

APPENDIX C-1 TABLE

HABITAT RESTORATION AND ENHANCEMENT PROJECTS SUMMARY

Project # Priority <sup>1</sup> Action Plan	Project Name	Project Type	Status	Project Area	Comments*	Project Cost
1 Low SE-3	Little Lake Worth	-Filling/Capping	Dredged hole, anoxic sediments, no littoral area	40 acre submerged dredge hole (approx. 500,000 cy capacity)	Substrate and habitat to support SAV, stone crab, fisheries and water quality improvements. Low maintenance/monitoring.	\$5,500,000 to \$10,000,000 fill costs-depend on sand source
2 Low HE-5, SE-3	Monastery Dredge Hole	-Filling/Capping -Artificial Reef	~9 acres of the 26 acres submerged dredged hole were filled (100,000 cu. yds.) to -8ft NGVD in 1993.	17 acres of submerged dredged hole remains to be filled (150,000cy)  2 acre artificial reef	Substrate and habitat to support SAV, stone crab, fisheries and water quality improvements. Low maintenance/monitoring.	\$2,400,000 to \$3,000,000/ fill costs-depend on sand source  \$400,000 / reef
3 High HE-2, HE-6	Singer Island Seagrass Sanctuary	-Acquisition -Conservation -Mangrove/spartina	Previous attempts have been made to acquire this land with no success to date.	Up to 154 acres of land for acquisition (147 submerged acres, 7 upland acres), 6,100 ft. shoreline.	This submerged area contains the densest and healthiest seagrass beds in the Lake Worth Lagoon.	Acquisition -TBD
4 High HE-2	Little Munyon Island	-Acquisition -Mangrove/spartina -Coastal hammock	Site is targeted to mitigate SAV impacts from dredging Spencer/Rybovich Marina.  Not available for restoration at this time.	~18 acres of land for acquisition (15 submerged acres, 3 upland acres), 2.5 acres mangrove and , 0.5 acres coastal hammock	After completion of mitigation, site is to be transferred to John D. MacArthur Beach State Park for management.	Mitigation Note: To be completed by others
5 Med HE-5	Sugar Sands/Palm Beach Isles Artificial Reef Site	-Artificial reef	10 acre dredged hole (~ 2000' x 200'), 25'deep. Reef materials have been place within 7 acres of the site.	3 acres remain for future reef projects. The current artificial reef is very successful.	Site is successful & highly utilized by marine fauna due to close proximity to inlet. Low maintenance, primarily monitoring.	\$600,000

<sup>1</sup> High = anticipated to be approved, permitted and constructed within the next 5yrs

Med = anticipated to be designed, approved & initiate permitting within the next 5yrs, construction 2yrs post permitting.

Low = anticipated to receive conceptual approval within the next 5yrs

Please note: all projects are conceptual until proper approvals and permitting have been received. The projected timeline for construction is subject to time delays associated with permitting and available funding.

\*Listed Agencies have not committed funds and are subject to Agencies' budget approvals

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6 Med HE-5	Kelsey Park Artificial Reef	-Artificial reef	6 acres dredged hole is 10' deep. ~2,000 ton of limestone rock has been placed to date.	Up to 4 acres of submerged area remains for future reef projects.	Site is successful & highly utilized by marine fauna due to close proximity to inlet. Low maintenance, primarily monitoring.	\$800,000
7 Low HE-2, HE5	Phil Foster Park	-Artificial reef -Riprap/mangrove	The park was refurbished by PBC Parks & Recreation Department (2006). Parks proposes a 221 slip marina.	Artificial reef site ~0.2 acres Rip rap/mangrove planters ~1300 lf.	Artificial reef site located off of west seawall. Riprap/Mangrove planter to be constructed off seawall as part of proposed marina project.	Artificial reef - \$50,000 Mangrove Planter \$400,000
8 Low HE-4, HE-5	Peanut Island shoal	-Seagrass Habitat -Artificial Reef -Water Quality	Identify area to receive sand for restoration purposes. Requires public support	~30 acres shoal, remove ~100,000 cu. yds. of sand, add reef habitat	May improve tidal flushing to northern LWL; provides habitat and recreational opportunities. Sand will be used to fill dredged hole sites for additional SAV enhancement.	\$1,100,000
9 Med HE-5	Rybovich Artificial Reef Site	-Artificial Reef	3 acres of the 5 acres site have been filled with reef structures.	~2 acres remain to be filled with reef materials.	Reef is successful and highly utilized by marine fauna due to close proximity to inlet. Low maintenance, primarily monitoring.	\$400,000
10 Low HE-2	PB Country Club Mangroves	-Mangrove Planter	Will require an agreement with the golf course landowner	1500 linear ft. of shoreline	Mangrove planters will stabilize shoreline and provide habitat	\$450,000
11 Low HE-2	West Palm Beach Currie Park	-Mangrove Planter -Riprap	Reef placement under the pier & prototype mangrove planter, completed in 2002.	2000 linear ft.	Mangrove planters/riprap will be constructed waterward of seawall. Project will attenuate waves/wakes.	Riprap for mangrove planters - \$600,000

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12  High HE-1, HE-2, HE-5, SE-3	City of West Palm Beach  South Cove Waterfront Restoration	-Filling -Mangrove Is/Spartina -Seagrass Habitat -Riprap/Oyster Habitat -Artificial Reef	Requires an Interlocal Agreement with the City  Identify sand source: Peanut Island or ICW shoal dredging	1.8 acres mangroves/ spartina 3.5 acres seagrass ~1 acre artificial reef ~1650 lf oyster reef ~2480 linear ft riprap	Enhancement of this site by filling anoxic dredged holes and placing rock will provide vital habitat in an urban setting. Substrate and habitat improvements will provide water quality improvements.	\$4,400,000
13  High HE-1, HE-2, HE-4, SE-3,	Palm Beach Atlantic Univ.  Mangroves	-Mangrove Planter -Filling/Capping -Seagrass/Oyster	Requires Interlocal Agreement with PBAU	<3 acre area  ~0.5 ac mangrove/spartina	Mangrove planter will provide habitat and wave attenuation. Filling/capping mucks will provide substrate for SAV.	\$300,000 / fill  \$400,000 oyster/mangrove
14  Med HE-1, HE-2	Bradley Park- Town of Palm Beach	-Mangrove Planter -Riprap	Interlocal Agreement signed (May 2007) by Town of Palm Beach and Palm Beach County to initiate project	450 linear ft.	Mangrove planter will be constructed waterward of seawall	\$200,000
15  Med HE-5	Royal Park Bridge- Hole	-Artificial reef	May be coordinated with FDOT improvements to other local bridges	Approximately 1 acre project.	Location is isolated from other resource areas and inlets. Proximity to channel and/or bridge may result in concerns and objections.	\$200,000
16  Low HE-1	Everglades Island Country Club	-Riprap	Needs approval by land owners	4000 linear ft.	Riprap can be placed at the toe of the existing bulkhead with equipment on a barge.	\$1,200,000
17  Med HE-1, HE-2, HE-4	Town of Palm Beach Mangrove Islands and Oyster Reefs	-Mangrove Islands -Oyster Reef -Seagrass Habitat -Capping/Filling	Interlocal Agreement signed by Town of Palm Beach and Palm Beach County May 2007.	4 acre area of primarily submerged habitat between Southern Blvd north to Everglades Island.  2 acre oyster/mangrove	Increased oyster, mangrove and seagrass habitat will benefit water quality, bird and fisheries resources.	\$500,000 / fill  \$400,000/oyst mangrove
18  Med HE-5	Southern Boulevard Bridge - Hole	-Artificial reef	Small dredged hole	Undetermined project area.	Located in the vicinity of significant resources but away from inlets.	\$100,000

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19  High HE-1, HE-2	Bingham/ Audubon Islands	-Exotic vegetation removal  -Mangrove/Oyster habitat	Requires an agreement with landowners  Preservation/restoration	7 acre area of primarily 50% submerged and 50% existing high quality mangrove habitat.	Increased oyster, mangrove and seagrass habitat will benefit water quality, bird and fisheries resources. Located in an area of significant resources.	\$800,000
20  High HE-1	John's Island	-Oyster Habitat	A pilot oyster project that will be utilized to expand oyster habitat throughout the LWL	6.0 acres	Near C-51 canal freshwater discharge creating salinities favorable for oyster habitat. Shallow water area.	\$1,200,000
21  High HE-1, HE-2 SE-3	Palm Beach Ibis Isle Restoration	-Mangrove/Spartina  -Filling/capping  -Oyster	Interlocal signed with Town of Palm Beach and Palm Beach County May 2005.	8 acre site  2 ac mangrove/spartina  6 ac oyster/seagrasses	Cap muck sediments to provide, mangrove, seagrass & oyster habitat to benefit water quality, bird and fisheries resources.	\$1,000,000
22  Med HE-1, HE-4, SE-3	Snook Islands (Phase II)	-Filling and minor capping  -Mangrove Island(s)  -Oyster/Seagrasses	A continuation of the Snook Islands Natural Area	Approximately 80-100 acres	Utilize fill material on site and Bring elevations up to support SAV. Rock placement to provide oyster habitat and mangrove islands.	\$10,000,000
23  High SE-3, HE-1, HE-2, HE-4	Bryant Park Islands	-Filling/Capping  -Mangrove/oyster  -Seagrass	Requires an Interlocal Agreement with City of Lake Worth	30 acre site  ~5-10 ac mangroves	Fill would need to come from offsite. Continuation from Snook Islands Project. Increased oyster, mangrove and seagrass habitat will benefit water quality, bird and fisheries resources.	\$9,000,000

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24 Low HE-2	Lake Worth/ A1A Spartina Wetlands	-Riprap -Spartina Planter	City Owned, under private lease. Requires Interlocal Agreement	1000 linear ft.	Exotic plant removal, install native plants. Riprap will provide habitat.	\$300,000
25 Med HE-1, HE-2, SW-3	City of Lake Worth South Palm Park and Road Right of Ways	-Spartina Planter -Oyster Reef/riprap -Stormwater treatment	Needs an Interlocal Agreement with the City.	250 linear ft.	Moderate energy shoreline. Some submerged areas along the shoreline can be filled to form planting areas.	\$75,000 riprap Stormwater treatment \$50,000
26 Low HE-2	Lantana Nature Preserve	-Mangrove/Spartina -Exotic removal -Enhanced Flushing	Needs an Interlocal Agreement with the Town. Requires Project Scoping	2 acre mangrove area	Mangrove planting, exotic removal. Excavate sediments in mosquito ditches to increase flushing to mangroves.	\$75,000 exotic removal & planting \$50,000 enhance flushing
27 Med HE-2, SW-3	Lantana Pocket Parks	-Spartina/mangrove planters -Water Quality Imp.	Requires Interlocal Agreement with Town	300 linear ft.	Isolated planters will provide habitat and stormwater treatment	\$100,000 planters \$150,000 stormwater
28 High HE-2	Mangrove Preserves Palm Beach County/ Ocean Ridge & Boynton Bch property	-Land acquisition -Riprap -Exotic vegetation control Public Boardwalk	PBC is expected to acquire the Ocean Grand site and install riprap & boardwalk along the shore.  Will require Interlocal Agreement with Town	Approximately 40 acres PBC - approximately 12 acres of Ocean Grand mitigation tract - Private - 20 acres	Selective exotic vegetation removal. Riprap to protect eroding shoreline	Acquisition - \$200,000 Mangrove enhancement and creation - \$300,000
29 Med HE-2	Island Drive Riprap	Riprap	Vertical seawall on public road ROW	700 linear ft	Install 1500 tons of riprap to reduce wave energy & provide habitat	\$210,000

APPENDIX C-2 TABLE

STUDIES AND MONITORING PROJECTS SUMMARY

Project #/ Priority Action Plan	Project Name	Project Type	Status	Project Area	Comments*	Project Cost
1 High EM-1	Implement Sea Turtle Monitoring Goals for LWL	Monitoring	The netting survey has been ongoing since March 2005. Additional sampling events will be scheduled quarterly for the next four years as funding is made available.	All three segments of the Lake Worth Lagoon	Monitor the health of the seaturtle population utilizing LWL by continuing to perform quarterly netting events for 5 years.	\$35,000/yr \$175,000/5yr
2 High EM-2	Develop a Fishery Monitoring Program	Monitoring	To be implemented. Develop a long-term, comprehensive database on fish and selected invertebrate species inhabiting the LWL.	All three segments of the Lake Worth Lagoon	FWC/FWRI will contribute \$75,000 in staff & services. The remaining \$75,000 is contingent upon grant funds.	\$150,000/yr \$750,000/5yr
3 High EM-3	Develop a SAV Monitoring Program	Monitoring	To be implemented. Develop a long-term, comprehensive SAV monitoring program for LWL.	All three segments of the Lake Worth Lagoon.	Develop a monitoring protocol capable of detecting SAV changes in both short- and long term spatial and temporal scales. The current monitoring protocol utilized by PBCERM will be modified when a standardized monitoring protocol is developed by the RECOVER Northern Estuaries SAV sub-team.	\$140,000/yr \$700,000/5yr
4 High EM-4	Monitor Oyster Reef Habitat in LWL	Monitoring	The establishment of a baseline for oysters in the lagoon is currently ongoing through a long-term monitoring program headed by the Florida Fish and Wildlife Conservation Commission (FWC). FWC has been conducting a comprehensive study in LWL under the RECOVER Monitoring and Assessment Plan since January 2005.	All three segments of the Lake Worth Lagoon.	The goal is to increase monitoring of the oyster population in LWL and on artificial substrate (walls, pilings, rock).	\$100,000/yr \$500,000/5yr
5 High HE-1, HE-2, HE-4	Post Construction Project Monitoring	Monitoring	Establish monitoring program to determine success of constructed restoration/enhancement projects.	All three segments of the Lake Worth Lagoon.	Monitor the project success and re-establishment of resources.	\$100,000/yr \$500,000/5yr

TABLE C-3 TABLE

WATER AND SEDIMENT QUALITY PROGRAM

Project Name	Project No. & Priority	Activity or Product	ESTIMATED COST	POTENTIAL* PARTNERS	STATUS
WATER QUALITY	WQ - 1 High	Implement Water Quality Monitoring for Lake Worth Lagoon. Monitor the health of the Lake Worth Lagoon and trend analysis by increasing the number of water quality stations from 10 to 22.	\$134,000/yr \$670,000/5yr	PBCERM, SFWMD, FDEP, Local governments	This is part of the new proposed monitoring network in cooperation with SFWMD
	WQ - 2 Med	Reduce the occurrence of municipal sewer overflows to the Lake Worth lagoon.	TBD	EPA Region 4, FDEP, Local governments, PBCERM	To be implemented
	WQ - 3 Low	Install Additional Sewage Pump-out Facilities for Recreational Boaters and Live-aboard Vessels.	Stationary or portable pump-out unite range from approximately \$2,000 to \$6,000. Costs for a portable toilet waste station may vary from \$1,100 to \$1,800.	FDEP, Local governments, PBCERM	To be implemented
	WQ - 4 Low	Improve Fueling and Bilge-Pumping Practices Among Recreational Boaters.	TBD	FDEP, U.S. Coast Guard Auxiliary, PBCERM, Lagoon Keepers, Local Municipalities	To be implemented
	WQ-5 Low	Provide sewage removal from vessels within the Lake Worth Lagoon (LWL) to live-aboard vessels through a pump-out boat.	Costs vary depending on type of pump-out boat selected and the size. The annual cost to run this program is \$70,000/year. This amount includes a full-time employee to run the service, and the associated costs for docking fees.	FDEP, Florida's Clean Vessel Act grant program, Florida's Clean Marina program, PBC Boater Registration, FIND grant program.	To be implemented
WASTE WATER TREATMENT	WW - 1 High	Identify Septic systems and Municipal Wastewater Loading to Lake Worth Lagoon and associated watershed. Implement bacteriological assessment to identify problem areas associated with septic loading.	\$125,000	PBC Board of County Commissioners, FDEP, PBC DOH, EPA, NOAA FACE Program, Local Municipalities	To be implemented
	WW - 2 Med	Provide Additional Sanitary Sewer Connections to Priority Areas of Lake Worth Lagoon.	TBD	PBC Board of County Commissioners, FDEP, Palm Beach County Health Unit, EPA, NOAA FACE Program, Local Municipalities, SFWMD	To be implemented

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Project Name	Project No. & Priority	Activity or Product	ESTIMATED COST	POTENTIAL* PARTNERS	STATUS
STORMWATER TREATMENT	SW – 1 High	Reduce Discharge of Freshwater and Total Suspended Solids in the Lake Worth Lagoon through the C-51 Canal.	NPBC-1 Project with all its components is \$425,079,000; however, the allocated sum for the C-51 dredging project is currently \$2.7 million/year.	SFWMD, USACE, PBCERM, FDEP	The C-51 Project is currently on-going.
	SW – 2 High	Implement Best Management Practices on Golf Courses near the Lake Worth Lagoon.	TBD	FDEP, SFWMD, IFAS, Environmental Education Centers, Lagoon Keepers	To be implemented
	SW – 3 High	Identify and Increase stormwater retrofit projects by identifying and collect ArcGis data to create map for project prioritization.	\$50,000	SFWMD, PBCERM, FDEP, Municipalities, PBC NPDES Program	To be implemented
SEDIMENT QUALITY	SE – 1 Med	Substrate Characterization in Lake Worth Lagoon	\$125,000	RECOVER, SFWMD, FWC, FIND, FDEP	To be implemented
	SE – 2 High	C-51 Basin and Lake Worth Lagoon Sourcing Study	\$150,000	SFWMD, FDEP, PBCERM, LWDD	To be implemented
	SE – 3 Med	Capping Sediments in Lake Worth Lagoon	\$2,000,000	SFWMD, USFWS, EPA, USACOE, PBC, LWLPGP, FIND	To be implemented

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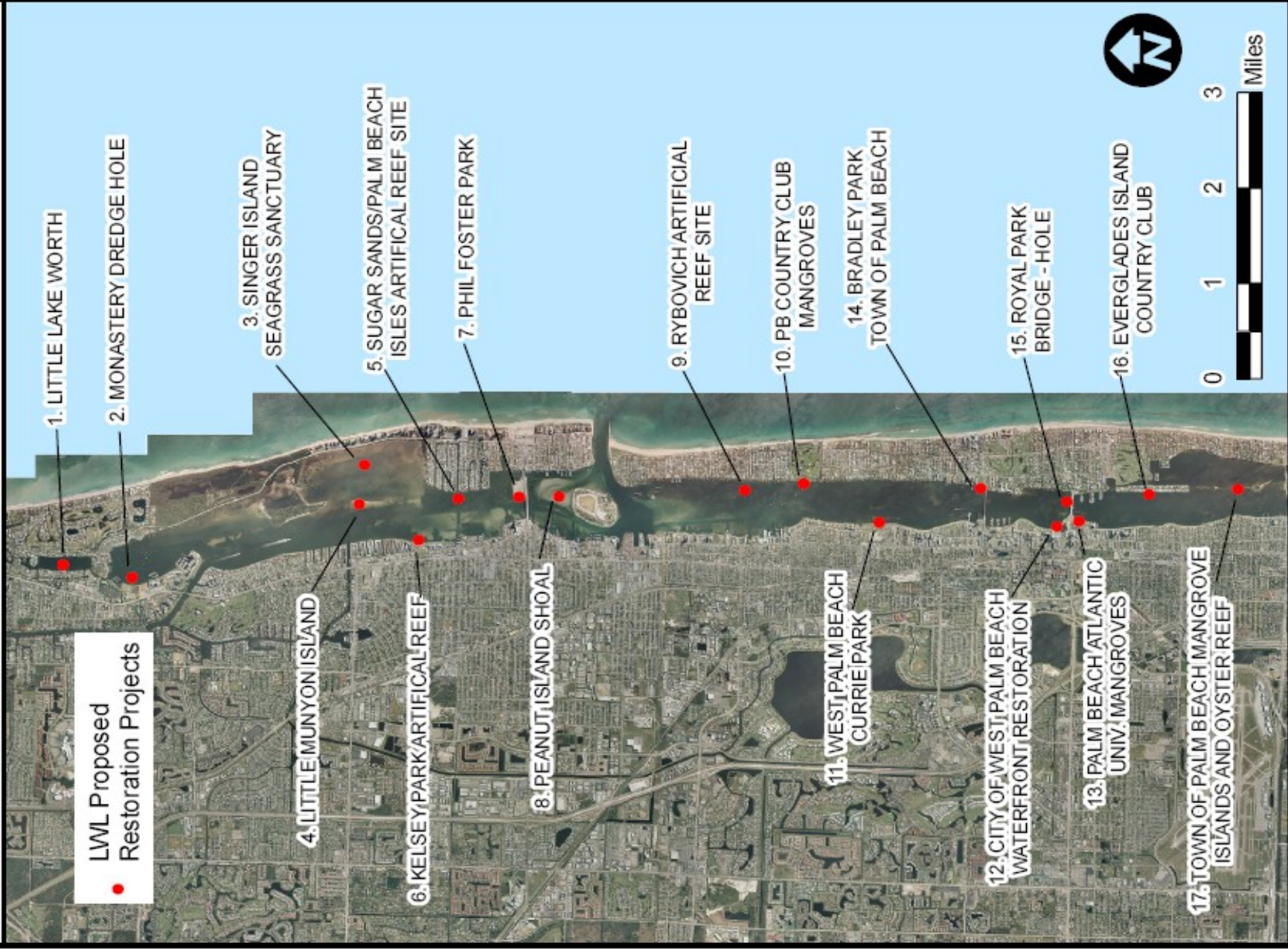
TABLE C-4 TABLE

PUBLIC USE AND OUTREACH PROGRAM – FUNDING PROGRAM

Project Name	Project No. & Priority	Activity or Product	ESTIMATED COST	POTENTIAL* PARTNERS	STATUS
PUBLIC USE AND OUTREACH	PO – 1 Med	Established the LWL Initiative to facilities stakeholders partnerships and seek funding assistance	Average appropriations for the since 1998 has been \$1.7 million	LWL Stakeholders	To be implemented
	PO – 2 High	Promote Public Outreach in Lagoon Restoration and protection through education and citizens' involvement	Annual costs for staff are estimated at approximately \$75,000/yr, plus costs for DVDs and other educational materials	LWL OAC, PBCERM, IFAS, SFWMD, FDEP, Environmental Education Centers, Lagoon Keepers	To be implemented
	PO – 3 Med	Implement Pollution Prevention Initiatives and the Florida Yards & Neighborhoods Program	Annual costs for staff and other educational materials are estimated at approximately \$100,000/yr	IFAS, SFWMD, SWWMD, FDEP, PBCERM, Local Governments, Mounts Botanical Gardens, Bush Wildlife Sanctuary	To be implemented
	PO – 4 High	Identify and construct areas around the Lake Worth Lagoon (LWL) for public access features dedicated to non-motorized vessels such as kayaks and canoes, and features promoting birding, fishing, etc.	Siting and construction of public access facilities is contingent upon the type of facilities selected at each location	PBCERM, PBC Parks & Recreation, SFWMD, FDEP, Municipalities	To be implemented
FUNDING	FD – 1 High	Increase Funding and Partnerships for the Lake Worth Lagoon Partnership Grant program	Annual costs for staff, database development, and grant writing are estimated at approximately \$75,000/yr	PBCERM, FDEP, SFWMD, FFWCC, USFWS, NOAA/NMFS, FIND, Local Municipalities	To be implemented
FUNDING	FD – 2 High	Increase funding directed toward LWL management through Federal, State and local government grants and partnerships, private-public partnerships with non-governmental organizations (NGOs), grants from privately managed trusts and direct funding from the public	Annual costs for staff and grant writing are estimated at approximately \$134,000 per year	PBCERM, SFWMD, FWC, USFWS NOAA / NMFS, FDEP, FIND, Tourism Development Council, Municipalities, Marine Industries Association	To be implemented

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# Lake Worth Lagoon Proposed Restoration Projects - North



# Lake Worth Lagoon Proposed Restoration Projects - South

