Anejo 1

Expansión Muelle Hotel Club Seabourne
Culebra, Puerto Rico
Análisis de Impactos a Hierbas Marinas

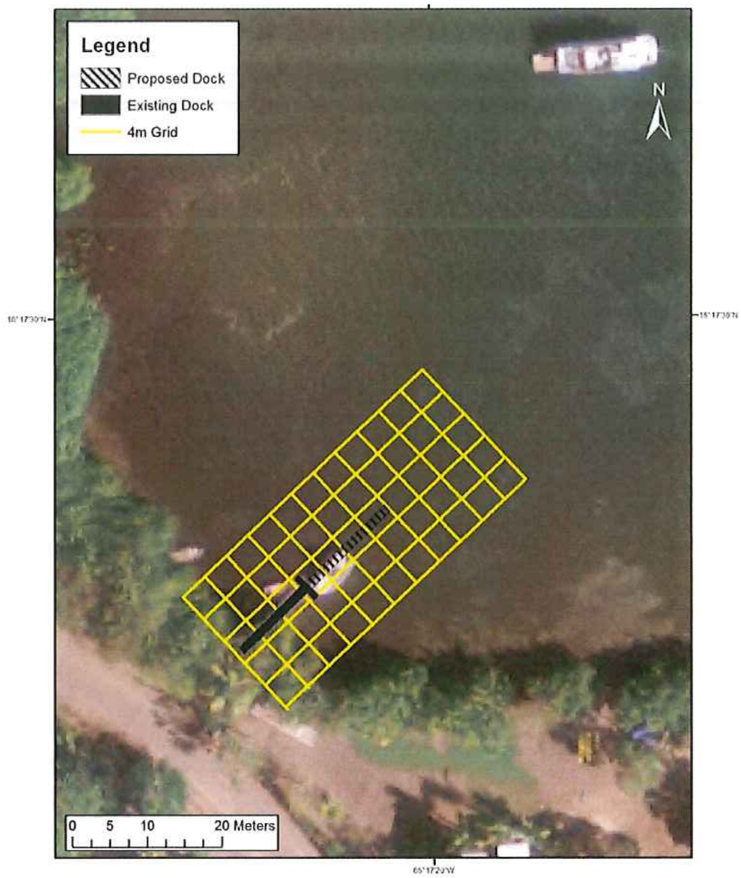
Trasfondo:

El proyecto contempla la expansión de un muelle existente propiedad del Hotel Club Seabourne localizado en Ensenada Fulladosa, Culebra por medio de una Solicitud de Permiso Conjunto o "Joint Permit" y la Solicitud de Concesión para Aprovechamiento de Bienes de Dominio Público Marítimo Terrestre a ser emitida por el DRNA. El proyecto contempla la expansión del muelle a sus dimensiones originales de acuerdo con permiso original emitido por el Cuerpo de Ingenieros en el año 1982. Se propone la sustitución del muelle en pilotes de 30 pies de largo por un nuevo muelle en pilotes de 88 pies de largo por 4 pies de ancho a ser añadido a la plataforma de concreto existente de 24 pies para un muelle de 112 pies, de dimensión similar al autorizado originalmente por el Cuerpo de Ingenieros. El nuevo muelle de 88 pies será hecho de una combinación de madera y "fiber glass" en donde los elementos estructurales serán de madera y la pasarela será de paneles de rejilla de "fiber glass" para permitir el paso de la luz solar.

Este análisis contiene una descripción detallada de la magnitud de los impactos directos e indirectos a hierbas marinas en el área del proyecto propuesto. Incluye un estimado, en acres, de la cantidad de hierbas marinas que resultarán impactadas por la sombra de la estructura propuesta, la instalación de pilotes y las embarcaciones que utilizarán el muelle.

Metodología utilizada:

Los cómputos de cobertura se basan en el estudio béntico del área titulado "Biological survey and benthic habitat map in the vicinity of the Seabourne Hotel Pier in Ensenada Fulladosa, Culebra, Puerto Rico" (en adelante "Estudio Béntico") levantado por el Sr. Jorge Sabater. Se incluye la Figura 2 del Estudio Béntico que demuestra la malla de muestreo utilizada para el estudio.



Esta malla, con una resolución de 4x4 metros por celda se compone de 11 transeptos perpendiculares al muelle y 6 paralelos a este. El área total documentada en el estudio equivale a 880 metros cuadrados.

Las determinaciones de cobertura de hierbas marinas se lograron por observación directa y las celdas georreferenciadas mediante la utilización de un receptor/procesador de sistema de navegación global (GPS). Se utilizó una cinta métrica a lo largo de cada transepto y se registró la posición donde se observaron transiciones en composición béntica y/o densidad en las áreas de cobertura. Para más detalles sobre la metodología favor ver el Estudio Béntico que se incluye como "Attachment 5" de la Solicitud de Permiso Conjunto.

Observaciones:

Abajo se incluye la Tabla 1 del Estudio Béntico. Esta resume la naturaleza y cobertura (en metros cuadrados) del sustrato o comunidades bénticas observadas en el estudio. En el área total de estudio, que incluye áreas a ser impactadas y áreas periferales a estas, se distinguen tres clases de cobertura dominante distribuidas según aparece en la Figura 3 del Estudio Béntico (abajo).

Habitat	Area (m^2)	% Total Area Surveyed
Mud	28.4	3.2
Mud & Macroalgae	91.7	10.4
Turtle Grass/50-70%	261.8	29.8
Turtle Grass/Continuous	497.9	56.6
Total=	879.7	100.0

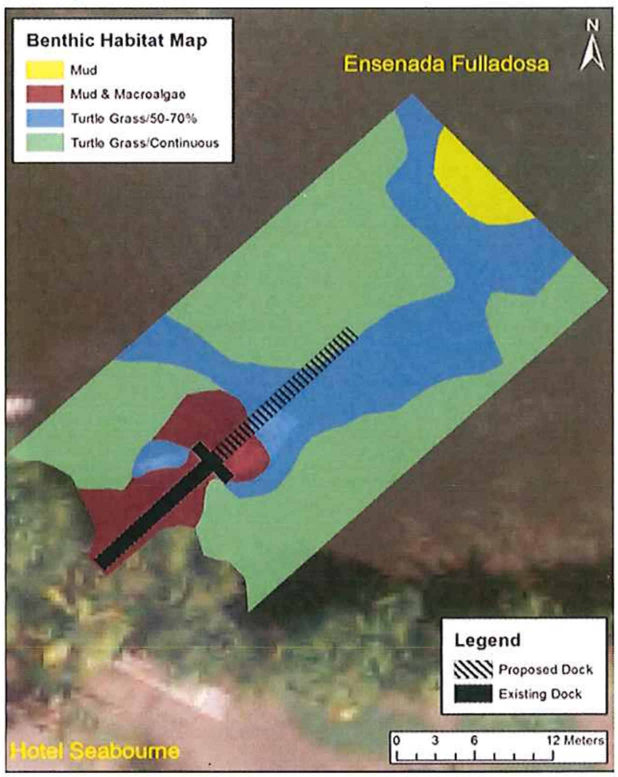
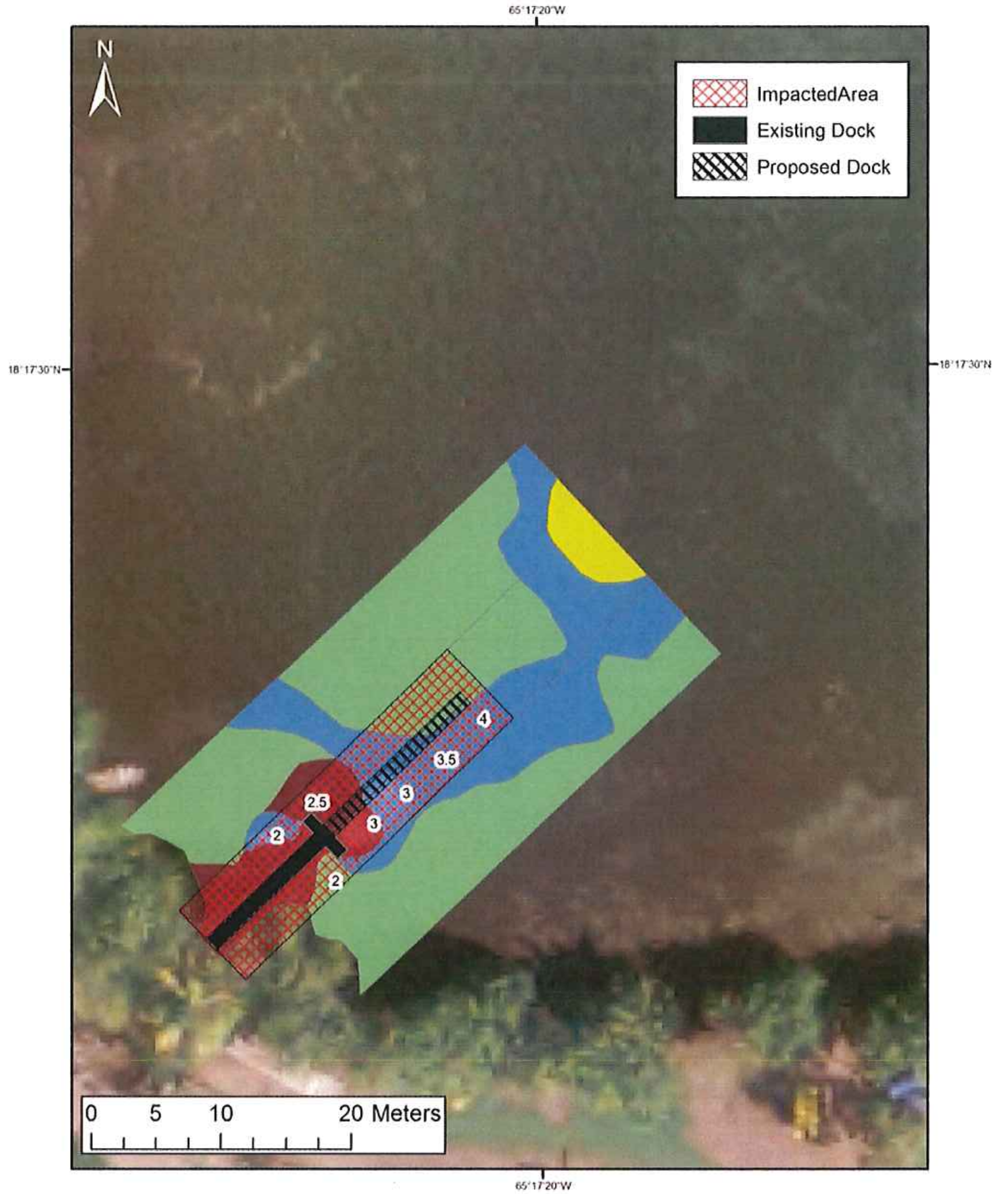


Figura 3

Area de impacto:

En la siguiente figura se delinean las áreas de posible impacto por la actividad propuesta. El área del muelle existente y el área del muelle propuesto

Area of Impact (m2) including docked vessels (3 meters beam)



La tabla a continuación resume los datos de área de impacto, tanto en el componente béntico total como en la hierba marina *Thalassia sp.* (Turtle grass).

Habitat	**Existing Dock**	**Proposed Dock**	**Total**
Mud			
Mud & Macroalgae	55.46	25.91	**81.370**
Turtle Grass 50-70%	7.58	63.59	**71.170**
Turtlr Grass Continuous	8.27	28.74	**37.010**
Total=	**71.31**	**118.24**	

	Maximum* area of Impacted Turtle Grass (*Thalassia sp.*) (m2)		
Habitat	**Existing Dock**	**Proposed Dock**	**Total**
Turtle Grass area (70%)	5.306	44.513	**49.819**
Turtlr Grass Continuous	8.27	28.74	**37.010**
Total Grass area=	**13.576**	**73.253**	**86.829 (m2)**
			TOTAL
			0.021 ACRES

Resumen:

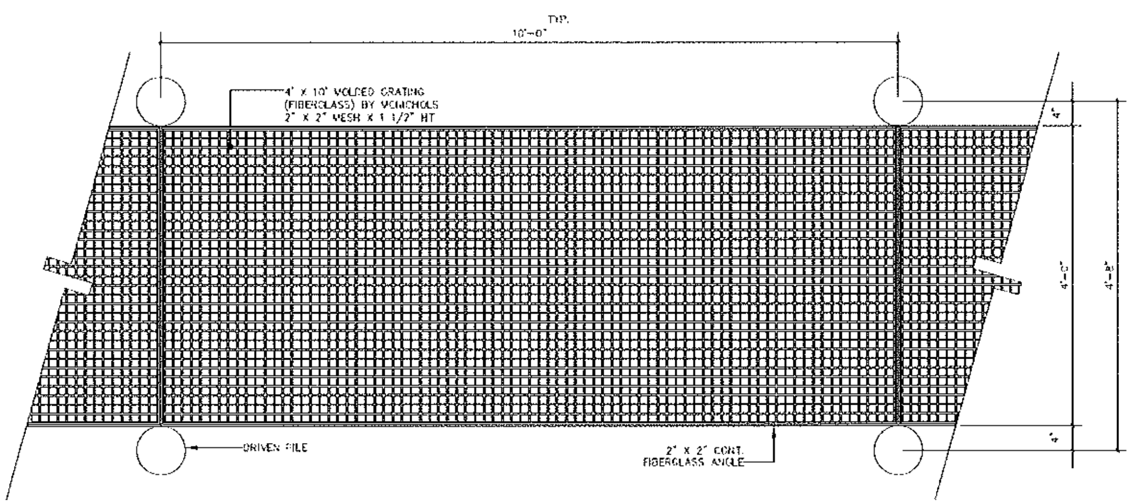
El total de área cubierta con potencial de ser impactado por la actividad propuesta suma 0.021 acres incluyendo áreas de pilotes así como áreas a ser cubiertas por embarcaciones utilizando el muelle.

Este estimado de área representa un máximo por las siguientes razones:

1. La mitad del muelle existente será reemplazado por una estructura nueva que cumple con las recomendaciones del USACE recogidas en el documento "Design and construction of docks to minimize seagrass impacts". Estas recomendaciones se enfocan en minimizar el efecto de sombra u oclusión a la irradiación solar como resultado del muelle. Una de las medidas seguidas en el diseño de este proyecto

recomienda que la superficie del muelle se ubique a una elevación pertinente para maximizar el tiempo que el sustrato bajo el muelle se encuentra expuesto. Para esto se diseñó el muelle con una elevación promedio sobre el nivel del mar de 1.3 metros (4 pies). La segunda medida incorporada en el diseño es la utilización de rejilla en la superficie de este con aperturas de 5x5 centímetros (2x2 pulgadas) según el diagrama incluido abajo.

Las medidas arriba descritas minimizarán el impacto de la sección nueva del muelle propuesto. Además mejorarán las condiciones de irradiación al sustrato bajo el muelle existente dado que su construcción es a menos de un metro de elevación e incluye una superficie de madera que no permite la penetración de luz.



TYPICAL DOCK BAY FLOOR PLAN
NTS

2. En el estimado se asume que el impacto por embarcaciones utilizando el muelle es de 3 metros de ancho. Sin embargo, más de la mitad del muelle será utilizado por embarcaciones menores (dinghy) de menos de 2 metros de manga o ancho. Además el muelle no es de uso permanente, sino de uso intermitente. Ambas condiciones están contempladas en el Plan de Uso del Muelle Hotel Club Seabourne, incluido como “Attachment 7” de la Solicitud de Permiso Conjunta.

El estudio titulado "Evaluation of the Use of Grid Platforms to Minimize Shading Impacts to Seagrasses (ERDC TN-WRAP-01-02), publicado en el año 2001 por el Wetlands Regulatory Assistance Program del Cuerpo de Ingenieros **(Ver, Appendix A)** evalúa el beneficio de adoptar las medidas arriba descritas y concluyen que el uso de rejillas de fibra de vidrio para aumentar la transmisión de la luz debe reducir la cantidad de hierbas afectada por la sombra de muelles ("the use of fiberglass grating to increase light transmission should reduce the amount of seagrass loss due to shading by docks and terminal platforms". Más adelante indica que a pesar de que la cobertura total por hierbas se reduce en alguna cantidad, las consecuencias ecológicas de dicha reducción en áreas pequeñas como muelles son probablemente insignificantes ("Although total percent cover and density are reduced somewhat, the ecological consequences of this reduction in the small area beneath the docks are not likely to be significant").

Wetlands Regulatory Assistance Program

ERDC TN-WRAP-01-02
May 2001

Evaluation of the Use of Grid Platforms to Minimize Shading Impacts to Seagrasses

INTRODUCTION

Background. Seagrasses are widely recognized as one of the most productive and valuable habitats in shallow marine environments. In addition to providing habitat and nursery grounds for many fishery species of commercial and recreational importance, seagrasses also filter the water column and stabilize sediments. The amount of available light is one of the most important factors affecting the survival, growth, and depth distribution of seagrasses (Bulthuis 1983, Dennison 1987, Abal et al. 1994, Kenworthy and Fonseca 1996).

Although the seagrass response to light has been reported in numerous studies (Bulthuis 1983, Neverauskas 1988, Abal et al. 1994, Gordon et al. 1994, Czerny and Dunton 1995, Fitzpatrick and Kirkman 1995), published reports which document the effects of shading by dock structures are rare. Due to the limited data available, there has been a lack of consistency in the development and application of regulatory policy to address dock shading impacts. Guidelines concerning the placement, height, width, and type of construction for docks and piers over seagrasses often address light availability to the underlying seagrass beds by setting minimum height and maximum width of the dock, spacing of the decking, etc. These guidelines have often been based on very limited surveys or best professional judgment and have been criticized for a lack of supporting data to evaluate their effectiveness.

Due to continuing rapid development in the coastal zone, there is a concern that the proliferation of dock structures will negatively impact seagrass meadows. Loss of seagrass cover in areas under and adjacent to docks may result from shading, piling installation, and boat traffic (i.e., prop scarring). The use of high-pressure jet pumps during piling installation often results in large bare clearings around individual pilings, which may persist for years following construction.[1] Although the area of seagrass loss associated with any individual dock is relatively small, cumulative impacts and fragmentation of seagrass beds may be significant along highly developed shorelines. In Palm Beach County, Florida, more than 50 acres of seagrasses are estimated to have been negatively impacted due to single-family dock structures (Smith and Mezich 1999). With seagrass populations in decline in many areas, coastal resource managers are interested in the development of consistent, defensible guidelines to reduce additional dock-associated impacts to an already stressed resource. Until recently, quantitative data to support the development of regulatory guidelines concerning the placement of docks over seagrass beds have been lacking (see Loflin (1995), Burdick and Short (1999), Shafer (1999)).

Guideline Development. In Massachusetts, studies on dock impacts to seagrasses have shown the three most important factors affecting seagrass growth are dock height, orientation, and width.

1 Personal observation, 2001, Deborah Shafer, Research Marine Biologist, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

However, due to differences in tidal range, latitude, water quality, and the light requirements of different seagrass species, specific dock guidelines developed in one region may not be appropriate elsewhere.

In July 1998, through the Wetlands Regulatory Assistance Program (WRAP), the Regulatory Office of the U.S. Army Engineer District, Jacksonville, invited representatives of the Engineer Research and Development Center, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Florida Department of Environmental Protection, and the private sector marine construction industry to attend a workshop to develop guidelines for the design and construction of docks in seagrasses. These guidelines were intended to minimize the loss of seagrass associated with docks in seagrass beds. Appendix A summarizes recommendations for construction and design of docks over seagrasses.

Study Objectives. Since light is one of the most important factors affecting seagrass survival and growth, the use of alternative construction techniques to increase the amount of light received by the seagrasses below has been suggested as a viable mechanism to reduce loss of seagrass due to dock shading impacts.

A preliminary investigation of alternative decking materials compared acrylic, acrylic with matting, lexan, aluminum grating and fiberglass grating. On the basis of this study, the Dade County (Florida) Department of Environmental Resources Management (DERM) concluded that only the fiberglass grating material showed promise (Molnar, Markley, and Mayo 1989). DERM recommended that additional studies involving dock construction with fiberglass grating be conducted (Molnar, Markley, and Mayo 1989).

The current version of the guidelines for construction of docks and piers requires that terminal platforms that exceed 120 ft^2 be constructed of fiberglass grating if they are built over seagrasses (Appendix A). The present study was designed to evaluate the effectiveness of the fiberglass grating through the construction and monitoring of two experimental platforms over seagrass beds in St. Andrew Bay, FL.

The major objectives of this study are:

- Compare the light environment under the experimental platform to nearby unshaded control sites.
- Measure changes in seagrass density and percent cover under the experimental platform over time (pre- and post-construction monitoring).
- Evaluate a construction technique designed to reduce seagrass loss associated with piling installation.

METHODS

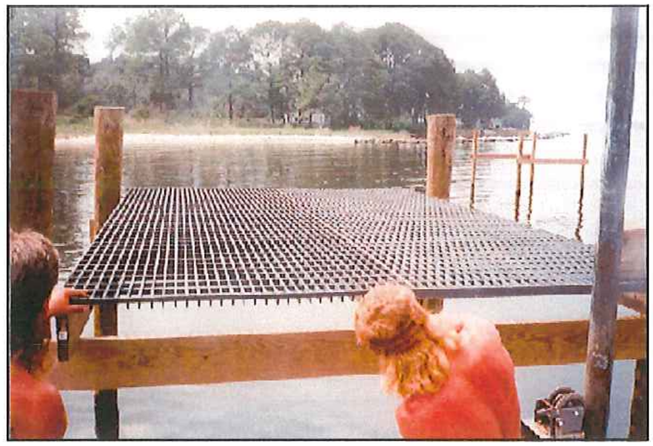


Figure 1. Experimental grid platform

Platform Construction. Two experimental platforms were constructed in April 1999 within the St. Andrew State Park in Panama City Beach, FL (Figure 1). Appropriate permits were obtained prior to platform construction. This site was chosen because of the presence of continuous beds of the seagrass *Thalassia testudinum* in a location that offered easy access for monitoring and data collection. Water depths at the site were approximately 3.5 ft MHW. Dimensions of each platform were 8 by 12 ft with the long axis oriented in an east-west direction. The two platforms were constructed at differing heights (4 ft and 5 ft above MHW) to compare the effects of dock height.

Based on the recommendations of dock construction guidelines used for Ono Island, AL, the following technique was adopted for piling installation during this study. All equipment was transported to the site on a shallow-draft barge. A pilot hole was created by using a 3-in. centrifugal pump run at low rpm and short, quick insertion of a hand-held 1-1/2-in.-diameter lance. The pile was sharpened to a point with a chain saw and the point then placed in the pilot hole. The pile was then driven to grade with a 350-lb drop hammer. Sediments that accumulated on top of the adjacent seagrasses were removed to prevent burial of the plants.

Immediately following piling installation, the distances between the piling and the nearest edge of the seagrasses were measured along the north, south, east, and west axis of each piling. After two growing seasons, these distances were re-measured in August 2000 to determine the extent of seagrass regrowth into the bare areas produced during piling installation.

Data Collection

In situ irradiance. Four spherical quantum light sensors (LI 193SA, LICOR, Inc.) were used to record simultaneous light data (LI 1000 data logger, LICOR, Inc.) in the air and underwater in shaded and unshaded plots. Shaded sensors were placed under the center of each platform. Underwater sensors were placed near the top of the seagrass canopy as described in Dunton (1994). Continuous light data were recorded for a total of 26 days during the 1999 growing season, and 37 days during the 2000 growing season (Table 1). The recorded light integration period was set at 15 min.

Table 1
Light Data Collection Periods

From	To
May 13, 2000	May 25, 2000
June 19, 2000	June 29, 2000
July 25, 2000	August 9, 2000
May 4, 1999	May 16, 1999
June 3, 1999	June 17, 1999

The percent surface irradiance for each underwater record was determined by comparison with the surface-mounted sensor at each dock. Mean daily percent surface irradiance (SI) values were calculated by averaging these values over a 10-hr period from 8:00 a.m. to 6:00 p.m. The relative amount of light reduction due to shading by the platform was also calculated for each using the difference between shaded and control stations.

Seagrass characteristics. Good water clarity at the site permitted estimates of seagrass percent cover and density using nondestructive visual sampling techniques. An initial site survey was performed to determine baseline conditions prior to platform construction; seagrass percent cover and shoot density were measured again in May and August 2000. Due to the large storage capacity of below-ground rhizomes of *Thalassia testudinum*, declines in shoot density may not become apparent until several months after the initiation of shading (Czerny and Dunton 1995). Therefore, estimates of shoot density and percent cover presented in this report were made at the beginning and end of the second growing season following platform construction. Mean seagrass percent cover was estimated using a series of twelve 2.7-ft^2 (0.25-m^2) plots. Mean shoot density was estimated from a series of ten 0.4-ft^2 (400-cm^2) plots beneath each platform. Mean shoot density and percent cover measured directly beneath each platform were compared with those of an unshaded control site at the same depth centered between the two platforms at a distance of approximately 50 ft.

Statistical Analysis

Changes in seagrass density and percent cover were analyzed with a two-factor analysis of variance (ANOVA) using season (spring and fall) and shade (5-ft platform, 4-ft platform, and control) as factors. If a significant interaction effect between season and shade was observed, a separate one-way ANOVA on shade was run for each season. This was necessary since it is not valid to interpret main effects in the presence of a significant interaction (Zar 1996). If a significant effect due to shade was observed, Tukey's multiple comparison was used to compare the various levels of shade. Data were tested for normality and homogeneity of variances prior to analysis.

RESULTS: Numerous studies have shown that seagrass biomass and density are decreased at lower light levels (Bulthuis 1983; Neveraskas 1988; Czerny and Dunton 1995). In this study, observed declines in seagrass density and percent cover were related to light reductions produced by dock structures.

Mean shoot density at unshaded sites was higher in August than in April (Figure 2); values ranged from approximately 454 shoots/m^{-2} to 789 shoots/m^{-2}. Mean shoot densities beneath the experimental platforms ranged from 377 shoots/m^{-2} to 454 shoots/m^{-2}. A significant effect due to shade was observed for both May ($p = 0.001$) and August ($p < 0.001$) sampling dates. In May 2000, seagrass densities beneath the 5-ft and 4-ft MHW platforms were 65 percent and 68 percent of the unshaded control, respectively. In August 2000, seagrass densities beneath the 5-ft and 4-ft MHW platforms were 52 percent and 58 percent of the unshaded control. Results of the Tukey's multiple comparison indicated that there was no significant difference in seagrass density beneath the 5-ft and 4-ft platforms, but that both were significantly lower than the unshaded control (Figure 2).

There were significant differences in seagrass percent cover due to both season ($p = 0.009$) and shade ($p < 0.001$). Seagrass percent cover at shaded sites was higher in May 2000 than in August 2000 (Figure 3). No interaction between season and shade was observed ($p = 0.214$). Tukey's

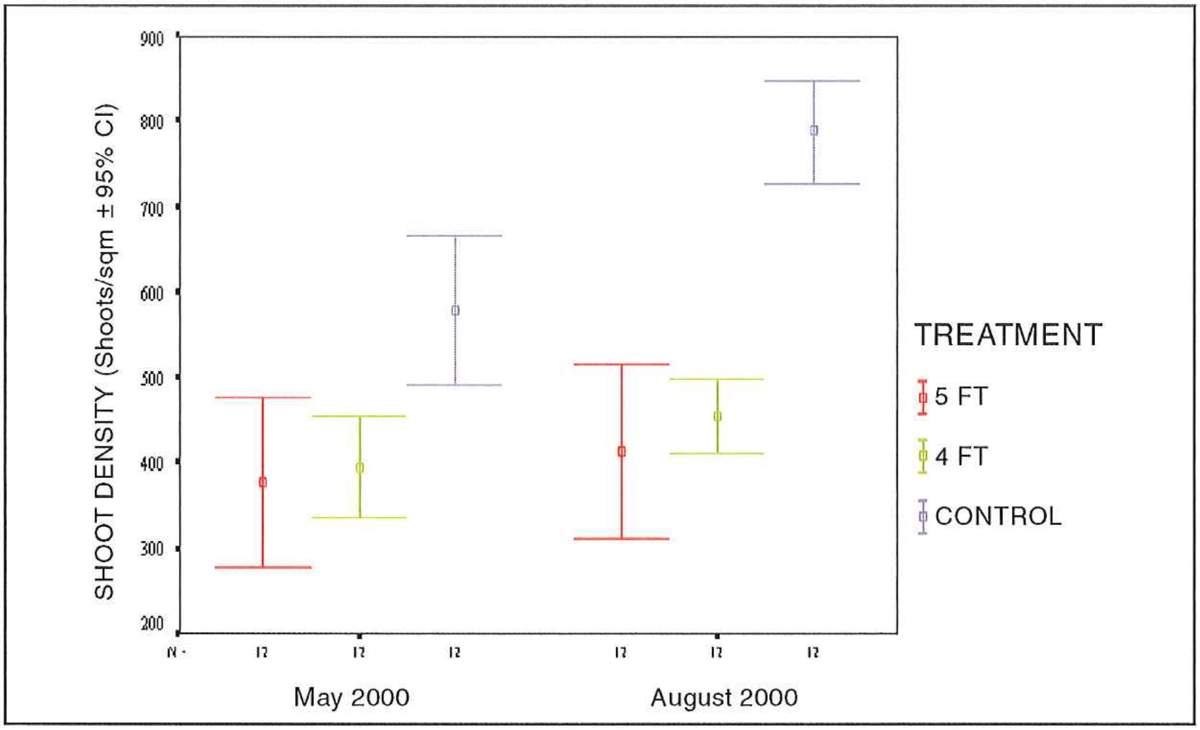


Figure 2. Comparison of shoot density between treatments at the beginning and end of the second growing season

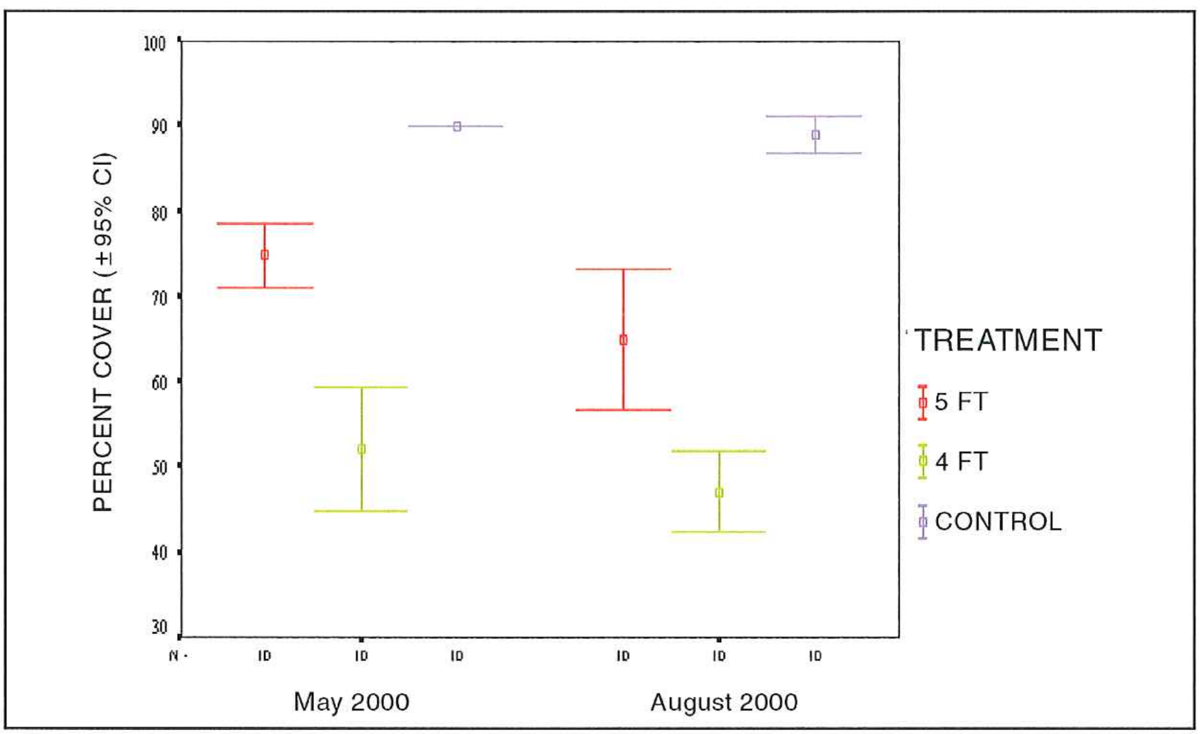


Figure 3. Comparison of percent cover between treatments at the beginning and end of the second growing season

multiple comparison indicated that seagrass percent cover in each of the three treatments (5-ft platform, 4-ft platform, and control) was significantly different from the others.

Previous studies have suggested that irradiance levels of 13-14 percent SI represent a critical threshold for seagrass survival. When light levels are at or below this level, complete elimination of seagrass cover results (Molnar, Markley, and Mayo 1989; Czerny and Dunton 1995; Lee and Dunton 1997; Shafer 1999). If light levels beneath the docks exceed this level, seagrasses are able to survive at reduced density and biomass (Shafer 1999). For example, shoot density of *Halodule wrightii* beneath docks in Perdido Bay, AL, was reduced by 40-50 percent at light levels of 16-19 percent SI (Shafer 1999).

In this study, light levels under the grid platforms were between 53 percent and 61 percent of the unshaded control (Table 2). These values are consistent with the manufacturer's rating of 50 percent light transmittance for this material. Mean irradiance levels at the unshaded control site ranged from 32.8 percent SI to 42.6 percent SI, with an average of 38.1 percent SI (Table 2). Light levels beneath the experimental grating platforms in St. Andrew Bay, FL ranged from a minimum of 16.6 percent to 27.8 percent (Table 2). Mean irradiance level at the 5-ft platform was 23.3 percent SI; mean irradiance level at the 4-ft platform was 20.8 percent SI. These levels are well above the critical threshold value of 14 percent SI; therefore, seagrasses could be expected to persist indefinitely under these lighting conditions, although biomass and density will be reduced compared to unshaded conditions.

Table 2
Monthly Summary of Measured Light Levels Under Shaded Platforms Compared to Unshaded Controls (hours 0800-1800)

	Mean Percent Surface Irradiance			Mean Percent of Unshaded Control	
Date	**5 ft**	**4 ft**	**Control**	**5 ft**	**4 ft**
May 1999	16.6	—	33.4	49.7	—
May 2000	27.8	22.0	42.5	65.1	51.9
June 1999	20.8	22.3	—	—	—
June 2000	27.3	20.9	39.3	66.3	56.1
July 2000	25.8	21.1	42.6	59.5	50.3
August 2000	21.5	17.8	32.8	65.1	54.8
Average	**23.3**	**20.8**	**38.1**	**61.1**	**53.3**

Seagrass regrowth around pilings. Even in the absence of dock platforms, the presence of pilings can induce changes in seagrass communities due to baffling of currents, sediment deposition, scouring, attraction of bioturbators, and leaching from chemically treated wood (Beal, Schmitt, and Williams 1999). Bare areas or clearings around each individual pier piling represent another source of seagrass loss associated with dock construction. The size of these bare areas ranged from 35-78 in. in diameter for some docks in St. Andrew Bay, FL, even though the age of these docks varied widely. Due to the close spacing of the individual pilings, these bare areas were often observed to overlap and coalesce into continuous expanses of bare sediments in the area beneath the docks. The subsequent accumulation of oyster and other shell debris around the base of the piling may limit the ability of the seagrasses to recolonize this area.

The method of piling installation used in this study reduces the physical removal and disturbance of the seagrasses. Measurements of the size of the bare areas surrounding each piling indicate that nearly complete regrowth of the seagrasses into the bare areas occurred within two growing seasons (Figures 4 and 5). One marine construction worker also noted that using the low pressure pump made the pilings steady faster, since less sand was disturbed. With the high-pressure pump, it was necessary to hold the piling in place longer and repack sand around the piling to steady it.[1]

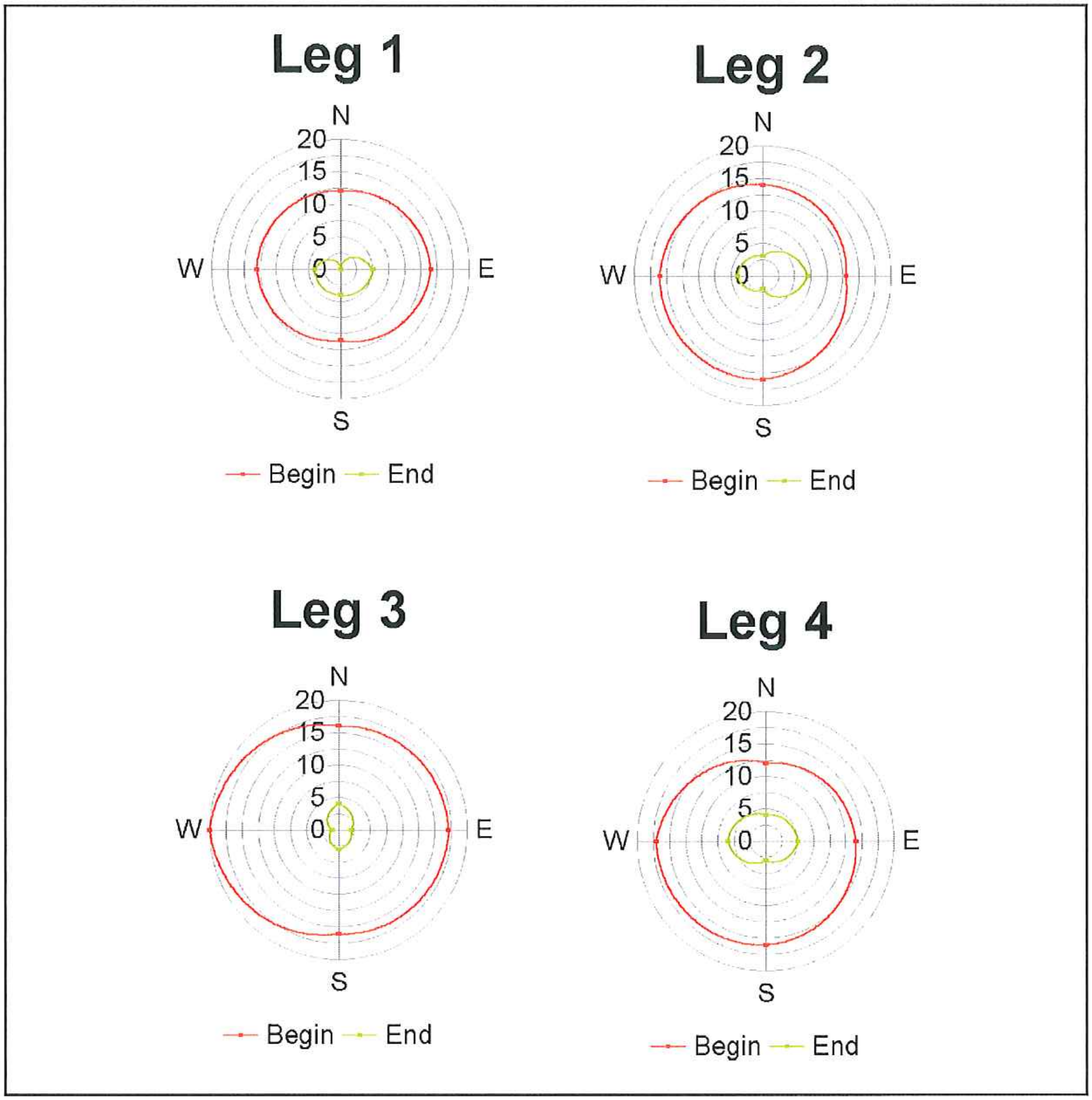


Figure 4. Changes in size of clearing around each leg of 4-ft platform (units: inches)

1 Personal Communication, 1999, R. J. Gorman, Inc., Panama City, FL.

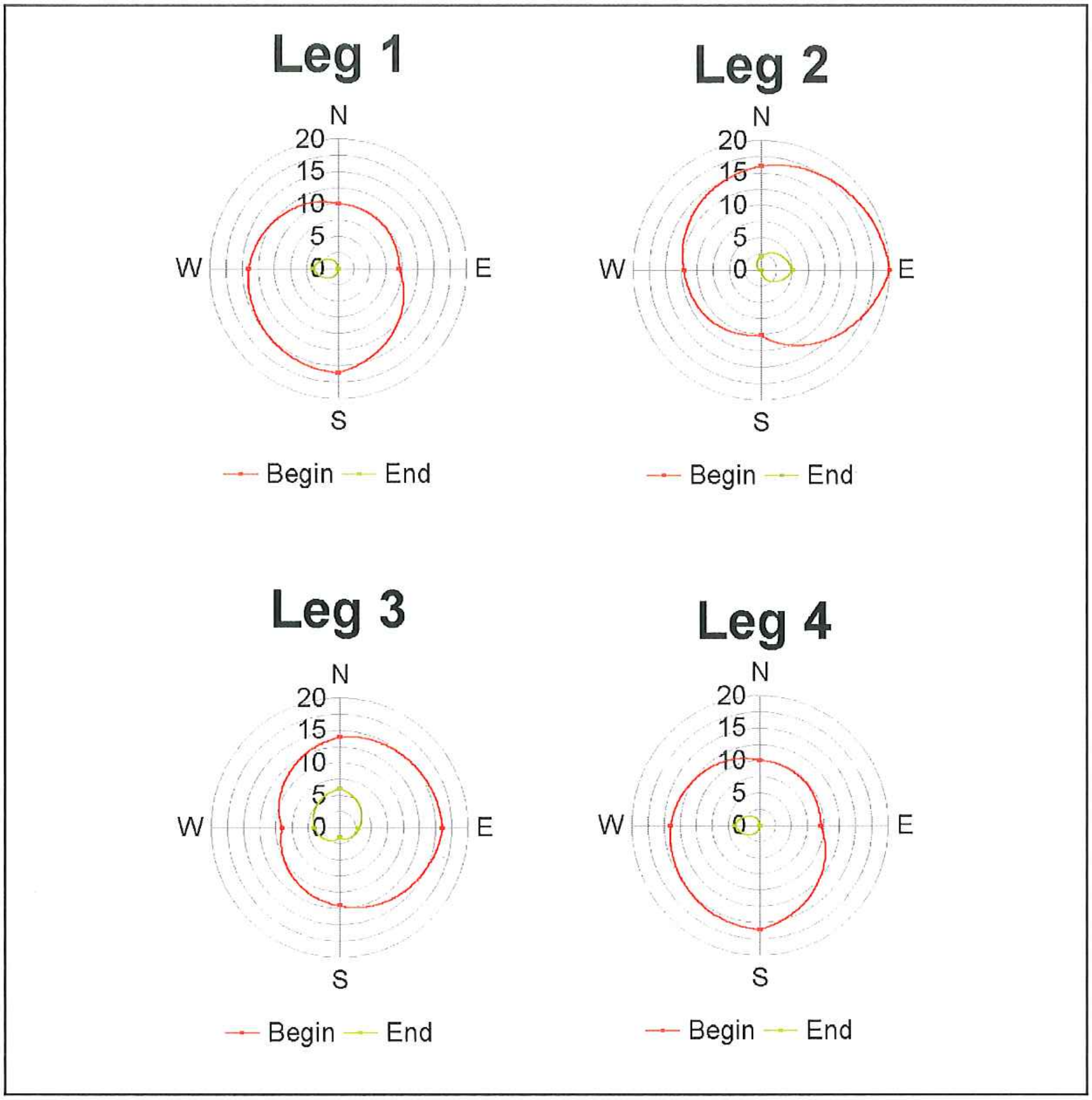


Figure 5. Changes in size of clearing around each leg of 5-ft platform (units: inches)

Site inspections of other docks constructed using this method of piling installation confirm that a low-pressure pump results in little to no sand deposition around the pilings and the remaining seagrasses around the pilings looked healthy and had good growth around the piling.[1] These results indicate that if used with care, this method of piling installation will reduce the area of seagrasses impacted compared to the alternative method of using a high-pressure jet pump.

Ecological implications. Loss of seagrass cover through shading, piling installation, or other means converts formerly vegetated areas of bay bottom into unvegetated areas. Total abundance and

1 Personal observation, 1999, J. Robinson, Fishery Biologist, National Marine Fisheries Service, Panama, FL.

species richness of fishes is typically lower in unvegetated areas adjacent to seagrass (Bell and Pollard 1989; Connolly 1994). At the levels of shading produced by the fiberglass grating, seagrasses are not eliminated, but density and percent cover are reduced compared to adjacent unshaded areas.

The ecological significance of a reduction in total density or percent cover is difficult to assess. Numerous studies have observed that total abundance of organisms is greater in areas with greater structural complexity (higher density) (Adams 1976; Heck and Wetstone 1977; Orth and Heck 1980; Gore et al. 1981; Leber 1985; Bell and Westoby 1986a; Williams, Coen, and Stoelting 1990). This difference has been attributed to reduced predation and/or habitat selection. However, there is compelling evidence to suggest that over larger spatial scales, there is very little, if any, correlation between seagrass density and total abundance and species richness (Bell and Westoby 1986b; Worthington et al. 1992). Individual species may respond positively, negatively, or not at all, to reduced seagrass density (Bell and Westoby 1986a; Horinouchi and Sano 1999). Bell and Westoby (1986b) suggest that total abundance and species richness in seagrass beds are ultimately controlled by larval supply, and that larvae do not discriminate among beds based on density when they settle. Although individuals do not leave a bed soon after settlement, they may redistribute themselves within a bed to those areas with a micro-climate more favorable to survival (Bell and Westoby 1986b).

Economic considerations. The fiberglass grating possesses the strength and safety characteristics necessary for dock construction and is available from several different manufacturers in a variety of opening sizes and thicknesses. A cost comparison indicates that use of grating material may increase construction costs. In the St. Andrew Bay area, construction of a 4-ft by 8-ft section of wooden deck, including materials and labor, is estimated to cost around $400; a fiberglass grid section of the same size is estimated to cost around $800.[1] Other studies report that costs may be comparable, since labor costs are greatly reduced for fiberglass grating dock construction (Beal, Schmit, and Williams 1999). Considerable savings could be achieved if only those sections of the dock or terminal platform directly over the seagrasses are built using the grating materials. Even if the initial cost for grating is higher, it may be more cost-effective in the long term because it requires no maintenance and the open grid is more likely to remain intact during the storm surge associated with hurricanes.

Summary and conclusions. Within the last few years, there has been a growing interest in the development of dock construction guidelines that will minimize the loss of seagrasses. In addition to the loss of seagrasses caused by shading, loss of seagrass cover occurs due to propellor scarring (Burdick and Short 1995; Loflin 1995) and piling installation. This study has demonstrated that: 1) the use of fiberglass grating to increase light transmission should reduce the amount of seagrass loss due to shading by docks and terminal platforms, and 2) the method of piling installation used in this study minimizes the physical destruction and removal of seagrasses, and resulted in nearly complete regrowth of the bare area by the end of the second growing season. Although total percent cover and density are reduced somewhat, the ecological consequences of this reduction in the small area beneath the docks are not likely to be significant. More importantly from an ecological

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1 Personal Communication, 1999, R. J. Gorman, Inc., Panama City, FL.

perspective, these alternative construction methods reduce patchiness and fragmentation of seagrasses, and contribute to maintaining the integrity of the seagrass beds.

ACKNOWLEDGMENTS: Completion of this project was made possible through the cooperative efforts of federal and state agency representatives and members of the private sector. Initial WRAP funding was provided by U.S. Army Corps of Engineers Headquarters, Regulatory Office. The construction of the experimental platforms was co-sponsored by the U.S. Army Engineer District, Jacksonville; U.S. Fish and Wildlife Service; and National Marine Fisheries Service. Three fiberglass grid panels used in construction of the experimental platforms were provided by ACR Process Equipment, Inc., in Lake Mary, FL. A local marine contractor (Bob Gorman, Inc.) donated time and labor for platform construction. Public awareness signs attached to each platform were produced at cost by the Bay County Board of County Commissioners.

ADDITIONAL INFORMATION: This information does not constitute an endorsement or advertisement for any particular provider and is provided as an example for use by those interested in obtaining these materials for dock construction. The fiberglass grate panels used in this study are manufactured by SeaSafe (Lafayette, LA; phone: 1-800-326-8842). Similar panels are manufactured by several other companies, including ChemGrate (1-800-527-4043). Panels are available in a variety of sizes and thicknesses. For safety, an anti-slip texture is integrally molded into the top surface. The manufacturer or local distributor should be consulted to ensure that the load-bearing capacity of the selected product is sufficient to support the intended purpose. Contact the manufacturer(s) for product specifications and a list of regional distributors.

POINTS OF CONTACT: For additional information, contact Deborah J. Shafer (601-634-3650, *Deborah.J.Shafer@erdc.usace.army.mil*), Engineer Research and Development Center, or the Program Manager of the Wetlands Regulatory Assistance Program, Dr. Russell F. Theriot (601-634-2733, *Russell.F.Theriot@erdc.usace.army.mil*). This technical note should be cited as follows:

> Shafer, D. J., and Robinson, J. (2001). "An evaluation of the use of grid platforms to minimize shading impacts to seagrasses," *WRAP Technical Notes Collection* (ERDC TN-WRAP-01-02), U.S. Army Engineer Research and Development Center, Vicksburg, MS. *www.wes.army.mil/el/wrap*

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APPENDIX A
SUMMARY OF RECOMMENDATIONS FOR DOCK DESIGN AND CONSTRUCTION TO MINIMIZE SEAGRASS SHADING IMPACTS

GENERAL RECOMMENDATIONS FOR DOCK DESIGN: **Dock height, orientation,** and **width** have been identified as the most important factors affecting the survival of seagrass under docks (Burdick and Short 1999).[1] Although minor factors such as plank spacing may also affect light levels beneath the docks, a recent study suggests that plank spacing is of minimal importance.[2] Species-specific differences in light requirements as well as environmental factors such as water clarity, water depth, and tidal range will also affect the ability of the plants to survive under docks. These factors should be considered in the development of guidelines to minimize dock shading impacts to seagrasses. Of these, dock height is the most critical. For fixed structures, height requirements are likely to vary from region to region depending on tidal range. Floating docks generally result in complete elimination of seagrass cover (Burdick and Short 1999), and should be avoided if possible. A north-south orientation provides a more favorable light environment for seagrass growth than an east-west orientation. Most docks are constructed perpendicular to shore, however, and property owners may have little choice concerning the orientation of the dock. Since the detrimental effects of poor orientation (east-west) may be at least partially offset by increased height (Burdick and Short 1999), higher minimum height requirements for docks oriented in an east-west direction could enhance seagrass survival. A narrow dock allows more light to be transmitted beneath the structure, particularly in the early morning and late afternoon hours. The construction of shared dock facilities would also reduce potential cumulative impacts from multiple dock structures. This concept could be promoted through the use of some type of incentives to property owners.

Using a combination of modeling and empirical data collected from several sites along the Massachusetts coast, the following recommendations for dock design were developed by Burdick and Short (1999). Docks less than 2 m wide, oriented within 10 deg of north-south, and at least 3 m above the bottom will have the least impacts to seagrasses. An additional 0.4 m in height should be added for each additional meter increment in width. If the alignment is more than 10 deg from north-south, the dock should be 0.2 m higher for each additional 10-deg increment.

REGULATORY GUIDELINES FOR DOCK CONSTRUCTION: The following guidelines are presented as an example of dock construction guidelines currently in use in the northern Florida panhandle. These were developed for single-family residential docks by an interagency team composed of representatives from the U.S. Army Engineer District, Jacksonville; the National Marine Fisheries Service (Panama City, FL); the U.S. Fish and Wildlife Service (Panama City, FL); and the Florida Department of Environmental Protection, as well as members of the private sector marine construction industry. Technical assistance was provided by the U.S. Army Engineer Research and Development Center under WRAP Request Number 98-13. These guidelines were based on a literature review and limited field surveys in St. Andrew Bay and St. Joseph Bay, FL.

1 References cited herein are located at the end of the main text.

2 Unpublished data. (1998). Deborah Shafer, Research Marine Biologist, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

These guidelines are being considered for use statewide by the Jacksonville District Regulatory Division as part of the State General Permit. They could be adapted for use in other coastal areas where seagrasses may be impacted by dock construction.

1. **Avoidance:** The pier shall be aligned to minimize the size of the footprint over seagrass.

2. **Orientation:** Over seagrass portions of the dock or terminal, platform shall be oriented in a north-south orientation to the maximum extent that is practicable.

3. **Pier height** shall be a minimum of 5 ft above MHW as measured from the top surface of the deck.

4. **Pier width** shall be a maximum of 4 ft. The pier may be constructed with railings. A turnaround area is allowed for piers greater than 200 ft in length. The turnaround is limited to a section of the pier no more than 10 ft in length and no more than 6 ft in width. The turnaround shall be located at the midpoint of the length of the pier.

5. **Pilings:** The spacing of the pilings through seagrass shall be a minimum of 10 ft. They shall be installed in a manner that will not result in the formation of large rings of bare sediment around each pile. Any material deposited in seagrasses around the piling should be immediately removed.

6. **Board Spacing:** Gaps between deckboards shall be a minimum of 1/2 in.

7. **Terminal Platforms:** If possible, terminal platforms shall be placed in an area devoid of seagrass. This will avoid shading impacts as well as prop scarring.

   a. **Plank construction:** The size of the platform shall be limited to 120 ft^2, not including catwalks. The configuration of the platform shall be a maximum of 6 ft by 20 ft, of which a maximum 4-ft-wide by 20-ft-long section shall conform to the 5-ft height requirement. A narrow 2-ft section may be placed 3 ft above MHW to facilitate boat access. The 2-ft section shall be cantilevered.

   b. **Grated deck construction:** The size of the platform shall be limited to 160 ft^2, not including catwalks. The grated deck material must be approved by the Corps. The configuration of the platform shall be a maximum of 8 ft by 20 ft, of which a maximum 5-ft-wide by 20-ft-long section shall conform to the 5-ft height requirement. A narrow 3-ft section may be placed 3 ft above MHW to facilitate boat access.

8. **Boatslips:** A single, uncovered boatslip is allowed. A narrow catwalk (2-ft wide) may be added to facilitate boat maintenance along the outboard side of the boatslip and a 4-ft-wide walkway may be added along the stern end of the boatslip, provided all such walkways are elevated at least 5 ft above MHW. The terminal end is designed to accommodate a boat lift, although the boat lift is not mandatory. The 2-ft-wide catwalk shall be cantilevered from the outboard mooring pilings (spaced no closer than 10 ft apart).

Anejo 2

Help Protect Seagrasses

About FWRI
Florida Manatee
Florida Panther
Freshwater
GIS and Mapping
Habitat
Coral Reefs
Freshwater Plant Research and Monitoring
Seagrasses
Seagrass Information
Seagrass Projects
Seagrass Publications
Upland Habitat Research
Coastal Wetlands
Red Tide
Saltwater
Wildlife

While seagrasses can be damaged by random and unpredictable natural phenomena, following several simple steps can prevent the damage caused by humans.

Each species of seagrass recovers from damage at a different rate, but in general, recovery can take anywhere between a few months to several years. Injuries to leaves and stems are less detrimental than damage to the underground root system, from which seagrasses may not be able to recover.


Curtis Kruer Photo

As Florida's population grows, the number of boats on the water also increases. The negative effects of careless boating on seagrasses are becoming more pronounced, especially in nearshore communities and popular boat access areas. When a boat's propeller

Publications

cuts through seagrasses, it fragments the bed and can restrict the movement of the species found in that habitat. This loss is detrimental to not only the animals that depend on seagrasses, but to the economy of the area and the state of Florida. The institute's 1995 publication, Scarring of Florida's Seagrasses: Assessment and Management Options, analyzes damage resulting from propeller scars in Florida's seagrass beds. This document includes many GIS-based maps documenting areas where scarring is present, information about the recovery of seagrasses after prop scar damage, and management options that address the problem.

Another important factor to consider when boating is what can happen to personal property when grounding in a shallow bottom area or seagrass bed: vessel engines, hulls, and propellers can be damaged. In addition to towing fees, groundings that cause damage to seagrasses can result in both federal and state fines. The economic and environmental importance of seagrasses has led to regulations that can hold boaters that scar seagrass beds responsible for the costs of assessing damage, restoring habitat, and long-term monitoring of the restored area.

The easiest way to protect seagrasses is by preventing damage in the first place. The tips that follow on how to protect seagrasses are taken directly from the institute's publication, Florida's Seagrass Meadows.

- **Be Aware:** If you live near the coast or along a river, be careful when applying fertilizers and pesticides to your lawn. Use only the amount of fertilizer required and consider using a slow-release fertilizer. Gutters and storm drains transport excess lawn chemicals to the water.
- **Read the Waters:** Wear polarized sunglasses when boating to reduce the surface glare to help you see shallow areas and seagrass beds. Polarized sunglasses can also help you see and avoid manatees and underwater hazards.
- **Know Your Boating Signs and Markers:** Operate your boat in marked channels to prevent running aground and damaging your boat and seagrass beds. Know the correct side to stay on when approaching channel markers. Learn the shapes and markings of signs warning boaters of dangerous shallows and areas where boats are prohibited by law.
- **Know Your Depth and Draft:** When in doubt about the depth, slow down and idle. If you are leaving a muddy trail behind your boat, you are probably cutting seagrass. Tilt or stop your engine if necessary. If you run aground, pole or walk your boat to deeper water. Never try to motor your way out. This will cause extensive damage to seagrass and may harm your motor. Know the times for your low and high tides.
- **Be On the Lookout:** Docks, boathouses, and even boats can block sunlight from reaching the seagrass below. When building or repairing a dock, consider building the dock five feet above the water and using grating rather than planks. Extend the dock to deeper water so your boat does not shade seagrass.
- **Study Your Charts:** Use navigational charts, fishing maps, or local boating guides to become familiar with waterways. These nautical charts alert you to shallow areas so

you don't run aground and damage seagrass. Know before you go.

FWC Facts:
Whooping cranes eat aquatic invertebrates (insects, crustaceans and mollusks), small vertebrates (fish, reptiles, amphibians, birds and mammals), roots, acorns and berries.

Learn More at AskFWC

Anejo 3

TORRES & GARCÍA, P.S.C.
ATTORNEYS AND COUNSELORS AT LAW
ENVIRONMENTAL, NATURAL RESOURCES, AND LAND USE

FRANCIS TORRES-FERNÁNDEZ
BRAULIO GARCÍA-JIMÉNEZ
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PO BOX 19539
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705 FERNÁNDEZ JUNCOS AVENUE
SAN JUAN, PUERTO RICO 00907-4226
TELEPHONE 787-721-8220
TELECOPIER 787-721-8223

2014 DEC 12 P 3:28

December 12, 2014

HAND DELIVERY

Mrs. Deborah J. Cedeño-Maldonado
Project Manager
Antilles Regulatory Section
U.S. Army Corps of Engineers
400 Fernández Juncos Avenue
San Juan, Puerto Rico 00901-3299

Re: SAJ-1988-57033 (LP-DCM)

Dear Mrs. Cedeño:

Reference is made to the U.S. Army Corps of Engineers ("USACE") letter dated October 29, 2014 with regards to the Joint Permit Application number 1385 filed by the Club Seabourne Hotel for reconstruction and expansion of its existing wooden pier. The USACE letter requests additional information necessary for evaluation of the proposal. On November 26, 2014, a 20 day extension was approved for the submittal of the requested information.

The requested information is included below.

a. Project Description - The pilings supporting the existing pier will be removed and replaced with new pilings for the following reasons: 1) The existing pilings do not have the required length for the proposed pier height of 4 ft. above MHW; 2) The existing pilings do not have the 10 ft. separation between each other required by the pier guidelines; and 3) the pilings are not in the required condition to support the new pier structure. With regards to the piling installation methodology, it will be "pile driving using a mechanical gravity hammer" and as indicated in the Avoidance and Minimization section of the Project Description Memorandum, a shallow-draft barge will be used during the project construction activities.

b. Project Drawings – Please refer to the enclosed modified drawings (**Attachment 1**) showing the dimensions of existing and proposed structures, the mean high tide line, the approximate water depth along the footprint of the pier based on the bathymetry report included as Attachment 5 of the Joint Permit Application and the proposed height of the pier from the sea bottom and the water surface.

c. Mailing Addresses - Enclosed please find the mailing addresses of the Culebra public library and postal office:

Culebra Library
P.O. Box 840
Culebra, PR 00775

Culebra Mail Station
General Delivery
#26 Pedro Márquez St.
Culebra, PR 00775

d. Proposed Special-Use Buoys – The reasoning/basis for the proposal of special marker buoys and selection of the point between Ensenada Fulladoza and Dakity Cove came from discussions at a meeting with Ms. Lisamarie Carrubba, Ph.D. of the National Marine Fisheries Service. Particularly the notion that the construction or improvement of a pier facility and installation of mooring buoys will increase the boat traffic in the area, although the proposed facilities will improve boat traffic and will prevent impacts to the seagrass floor. Hence, the proposal of the buoys to mark the referenced point, which is a shallow and seagrass covered area that already shows propeller scarring in aerial photographs.

However, taking in consideration that the proposed location is not within the immediate project area and that there are opportunities for more protection of shallow seagrass areas within Ensenada Fulladoza, particularly in the vicinity of the proposed project, an alternate location is proposed for the two special marker buoys (**Attachment 2**). The alternate locations showed in Attachment 2 will serve to warn general boat traffic in Ensenada Fulladoza as well as Club Seabourne pier users about the shallow seagrass areas in those locations and will certainly complement the educational program to be implemented by Club Seabourne. Alternate locations could be discussed the National Marine Fisheries Service.

The type of special marker buoy is the commonly used for seagrass protection projects as illustrated in the attached diagram taken from the report "Beds, Boats, and Buoys: A Study in Protecting Seagrass Beds from Motorboat Propeller Damage" (**Attachment 3**). The buoys could be identified with the following message: "Cuidado – Area de Yerbas Marinas" or any other message suggested by the USACE or the National Marine Fisheries Service.

If you should need additional information regarding this matter or would like to further discuss the information provided please contact the undersigned at (787) 721-8220.

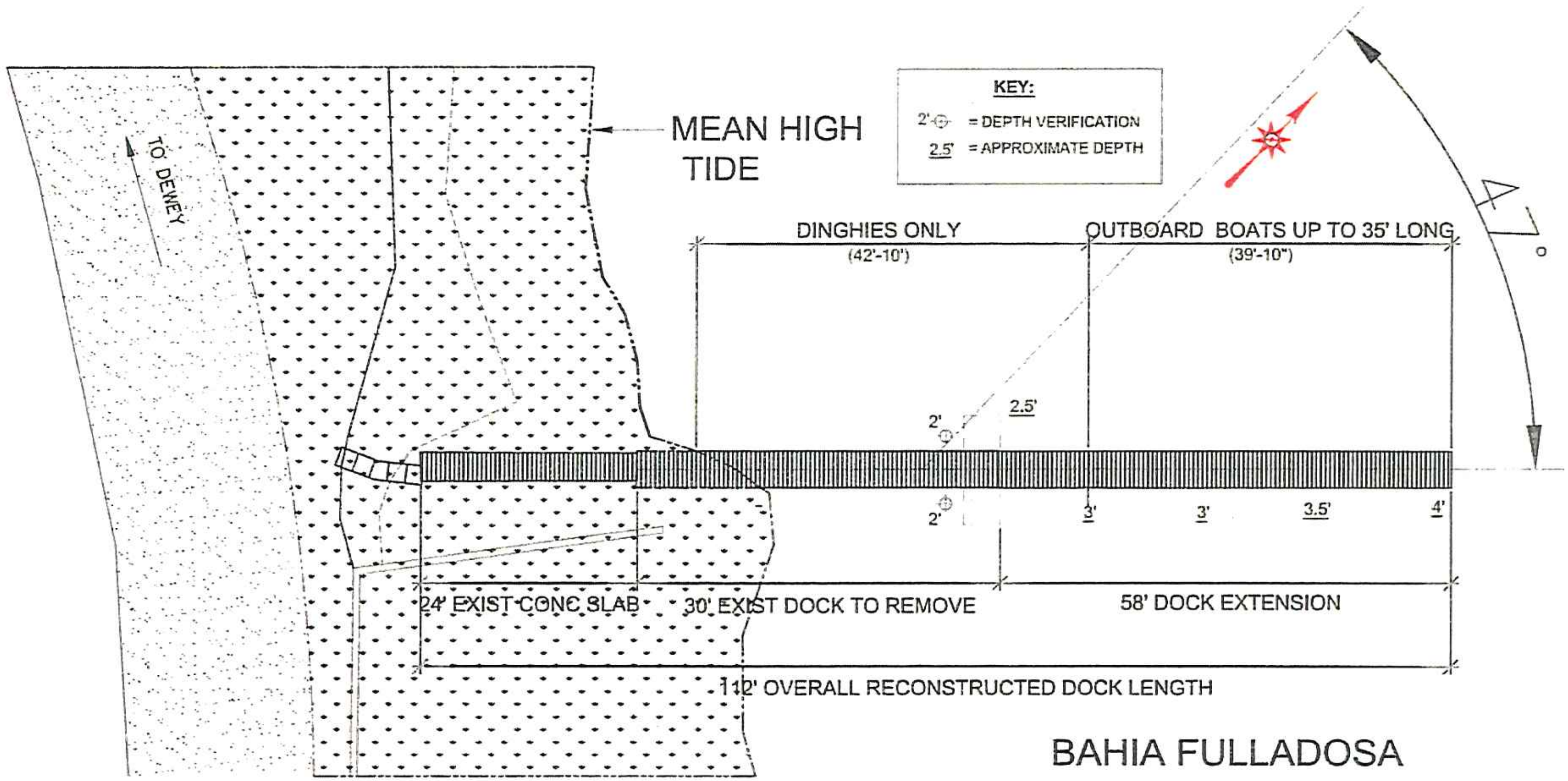
Cordially,

Raúl Negrón-Casasnovas

Attachments

c: Jose Martí

ATTACHMENT 1



SHEET 1 - SITE PLAN

NTS

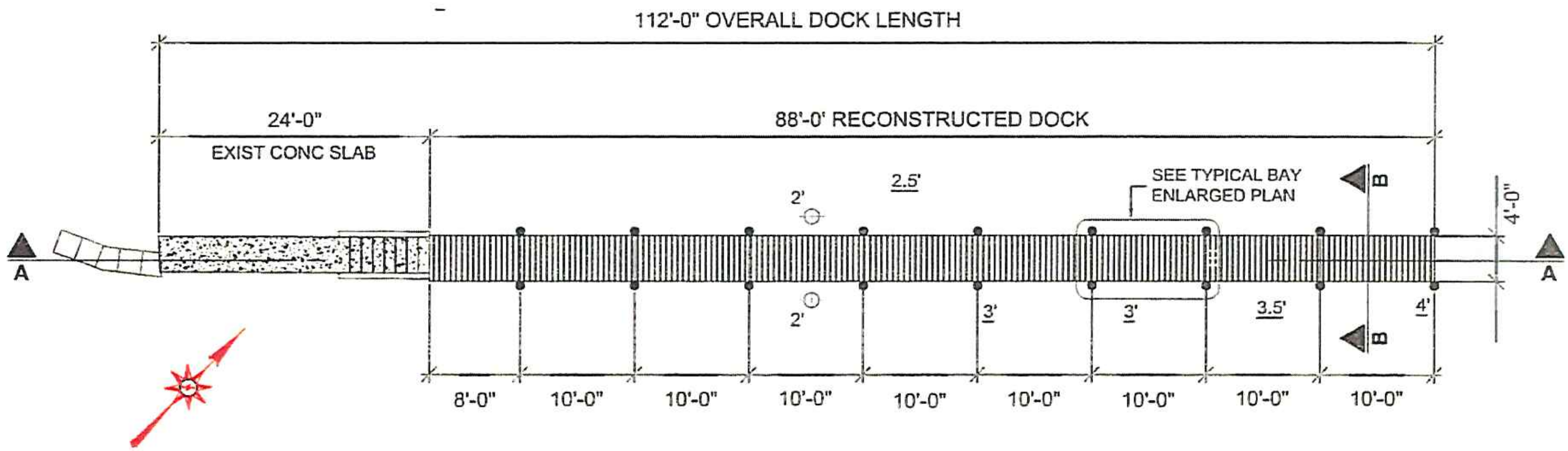
Joint Permit Application # SAJ-1988-57033 (LP-DCM)

Club Seabourne	Reconstruction of a Boat Pier, Ensenada Fulladosa Club Seabourne Boutique Hotel Culebra, Puerto Rico	**Arturo J. García, AIA** Licensed Architect ICSC Certified Development, Design and Construction Professional ICSC Certified Retail Property Executive PO Box 191707, San Juan, PR. 00919-1707 • (747) 630-2372 • arturojgarcia@gmail.com	1/6

KEY:

2' ⊕ = DEPTH VERIFICATION

<u>2.5'</u> = APPROXIMATE DEPTH

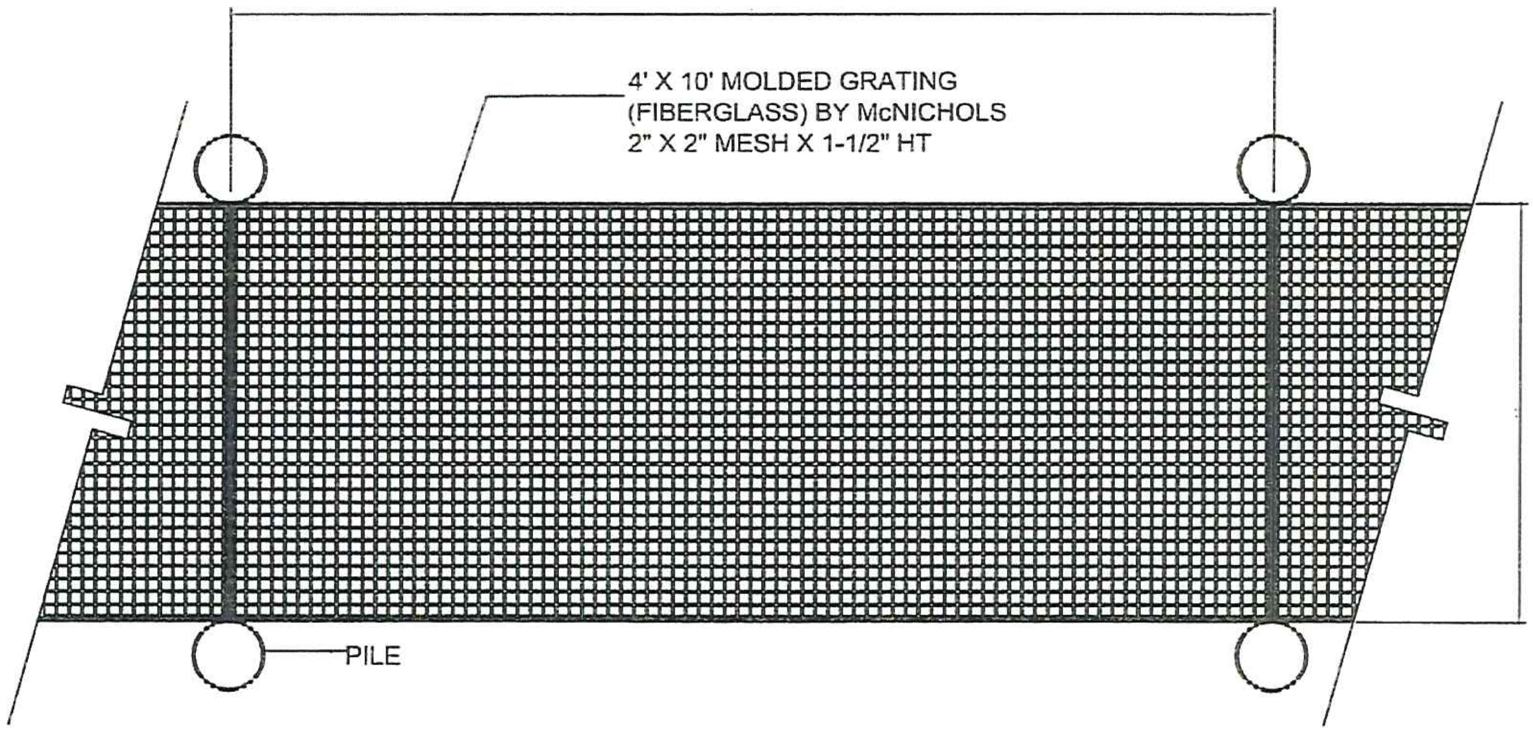


SHEET 2 - RECONSTRUCTED DOCK PLAN

NTS

Joint Permit Application # SAJ-1988-57033 (LP-DCM)

Club Seabourne	Reconstruction of a Boat Pier, Ensenada Fulladosa Club Seabourne Boutique Hotel Culebra, Puerto Rico	**Arturo J. García, AIA** Licensed Architect · ICSC Certified Development, Design and Construction Professional ICSC Certified Retail Property Executive	2 / 6

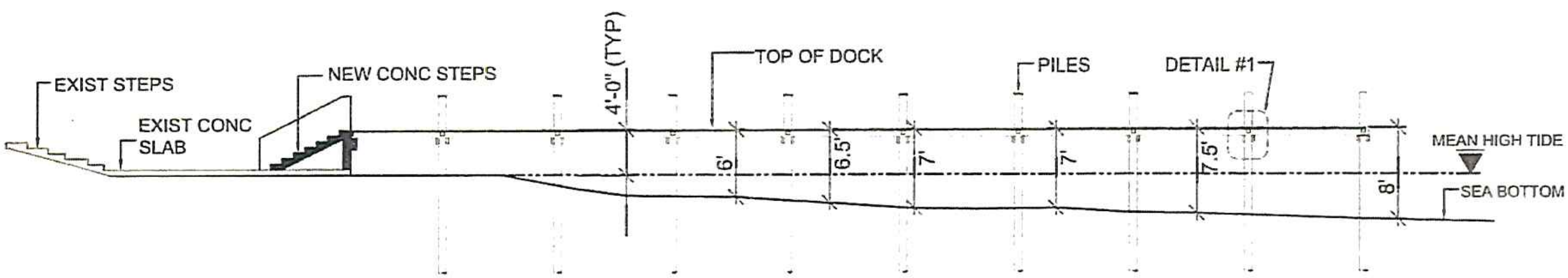


SHEET 3 - TYPICAL BAY ENLARGED PLAN

NTS

Joint Permit Application # SAJ-1988-57033 (LP-DCM)

Club Seabourne	Reconstruction of a Boat Pier, Ensenada Fulladosa Club Seabourne Boutique Hotel Culebra, Puerto Rico	**Arturo J. García, AIA** Licensed Architect / ICSC Certified Development, Design and Construction Professional ICSC Certified Retail Property Executive PO Box 191707, San Juan, PR, 00919-1707 • (787) 614-2372 • arturojgarcia@gmail.com	3/6

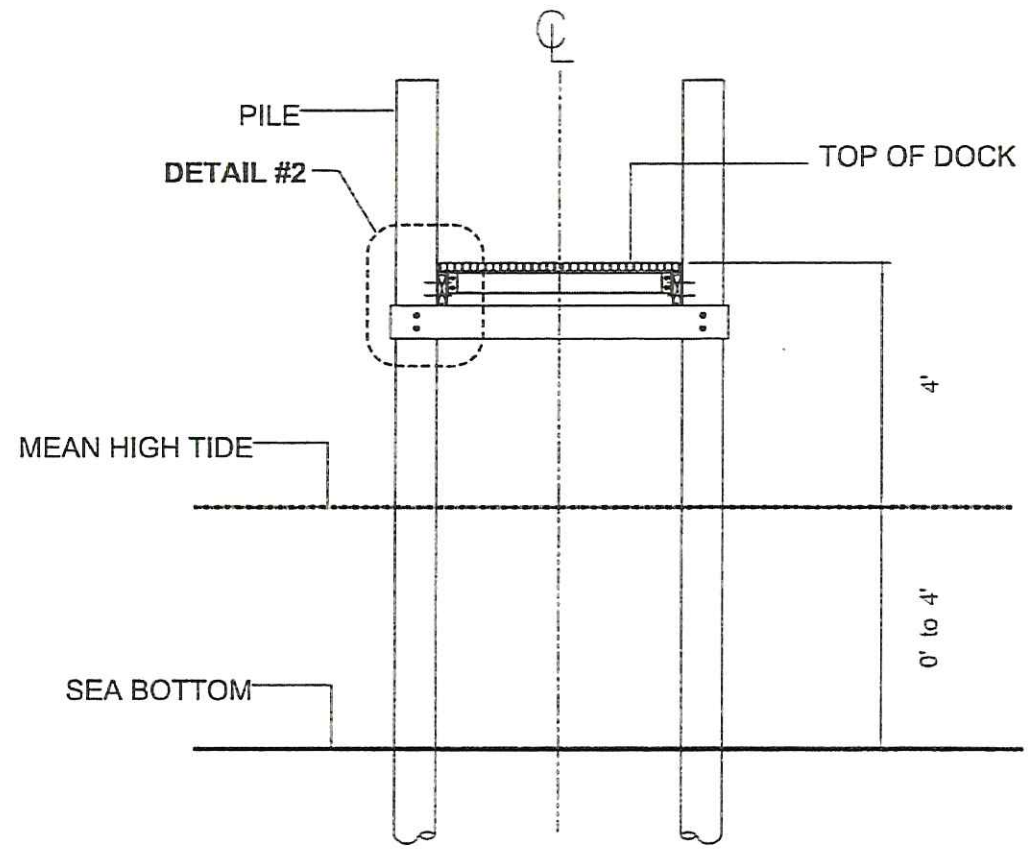


SHEET 4 - LONGITUDINAL SECTION A-A

NTS

Joint Permit Application # SAJ-1988-57033 (LP-DCM)

Club Seabourne	Reconstruction of a Boat Pier, Ensenada Fulladosa	Arturo J. García, AIA	4/6
	Club Seabourne Boutique Hotel Culebra, Puerto Rico	Licensed Architect · ICSC Certified Development, Design and Construction Professional ICSC Certified Retail Property Executive PO Box 191707, San Juan, PR, 00919-1707 • (787) 549-2372 • arturojgarcia@gmail.com	

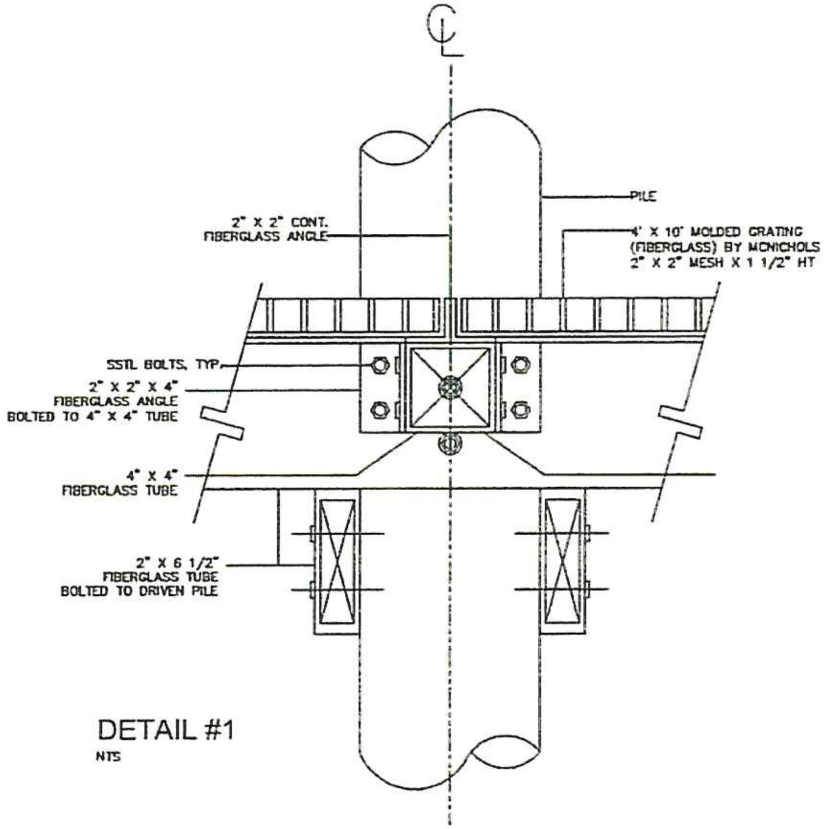


SHEET 5 - TRANSVERSE SECTION B-B

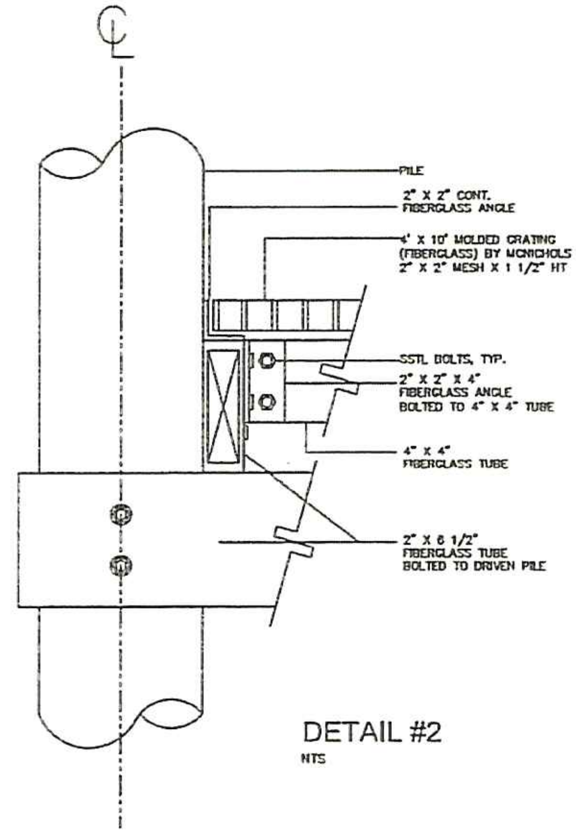
NTS

Joint Permit Application # SAJ-1988-57033 (LP-DCM)

Club Seabourne	Reconstruction of a Boat Pier, Ensenada Fulladosa	**Arturo J. García, AIA**	5/6
	Club Seabourne Boutique Hotel Culebra, Puerto Rico	Licensed Architect · ICSC Certified Development, Design and Construction Professional ICSC Certified Retail Property Executive PO Box 19170*, San Juan, PR. 00919-1707 • (787) 619-2372 • arturojgarcia@gmail.com	



DETAIL #1
NTS



DETAIL #2
NTS

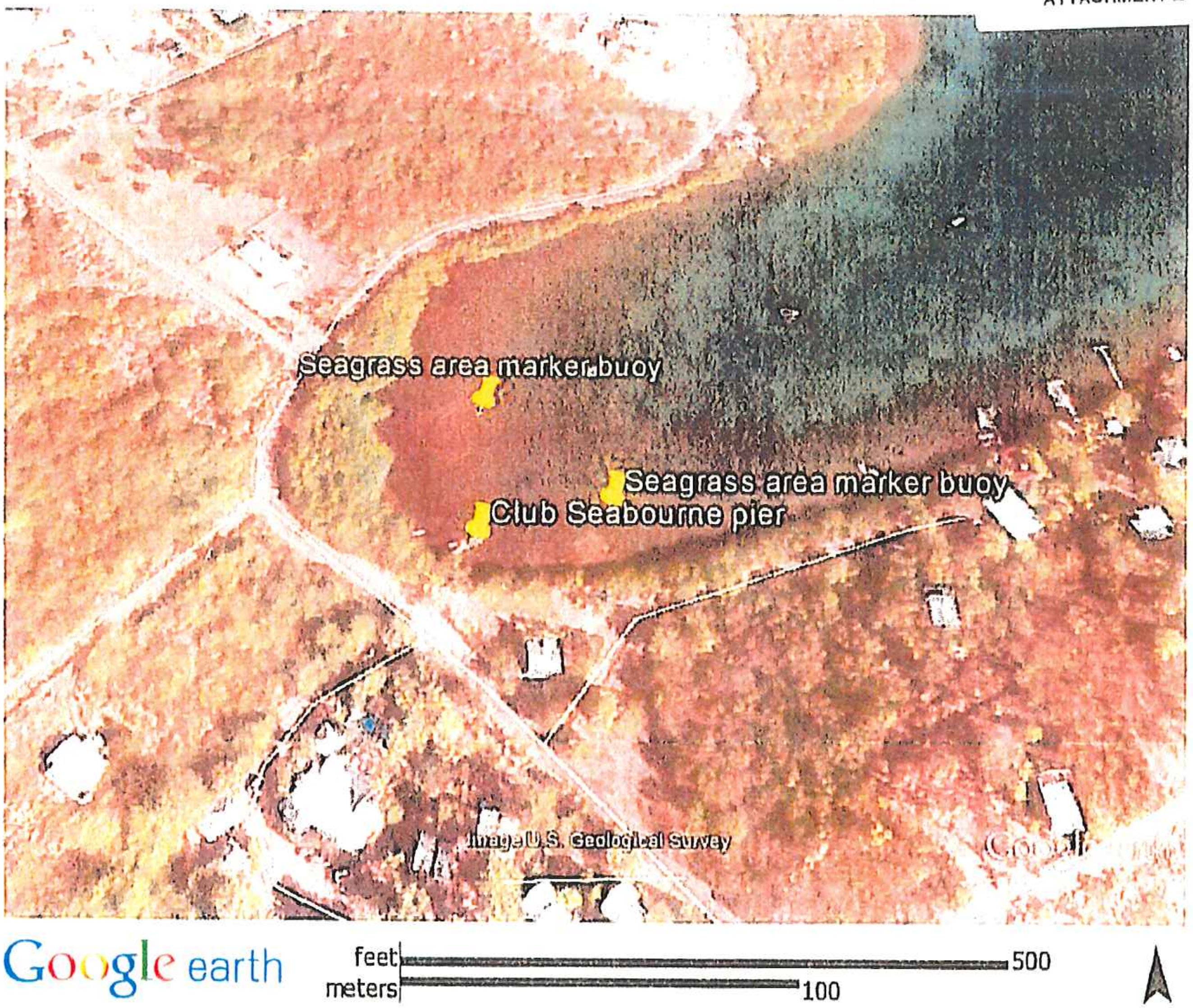
SHEET 6 - DETAILS

NTS

Joint Permit Application # SAJ-1988-57033 (LP-DCM)

Club Seabourne	Reconstruction of a Boat Pier, Ensenada Fulladosa	**Arturo J. García, AIA**	6/6
	Club Seabourne Boutique Hotel Culebra, Puerto Rico	Licensed Architect ICSC Certified Development, Design and Construction Professional ICSC Certified Retail Property Executive PO Box 191707, San Juan, PR. 00919-1707 • (787) 640-2372 • arturojgarcia@gmail.com	

ATTACHMENT 2



ATTACHMENT 3

BEDS, BOATS, AND BUOYS: A STUDY IN PROTECTING SEAGRASS BEDS FROM MOTORBOAT PROPELLER DAMAGE

Ruth Folit
Julie Morris
Environmental Studies Program Publication # 39
New College of University of South Florida
with the support of the New College Foundation, Inc.
Sarasota, Florida
June, 1992

Prepared as an Early Action Demonstration Project
for the Sarasota Bay Project
National Estuary Program
1660 Thompson Parkway
Sarasota, Florida 34236

Figure 8. Buoy and anchoring system

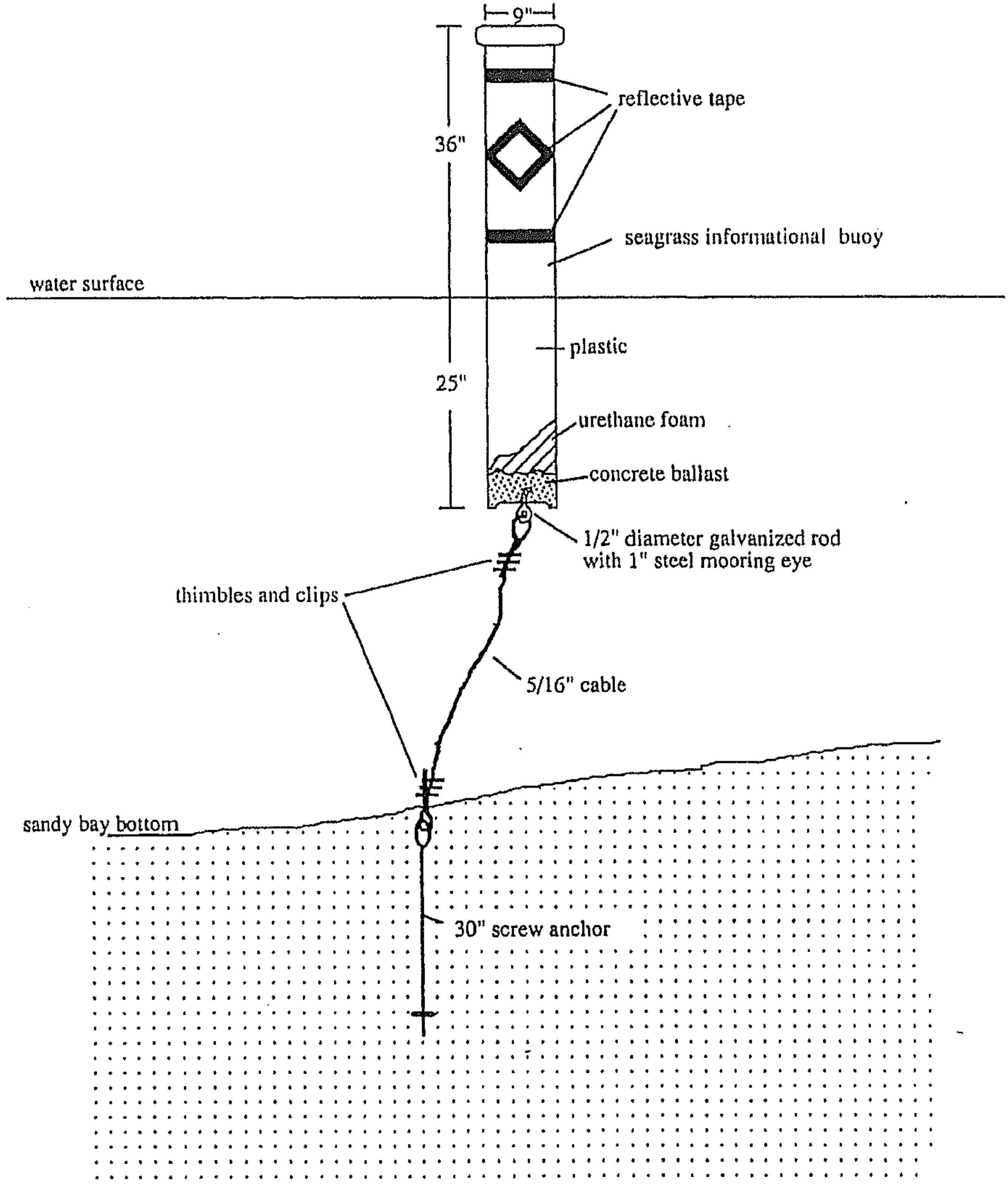
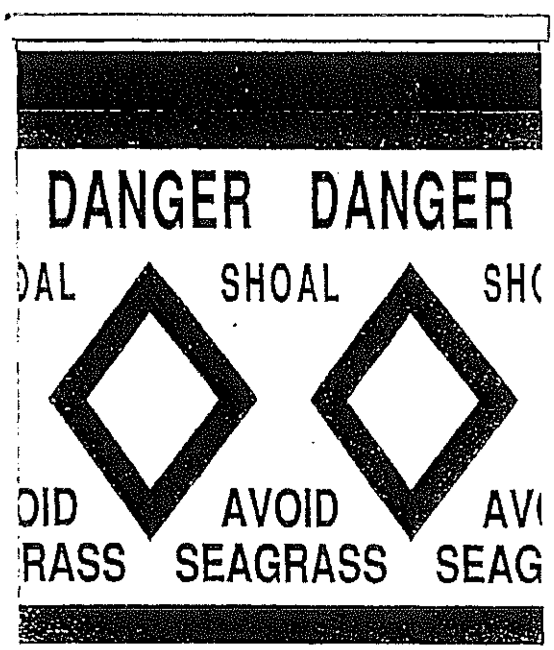


Figure 9. Buoy messages

City Island grass bed



Sister Keys and Big Pass grass bed