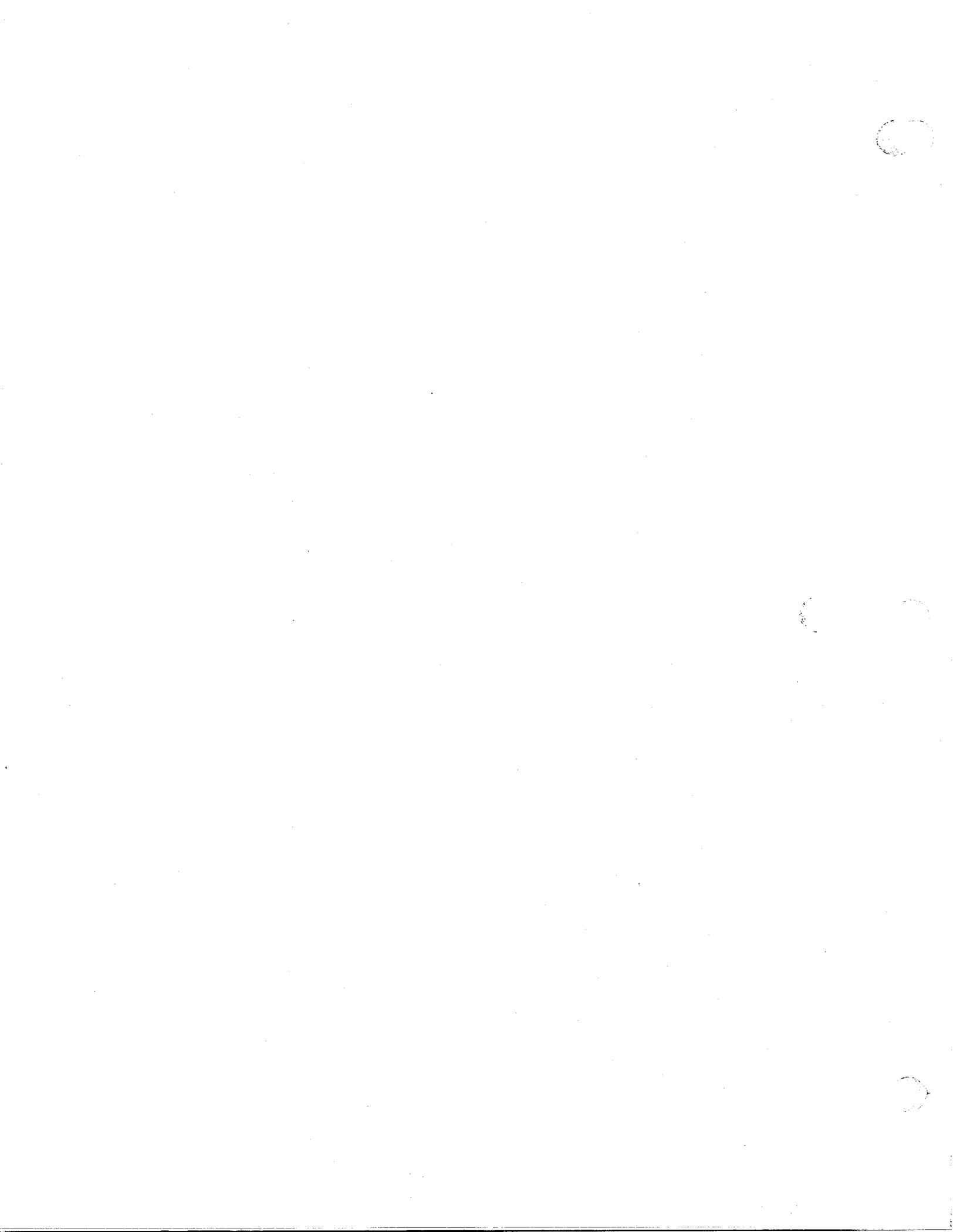


**APPENDIX H**

**CITY OF LAKE WORTH WETLAND RESTORATION PROJECT**



## APPENDIX H.

### CITY OF LAKE WORTH WETLAND RESTORATION PROJECT

#### SECTION 204

##### LOCATION

The proposed project is located on submerged lands within ownership of the City of Lake Worth in Palm Beach County, Florida. These submerged lands lie adjacent to the Lake Worth Municipal Golf Course (LWGC), located along the western shoreline of the Atlantic Intracoastal Waterway (IWW) south of the City of West Palm Beach (Figure 1). This portion of the IWW is situated within the salt water lagoon known as Lake Worth Lagoon, on the east coast of Florida. The LWGC is located approximately 10 miles south of Peanut Island.

##### PROJECT HISTORY

The LWGC has approximately 1.2 linear miles of shoreline along the western shore of the IWW. The existing upland portions of the property were created largely through historic dredging and filling of inter- and sub-tidal wetland resources. A substantial portion of the fill was likely generated through IWW construction and maintenance activities. These and other dredge and fill activities along the shoreline have resulted in a steep littoral profile, with elevations dropping quickly from 3.0 to -7.0 feet NGVD. This steep grade has minimized the area suitable for development of inter- and shallow sub-tidal resources such as mangroves, seagrasses, and oyster reefs. Open water dredge holes as deep as -23.0 FT NGVD currently exist, and depths below -12.0 FT NGVD are common at the project site. Approximately 3,850 of the existing 6,700 feet of adjacent inter-tidal and upland shoreline are fringed with three species of mangroves (red, black, and white), inter-mixed with the exotics Australian pine and Brazilian pepper. The existing LWGC shoreline has been retreating as a result of erosion from wind and wake generated wave energy.

##### PROPOSED WETLAND RESTORATION SCOPE OF WORK

Figure 2 shows the conceptual restoration plan for the LWGC. Features include: restoration of approximately 1.7 acres of existing mangrove fringe, creation of approximately 14.0 acres of new red mangrove wetlands, 2.0 acres of oyster reef, and 67.0 acres with bottom elevations of -6.0 ft. NGVD and shallower. All exotic plant species, as appropriate, on approximately 5 acres will be removed and chipped on site. There will be inter- and sub-tidal placement of approximately 965,000 yds<sup>3</sup> of spoil material, grading to wetland elevations, and placement of approximately 12,000 tons of 1-3 foot diameter limestone boulder rip-rap. Planting will consist of approximately 78,850 red mangroves (*Rhizophora mangle*), and approximately 14,000 plugs of

78,850 red mangroves (*Rhizophora mangle*), and approximately 14,000 plugs of smooth cordgrass (*Spartina alterniflora*). Planting will be accomplished with the red mangroves being placed 3 feet on center, and the smooth cordgrass placed 2 feet on center around the wetland perimeter. Figures 3, 4, and 5 depict typical cross-sections of the completed project. Table 1 itemizes the projected \$8,007,080 construction cost.

## PROJECT BENEFITS

Restoration of submerged lands along the LWGC will help reverse the historical trend in the Lake Worth Lagoon area of inter- and sub-tidal wetland habitat loss. The planting of mangroves will help to reestablish wildlife habitat and partially offset the effects of shoreline bulkheading that has occurred in Lake Worth Lagoon over the years. Mangroves help stabilize sediments and filter nutrients out of the system, contributing to increased water quality. New mangrove areas introduced into the Lake Worth Lagoon system will also contribute to increased primary productivity in the estuarine food chain.

Seagrasses currently exist at elevations between approximately -1.5 ft. NGVD and -3.5 ft. NGVD in the project vicinity. Species documented include the threatened Johnson's seagrass (*Halophila johnsonii*), paddle grass (*Halophila decipiens*), and shoal grass (*Halodule wrightii*). Light penetration is the most critical factor limiting the coverage of seagrasses in the lagoon. Existing submerged bottom elevations along the project area are generally too deep to support seagrasses under the water quality conditions that currently exist. The placement of fill will result in 67 acres of submerged bottom at -6.0 ft. NGVD or shallower. Much of this area will be shallow enough for sunlight to penetrate at the intensity required to sustain seagrass growth. Under post-construction conditions, seagrass recruitment and colonization at the project site is expected to occur over time.

A small (0.5 acre) mangrove restoration project was completed at the project site in 1991. Oysters (*Crassostrea virginica*) have recruited to the base of the limestone boulder wave-break constructed to protect the mangroves. Oysters are colonizing suitable substrate between approximately 1.5 ft. NGVD and -1.5 NGVD in the project vicinity. Creation of two acres of limestone boulder oyster reef will occur as a result of project construction. Oysters are filter feeders, and can filter water at a rate of approximately 1.8 gallons/hour. Inter-tidal oyster densities of 136 individuals per square yard have been documented. At these densities, over 1.6 million oysters are expected to recruit to the project's rip-rap structures. As a result, approximately 2.8 million gallons of water per hour (67.2 million gallons/day) will be filtered by the oysters recruiting to the project area. This filtering process should contribute to increased water quality in the project vicinity.

In addition to increased water quality, oyster reefs also provide habitat for countless infaunal and epifaunal animal species. Studies have shown anywhere from 2,949 to 24,747 individuals per square meter on inter-tidal oyster reefs. The addition of oyster

reefs will contribute to biodiversity at the project site, and the reefs will support countless animals by providing shelter and feeding areas.

Creation of mangrove planting areas, seagrass recruitment areas and oyster reefs will restore a more natural littoral profile, and substantially increase the area within which seagrasses are likely to colonize. Mangroves, seagrasses and oysters recruiting to these areas will contribute to increased water quality through filtering, nutrient uptake, and sediment stabilization, as well as provide forage and shelter to fish and wildlife. The proposed project will also complement the restoration activities recently completed on Munyon Island and those planned for Peanut Island, both of which are also located in the Lake Worth Lagoon.

The options left for creation and restoration of shoreline and wetland habitats is limited due to the development of coastal areas. The coastal and estuarine shoreline areas available to enhance or restore amount only to a fraction of what has been lost. Therefore, it is clear that if only a portion of the estuarine habitat is to be restored, it is important that it be optimized for productivity. The City of Lake Worth Wetland Restoration Project provides an opportunity to restore and optimize productivity on approximately 81 acres of inter- and sub-tidal wetland habitat.

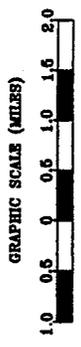
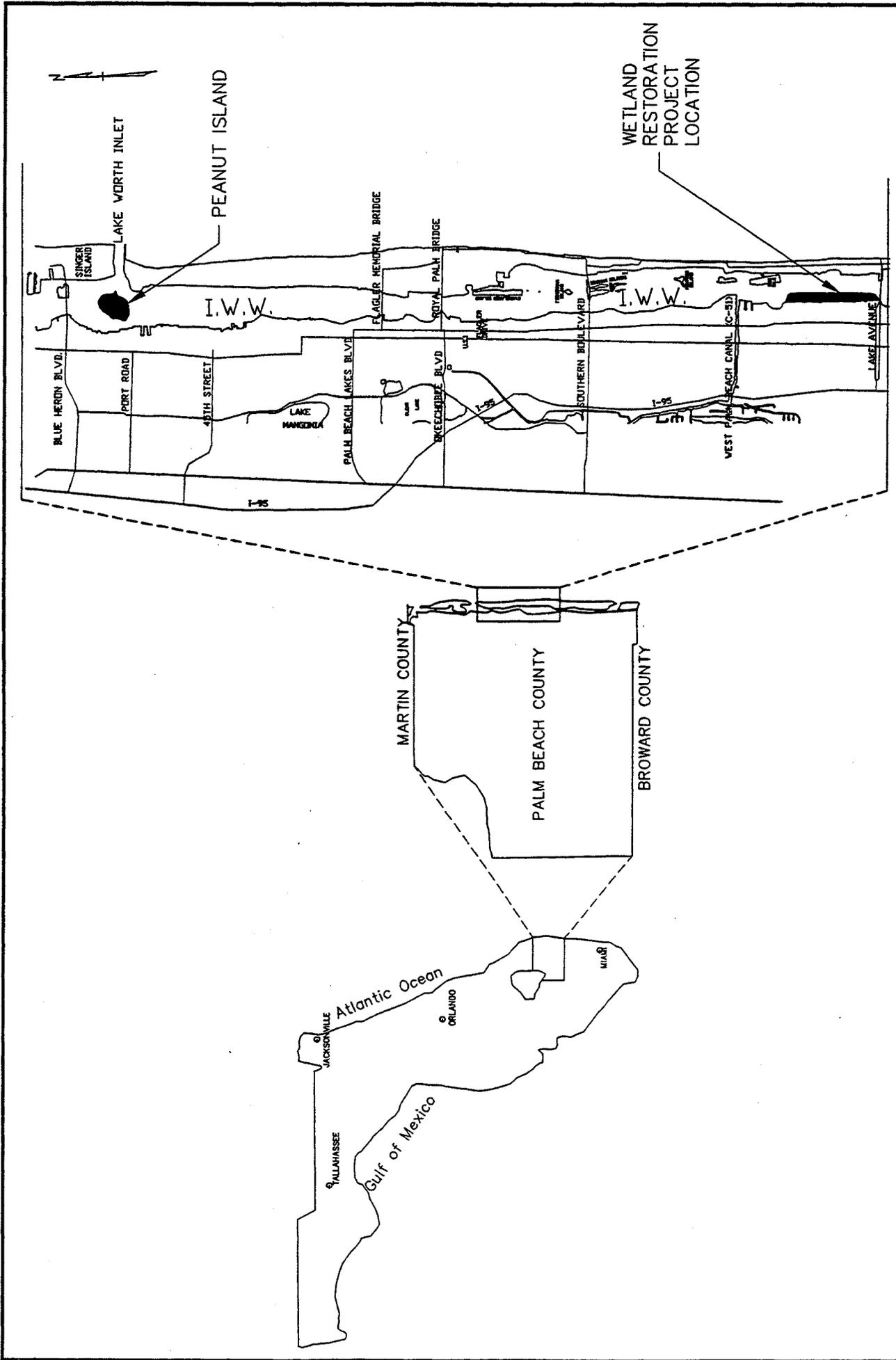
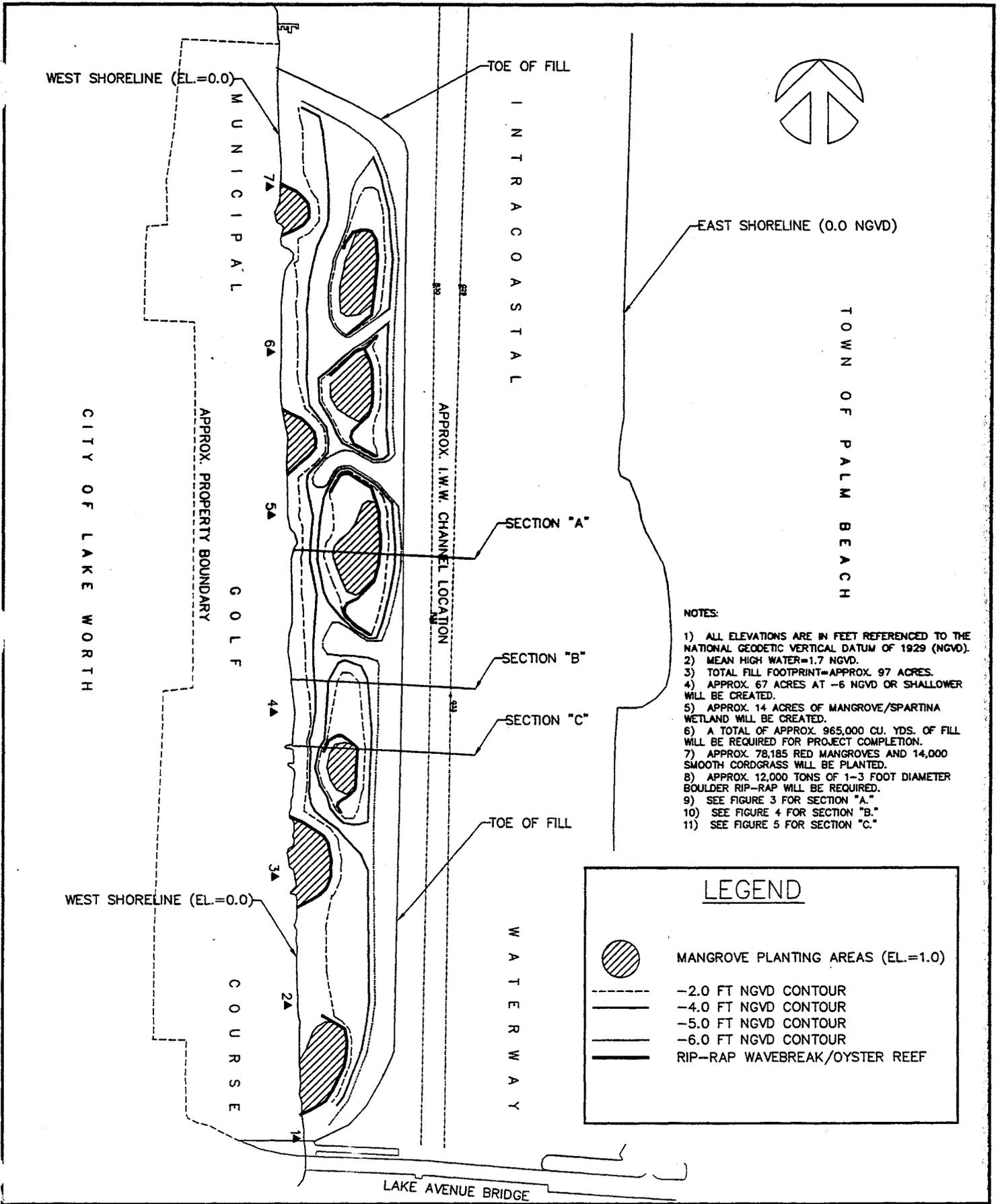


FIGURE 1.  
CITY OF LAKE WORTH WETLAND RESTORATION  
PROJECT LOCATION AND VICINITY MAP

DEPARTMENT OF  
ENVIRONMENTAL  
RESOURCES  
MANAGEMENT

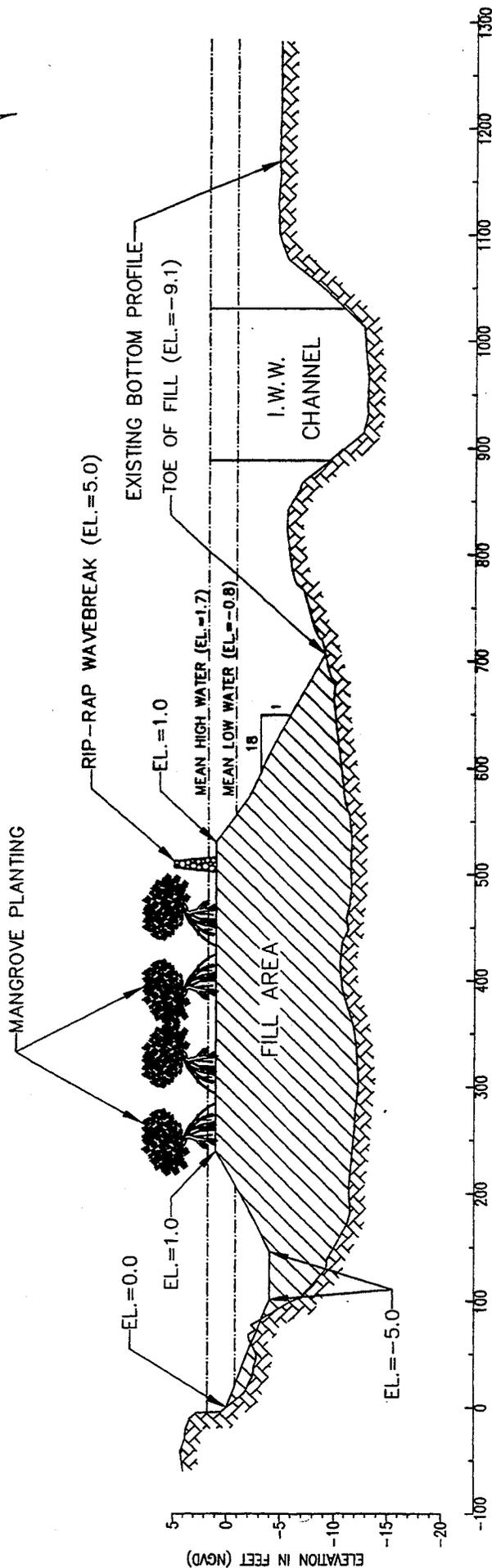
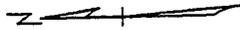




- NOTES:
- 1) ALL ELEVATIONS ARE IN FEET REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD).
  - 2) MEAN HIGH WATER=1.7 NGVD.
  - 3) TOTAL FILL FOOTPRINT=APPROX. 97 ACRES.
  - 4) APPROX. 67 ACRES AT -6 NGVD OR SHALLOWER WILL BE CREATED.
  - 5) APPROX. 14 ACRES OF MANGROVE/SPARTINA WETLAND WILL BE CREATED.
  - 6) A TOTAL OF APPROX. 965,000 CU. YDS. OF FILL WILL BE REQUIRED FOR PROJECT COMPLETION.
  - 7) APPROX. 78,185 RED MANGROVES AND 14,000 SMOOTH CORDGRASS WILL BE PLANTED.
  - 8) APPROX. 12,000 TONS OF 1-3 FOOT DIAMETER BOULDER RIP-RAP WILL BE REQUIRED.
  - 9) SEE FIGURE 3 FOR SECTION "A."
  - 10) SEE FIGURE 4 FOR SECTION "B."
  - 11) SEE FIGURE 5 FOR SECTION "C."

**LEGEND**

	MANGROVE PLANTING AREAS (EL.=1.0)
	-2.0 FT NGVD CONTOUR
	-4.0 FT NGVD CONTOUR
	-5.0 FT NGVD CONTOUR
	-6.0 FT NGVD CONTOUR
	RIP-RAP WAVEBREAK/OYSTER REEF



SECTION "A"

NOTES:

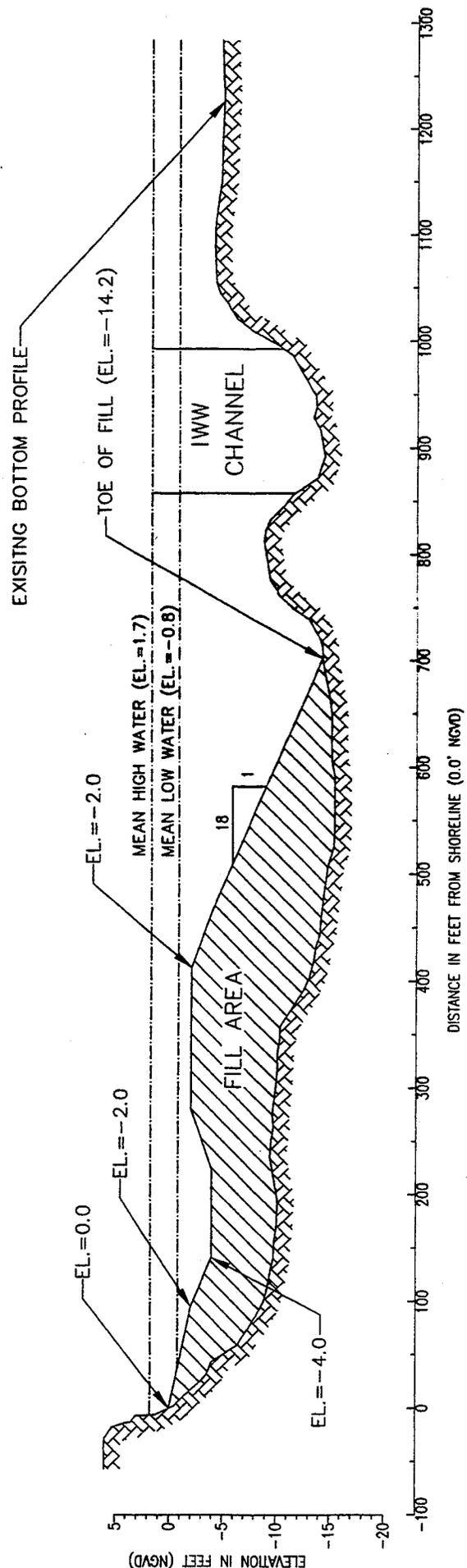
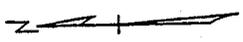
- 1) ALL ELEVATIONS ARE IN FEET REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD).



PALM BEACH COUNTY  
DEPARTMENT OF  
ENVIRONMENTAL  
RESOURCES  
MANAGEMENT

FIGURE 3.  
CITY OF LAKE WORTH WETLAND  
RESTORATION PROJECT  
SECTION "A"

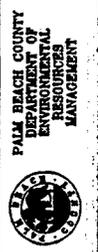
Project \_\_\_\_\_  
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SECTION "B"

NOTES:

- 1) ALL ELEVATIONS ARE IN FEET REFERENCED TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD).



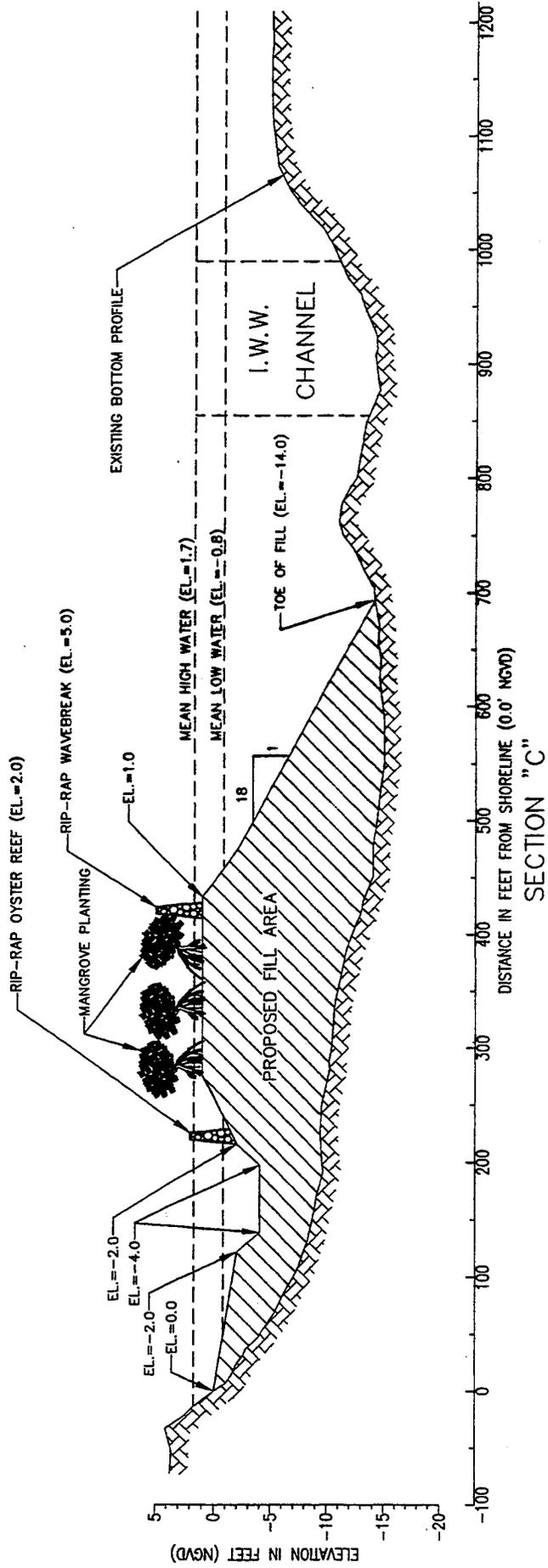
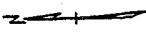


FIGURE 5.  
CITY OF LAKE WORTH WETLAND  
RESTORATION PROJECT  
SECTION "C"

DEPARTMENT OF  
ENVIRONMENTAL  
RESOURCES  
MANAGEMENT



TABLE 1

ESTIMATED COST FOR CONSTRUCTION CITY OF LAKE WORTH WETLAND RESTORATION PROJECT				
ITEM	QUANTITY	UNIT	UNIT COST	COST
Mobilization/Demobilization	1	1	\$500,000	\$500,000
Grade Work on Peanut Island	677925	cubic yard	\$2	\$1,355,850
Off-Island Transport & Placement in Dredged Hole	677925	cubic yard	\$4	\$2,711,700
Grade Work at Lake Worth	677925	cubic yard	\$2	\$1,355,850
Rock for Reef	7100	lineal feet	\$125	\$887,500
Spartina	14000	each	\$1.5	\$21,000
Mangroves	78185	each	\$2.0	\$156,370
Federally funded project				\$6,988,270
20% Contingencies				\$1,397,654
Totals				\$8,385,924
<b>Public Access Components</b>				
Mangrove Boardwalk	2500	sq. ft.	\$50.0	\$125,000
Totals				\$125,000
<b>Grand Totals</b>				<b>\$8,510,924</b>

