2 Green Sea Turtle *(Chelonia mydas)*

Distribution. Green turtles are distributed circum-globally. In the western Atlantic they range from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare north of Cape Hatteras (Wynne and Schwartz 1999). Several major nesting assemblages have been identified and studied in the western Atlantic (Peters 1954; Carr and Ogren 1960; Carr *et al.,* 1978). Most green turtle nesting in the continental United States occurs on the Atlantic coast of Florida (Ehrhart 1979). Green turtles are the largest of the hard-shelled sea turtles. Adult male green turtles are smaller than adult females whose lengths range from 92 to 110 cm (36 to 43 in.) and weights range from 119 to 182 kg (200 to 300 lbs). Their heads are small compared to other sea turtles and the biting edge of their lower jaw is serrated.

Green turtles have a more tropical distribution than loggerhead turtles; they are generally found in waters between the northern and southern 20°C isotherms (Hirth 1971). Green turtles, like most other sea turtles, are distributed more widely in the summer when warmer water temperatures allow them to migrate north along the Atlantic coast of North America. In the summer, green turtles are found around the U.S. Virgin Islands, Puerto Rico, and continental North America from Texas to Massachusetts. Immature greens can be distributed in estuarine and coastal waters from Long Island Sound, Chesapeake Bay, and the North Carolina sounds south throughout the tropics (Musick and Limpus 1997). In the United States, green turtles nest primarily along the Atlantic coast of Florida, the U.S. Virgin Islands, and Puerto Rico. In the winter, as water temperatures decline, green turtles found north of Florida begin to migrate south into subtropical and tropical water.

Status and Population Trends. The green turtle was protected under the ESA in 1978, breeding populations off the coast of Florida and the Pacific coast of Mexico are listed as endangered, and all other populations are listed as threatened. Recent population estimates for the western Atlantic area are not available. However, there is evidence that green turtle nesting has been on the increase during the past decade. Recently, green turtle nesting occurred on Bald Head Island, North Carolina just east of the mouth of the Cape Fear River, on Onslow Island, and on Cape Hatteras National Seashore. Increased nesting has also been observed along the Atlantic coast of Florida on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). Certain Florida nesting beaches where most green turtle nesting activity occurs have been designated index beaches, which were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green turtle nesting shows biennial peaks in abundance with a generally positive trend during the six years of regular monitoring. The majority of sea turtle nesting activity occurred during the summer months of June, July, and August, with nesting activity occurring as early as March and as late as September (Miami-Dade County 2000).

Natural History. While nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging grounds. Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida, the northwestern coast of the Yucatan Peninsula, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean Coast of Panama, and scattered areas along the coasts of Colombia and Brazil (Hirth 1971). Juvenile green sea turtles occupy pelagic habitats after leaving the nesting beach. Pelagic juveniles are assumed to be omnivorous, but with a strong tendency toward carnivory during early life stages. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas, shifting to a chiefly herbivorous diet (Bjorndal 1997). Post-pelagic green turtles feed primarily on sea grasses and benthic algae but also consume jellyfish, salps, and sponges. In the western Atlantic region, the summer developmental habitat encompasses estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and North Carolina Sound, and south throughout the tropics (Musick and Limpus 1997). Like loggerheads and Kemp's ridleys, green sea turtles that use northern waters during the summer must return to southern waters in autumn or face the risk of cold stunning.

Threats. The greatest threat to this species is the loss of its nesting habitat. Throughout the tropical and subtropical distribution of this species, beaches are eroded, armored, renourished, or converted for residential or commercial purposes. Green turtles are also threatened by fibropapilloma disease, incidental takes in commercial or recreational fishing gear, and poaching (although poaching is infrequent in the United States). Green turtles are harvested in some nations for food, leather, and jewelry. Green turtles are also threatened by natural causes including hurricanes; predation by fire ants, raccoons, and opossums; and poaching of eggs and nesting females.

Anthropogenic impacts to the green turtle population are similar to those for other sea turtle species. Sea sampling coverage in the pelagic driftnet, pelagic longline, scallop dredge, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. In addition, the NMFS/Northeast Fisheries Science Center (NEFSC) is conducting a review of bycatch levels and patterns in all fisheries in the western Atlantic for which observer data are available. Bycatch estimates will be made for all fisheries for which sample sizes are sufficiently large to permit reasonable statistical analysis. This will be compiled into an assessment report. Until that analysis is completed, the only information on the magnitude of takes available for fisheries in the action area are un-extrapolated numbers of observed takes from the sea sampling data. Preliminary sea sampling data summary (1994-1998) shows the following total take of green turtles caused by: anchored gillnets, pelagic driftnets, and pelagic longlines. Stranding reports indicate that 200-300 green turtles strand annually from a variety of causes (Sea Turtle Stranding and Salvage Network, unpublished data). As with the other species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality.

Critical Habitat. In 1998, NMFS designated the waters surrounding the islands of Culebra, Puerto Rico as critical habitat for the green turtle. This area supports major seagrass beds and reefs that provide forage and shelter habitat. The action area does not comprise critical habitat for green turtles.

4.3 Hawksbill Sea Turtle *(Eretmochelys imbricata)*

Distribution. Hawksbill turtles occur in tropical and subtropical waters of the Atlantic, Pacific, and Indian Oceans. Recognized subspecies occupy the Atlantic Ocean (ssp. *imbricata)* and the Pacific Ocean (ssp. *squamata).* Richardson *et al.* (1989) estimated that the Caribbean and Atlantic portions of the U.S. support a minimum of 650 hawksbill turtle nests each year. In the United States, hawksbill turtles have been recorded in all states along the Gulf of Mexico and along the Atlantic coast from Florida to Massachusetts. United States populations nest primarily in the U.S. Virgin Islands and Puerto Rico, but occasionally on the Atlantic coast of Florida.

Natural History. Hawksbill turtles use different habitats for different stages in their life cycles. Post-hatchling hawksbill turtles remain in pelagic environments to take shelter in weedlines that accumulate at convergence points. Juvenile hawksbill turtles (those with carapace lengths of 20-25 cm) re-enter coastal waters where they become residents of coral reefs, which provide sponges for food, and ledges and caves for shelter. Hawksbill turtles are also found around rocky outcrops, high-energy shoals, and mangrove-fringed bays and estuaries (particularly in areas where coral reefs do not occur). Hawksbill turtles remain in coastal waters until they develop into sub-adults and adults.

Status and Threats. The hawksbill turtle was listed as an endangered species on June 2, 1970 (35 FR 8491). Populations are threatened by significant modifications of coastal habitats throughout its range. The National Research Council (1990) and NMFS/FWS (1993) have published general overviews of the effects of habitat alteration on hawksbill turtles. In the U.S. Virgin Islands, problems such as egg poaching, domestic animals, beach driving, litter, and recreational use of beaches have presented problems for nesting hawksbill turtles. In addition, beachfront lights appear to pose a serious problem for hatchling hawksbill (and other) turtles in the U.S. Virgin Islands. At sea, activities that damage coral reefs and other habitats important to the hawksbill turtle threaten the continued existence of this species. Hawksbill turtles are also threatened by stochastic events (e.g., hurricanes); predation by fire ants, raccoons and opossums; and by poaching of eggs and nesting females by humans.

Critical Habitat. In 1998, NMFS designated the waters surrounding Mona and Monito Islands, Puerto Rico as critical habitat for the hawksbill turtle. The designated critical habitat for the species does not occur in the action area.

4.4 Kemp's Ridley Sea Turtle *(Lepidochelys kempii)*

Status and Population Trends. Of the seven existing species of sea turtles of the world, the Kemp's ridley has declined to the lowest population level. The Recovery Plan for the Kemp's Ridley Sea Turtle (USFWS and NMFS 1992) contains a description of the natural history, taxonomy, and distribution of the Kemp's ridley turtle. Kemp's ridleys nest in daytime aggregations known as *arribadas.* The primary *arribada* in the Gulf of Mexico is at Rancho Nuevo, a stretch of beach in Mexico. Most of the population of adult females nest in this single locality (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the early 1970's, the world population estimate of mature female Kemp's ridleys had been reduced to 2,500-5,000 individuals. The population declined further through the mid-1980s. Recent observations of increased nesting suggest that the decline in the ridley population has stopped and there is cautious optimism that the population is now increasing.

After unprecedented numbers of Kemp's ridley carcasses were reported from Texas and Louisiana beaches during periods of high levels of shrimping effort, NMFS established a team of population biologists, sea turtle scientists, and managers, known as the Turtle Expert Working Group (TEWG) to conduct a status assessment of sea turtle populations. Analyses conducted by the group have indicated that the Kemp's ridley population is in the early stages of recovery; however, strandings in some years have increased at rates higher than the rate of increase in the Kemp's population (TEWG 1998).

TEWG (1998) developed a population model to evaluate trends in the Kemp's ridley population through the application of empirical data and life history parameter estimates chosen by TEWG. Model results identified three trends in benthic immature Kemp's ridleys. Benthic immatures are those turtles that are not yet reproductively mature but have recruited to feed in the nearshore benthic environment where they are available to nearshore mortality sources that often result in strandings. Benthic immature Kemp's ridleys are estimated to be 2-9 years of age and 20-60 cm in length. Increased production of hatchlings from the nesting beach beginning in 1966 resulted in an increase in benthic Kemp's ridleys that leveled off in the late 1970s. A second period of increase followed by leveling occurred between 1978 and 1989 as hatchling production was further enhanced by the cooperative program between USFWS and Mexico's lnstituto Nacional de Pesca to increase the nest protection and relocation program in 1978. A third period of steady increase, which has not leveled off to date, has occurred since 1990 and appears to be due to the greatly increased hatchling production and an apparent increase in survival rates of immature turtles beginning in 1990 due, in part, to the introduction of turtle excluder devices (TEDs). Adult Kemp's' ridley numbers have now grown from a low of approximately 1,050 adults producing 702 nests in 1985 to greater than 3,000 adults producing 1,940 nests in 1995 and about 3,400 nests in 1999.

TEWG (1998) was unable to estimate the total population size and current mortality rates for the Kemp's ridley population; however, they listed a number of preliminary conclusions. TEWG indicated that the Kemp's ridley population appears to be in the early stage of exponential expansion. Over the period 1987 to 1995, the rate of increase in the annual number of nests accelerated in a trend that would continue with enhanced hatchling production and the use of TEDs. Nesting data indicated that the number of adults declined from a population that produced 6,000 nests in 1966 to a population that produced 924 nests in 1978 and a low of 702 nests in 1985. This trajectory of adult abundance tracks with trends in nest abundance from an estimate of 9,600 in 1966 to 1,050 in 1985. TEWG estimated that in 1995 there were 3,000 adult Kemp's ridleys. The increased recruitment of new adults is illustrated in the proportion of neophytes, or first time nesters, which increased from 6% to 28% from 1981 to 1989 and from 23% to 41% from 1990 to 1994. The population model in the TEWG plan projected that Kemp's ridleys could reach the intermediate recovery goal identified in the Recovery Plan of 10,000 nesters by the year 2020 if the assumptions of age to sexual maturity and age-specific survivorship rates plugged into their model are correct. It determined that the data reviewed suggested that adult Kemp's ridley turtles were restricted somewhat to the Gulf of Mexico in shallow nearshore waters, and benthic immature turtles of 20-60 cm straight line carapace length are found in nearshore coastal waters, including estuaries of the Gulf of Mexico and the Atlantic.

TEWG (1998) identified an average Kemp's ridley population growth rate of 13% per year between 1991 and 1995. Total nest numbers have continued to increase. However, the 1996 and 1997 nest numbers reflected a slower rate of growth, while the increase in the 1998 nesting level was much higher and decreased in 1999. The population growth rate does not appear as steady as originally forecasted by TEWG, but annual fluctuations, due in part to irregular inter-nesting periods, are normal for other sea turtle populations. Also, as populations increase and expand, nesting activity would be expected to be more variable.

The area surveyed for ridley nests in Mexico was expanded in 1990 due to destruction of the primary nesting beach by Hurricane Gilbert. TEWG (1998) assumed that the increased nesting observed particularly since 1990 was a true increase rather than the result of expanded beach coverage. Because systematic surveys of the adjacent beaches were not conducted prior to 1990, there is no way to determine what proportion of the nesting increase documented since that time is due to the increased survey effort rather than an expanding ridley nesting range. As noted by TEWG, trends in Kemp's ridley nesting even on the Rancho Nuevo beaches alone suggest that recovery of this population has begun but continued caution is necessary to ensure recovery and to meet the goals identified in the Kemp's Ridley Recovery Plan.

<u>Natural History.</u> Juvenile Kemp's ridleys use northeastern and mid-Atlantic coastal waters of the U.S. Atlantic coastline as primary developmental habitat during summer months, with shallow coastal embayments serving as important foraging grounds. Post-pelagic Kemp's ridleys feed primarily on crabs, consuming a variety of species, including *Callinectes* sp., *Ovalipes* sp., *Libinia* sp., and *Cancer* sp. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Juvenile Kemp's ridleys migrate south as water temperatures cool in fall, and are predominantly found in shallow coastal embayments along the Gulf Coast during fall and winter months. Kemp's ridleys found in mid-Atlantic waters are primarily post-pelagic juveniles averaging 40 cm in carapace length, and weighing less than 20 kg (Klinger and Musick 1995). Next to loggerheads, they are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June, and migrating to more southerly waters from September to November (Keinath *et al.,* 1987; Musick and Limpus 1997). In the Chesapeake Bay, Kemp's ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation (Lutcavage and Musick 1985; Bellmund *et al.,* 1987; Keinath *et al.,* 1987; Musick and Limpus 1997). The juvenile population in Chesapeake Bay is estimated to be 211 to 1,083 turtles (Musick and Limpus 1997).

Research being conducted by Texas A&M University has resulted in the intentional live-capture of hundreds of Kemp's ridleys at Sabine Pass and the entrance to Galveston Bay. Between 1989 and 1993, Galveston NMFS Laboratory staff tracked 50 of these turtles using satellite and radio telemetry. The tracking study was designed to characterize sea turtle habitat and to identify small- and large-scale migration patterns. Preliminary analysis of the data collected during these studies suggests that sub-adult Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud, NMFS Galveston Laboratory, pers. comm.).

<u>Threats.</u> Observations in the northeast otter trawl fishery, pelagic longline fishery, and southeast shrimp and summer flounder bottom trawl fisheries have recorded takes of Kemp's ridley turtles. As with loggerheads, a large number of Kemp's ridleys are taken in the southeast shrimp fishery each year. Kemp's ridleys were also affected by the apparent large-mesh gillnet interaction that occurs in the spring off the North Carolina coast. A total of five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 277 loggerhead carcasses were found. This is expected to be a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction since it is unlikely that all carcasses washed ashore. Stranding events illustrate the vulnerability of Kemp's ridley and loggerhead turtles to the impacts of human activities in nearshore Gulf of Mexico waters as well (TEWG 1998). While many of the stranded turtles observed in recent years in Texas and Louisiana have been incidentally taken in the shrimp fishery, other sources of mortality, such as those observed in the northeastern and southeastern Atlantic zones, exist in these waters.

<u>Critical Habitat.</u> No critical habitat has been designated for the Kemp's ridley turtle.

4.5 Leatherback Sea Turtle *(Dermochelys coriacea)*

Species Description and Distribution. The leatherback is the largest living turtle species. Leatherback sea turtles are widely distributed throughout the oceans of the world, and are found throughout waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972).

Leatherback turtles undertake the longest migrations of any other sea turtle and exhibit the broadest thermal tolerances (NMFS and USFWS 1998). Leatherback turtles are able to inhabit intensely cold waters for a prolonged period of time because they are able to maintain body temperatures several degrees above ambient temperatures. Leatherback turtles are typically associated with continental shelf habitats and pelagic environments. Leatherback turtles regularly occur in deep waters (> 328 ft), and an aerial survey study in the north Atlantic Ocean sighted leatherback turtles in water depths ranging from 3 to 13,618 feet, with a median sighting depth of 131.6 feet (CeTAP 1982). This same study found leatherbacks in waters ranging from 7 to 27.2°C.

Life History 1nformation. Although leatherbacks are a long-lived species (> 30 years), they are somewhat faster to mature than loggerheads, with an estimated age at sexual maturity reported as about 13-14 years for females, and an estimated minimum age at sexual maturity of 5-6 years, with 9 years reported as a likely minimum (Zug and Parham 1996).

Leatherback sea turtles are predominantly distributed pelagically where they feed on jellyfish such as *Stomolophus* sp., *Chryaora* sp., and *Morelia* sp. (Rebel 1974). Leatherbacks are deep divers, with recorded dives to depths in excess of 1000 m, but they may come into shallow waters if there is an abundance of jellyfish nearshore. They also occur annually in places such as Cape Cod and Narragansett Bays during certain times of the year, particularly the fall.

Listing Status. The leatherback was listed as endangered on June 2, 1970 and a recovery plan was issued in 1998. Leatherback turtles are included in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, which effectively bans the trade of this species.

Population Status and Trends. Globally, leatherback turtle populations have been decimated worldwide. The global leatherback turtle population was estimated to number approximately 115,000 adult females in 1980 (Pritchard 1982), but only 34,500 in 1995 (Spotila *et al.,* 1996). The decline can be attributed to many factors including fisheries as well as intense exploitation of the eggs (Ross 1979). On some beaches nearly 100% of the eggs laid have been harvested (Eckert 1996). Eckert (1996) and Spotila *et al.* (1996), record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries.

The status of the Atlantic population is not clear. In 1996, it was reported to be stable, at best (Spotila 1996), but numbers in the Western Atlantic at that writing were reported to be on the order of 18,800 nesting females. According to Spotila (pers. comm.), the Western Atlantic population currently numbers about 15,000 nesting females, whereas current estimates for the Caribbean (4,000) and the Eastern Atlantic (i.e. off Africa, numbering - 4,700) have remained consistent with numbers reported by Spotila *et al.* in 1996. Between 1989 and 1995, marked leatherback returns to the nesting beach at St. Croix averaged only 48.5%, but the overall nesting population grew (McDonald *et. al.,* 1993). This is in contrast to a Pacific nesting beach at Playa Grande, Costa Rica, where only 11.9% of turtles tagged in 1993-94 and 19.0% of turtles tagged in 1994-95 returned to nest over the next 5 years. Characterizations of this population suggest that it has a very low likelihood of survival and recovery in the wild under current conditions.

Spotila *et al.* (1996) describes a hypothetical life table model based on estimated ages of sexual maturity at both ends of the species' natural range (5 and 15 years). The model concluded that leatherbacks maturing in 5 years would exhibit much greater population fluctuations in response to external factors than would turtles maturing in 15 years. Furthermore, the simulations indicated that leatherbacks could maintain a stable population only if both juvenile and adult survivorship remained high and if other life history stages (i.e., egg, hatchling, and juvenile) remained static. Stable leatherback populations could not withstand an increase in adult mortality above natural background levels.

Threats. The primary threats to leatherback turtles are entanglement in fishing gear (e.g., gillnets, longlines, lobster pots, weirs), boat collisions, and ingestion of marine debris (NMFS and USFWS 1997). The foremost threat is the number of leatherback turtles killed or injured in fisheries. Spotila (2000) states that a conservative estimate of annual leatherback fishery-related mortality (from longlines, trawls, and gillnets) in the Pacific during the 1990s is 1,500 animals. He estimates that this represented about a 23% mortality rate (or 33% if most mortality was focused in the East Pacific population). As noted above, leatherbacks normally live at least 30 years, usually maturing at about 12-13 years of age. This long-lived species cannot withstand such high rates of anthropogenic mortality.

Critical Habitat. Critical habitat for the leatherback turtle includes the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands, up to and inclusive of the waters from the hundred fathom curve shoreward to the level of mean high tide with boundaries at 17°42'12" N and 64°50'00" W.

5.0 RESEARCH AND COMPILATION OF BASELINE DATA

5.1 Dredging Documentation, Sea Turtle Takes, and Sea Turtle Strandings

Dredging history reports for dredging projects conducted from January 1990 to present within Port Everglades were requested and provided by USACE, Jacksonville District. These reports were reviewed to determine if information about the use of bed-leveling devices was included in the documentation and to determine how much bucket and hopper dredging has been conducted in the last 15 years. A document and database search was also conducted regarding hopper dredging and the use of bed-leveling devices as a component of dredging projects. If available, data compiled include dates of dredging projects, contractor, contract number, location of dredging event, project type, dredge type (i.e., hopper, clamshell, bucket), name of the dredge used, total pay volume dredged (cubic yards), material type dredged (i.e., sand, silt, clay), and whether a bed-leveler was used (if known). Copies of dredging history reports are provided in Appendix A.

Data regarding sea turtle mortality (takes) directly attributable to the dredging operations occurring during dredging projects were also compiled from the USACE Sea Turtle Warehouse website. This internet-based database was created to centralize and archive historical and future data regarding sea turtle impacts from hopper dredging activities for long-term continuity and evaluation of these data.

In addition, a sea turtle stranding search was conducted using the Florida Fish and Wildlife Conservation Commission (FWC) STSSN databases. The STSSN documents dead or injured sea turtles along the coasts of the eastern United States (Schroeder 1989). The STSSN relies on a trained group of volunteers, including state and federal employees and private individuals, to collect basic biological data on each turtle located (Epperly and Teas 1999). Each animal is identified to species; the condition or state of decomposition is determined; standard carapace measurements are taken; and any obvious wounds, injuries, or abnormalities are noted and described. Volunteers who have additional training may also perform necropsies, or internal exams, on a carcass to determine the general state of health of the animal prior to death, determine sex, and locate any obvious internal abnormalities. Data are recorded on standardized report forms that are submitted first to a state coordinator and then to the national STSSN coordinator at NMFS, Southeast Fisheries Science Center, Miami, Florida.

The sea turtle stranding reports of interest include those involving impact- or crushing- (non-propeller) type injuries coinciding with dredging project timeframes (i.e., during each dredging project and within two weeks after a dredging project had been completed) and occurring within a 4-mile radius of the Port Everglades entrance channel. In order to identify the reports of interest, the STSSN database was sorted in several steps. FWC provided an initial database file that included all sea turtle strandings occurring in Broward County during 1990-2005 that involved non-propeller type injuries. These data were converted to GIS format (ArcView shapefile) and clipped geographically to include only those strandings occurring within the designated 4-mile radius of the entrance channel. Finally, strandings that occurred during the specific dredging timeframes of interest (i.e., during each dredging project and 2 weeks after each dredging project) were identified. These stranding reports along with associated photos and necropsy reports were requested from FWC.

The number of sea turtle strandings occurring during the dredging timeframes was determined. For comparison purposes, the number of sea turtle strandings occurring outside the dredging timeframes but within the 4-mile radius was also determined. These data were mapped and developed into graphics using ArcView GIS to depict the number of sea turtle strandings that occurred between 1990 and 2005 and their proximity to the Port Everglades entrance channel (Figure 2).

5.2 Interviews with Dredging Professionals and USACE SAD District

In May 2003 and February 2005, USACE ERDC distributed questionnaire surveys about bed-leveler use during USACE dredging projects to Charleston, Wilmington, Savannah, Jacksonville, and Mobile District personnel and selected dredging industry contractors (Bean Dredging Corporation, New Orleans, LA; Great Lakes Dredge and Dock Company, Oak Brook, IL; Manson Construction Company, Seattle, WA; Weeks Marine Incorporated, Kenner, LA). These four contractors represent the predominant hopper dredging capability in the United States. The survey questions presented to the dredging industry and SAD Districts are included in Appendix B. The data compiled include information regarding the variety of bed-leveling devices currently utilized by the industry and how the devices are used. Additional information collected includes drawings, schematics, and photos of these devices. ERDC (2003) and Hales *et al.* (2005) summarize composite findings of the industry survey and USACE SAD District survey.

To supplement information from the USACE ERDC survey and to gather specific information regarding the extent of bed-leveler use in Port Everglades, additional interviews were conducted with dredging professionals at companies that performed dredging operations in Port Everglades between 1990 and 2005. The Area Engineer for USACE, Jacksonville District was also contacted to see if any journals or logs exist that may contain information or notes regarding dredging activities and equipment used during dredging projects.

6.0 COMPOSITE FINDINGS OF RESEARCH AND DATA COMPILATION

6.1 Dredging Documentation, Sea Turtle Takes, and Sea Turtle Strandings

Information compiled from dredging history reports, turtle take reports, and turtle stranding reports for turtles with impact- or crushing-type injuries (non-propeller) for dredging projects conducted within Port Everglades Harbor from 1990 to 2005 is summarized below. There was no information in any of the dredging history reports or turtle take reports regarding the use of bed-leveling devices during these dredging projects.

According to the dredging history reports, only one maintenance dredging project has been conducted in Port Everglades Harbor since 1990 (Contract Number W912EP-05-C-00). This project was conducted August 5-15, 2005 by Great Lakes Dredge and Dock Company (GLDD). A hopper dredge named *Dodge Island* was used for this project. The amount of material dredged was 46,686 cubic yards (cu yds). According to the USACE Sea Turtle Data Warehouse, there were no sea turtle takes associated with this project.

According to the STSSN database, there was a total of 23 turtle strandings that involved crushing- or impact-type injuries within the designated 4-mile radius of the Port Everglades Harbor entrance channel between 1990 and 2005. None of these strandings occurred during a dredging project or within two weeks after a dredging project had been completed (Figure 2). Strandings were reported during each month of the year except for September and October (Figure 3).

6.2 Industry Survey

GLDD is the only contractor that conducted dredging within the Port Everglades Harbor since 1990. USACE ERDC previously surveyed GLDD as part of their industry survey of selected dredging industry contractors. The following information is a summary of results from the 2003 and 2005 USACE ERDC survey questionnaires (ERDC 2003; Hales *et al.,* 2005).

Bed-levelers are used most often in soft sediments such as silts and clays, and less frequently in sandy sediments such as typically occur in bar entrance channels. They are routinely used following new work and maintenance dredging by conventional dredging methods (i.e., clamshell, bucket, hydraulic cutterhead, and hopper dredges) to relocate sediment from high spots into adjacent low areas. A hopper dredge draghead, especially one equipped with a Turtle Excluder Device (TED), will tend to fall off ridges, dig deep, and follow the same path with successive passes. This tends to dredge trenches and leave ridges. Clamshell and bucket dredges typically leave high spots between lifts. If the contractor is required to bring the high spots down to desired grade, bed-leveling is a far more efficient and cost-effective method for lowering these high spots than using conventional dredging methods. Bed-leveling operations can also efficiently locate target areas in tandem with multi-beam precision bathymetry survey systems.

Historically, drag bars first used as bed-levelers were probably sections of spuds or fabricated from I-beams. Bed-levelers are custom-fabricated devices resembling a bulldozer blade or a box-beam reinforced with added weight to facilitate penetration into soft or hard substrates, occasionally including small grades of rock (Figures 4 and 5). These bed-levelers are suspended from work-barges by winches on A-frames to control the operating depth of the device. A 1,000- to 3,000-hp tug is generally used to push or pull the barge-mounted bed-leveler at towing speeds ranging from 1 to 2 knots. A typical bed-leveler varies from 30 to 50 feet in width and weighs anywhere from 25 to 50 tons. Additional photographs and a schematic are provided courtesy of Bean Stuyvesant, Inc. in Appendix C.

The vertical amount of material moved per pass is dependent on the type of material being moved. In very soft mud, up to 1 foot or more of surficial sediment can be moved in a single pass, whereas in stiffer material like clay, much less would be moved per pass (2 to 4 inches per pass is a representative depth). The number of passes required depends on the type of material being moved, the height of the ridge to be leveled, and the performance characteristics (e.g., weight) of the bed leveler. In soft materials, a 1- to 2-foot high ridge may be created by passage of a draghead, whereas in clay materials the ridge may be only ½ to 1 foot high. At a 2- to 4-inch height reduction per pass, multiple passes may be required to obtain overlap of passes and complete coverage of the area.

Within the dredging industry, the H-beam method of bed-leveling is typically used following cutterhead or excavator dredge operations. Drag bar bed-leveling is used following hopper dredging operations. The H-beam method was used by Bean Stuyvesant in Houston, Texas in 2003-2004 and in New York Harbor from 2000 to present with no impact to endangered species (R.E. Courtright 2005, personal correspondence). Both projects utilized an excavator dredge.

6.3 USACE SAD Survey

The results of the USACE SAD survey concluded that bed-levelers are used to a limited extent in the Jacksonville District because much of the hopper dredging is performed in entrance channels with sandy materials and wave activity that smoothes the bottom and eradicates any ridges left by the dredge. However, bed-levelers have been used effectively in the Tampa Bay entrance channel where the wave climate is mild and within Canaveral Harbor in areas of stiff materials (Hales *et al.,* 2005).

Because bed-leveling has been a common and accepted dredging practice, contract language and dredging company daily operation logs typically do not require specific dates and corresponding locations where this technique was used (Hales *et al.,* 2005). The Area Engineer from the Jacksonville District was contacted regarding whether there were any journals or logs kept by USACE Resident Engineers regarding bed-leveling use by dredge contractors. He stated the Resident Engineers were instructed either by regulation or by guidance from the Chief of Engineer's office about 15+ years ago to not keep "Resident Engineer journals" (John G. Cooper, personal communication, Nov. 8, 2005). However, contract language has been written and used by the Jacksonville District to help clarify specifications and document bed-leveler use in that District. The most recent version of the Jacksonville District Local Master Guide Specifications contains language that requires the contractor to submit drawings and one photograph showing drag bar equipment used for final leveling work. In addition, it states that bed-leveling by dragging the bottom with a drag bar or other apparatus shall be allowed only in the designated dredging areas shown on the drawings. Dragging in areas outside of the designated dredging areas shown on the drawings is specifically prohibited without written approval of the Contracting Officer. The contractor shall fully document all bed-leveling activity including date and time for initiation and completion of bed-leveling. All bed-leveling activity shall be documented on the Contractor's Quality Control Report (QCR). This language is provided in Appendix D.

7.0 SUMMARY AND CONCLUSIONS

According to the dredging history reports, only one maintenance dredging project has been conducted in Port Everglades Harbor since 1990, and there were no sea turtle takes associated with that project. According to the STSSN database, there was a total of 23 turtle strandings that involved crushing- or impact-type injuries within the designated 4-mile radius of the Port Everglades Harbor entrance channel between 1990 and 2005. None of these strandings occurred during a dredging project or within two weeks after a dredging project had been completed. Strandings were reported during each month of the year except for September and October.

Bed-leveling is a technique that has been used periodically (not frequently) during dredging projects throughout the sea turtles' U.S. range (Dickerson and Clausner 2003). Bed-levelers consist of a large customized plow, I-beam, or old spud that is slowly dragged across the sediment to smooth out the peaks and trenches during the final cleanup of the dredging activity. This technique was mentioned in passing in some of the early (1984-1987) Canaveral observer reports but has never been an issue of concern until a recent dredging project at Brunswick Harbor. During this project, six sea turtles were found stranded nearby with questionable injuries not consistent with those produced by hopper dredges. Although no conclusive evidence was found to directly link the bed-leveler with any of the reported sea turtle strandings, this incident raised the issue that the bed-leveler operation during the cleanup phase of this project was a possible cause of sea turtle mortalities. The concern is that brumating/resting/foraging sea turtles may be crushed as the leveling device passes over a turtle which fails to move out of the way or is not pushed out of the way by the sediment wedge "wave" which is generated by and moves ahead of the device (NMFS 2003b). In Port Everglades Harbor, the water is much warmer in the winter months compared to Brunswick Harbor; therefore, turtles should be much more active and better able to detect and avoid approaching dredging equipment.

Although there are concerns regarding bed-leveling and its potential to affect sea turtles, one argument has been made in support of bed-leveler use during the clean-up phase of projects using hopper dredges. It is thought that sea turtles may rest in trenches created by repetitive transits of the dragheads then become susceptible to entrainment when the dredge attempts to level the remaining high spots during the clean-up phase of the project (Hales *et al.,* 2005). Therefore, the use of bed-levelers for cleanup operations is probably preferable to use of hopper dredges since turtles which are foraging/resting/brumating on irregular bottoms are probably more likely to be entrained by suction dragheads because (1) sea turtle deflector dragheads are less effective on uneven bottom; (2) hopper dredges move considerably faster than bed-leveler "dredges"; and (3) bed-levelers do not use suction (NMFS 2003b). The rationale is if bed-levelers are used during hopper dredging projects to minimize trench formation and perform clean-up operations, the actual duration of dredging can conceivably be shortened and the potential turtle take reduced (Hales *et al.,* 2005). Furthermore, a bed-leveler that works more on the tops of the trenches with no hydraulic suction capabilities could potentially impact fewer sea turtles than a draghead with entraining flow fields exposed as it skips over bottom trenches (Hales *et al.,* 2005).

Since bed-leveling is not a specific pay item, tugs and drag beams for bed-leveling have not previously been included in the plan and equipment lists of contractor's bids. Contract language and dredging company daily operation logs typically do not require specific dates and corresponding locations where this technique is used (Hales *et al.*, 2005). The recent USACE ERDC survey confirmed that little or no information exists about the use of bed-leveling devices during dredging projects. USACE ERDC and SAD have proposed devising studies to evaluate the potential impacts of bed-levelers on sea turtles during cleanup dredging activities (Dickerson and Clausner 2003). In addition, USACE Jacksonville District has responded to the issue by including language in its dredging contracts to help clarify specifications and to document bed-leveler use in that District. Other USACE Districts are using this language as a potential model to help clarify contracts that utilize bed-levelers. This information will be crucial in fully assessing whether bed-leveling activities adversely affect sea turtle populations.

Determination

Although NMFS has, on two separate occasions, made the determination that bed leveling is a cause of injurious or lethal take to sea turtles (NMFS 2003a and 2003b), a review of the data from the use of bed leveling devices at Port Everglades over the last 15-years does not support this belief. The area around Port Everglades is known to have high concentrations of sea turtles utilizing the offshore reefs, and recent data from the Broward County Shore Protection Project Segment III completed in November 2005 found a consistent presence of sea turtles near the channel. After reviewing numbers and locations of stranded turtles within a 4-mile radius of the port's entrance channel, the dates that the strandings were recorded, and the types of injuries exhibited on the carcasses, the Corps can not find a link between bed-leveling and crushing/impact injuries on stranded sea turtles, nor can we find that a significant difference exists in stranding numbers and locations between dredging event time periods and non-dredging event time periods.

Based on a review of all of the information provided in this Biological Assessment, the Jacksonville District of the US Army Corps of Engineers has determined that the proposed use of bed-leveling devices in Port Everglades may affect, but is not likely to adversely affect listed marine turtle species within the action area, and requests concurrence with this determination.

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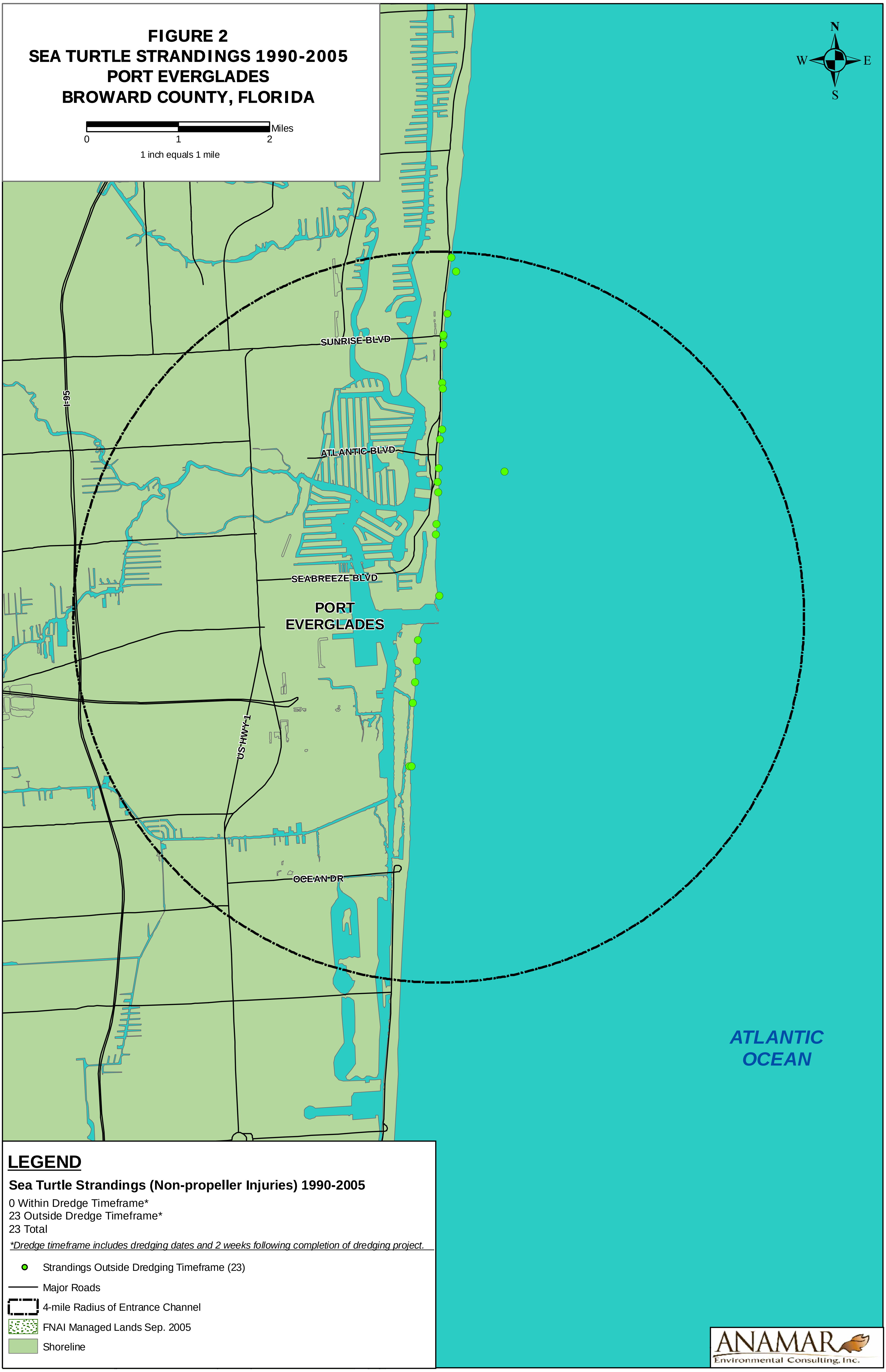
Table 1. Description of Turtle Stranding Injuries During the Brunswick Harbor Deepening Project, 2003, Brunswick, GA*

Date	Island	Species	Size	Injury
29-Mar-03	Brunswick Ship Channel	Kemp's Ridley	38.2 x 39.1	Crushed skull
2-Apr-03	Jekyll Island	Loggerhead	69.1 x 64.4	Crushed/scraped skull
25-Apr-03	St. Simons Island	Loggerhead	no measurements	Head, right front flipper and piece of plastron; no photo
28-Apr-03	Jekyll Island	Loggerhead	no measurements	Front half of carapace only
6-May-03	Jekyll Island	Kemp's Ridley	no measurements	Front half of carapace only
9-May-03	St. Simons Island	Loggerhead	no measurements	Crushed, but badly decomposed

* This information was taken from the 2004 Study on Bed-Leveler Use in Brunswick Harbor Deepening Project, Brunswick, GA.

Data source: LABINS, SFWMD. Data provided as-is. 25OCT05 05-0023 land_use.mxd

FIGURE 2
SEA TURTLE STRANDINGS 1990-2005
PORT EVERGLADES
BROWARD COUNTY, FLORIDA



LEGEND

Sea Turtle Strandings (Non-propeller Injuries) 1990-2005

0 Within Dredge Timeframe*
23 Outside Dredge Timeframe*
23 Total

**Dredge timeframe includes dredging dates and 2 weeks following completion of dredging project.*

- Strandings Outside Dredging Timeframe (23)
- Major Roads
- 4-mile Radius of Entrance Channel
- FNAI Managed Lands Sep. 2005
- Shoreline

ANAMAR Environmental Consulting, Inc.

Data sources: FWC Sea Turtle Stranding and Salvage Network, FGDL, FNAI. Data provided as-is. 31OCT05

Figure 3. Monthly Turtle Strandings with Non-Propeller Type Injuries Occurring within a 4-Mile Radius of the Port Everglades Entrance Channel from 1990-2005

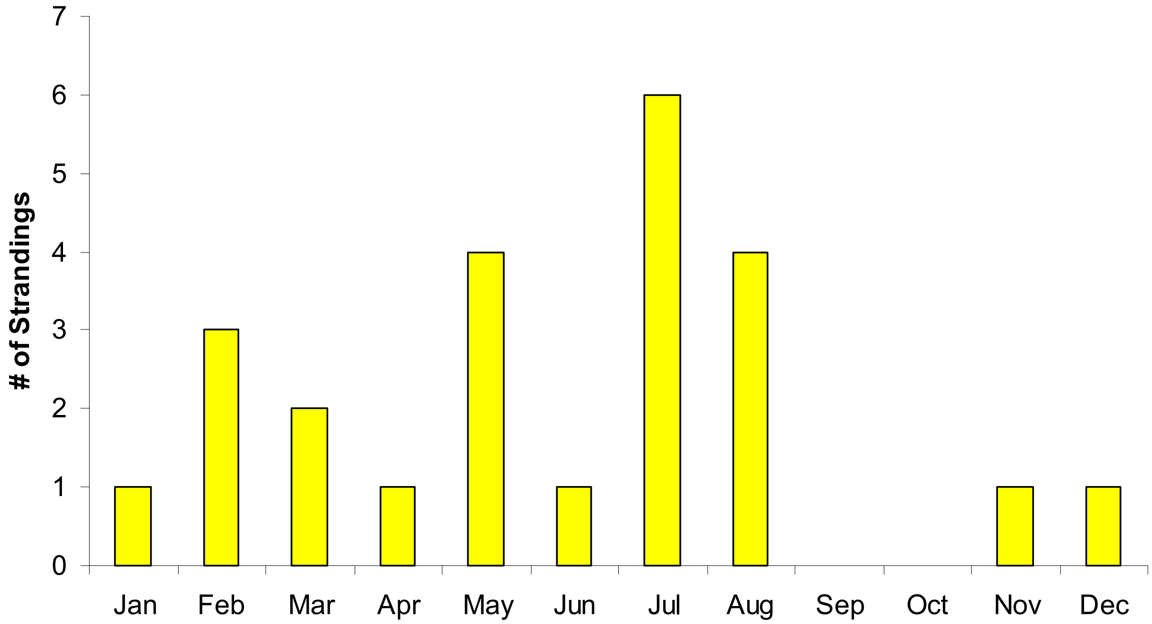


Figure 4. Photographs of Bed-leveling Devices Provided to USACE ERDC by Dredging Industry Professionals (compiled from Hales *et al.,* 2005)

Bed-leveler (photo courtesy of Bean Dredging Corporation)

Close-up of bed-leveler beam (photo courtesy of Bean Dredging Corporation)

Bed-leveler suspended by A-frame on work-barge (photo courtesy of Bean Dredging Company)

Bed-leveler on work-barge being pushed by tug (photo courtesy of Bean Dredging Company)

Bed-leveler (photo courtesy of Great Lakes Dredge and Dock Company)

Close-up of bed-leveler beam (photo courtesy of Great Lakes Dredge and Dock Company)

Bed-leveler suspended by A-frame on work-barge (photo courtesy of Great Lakes Dredge and Dock Company)

Bed-leveler (photo courtesy of Weeks Marine Incorporated)

Bed-leveler suspended from work-barge (photo courtesy of Weeks Marine Incorporated)

Figure 5. Photographs of a Drag Barge (Courtesy of Great Lakes Dredge and Dock, Nov. 2005)

Port Everglades Harbor

Dredging History
Full Report

Project Description: North Turning Basin, 31' Project
Fiscal Year: 2005
Bid Open Date: 06/28/2005
Contract No: W912EP-05-C-00
Award Date: 07/25/2005
OPS Project Engineer: Brodehl **Ext:** 3600
D.O. File No: 19-38,448
Start Date: 08/05/2005
DP Project Manager: Ross **Ext:**
IFB No: W912EP-05-B-0029
Finish Date: 08/15/2005

Bid Item	Description	Location	Stationing	Cut	Work Type	Material Type	Disposal Location	Unit	Bid Volume	Pay Volume	Contractor Bid Price	Unit Price	Final Cost
0001	Mob & Demob								0	0	$0	$0.00	$242,000
0002	Dredging	Turning Basin			MD	Sand/silt	Odmds		50,000	46,686	$0	$5.03	$251,500
0003	Turbidity Monitoring								0	0	$0	$0.00	$3,258
0004	Endg Species Observer								0	0	$0	$0.00	$1,901
0005	Additional Mob/DeMob								0	0	$0	$0.00	$3,054
0006	Sea Turtle - Trawling								0	0	$0	$0.00	$17,815
								Total:	50,000	46,686	$0		$519,528

Contractor: Great Lakes D&D **Plant:** Dodge Island **Type:** Hopper

Remarks:
- All material going to ODMDS
- Entrance channel shoal exists but being dredged under Broward County shore protection project.

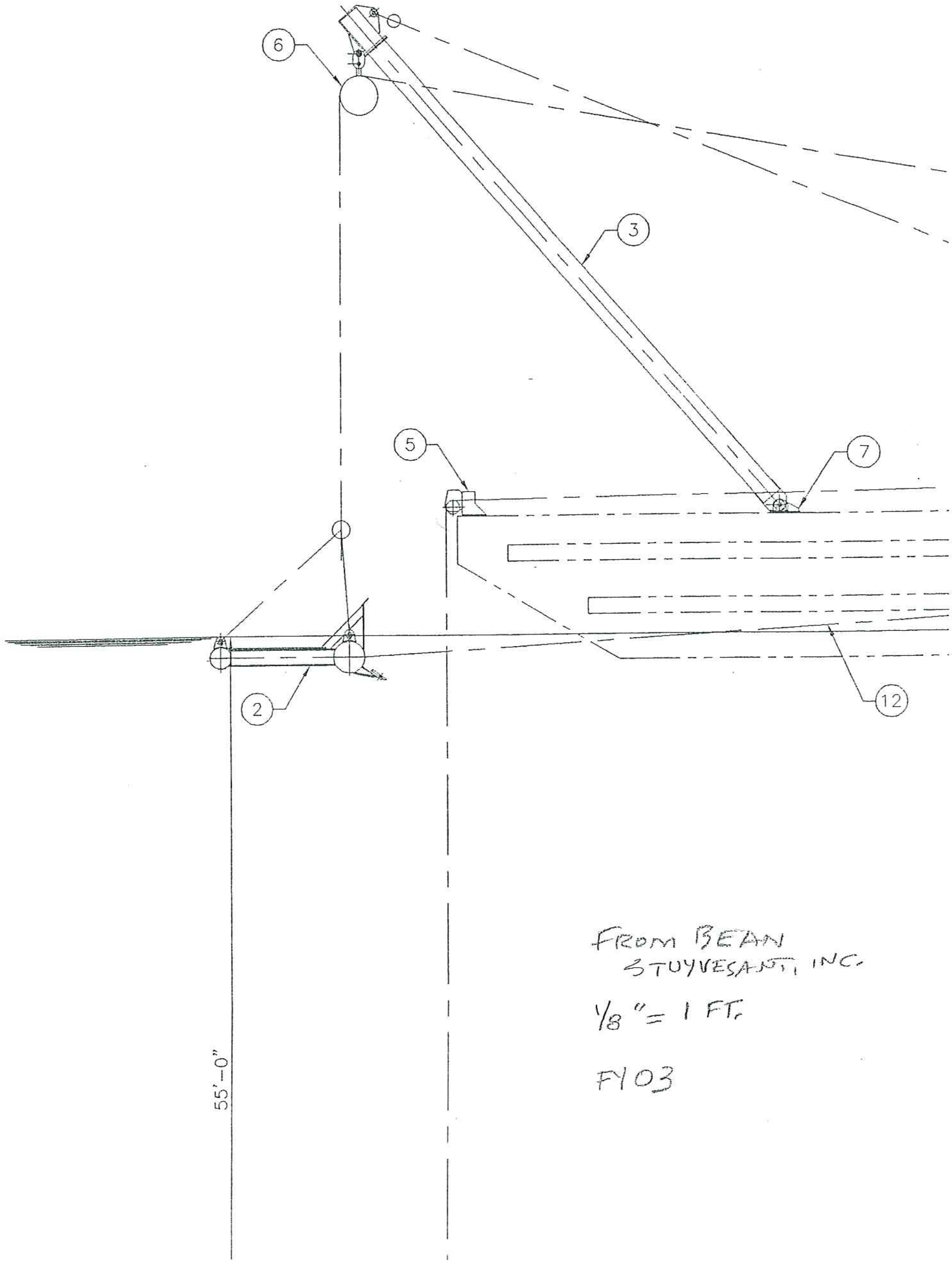
APPENDIX B: USACE ERDC SURVEY QUESTIONNAIRE

Industry Query

(a) Where has a bed-leveler been used by your company in the past in U.S. waters?
(b) Why was the bed-leveler used?
(c) Please describe the bed-levelers used by your company?
(d) Are photos available of the devices?
(e) What are the dimensions and weights of these devices?
(f) What kind of vessel is used to deploy these devices?
(g) How much horsepower is typically required to deploy these devices?
(h) In what current and wave conditions have you operated these devices?
(i) What vessel speeds are typical for towing or pushing the bed-leveler barge?
(j) What kind of material (sand, clay, etc.) is usually leveled?
(k) How much vertical leveling is typically achieved per pass of the bed-leveler?
(l) How many passes are typically required to achieve desired grade?
(m) Does you company use these devices in association with any dredging equipment other than hopper dredges?

District Query

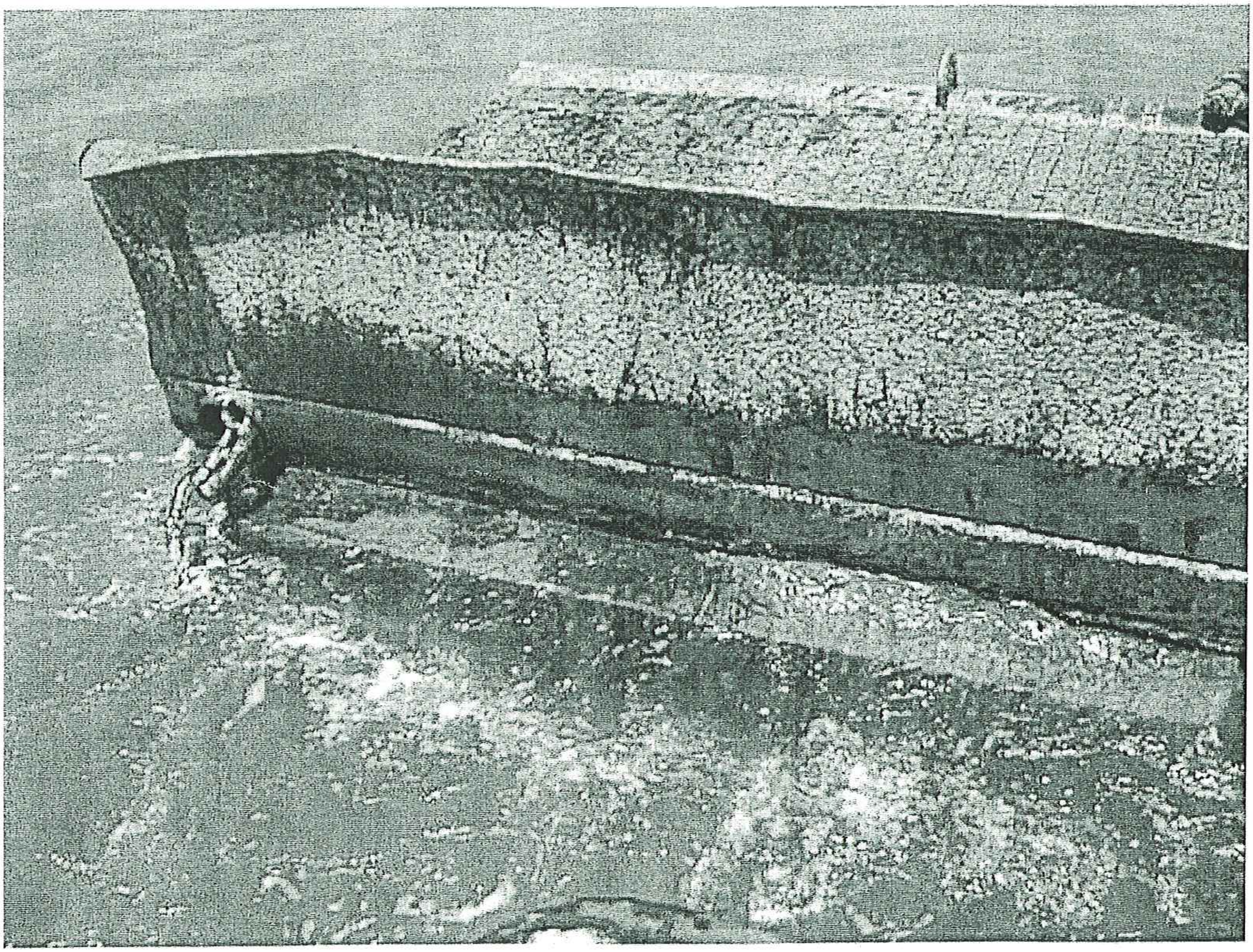
(a) What locations along the project were bed-levelers used (entrance channel, inlet, interior channel, harbor, etc.)?
(b) When (date) were bed-leveler operations <u>first</u> used at this project location?
(c) When (date) were bed-leveler operations <u>last</u> used at this project location?
(d) Was this new work, maintenance dredging, or some combination (please specify)?
(e) What kind of material was being dredged (consolidated material, sand, silt, mud, shell, or some combination) (please specify)?
(f) What type of dredge was used (hopper, pipeline, dustpan, clamshell, bucket, etc.)?
(g) What is the frequency of bed-leveler usage at this project location?
(h) Are bed-levelers typically used during each dredging event at this project location?
(i) What was the estimated volume of material leveled at this project location (cu yd)?
(j) What was the linear extent of bed-leveler usage at this project location (ft)?
(k) What type of bed-leveler was used at this project location (blade, box beam, etc.)?
(l) Does this District's dredging contracts contain any language regarding use of bed-levelers at this project location?
(m) Were any environmental concerns identified during bed-leveling at this project location?
(n) Who was the contractor, and what was the contract number during this dredging event at this dredging location?
(o) Other comments?



FROM BEAN
STUYVESANT, INC.

1/8" = 1 FT.

FY03



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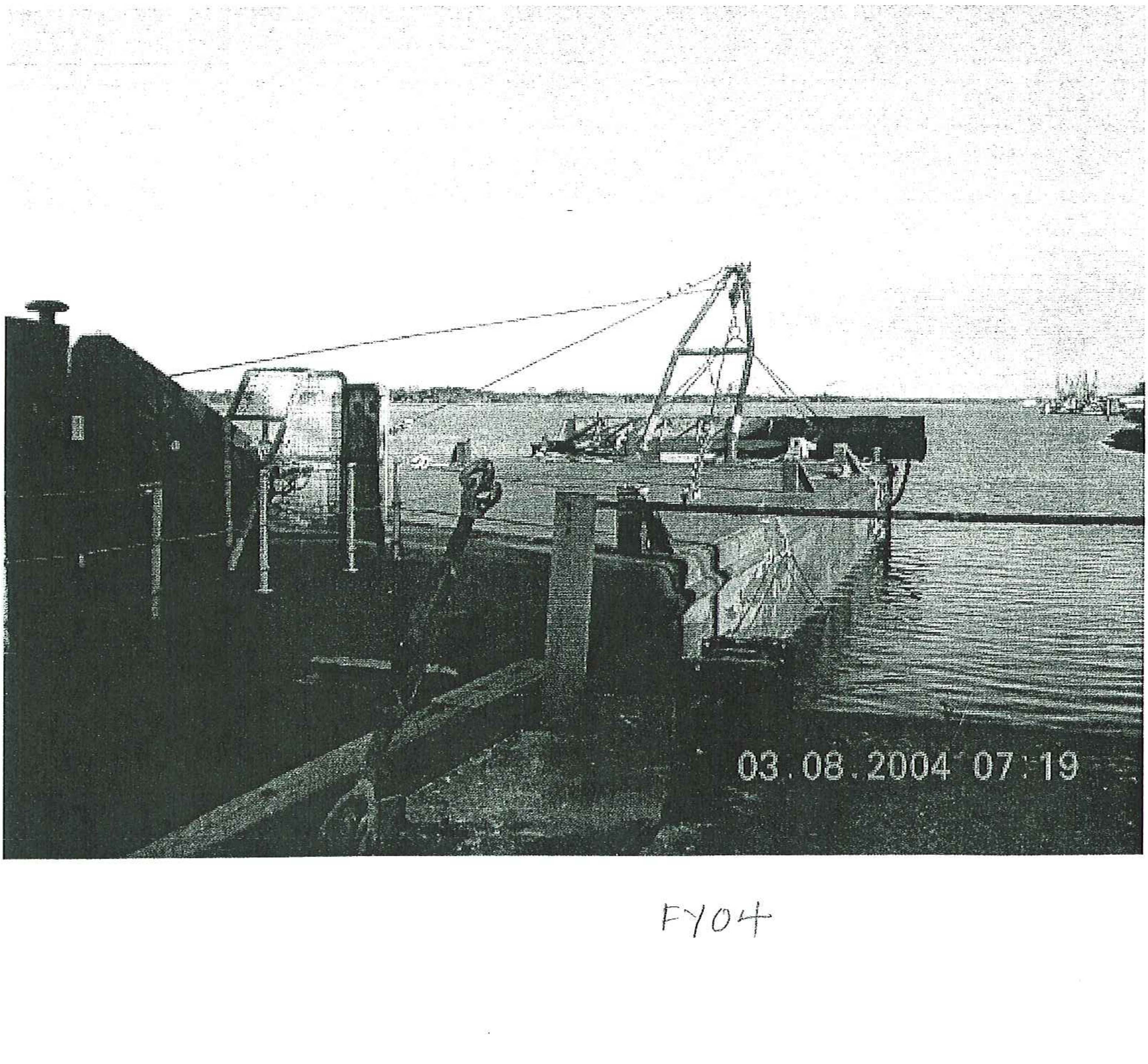

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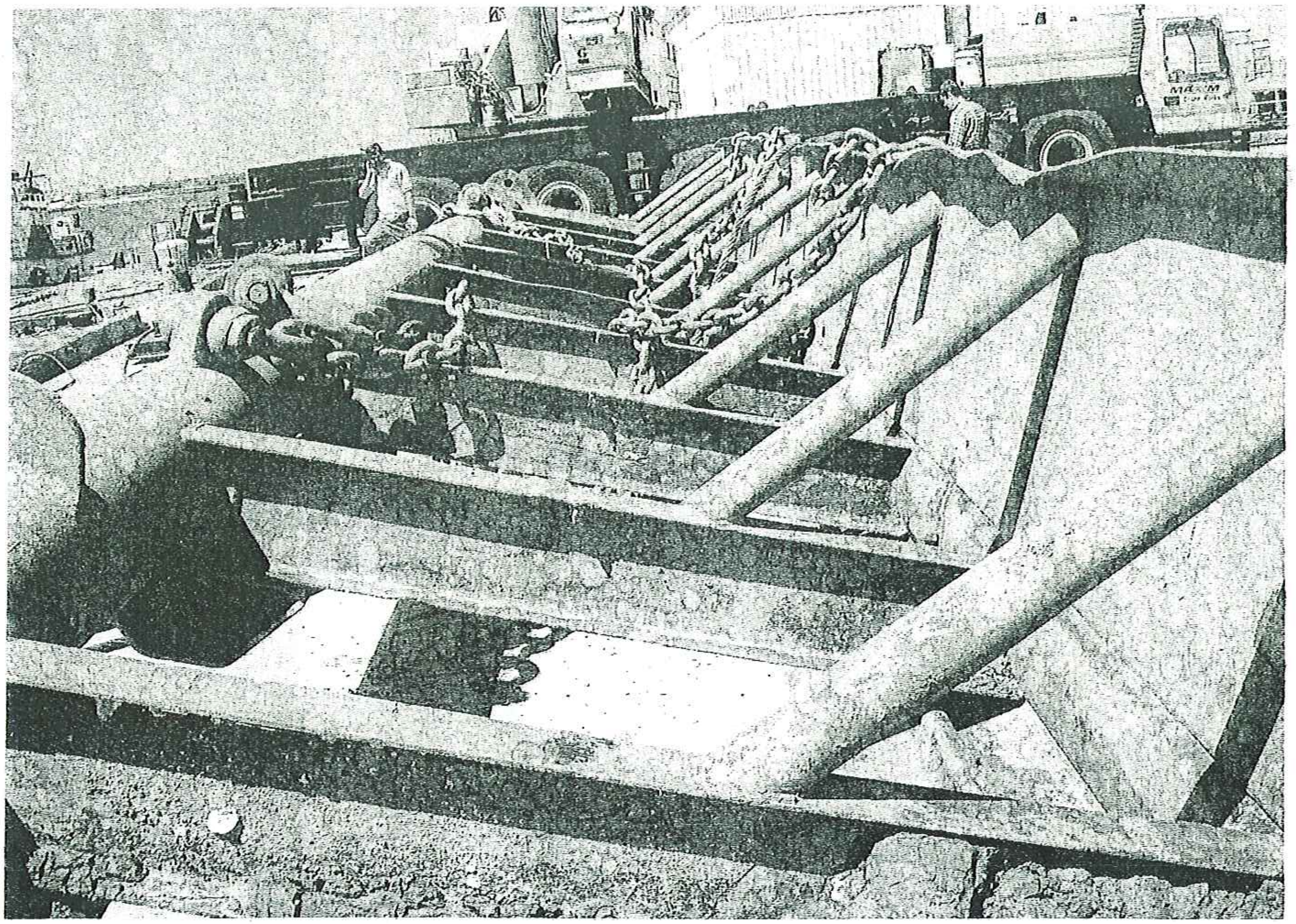

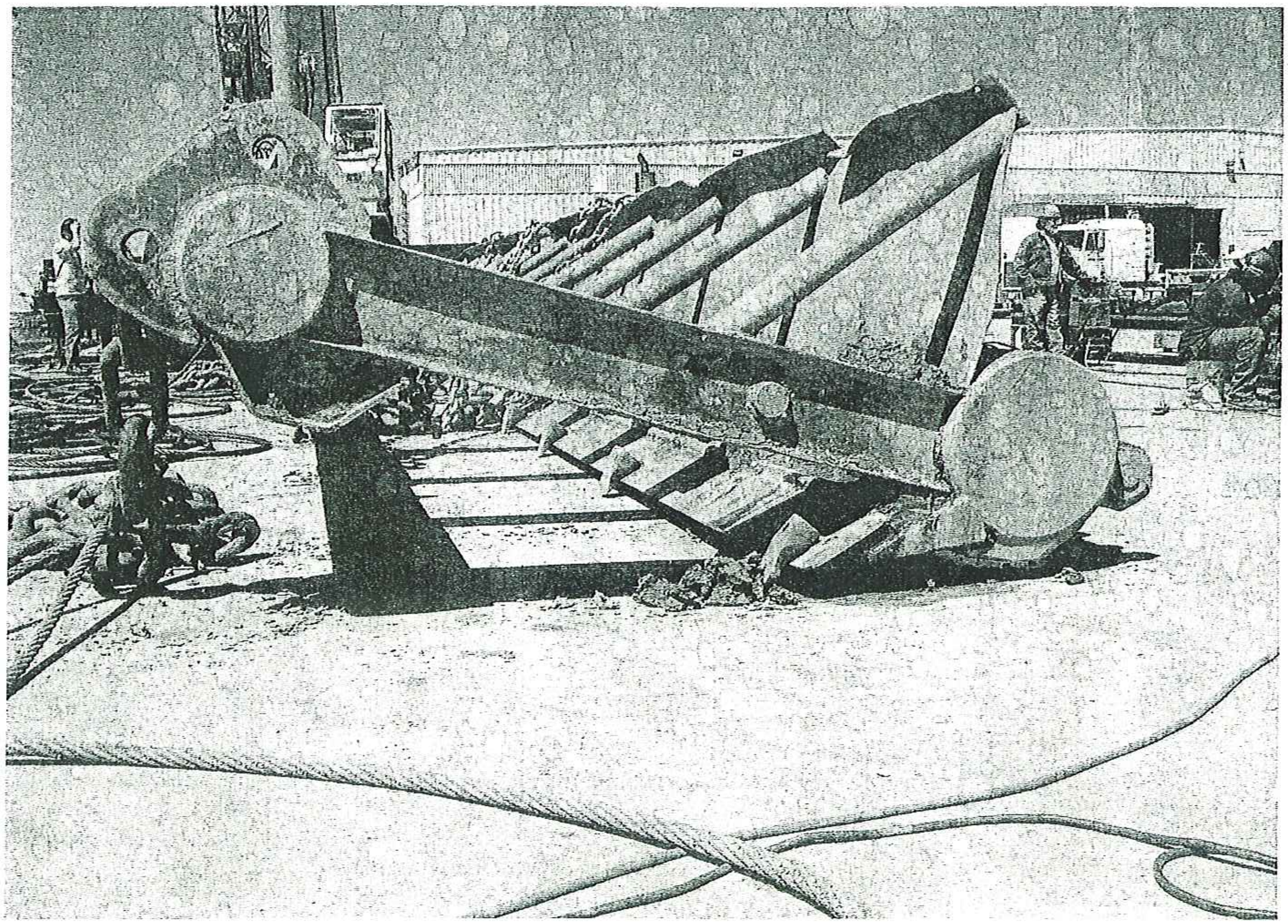

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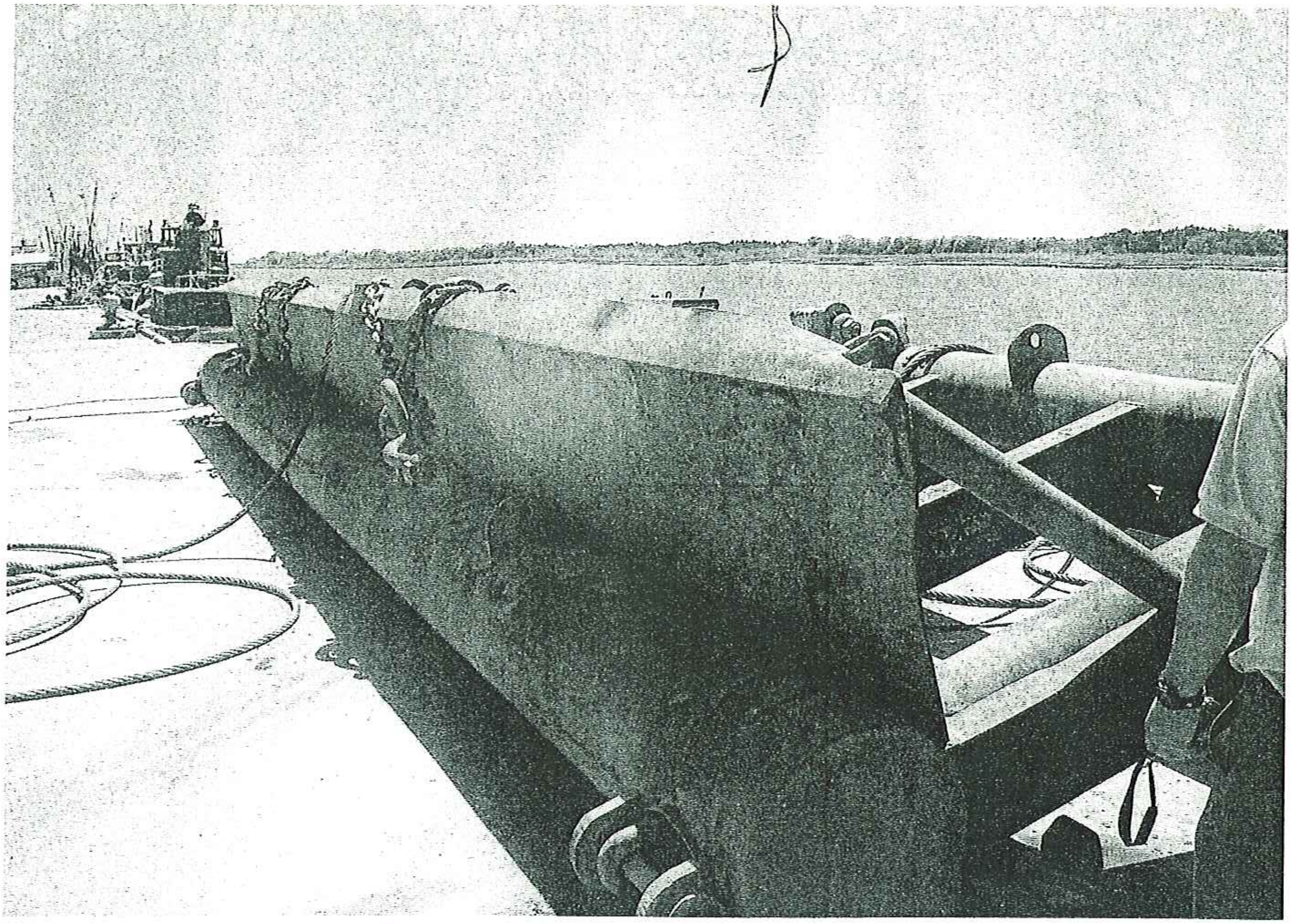

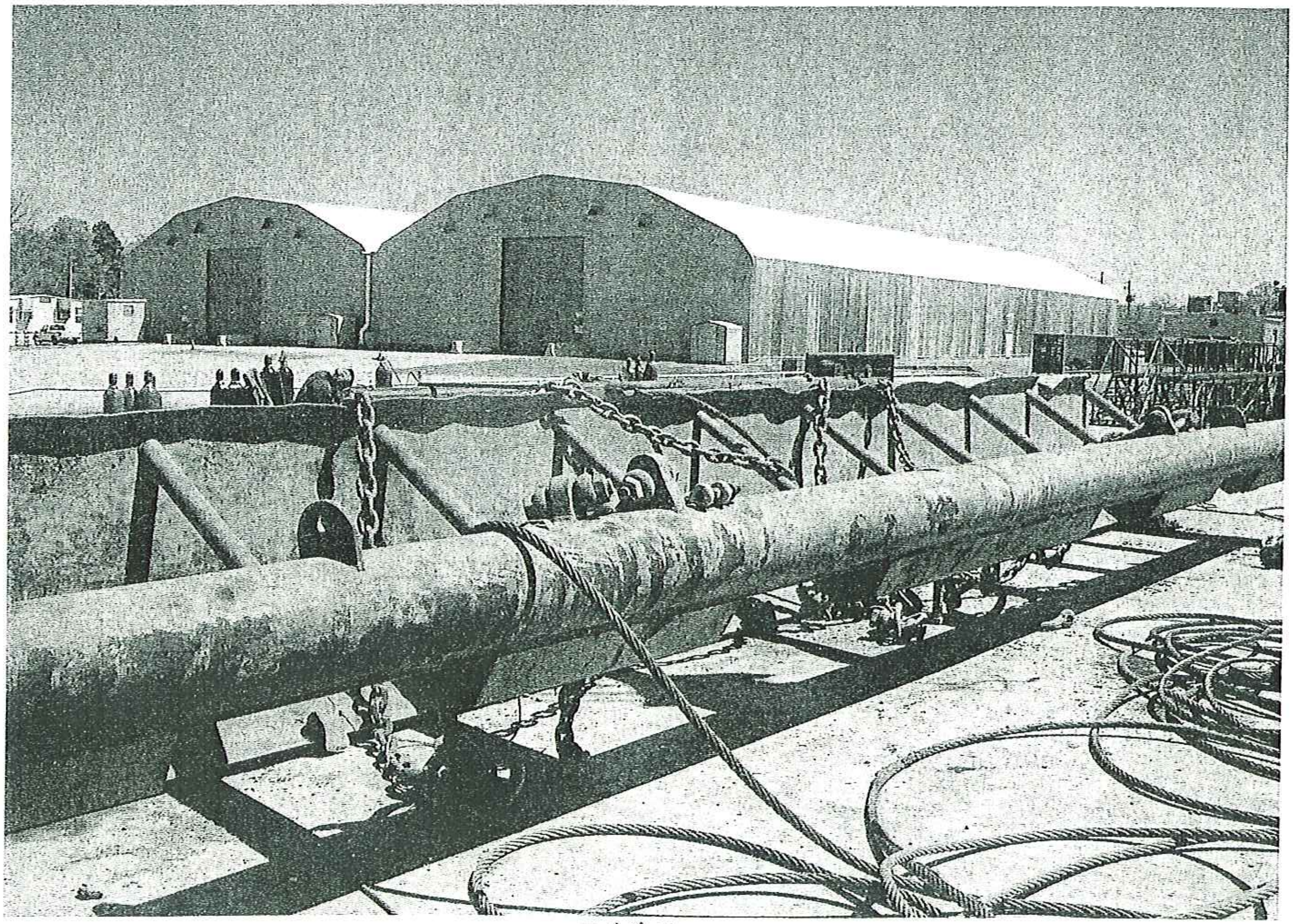

FY04

APPENDIX D: JACKSONVILLE DISTRICT CONTRACT LANGUAGE

The Jacksonville District will include the following bed leveler specification language in future dredging contracts.

3.7 FINAL EXAMINATION AND ACCEPTANCE

3.7.1 Final Examination of Work

As soon as practicable and no later than three (3) weeks after the completion of the entire work or any section thereof (if the work is divided into sections) as in the opinion of the Contracting Officer will not be subject to damage by further operations under the contract, such work will be thoroughly examined at the cost and expense of the Government by sounding or by sweeping, or both, as determined by the Contracting Officer. Should any shoals, lumps, or other lack of contract depth be disclosed by this examination, the Contractor will be required to remove same by dragging the bottom in accordance with the subparagraph Bed Leveling below or by dredging at the contract rate of dredging. The Contractor or his authorized representative will be notified when soundings and/or sweepings are to be made and will be permitted to accompany the survey party. When the area is found to be in a satisfactory condition, it will be accepted finally. Should more than two sounding or sweeping operations by the Government over an area be necessary by reason of work for the removal of shoals disclosed at a prior sounding or sweeping, the cost of such third and any subsequent soundings or sweeping operations will be charged against the Contractor at the rate of $5,500 per day for each day in which the Government plant is engaged in sounding or sweeping and/or is enroute to or from the site or held at or near the said site for such operation.

3.7.2 Bed Leveling

Bed leveling by dragging the bottom with a drag bar or other apparatus shall be allowed only in the designated dredging areas shown on the drawings. Dragging in areas outside of the designated dredging areas shown on the drawings is specifically prohibited without written approval of the Contracting Officer.

3.7.3 Bed Leveling—Reporting and Documenting

The contractor shall fully document all bed leveling activity, including date and time for initiation and completion of bed leveling. All bed leveling activity shall be documented on the Contractor's Quality Control Report (QCR).

3.7.4 Shop Drawings

The contractor shall submit shop drawings and one photograph showing drag bar equipment used for final bed leveling work indicated in subparagraph 3.7.1 Final Examination of Work above.