TAMPA BAY ESTUARY PROGRAM:

2020 HABITAT MASTER PLAN UPDATE

AUGUST 2020

TBEP
TAMPA BAY ESTUARY PROGRAM
PARTNERSHIP FOR A HEALTHY BAY

TAMPA BAY ESTUARY PROGRAM

Habitat Master Plan Update

TBEP Technical Report #07-20

Prepared for **August 2020**

TAMPA BAY ESTUARY PROGRAM
PARTNERSHIP FOR A HEALTHY BAY

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ACKNOWLEDGEMENTS

This project was cooperatively funded by the Southwest Florida Water Management District (Grant No. 17PO0000368) and the Tampa Bay Estuary Program. This document was prepared by Environmental Science Associates (ESA) under contract to the Tampa Bay Estuary Program. The primary ESA project team consisted of the following:

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- Dave Tomasko – contributing author for the seagrass status and trends analysis;
- Christine Sciarrino – contributing author for the habitat restoration database update.

The recommendations presented in this document represent a collaborative effort between the ESA consultant team, TBEP staff, and the TBEP stakeholders. Key contributors included the following:

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Recommended Document Citation:

Robison, D., T. Ries, J. Saarinen, D. Tomasko, and C. Sciarrino. 2020. Tampa Bay Estuary Program 2020 Habitat Master Plan Update. Technical Report #07-20 of the Tampa Bay Estuary Program. Final report prepared by Environmental Science Associates. 136 pp. + appendix.

EXECUTIVE SUMMARY

This 2020 Tampa Bay Habitat Master Plan Update builds upon and extends the work from two previous habitat master plans published by the TBEP:

- *Setting Priorities for Tampa Bay Habitat Protection and Restoration: Restoring the Balance (TBEP Technical Publication #09-95);* and
- *Tampa Bay Estuary Program Habitat Master Plan Update* (*TBEP Technical Publication #06-09*)*.*

In addition, this update considers and builds upon another TBEP technical publication:

- *Master Plan for the Protection and Restoration of Freshwater Wetlands in the Tampa Bay Watershed, Florida* (*TBEP Technical Publication #05-14*)*.*

Finally, this update directly implements the Bay Habitat and Fish and Wildlife goals identified in Actions BH-1 (Activities 1-3); BH-2 (Activities 1 and 2); BH-4 (Activities 1, 2, 4 and 6); BH-6 (Activity 2); BH-8 (Activities 1 and 2); BH-9 (Activity 3); BH-10 (Activities 1-4); and FW-6 (Activity 1) identified in:

- Charting the Course: The Comprehensive Conservation and Management Plan for Tampa Bay, August 2017 Revision (*TBEP Technical Publication #10-17*)

The plan establishes 2030 protection and restoration targets and longer-term 2050 goals for Tampa Bay critical coastal habitats. Moving from the open bay to the headwaters and uplands of the Tampa Bay watershed, the habitats of interest include:

<u>Subtidal</u>

- Hard bottom;
- Artificial reefs;
- Tidal flats;
- Seagrasses;
- Oyster bars;

<u>Intertidal</u>

- Living shorelines;
- Mangrove forests;
- Salt barrens;
- Salt marshes;
- Tidal tributaries;

<u>Supratidal</u>

- Coastal uplands;
- Non-forested and forested freshwater wetlands;
- Native forested uplands.

This Habitat Master Plan Update has been developed using a different target setting approach than previous plans, which were based on the “Restoring the Balance” (RTB) paradigm (Lewis and Robison, 1996). **The target setting approach used in this update, termed the “Maximizing the Potential” (MTP) approach, is both retrospective and prospective.** It is informed by past changes, as determined through a three-decade habitat change analysis, and over forty years of habitat restoration experience in the region. It is also primarily focused on what is possible today and the projected needs for the future, rather than replicating past ecological conditions. The new paradigm accounts for future stressors – especially sea level rise, climate change, and watershed development – in the target setting process. Furthermore, numeric targets are “place-based,” meaning that they are based on actual “opportunity areas” that can be mapped in the watershed.

It is anticipated that the TBEP Habitat Master Plan will be updated approximately every 10 years. Accordingly, this 2020 Habitat Master Plan Update defines 10-year (2030) habitat protection and restoration targets. Furthermore, this update maps habitat protection and restoration opportunity areas where these 2030 targets can be attained. Specifically, it identifies where the 2017 CCMP Bay Habitat goals and strategies and the 2021-2025 Strategic Plan (Burke and Amaral, 2020) thriving habitats and abundant wildlife programmatic priorities can be implemented over the 10-year planning horizon. However, it also recognizes that the identified habitat protection and restoration areas will change over time, and it is appropriate that they be revised on a 10-year recurring cycle.

As noted above, this update specifically addresses the impending threats to Tampa Bay coastal habitats posed by sea level rise. Therefore, a 30-year planning horizon (2050) is also identified based upon sea level rise projections developed specifically for Tampa Bay (Burke et al., 2019). This 30-year planning horizon is addressed through the identification and mapping of a “coastal stratum” which extends from the existing mean low water line to the approximate 5-foot contour. The coastal stratum is projected to directly experience the effects of sea level rise by 2050, and is the primary focus area for coastal habitat protection and restoration activities, both in the near-term 10-year, and the extended 30-year, planning horizons.

Key findings and recommendations from this document are summarized in the following subsections.

Habitat Status and Trends

Technical reports and other information and data addressing the current extent and condition the various habitats were assessed and compiled. To address data gaps for some habitats the TBEP and collaborators have conducted and/or requisitioned several special studies over the past decade. Key documents and information sources are discussed in the following sections for each habitat type. However, for the majority of subtidal, intertidal and supratidal habitats, primary data derived from two routine spatial assessment programs conducted by the Southwest Florida Water Management District (SWFWMD) were utilized.

The current status, or best estimate of the extent (e.g., acres or linear feet) of the habitats discussed in the previous sections is summarized in **Table ES-1** below, including the data year(s) and source(s) from which the estimate was derived.

When viewed as a whole, the most significant and meaningful trends in the TBEP habitats of interest over the periods of record examined include: 1) the 75 percent gain in seagrasses since 1988; 2) the slight gains in both emergent tidal wetlands (10% gain) and freshwater wetlands (2% gain) since 1990; and 3) the 39 percent loss in native upland habitats since 1990. The increasing trend in seagrass coverage is a testament to improved bay water quality resulting from focused reductions in both point and non-point sources of pollution. Improved domestic wastewater treatment by local government utilities – as required by the Grizzle-Figg legislation (Section 403.086, Florida Statutes) – was responsible for the most

Table ES-1
Summary of Current Extent of TBEP Habitats

Habitat Type	Current Extent	Data Year	Data Source(s)
Subtidal Habitats			
Hard Bottom	423 acres	2017 - 2019	SWFWMD, 2017; CSA Ocean Sciences, 2019
Artificial Reefs	166 acres	2019	EPCHC, 2020; ESA, 2020
Tidal Flats	16,220 acres	2018	SWFWMD, 2018
Seagrasses	40,653 acres	2018	SWFWMD, 2018
Oyster Bars	171 acres	2018	SWFWMD, 2018
Intertidal Habitats			
Living Shorelines	11.3 miles	2020	ESA, 2020; Tampa Bay Watch, 2020
Mangrove Forests	15,300 acres	2017	SWFWMD, 2017
Salt Barrens	496 acres	2017	SWFWMD, 2017
Salt Marshes	4,557 acres	2017	SWFWMD, 2017
Tidal Tributaries	387 miles	2019	Janicki Environmental/Mote Marine Lab, 2019
Supratidal Habitats			
Coastal Uplands	3,619 acres	2017	ESA, 2020
Non-Forested Freshwater Wetlands	67,587 acres	2017	SWFWMD land use/cover mapping
Forested Freshwater Wetlands	152,132 acres	2017	SWFWMD land use/cover mapping
Native Uplands (Non-Coastal)	140,600 acres	2017	SWFWMD land use/cover mapping

significant improvements in Tampa Bay water quality. Pollutant load reduction commitments made by permittees associated with the TBEP Nitrogen Management Consortium have also led to additional improvements in bay water quality (Greening et al., 2016).

As discussed above, the observed gains in both emergent tidal wetlands and freshwater wetlands are likely a reflection of: 1) the effectiveness of state and federal wetland regulatory programs; and 2) the cumulative gains resulting from, primarily, publicly-funded habitat restoration projects. Minor gains in some emergent tidal wetlands (e.g., salt barrens) may also be a reflection of the landward expansion of the complex suite of these habitats associated with climate change and sea level rise. Also, since 1990 there has been a larger gain in vegetated non-forested freshwater wetlands, slightly decreasing disproportionate losses in this habitat type between 1950 and 2007. It is surmised that this shift is related to the clearing of forested wetlands associated with development, mining, and silviculture followed by the creation of herbaceous mitigation areas and surface water management system features (e.g., storm water ponds and swales).

The decreasing trend in native upland habitats is the result of continued human population growth and urban development in the Tampa Bay watershed, combined with the lack of state and federal regulatory protection of native upland habitats. The responsibility for protecting native upland habitats resides mostly with local governments through the implementation of their planning, zoning, and land development regulations. Federal and state regulations related to listed species management impart some protection to certain rare habitats (e.g., scrub jay habitat); however, common and historically abundant native habitats, such as pine flatwoods, are left largely unprotected. Unless local governments in the Tampa Bay watershed improve local protections for native upland habitats, such as strengthening language within comprehensive plans and development ordinances, this trend will likely continue.

Existing Habitat Protection and Restoration

The Tampa Bay watershed now includes a total of **311,285 acres** of existing conservation lands, either publicly owned or in conservation easements, about 21.4 percent of the total Tampa Bay watershed area of 1,450,883 acres. State-owned lands, including the intertidal and supratidal portions of the Aquatic Preserves, comprise the greatest percentage (63.6%) of the total acreage of conservation lands in the watershed, followed by lands acquired and managed by local governments (33.2%). Federal and private lands constitute a much smaller percentage of the total.

Table ES-2 provides a summary of the number of projects, and the restored acres and linear feet, for each of the four major habitat types. Nearly 5,000 acres of habitat restoration have been recorded in the Tampa Bay watershed, including about 2,049 since the 2010 Habitat Master Plan update (the predecessor to this document).

Table ES-2
Enhancement and Restoration Projects in Tampa Bay (1970-2019 and 2010-present)

Habitat Type	No. Projects	Enhancement		Restoration (1970-2019)	Restoration (2010-2019)
		Acres	Linear Feet	Acres	Acres
Estuarine	228	3,147.6	99,501	2,074.0	862.6
Freshwater	53	449.1	23,156.8	1,191.1	903.0
Mixed	60	5,924.5	0	1,195.4	252.0
Upland	119	22,428.6	17,710	426.9	31.9
Totals	460	31,949.8	140,367.8	4,887.3	2,049.4

Eighty-nine (89) living shoreline projects, seawall enhancements, and oyster reef module installations along shorelines were inventoried separately and are not included in this summary of restoration and enhancement projects. These living shorelines cover a total of **11.3 miles**.

As part of this Habitat Master Plan Update, a compendium of lessons learned and habitat restoration best practices has been prepared and is provided as a standalone document titled *Tampa Bay Habitat Restoration: Best Management Practices Manual*. This document was prepared to address the restoration of critical coastal habitats represented in the Tampa Bay watershed, and describes habitat restoration techniques that have been successfully utilized over the past four decades to restore coastal ecosystems specifically in Tampa Bay. By integrating lessons-learned from over one hundred projects within the watershed, the manual also provides a stepwise approach to effectively implement future habitat restoration projects in Tampa Bay. Finally, this manual includes recommendations for monitoring protocols and emerging technologies to facilitate future coastal habitat restoration efforts in consideration of climate change and sea level rise.

Recommended Habitat Protection and Restoration Paradigm

Given the limitations of the previous RTB paradigm, a more diverse approach is recommended that integrates multiple and disparate types of information into a comprehensive and repeatable method for developing and updating habitat protection and restoration targets – in both this and future Habitat Master Plan updates. Furthermore, this approach should establish a broader framework that guides both watershed-level habitat master planning and site-level restoration design activities; and should incorporate elements of the other habitat restoration paradigms discussed above (where applicable). This recommended approach is herein termed "Maximizing the Potential" (MTP). The MTP approach differs from the RTB approach in that it integrates the whole watershed, and is both retrospective and prospective.

Accordingly, the MTP approach:

- **Integrates all native habitats in the watershed including coastal, freshwater and upland habitats;**
- **Is informed by contemporary trends in both habitat changes and restoration performance;**
- **Considers both current and future stressors – especially land development, sea level rise and climate change; and,**
- **Focuses on existing opportunities, and what is realistically possible in the future, rather than replicating past ecological conditions.**

Habitat Protection and Restoration Opportunities

Pursuant to the MTP approach, the term "opportunity areas" refers to geographic areas where habitat protection and restoration activities are possible, and where they should best be focused to attain defined targets. Defining and mapping opportunity areas is the first step in quantifying the "restoration potential" for a particular habitat type, which is a measure of what is actually possible under current and future projected conditions. The mapping and quantification of opportunity areas for habitat protection and restoration activities involved a stepwise geospatial analytical process.

Table ES-3 provides a summary of the opportunity assessment analyses for each of the TBEP habitats of interest. The "Native Habitats" columns show the current extent as well as the portion of the current extent occurring on existing conservation lands and proposed conservation lands, respectively. The current, native habitat extents, are inclusive of areas that occur neither on existing nor proposed conservation lands. The "Restorable Habitats" columns show the "total restoration opportunity" as well as the portion of the total restoration opportunity on existing and proposed conservation lands, respectively.

While existing development areas are not considered feasible for major habitat restoration activities at this time, there are many opportunities to enhance and restore habitat functions and improve coastal resilience in certain areas. Examples include the construction of living shorelines, and/or the placement of submerged habitat modules, along developed urban

Table ES-3
Summary of the Opportunity Assessment Analysis

Habitat Type	Native Habitats			Restorable Habitats		
	Current Extent	Existing Conservation Lands	Proposed Conservation Lands*	Total Restoration Opportunity**	Existing Conservation Lands Restoration Opportunity	Proposed Conservation Lands Restoration Opportunity*
Subtidal Habitats						
Hard Bottom	423 ac.	423 ac.	N/A	N/A	N/A	N/A
Artificial Reefs	166 ac.	166 ac.	N/A	N/A	N/A	N/A
Tidal Flats	16,220 ac.	16,220 ac.	N/A	I/D	I/D	N/A
Seagrasses	40,653 ac.	40,653 ac.	N/A	14,131 ac.	14,131 ac	N/A
Oyster Bars	171 ac.	171 ac.	N/A	I/D	I/D	N/A
Intertidal Habitats						
Living Shorelines	11.3 mi.	LSSM	N/A	LSSM	N/A	N/A
Mangrove Forests	15,300 ac.	10,864 ac.	4,078 ac.	2,757 ac.	1,309 ac.	1,448 ac.
Salt Barrens	496 ac..	430 ac.	62 ac.			
Salt Marshes (low salinity *Juncus*)	4,557 ac.	2,104 ac.	2,316 ac.	1,092 ac. (JU)	241 ac. (JU)	851 ac. (JU)
Tidal Tributaries	387 mi.	N/A	N/A	LSSM	N/A	N/A
Supratidal Habitats						
Coastal Uplands	3,619 ac.	1,725 ac.	1,706 ac.	1,272 ac.	311 ac.	961 ac.
Non-Forested Freshwater Wetlands	67,587 ac.	11,482 ac.	25,971 ac.	159,836 ac.	27,447 ac.	132,389 ac.
Forested Freshwater Wetlands	152,132 ac.	58,222 ac.	56,505 ac.			
Native Uplands (Non-Coastal)	140,600 ac.	64,374 ac.	52,834 ac.	43,928 ac.	13,265 ac.	30,663 ac.

N/A – Not Applicable; I/D – Insufficient Data; LSSM – Living Shoreline Suitability Model; JU – Potential *Juncus* Marsh Opportunity

**All lands identified for acquisition by partners, does not represent a 2030 target or 2050 goal

*Does not account for lands neither currently protected nor currently under consideration for acquisition

shorelines and seawalls. In addition to urban development, four major types of disturbed sites around the Tampa Bay coastline have been identified as priority estuarine habitat restoration sites by TBEP stakeholders over the past two decades, including: 1) dredged holes; 2) filled and spoil disposal areas; 3) abandoned aquaculture ponds; and 4) coastal borrow pits and stormwater ponds.

Recommended Habitat Protection and Restoration Targets and Goals

Recommended targets are based on the analyses presented in this Habitat Master Plan Update, including: 1) the habitat status and trends analysis; 2) the habitat restoration database update; and 3) the opportunity assessment summary. Recommended targets are consistent with estimated opportunity areas and restoration potential for each respective habitat type. Finally, in addition to the supporting technical analyses, targets are also based on "best professional judgement" with respect to current and anticipated future trends in development, available funding, and regulations. **Map ES-1** illustrates available restoration space on current public lands as well as lands identified for acquisition by public entities.

Table ES-4 presents a summary of the recommended targets discussed above, including a narrative statement on the restoration and protection rationale for each. The recommended benchmarks represent 10-year targets, or those that can be reasonably attained by 2030, and longer-term goals established for 2050 and as approved by the TBEP Management and Policy Boards in May 2020.

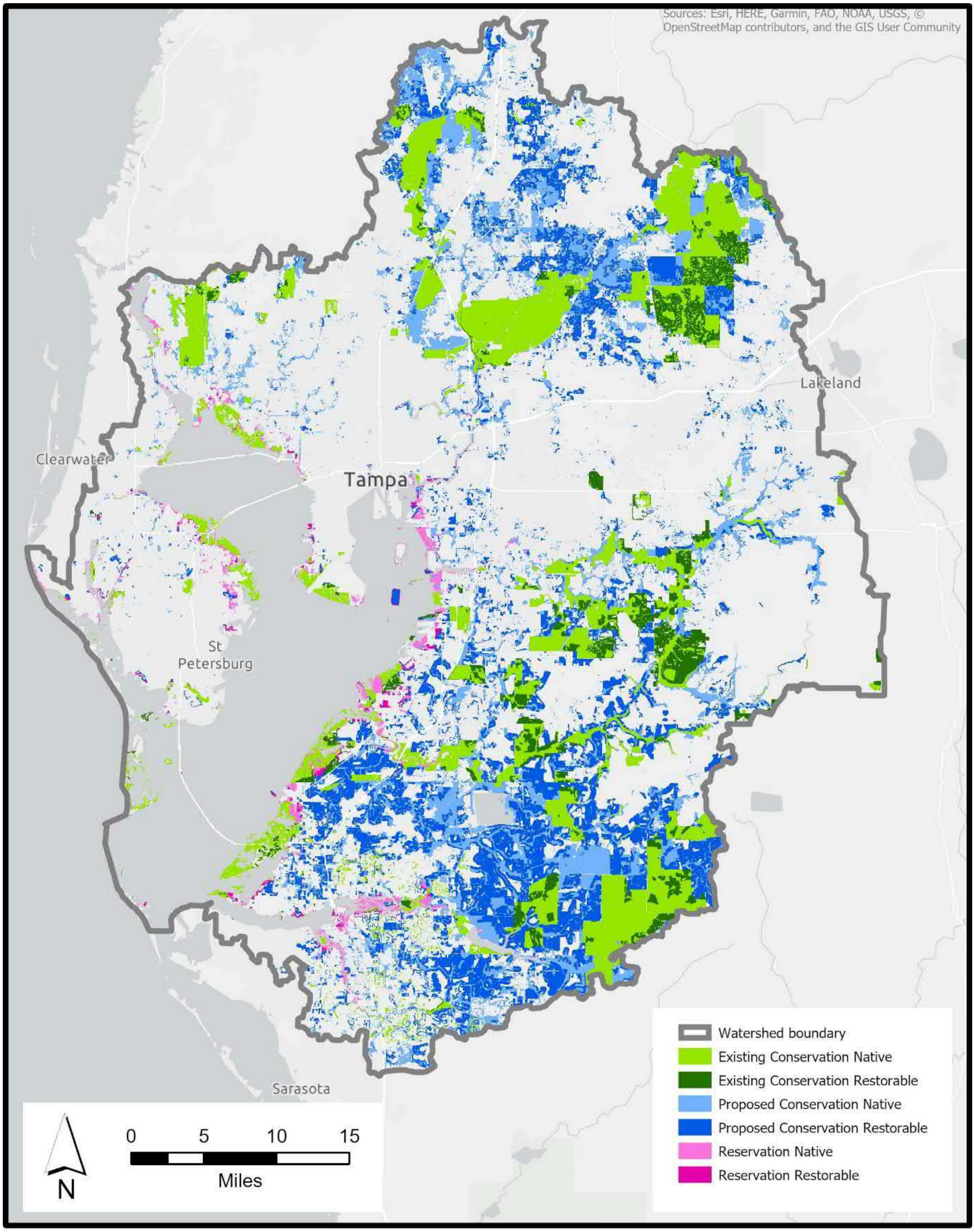
Habitat Monitoring and Assessment

In the context of this Habitat Master Plan Update, monitoring is differentiated from assessment in that monitoring is an ongoing, routine process; whereas assessment activities are performed initially, and then repeated only periodically, as needed to fill data gaps. Habitat data assessment needs are identified in this 2020 Habitat Master Plan Update, and programs are recommended to address specific data gaps for: 1) hard bottom; 2) oyster bars; 3) tidal tributaries; 4) coastal uplands; and 5) reclaimed mined lands. Improvements to ongoing monitoring of the status and trends of subtidal, intertidal and supratidal habitats are also recommended.

Linking Habitat Restoration and Compensatory Mitigation

Wetland impacts and associated compensatory mitigation projects authorized under wetland regulatory programs have historically been conducted independent of watershed-level planning and monitoring processes. This disconnect has contributed to fragmented implementation and inconsistent compliance monitoring of mitigation projects, as well as historically poor documentation of wetland losses and gains in the Tampa Bay watershed. However, if properly focused, and comprehensively coordinated and implemented, compensatory mitigation activities could significantly contribute to the attainment of wetland habitat restoration goals and targets for the Tampa Bay estuarine system and its contributing watershed, as defined in this Plan.

In 2019, the Florida Legislature amended Chapter 373.4135, F.S. to allow public entities to permit and sell credits to fund the enhancement and/or restoration of their conservation lands, even if those lands were purchased with public conservation funds. These amendments allow for greater flexibility by state, regional, and local governments in attaining watershed-level goals, as well as for potentially improved coordination between habitat restoration and compensatory mitigation activities. In essence, this new mechanism creates incentives for local governments



Source: ESA, 2020

2020 Tampa Bay Habitat Master Plan Update

Map ES-1
Combined Opportunities in the Tampa Bay Watershed

ESA

Table ES-4
Summary of Recommended 2030 Targets and 2050 Goals

Habitat Type	Current Extent	Total Restoration Opportunity*	2030 Target	2050 Goal	Target Narrative and Restoration and Protection Rationale
Subtidal Habitats					
Hard Bottom	423 acres	N/A	>423 acres	>423 acres	Protect existing hard bottom; continue to identify new hard bottom area using proven mapping techniques
Artificial Reefs	166 acres	N/A	>166 acres	>166 acres	Protect existing artificial reefs; enhance habitat complexity where feasible; expand reef area to promote fish and wildlife benefits
Tidal Flats	16,220 acres	N/A	16,220 acres	16,220 acres	Identify and protect existing persistent tidal flats; assess restoration potential of other non-vegetated subtidal areas
Seagrasses	40,653 acres	14,131 acres	>40,000 acres	>40,000 acres	Protect existing seagrasses; establish new HMPU lower limit of 40,000 acres; assess restoration potential of non-vegetated subtidal areas
Oyster Bars	171 acres	I/D	221 acres	471 acres	2030: Protect existing oysters + restore 50 acres; increase target by 50 acres each out-decade; consider filtration rate to refine long-term goal; an oyster habitat suitability index (HSI) will inform opportunity space
Intertidal Habitats					
Living Shorelines	11.3 miles	LSSM	21.3 miles	56.3 miles	2030: Construct 1 mile of LS each year; includes privately owned seawalls; need better definition of opportunity areas; increase target to 1.5 & 2 miles per year for out decades
Total Intertidal	**20,353 acres**	**3,849 acres**	**21,353 acres**	**23,803 acres**	**2030: Protect existing intertidal mosaic + restore 1,000 acres (based on hydric soils); increase target by 150 acres each out-decade; includes the mosaic of mangrove, salt barren, and salt marsh habitats**
Mangrove Forests	15,300 acres	2,757 acres	>15,300 acres	>15,300 acres	Protect existing mangrove forests; restore opportunistically within the intertidal mosaic
Salt Barrens	496 acres		546 acres	796 acres	2030: Protect existing salt barrens + restore 50 acres; increase target by 50 acres per out decade
Salt Marshes (low salinity *Juncus*)	4,557 acres	1,092 acres	4,807 acres	5,457 acres	2030: Protect existing low salinity salt marshes + restore 250 acres; increase target by 50 acres each out-decade; *significant land acquisition and/or Public Private Partnerships required to achieve this 2030 target and 2050 goal*
Tidal Tributaries	387 miles	I/D	4 miles	18 miles	Inventory mapped tidal tributaries and assess/rank restoration potential; restore ~4 miles (1%) of urban tidal creek habitat where feasible; increase target by 2 miles per out decade

N/A – Not Applicable; I/D – Insufficient Data; LSSM – Living Shoreline Suitability Model; JU – Potential *Juncus* Marsh Opportunity
*Does not account for lands neither currently protected nor currently under consideration for acquisition

Table ES-4 (Continued)

Supratidal Habitats					
Habitat Type	**Current Extent**	**Total Restoration Opportunity***	**2030 Target**	**2050 Goal**	**Target Narrative and Restoration and Protection Rationale**
Coastal Uplands	3,619 acres	1,272 acres	3,769 acres	4,219 acres	2030: Protect existing coastal uplands + specifically restore 150 acres (upland restoration total = 600 acres); increase target by 50 acres each out decade
Non-forested Freshwater Wetlands	67,587 acres	159,836 acres	68,937 acres	71,787 acres	2030: Protect existing non-forested freshwater wetlands + restore 1,350 acres; increase target by 50 acres each out decade
Forested Freshwater Wetlands	152,132 acres		152,282 acres	152,732 acres	2030: Protect existing forested freshwater wetlands + restore 150 acres; increase target by 50 acres each out decade
Native Uplands (non-coastal)	140,600 acres	43,928 acres	141,050 acres	142,100 acres	2030: Protect existing native uplands + specifically restore 450 acres (upland restoration total = 600 acres); increase target by 50 acres each out decade; focus on pine flatwoods and protect current extent (56,717 acres)

N/A – Not Applicable; I/D – Insufficient Data; LSSM – Living Shoreline Suitability Model; JU – Potential *Juncus* Marsh Opportunity
*Does not account for lands neither currently protected nor currently under consideration for acquisition

to cooperate with private and public entities seeking mitigation credits by allowing those entities – at their cost – to enhance and restore degraded habitats on publicly-owned conservation lands, and to receive mitigation credits in return for that work.

This mechanism has the potential to accelerate both the public acquisition, enhancement, and restoration of restorable habitats on lands targeted for conservation. However, Tampa Bay resource managers have cautioned that this approach may also contribute to the net loss of critical coastal habitats in the watershed, so when applying this mechanism, careful scrutiny should be employed to ensure that watershed-level habitat restoration targets are still following a recovery trajectory.

As such, **it is recommended that the TBEP continues to pursue a unique federal-state-local-private partnership or consortium to provide the framework for the development of a coordinated approach to linking regulatory (compensatory mitigation) and resource management (publicly funded habitat enhancement, restoration, and establishment) programs in the Tampa Bay watershed.**

As an example, the Tampa Bay Nitrogen Management Consortium has been extremely successful at breaking down historical regulatory barriers related to "pollution trading," and has fostered a voluntary, non-regulatory approach to reducing nitrogen loads to Tampa Bay. Through the implementation of a Tampa Bay Habitat Management Consortium, similar benefits could be achieved with respect to optimizing and improving the cost-effectiveness of habitat protection, restoration and mitigation activities in the watershed.

Linkages to the CCMP

This Habitat Master Plan addresses multiple actions from the 2017 update to the Tampa Bay Comprehensive Conservation and Management Plan, "Charting the Course" (CCMP). Habitat Restoration has implications for and must consider fish and wildlife, climate change, invasive species, changes in hydrology, the general public, and land use decisions and regulations. Therefore, actions from several different topic areas within the CCMP are relevant to the information in this document, including:

- Bays and Habitats
  - BH-1: Implement the Tampa Bay Habitat Master Plan
  - BH-2: Establish and implement mitigation criteria for Tampa Bay, and identify priority sites for mitigation
  - BH-3: Reduce propeller scarring of seagrass and pursue seagrass transplanting opportunities
  - BH-4: Identify hard bottom communities and avoid impacts
  - BH-6: Encourage habitat enhancement along altered waterfront properties
  - BH-8: Continue and enhance habitat mapping and monitoring programs
  - BH-9: Enhance ecosystem values of tidal tributaries
  - BH-10: Implement the Tampa Bay Freshwater Wetland Habitat Master Plan
- Fisheries and Wildlife
  - FW-6: Preserve the diversity and abundance of bay wildlife
- Climate Change
  - CC-1: Improve ability of bay habitats to adapt to a changing climate
- Water Quality
  - WQ-1: Implement the Tampa Bay nutrient management strategy
- Invasive Species

  - IS-2: Support prevention, eradication or management of invasive species in Tampa Bay and its watershed
- Freshwater Inflows
  - FI-1: Maintain seasonal freshwater flows in rivers
- Wastewater
  - WW-1: Expand the beneficial use of reclaimed water
- Public Access
  - PA-1: Provide for and manage recreational uses of the bay *(BMP Manual)*
- Public Education and Involvement
  - PE-1: Promote public involvement in bay restoration and protection *(BMP Manual)*
  - PE-2: Promote public education about key issues affecting the bay
- Local Implementation
  - LI-1: Incorporate CCMP goals and actions in local government comprehensive plans, land development regulations or ordinances

Section 1.0: Introduction

1.1 Tampa Bay Habitats of Interest

The word "habitat" is derived from the Latin word *habitare*, which means to dwell, inhabit, or possess. The term is widely used, not just in ecology, but elsewhere. It is generally understood to mean simply the place where an organism, or a population of organisms, normally lives or occurs (Odum, 1971). In context of this *Tampa Bay Habitat Master Plan Update*, habitat can best be defined as native plant and invertebrate communities, and artificial structures, that provide: 1) critical substrate, shelter and/or food for other animal populations; and 2) other physical, hydrological and biological functions that support a healthy and resilient estuarine ecosystem.

This definition encompasses a multitude of micro-habitats; however, the major habitat types can be described and organized pursuant to their relationship to tidal influence. Subtidal habitats include those that are submerged all or most of the time; intertidal habitats include those that are submerged during high tides but exposed during low tides; and, supratidal habitats include those that occur above the high tide line. Moving from the open bay to the headwaters and uplands of the Tampa Bay drainage area, the habitats of interest are listed as follows:

Subtidal

- Hard bottom;
- Artificial reefs;
- Tidal flats;
- Seagrasses; and
- Oyster bars.

Intertidal

- Living shorelines;
- Mangrove forests;
- Salt barrens;
- Salt marshes; and
- Tidal tributaries;

Supratidal

- Coastal uplands;
- Non-forested and forested freshwater wetlands; and
- Native forested uplands.

Like all estuaries, the health of Tampa Bay and its coastal habitats are inextricably linked to land uses and the management of both water quality and quantity in its watershed. The Tampa Bay Estuary Program (TBEP) is fully committed to a "watershed approach" with respect to pollutant load reduction and the maintenance of ecologically appropriate tributary and riverine flows. Therefore, it follows that the same watershed approach should be applied to habitat protection and restoration. Accordingly, the full array of estuarine, freshwater, and terrestrial habitats in the Tampa Bay watershed are addressed within this plan.

1.2 Relationship to Previous Habitat Master Plans

This 2020 Tampa Bay Habitat Master Plan Update builds upon and extends the work from two previous habitat master plans published by the TBEP:

- *Setting Priorities for Tampa Bay Habitat Protection and Restoration: Restoring the Balance (TBEP Technical Publication #09-95);* and
- *Tampa Bay Estuary Program Habitat Master Plan Update (TBEP Technical Publication #06-09).*

As with these two previous plans, this update emphasizes the protection and restoration of seagrass beds, and the three major types of emergent tidal wetlands in Tampa Bay - mangrove forests, salt marshes and salt barrens. In terms of their physical structure, and the primary and secondary productivity they provide, seagrass beds and emergent tidal wetlands have been the primary focus for maintaining diverse estuarine-dependent fauna in the Tampa Bay estuary. Accordingly, they have been identified by TBEP stakeholders as *critical coastal habitats.*

Seagrass beds are most threatened by reduced light penetration caused by poor water quality. Therefore, seagrass protection and restoration in Tampa Bay has been successfully addressed primarily through water quality management strategies and initiatives implemented by the TBEP and its partners (Greening and Janicki, 2006). The TBEP has also coordinated other ongoing efforts addressing other factors affecting seagrass, including wave and tidal energy, bioturbation, dredge and fill operations, and smaller-scale perturbation (Greening et al., 2011). For emergent tidal wetlands and the other habitats, the primary management focus has been on the prevention of physical and/or hydrological alteration, and the restoration of those habitats that have been affected by such impacts.

This update differs from the two previous plans in that it directly addresses threats to critical coastal habitats posed by sea level rise and climate change. Sea levels in the Tampa Bay estuarine system have been rising slowly since the late 1800's; however, the rate of sea level rise has increased in recent decades, and is very likely to increase further over the next century (Burke et al., 2019). Rising sea levels and temperatures, and altered rainfall patterns, are changing Tampa Bay habitats now (Price et al., 2017), and those changes are expected to become more pronounced over the next several decades (Sheehan et al., 2016).

This update also includes an increased focus on coastal uplands. Native coastal upland habitats, such as coastal hydric hammocks, buffer emergent tidal wetlands from urban and agricultural development, and provide transitional wildlife habitats. Both native and potentially restorable coastal uplands also serve important roles in accommodating the landward migration of emergent tidal wetlands, as well as seagrass, in response to future sea level rise. The concept of coastal upland "reservation" is presented and discussed in this plan, and quantitative reservation targets are recommended.

In addition, this update considers and builds upon another TBEP technical publication:

- *Master Plan for the Protection and Restoration of Freshwater Wetlands in the Tampa Bay Watershed, Florida (TBEP Technical Publication #05-14)*.

Freshwater wetlands provide important hydrological and biological functions that support estuarine health, including: flood attenuation and water quality treatment; production and export of complex organic matter; and wildlife shelter and migratory corridors. Accordingly, this update includes protection and restoration targets for native forested and non-forested freshwater wetlands. Furthermore, consistent with the "watershed approach," this update also addresses native upland habitats, and the significant threats to these habitats posed by rapidly expanding urban development in the remaining undeveloped portions of the watershed.

Finally, this update has been developed using a different target setting approach than previous plans, which were based on the "Restoring the Balance" (RTB) paradigm (Robison, 2010). The conceptual basis of the RTB paradigm focused on providing adequate habitat extent (e.g., acres) for the suite of estuarine-dependent faunal species guilds and their life history stages inhabiting Tampa Bay. The RTB paradigm used historical (circa 1950) ratios of those coastal habitats to define restoration targets that would support these faunal guilds. However, the RTB approach assumed that that coastal environment was more or less static, and did not consider the potential impacts of climate change and sea level rise on coastal habitats in the target setting process. In addition, the RTB approach derived habitat targets pursuant to a formula, with no quantitative assessment of restoration potential and what is actually possible under current and projected future conditions.

The target setting approach used in this update (termed "Maximizing the Potential", or MTP) is both retrospective and prospective. It is informed by past changes, as determined through a three-decade habitat change analysis, and over forty years of habitat restoration experience in the region. Is also primarily focused on what is possible today rather than replicating past ecological conditions. The new paradigm also accommodates future stressors – especially sea level rise, climate change, and watershed development – into the target setting process. Furthermore, numeric targets are "place-based," meaning that they are based on actual "opportunity areas" that can be mapped.

Pursuant to the 2017 revision of the TBEP Comprehensive Conservation and Management Plan (CCMP), and as described further within the document, this update revises numeric protection and restoration targets, and provides suggested management actions, for: seagrasses, mangroves, salt marshes, salt barrens, and freshwater wetlands; and establishes initial numeric protection and restoration targets for tidal creeks, oyster reefs, hard bottom habitats, coastal uplands, and other native upland habitats not addressed in previous plans. The findings and recommendations presented in this document address, and may be used to implement and enhance, the following actions described in the 2017 CCMP:

- BH-1 Implement the Tampa Bay Habitat Master Plan;
- BH-2 Establish and implement mitigation criteria;
- BH-3 Reduce propeller scarring of seagrass and pursue seagrass transplanting opportunities;
- BH-4 Identify hard bottom communities and avoid impacts;
- BH-6 Encourage habitat enhancement along altered waterfront properties;
- BH-8 Continue and enhance habitat mapping and monitoring programs;
- BH-9 Enhance ecosystem values of tidal tributaries;
- BH-10 Implement the Tampa Bay Freshwater Wetland Habitat Masterplan;
- FW-6: Preserve the diversity and abundance of bay wildlife;
- CC-1: Improve ability of bay habitats to adapt to a changing climate;
- WQ-1: Implement the Tampa Bay nutrient management strategy;
- IS-2: Support prevention, eradication or management of invasive species in Tampa Bay and its watershed;
- FI-1 Maintain seasonal freshwater flows in rivers:
- WW-1: Expand the beneficial use of reclaimed water;
- PA-1: Provide for and manage recreational uses of the bay (BMP Manual);
- PE-1: Promote public involvement in bay restoration and protection (BMP Manual);
- PE-2: Promote public education about key issues affecting the bay; and

- LI-1: Incorporate CCMP goals and actions in local government comprehensive plans, land development regulations or ordinances.

1.3 Planning Horizons

It is anticipated that the TBEP Habitat Master Plan will be updated approximately every 10 years. Accordingly, this 2020 Habitat Master Plan Update defines 10-year (2030) habitat protection and restoration targets. Furthermore, this update maps habitat protection and restoration opportunity areas where these 2030 targets can be attained, and where the 2017 CCMP habitat protection and restoration strategy can be implemented over the 10-year planning horizon. However, the identified habitat protection and restoration areas will change over time, and it is appropriate that they be revised on a 10-year recurring cycle.

As noted above, this update specifically addresses the impending threats to Tampa Bay coastal habitats posed by sea level rise. Therefore, a 30-year planning horizon (2050) is also identified based upon sea level rise projections developed specifically for Tampa Bay (Burke et al., 2019). This 30-year planning horizon is addressed through the identification and mapping of a “coastal stratum” which extends from the existing mean low water line to the approximate 5-foot contour (**Map 4-1**). The coastal stratum is projected to directly experience the effects of sea level rise by 2050, and is the primary focus area for coastal habitat protection and restoration activities, both in the near-term 10-year, and the extended 30-year, planning horizons.

Section 2.0: Habitat Status and Trends

This section presents updated information on the current status and temporal trends of the Tampa Bay habitats of interest. Data sources and methods are summarized, and coastal and watershed habitats are presented and discussed in order from the subtidal zone, to the intertidal zone, and finally to the supratidal zone.

2.1 Data Source and Methodologies

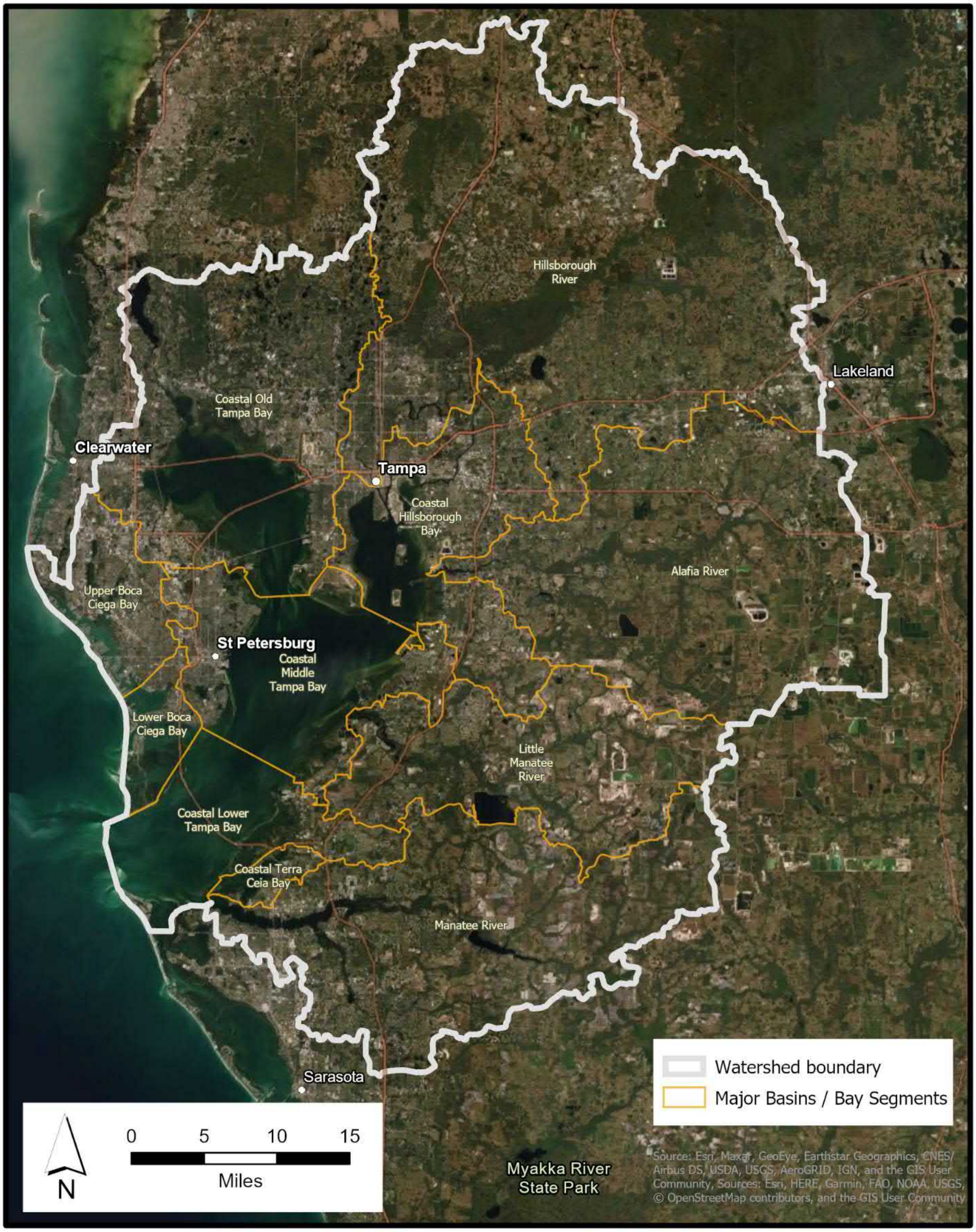
Technical reports and other information and data addressing the current extent and condition of the various habitats were assessed and compiled. To address data gaps for some habitats, the TBEP and collaborators have conducted and/or requisitioned several special studies over the past decade. Key documents and information sources are discussed in the following sections for each habitat type. However, for the majority of subtidal, intertidal and supratidal habitats, primary data derived from two routine spatial assessment programs conducted by the Southwest Florida Water Management District (SWFWMD) were utilized.

The source data used to estimate the most current areal coverage of three subtidal habitats in Tampa Bay - seagrasses, tidal flats, and oysters - was the *Seagrass in 2018* geospatial database published by SWFWMD on its website (SWFWMD, 2019a). This database classifies subtidal cover types photo-interpreted from 2018 aerial photography. The routine seagrass monitoring program was initiated in 1988 under SWFWMD's Surface Water Improvement and Management (SWIM) program. SWIM scientists assess seagrass in Tampa Bay and four other Gulf coast estuaries approximately every two years. GIS maps are produced from the photointerpretation of aerial photographs, and then verified for accuracy by conducting field surveys. The results are used to track trends in seagrass and to evaluate ongoing water quality improvement efforts. SWFWMD has estimated oyster bed coverage as part of this program since 2014.

The source data used to estimate and map the most current areal coverage of various land use and cover types in the Tampa Bay watershed was the SWFWMD *Land Use Land Cover 2017* (SWFWMD, 2019b) geospatial database also published by SWFWMD on its website. This database classifies the land use and cover types photo-interpreted from 2017 aerial photography pursuant to the Florida Land Use Cover and Forms Classification System (FLUCCS) developed by the Florida Department of Transportation (FDOT, 1999), as modified by SWFWMD (2014). The land use/cover mapping program began in 1990, and is conducted approximately every 2-3 years. The results are used to track trends in intertidal and supratidal habitats including emergent tidal wetlands, freshwater wetlands, and native upland habitats.

2.2 Bay and Watershed Segmentation

The open waters of Tampa Bay cover 242,988 acres (e.g., area below the approximate Mean Lower Low Water (MLLW) line), while its surrounding watershed encompasses another 1,450,883 acres, for a total combined area of approximately 1,693,871 acres. For management purposes, the TBEP has divided Tampa Bay proper into seven segments: Hillsborough Bay; Old Tampa Bay; Middle Tampa Bay; Lower Tampa Bay; Boca Ciega Bay; Manatee River; and Terra Ceia Bay. Similarly, the Tampa Bay watershed which serves as the TBEP study area boundary is divided into nine sub-basins (**Map 2-1**).



Source: TBEP, 2020

2020 Tampa Bay Habitat Master Plan Update

Map 2-1
Tampa Bay Watershed, Major Basin and Bay Segment Boundaries

ESA

2.3 Subtidal Habitats

Subtidal habitats addressed in this Habitat Master Plan Update include hard bottom, seagrasses, tidal flats, oyster bars, and artificial reefs. However, given the substantial ecosystem services they provide, as well as their recognition as a sentinel indicator of water quality improvement and overall bay health, this subsection gives greater attention to seagrass communities.

2.3.1 Hard Bottom

Hard bottom communities, also known as live-bottom, are widely distributed marine communities in Florida waters. They are found virtually anywhere, from shallow subtidal areas within estuaries, to the edge of the continental shelf edge (Jaap and Hallock, 1990). The main criterion for the establishment of hard bottom biota is a solid substratum upon which members of the epibiotic (e.g., surface attaching) community can become established. Attached sponges and corals can recruit onto a variety of hard substrates, from reef limestone and rocky outcrops on the sea floor, to artificial reefs in nearshore areas (Ash and Runnels, 2003).

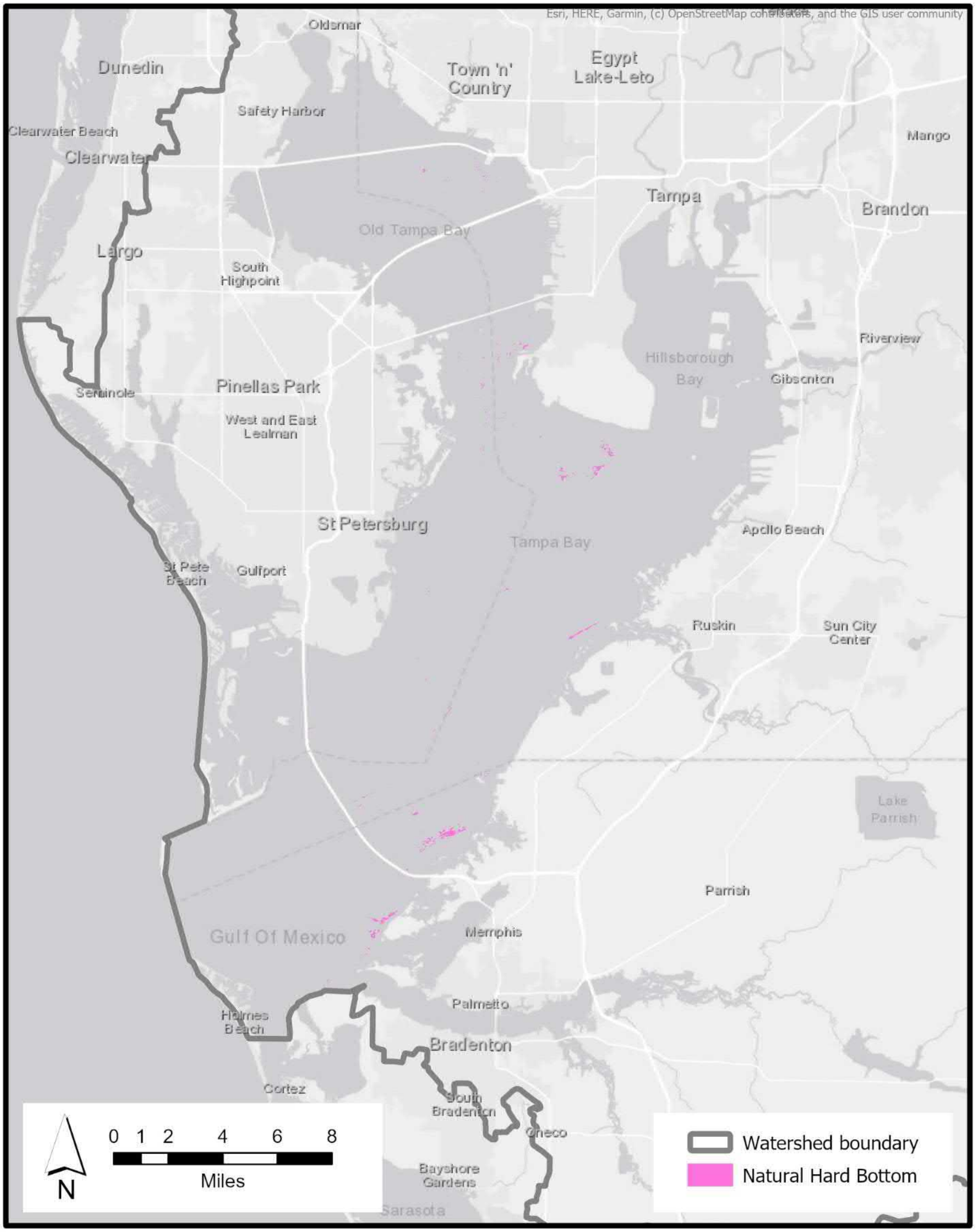
Prior to studies completed during the past three years (Kaufman, 2017; CSA Ocean Sciences, 2019), information on the extent and distribution of hard bottom habitat in Tampa Bay was largely anecdotal, or discussed in regulatory documents prepared in association with dredging and subaqueous pipeline projects. Based on the quantitative assessments provided by these studies, the best cumulative estimate of the current extent of natural hard bottom in Tampa Bay is **423 acres**. It should be noted that the two studies on Tampa Bay hard bottom communities used different classification methods for various types of hard bottom, and an additional 42 acres was classified as "artificial" hard bottom substrate. **Map 2-2** shows the estimated current (2019) spatial distribution of hard bottom habitat in Tampa Bay.

Documented hard bottom habitats in Tampa Bay are located primarily in the lower segments of the bay, and appear to be a landward extension of limestone outcroppings that occur further offshore (Ash and Runnels, 2003). The most extensive exposed rock is along the southeast margin of Tampa Bay. A line of hard bottom roughly parallels the shoreline from the Little Manatee River southward offshore of Bishop Harbor and Rattlesnake Key.

2.3.2 Seagrasses

Seagrasses are grass-like flowering vascular plants that live completely submerged in marine and estuarine waters. The depth at which seagrasses are found is limited by water clarity as some species require higher levels of light and therefore are limited to shallow areas. Although approximately 52 species of seagrasses exist worldwide, only eight species are found in Florida's marine waters. Six of these are widespread in Florida and extend beyond its borders. The following four species are the most dominant in Tampa Bay:

- **Widgeon-grass** (*Ruppia maritima*) grows in both fresh and salt water and is widely distributed throughout Florida's estuaries in less saline areas;
- **Shoal-grass** (*Halodule wrightii*) grows in salt water, is an early colonizer of vegetated areas, and usually grows in water too shallow for other species except Widgeon-grass;
- **Turtle-grass** (*Thalassia testudinum*) grows in salt water, is the largest of the Florida seagrasses, and has deeper root structures than any of the other seagrasses; and
- **Manatee-grass** (*Syringodium filiforme*) grows in salt water and is easily recognizable because its leaves are cylindrical instead of flattened like many other seagrass species.



Source: SWFWMD, 2017; CSA Ocean Sciences, Inc., 2019

2020 Tampa Bay Habitat Master Plan Update

Map 2-2
2019 Distribution of Hard Bottom

ESA

Seagrasses are sensitive to environmental stressors, and significant seagrass losses occurred in Tampa Bay prior to 1980. These losses have been attributed to indirect damage from light shading associated with degraded water quality caused by algal blooms and suspended solids as well as direct physical damage by dredging and filling, and propeller scars from boats.

Seagrasses have long been recognized as important coastal resources. The habitat value of seagrass meadows for recreationally and commercially important species of finfish and shellfish is well-documented, (Heck et al., 2003). Seagrass meadows can also stabilize sediments and reduce rates of shoreline erosion (Fonseca and Cahalan, 1992). Additionally, seagrass meadows play an important role in carbon sequestration through direct burial of biomass (Duarte et al., 2010; Fourqurean et al., 2012), or indirectly through bicarbonate sequestration (Burdige et al. 2010; Tomasko et al., 2016). The ability of seagrass meadows to partially offset, at least on a local to regional level, the impacts of ocean acidification, as documented in the Indo West Pacific by Unsworth et al., (2012) also appears to occur in Tampa Bay (Yates et al., 2016).

In Tampa Bay a 90 percent reduction in point source nitrogen loads has resulted in a substantial improvement in water quality and overall ecosystem health (Tomasko, 2002; Greening et al., 2016). Similar ecosystem recovery has been documented for Sarasota Bay in response to similar reductions in point source nutrient loads (Tomasko et al., 2005). In a recent review, it was found that seagrass coverage had increased over the period of 1999 to 2016 in six estuaries in southwest Florida: St. Joseph Sound, Clearwater Harbor, Tampa Bay, Sarasota Bay, Lemon Bay, and Charlotte Harbor (Tomasko et al., 2018). The total amount of seagrass increase across these six systems was in excess of 26,000 acres, an increase of 38 percent.

Sargent et al. (1995) documented significant propeller scarring of seagrasses throughout Florida. They also highlighted management activities to reduce scarring, including education, channel marking, increased enforcement, and limited-motoring zones. No-motor zones, such as those at Fort DeSoto and Weedon Island, or limited access areas, such as the beds near MacDill Air Force Base or Port Manatee, can help the recovery of scarring.

The photointerpretation of aerial photography has been used to create GIS data layers and quantitative assessments of each of the seven bay segments in Tampa Bay during the following years: 1950, 1982, 1988, 1990, 1994, 1996, 1999, 2001, 2004, 2006, 2008, 2010, 2012, 2014, 2016, and 2018. During the years of 1950 and 1982, estimates were for the category of “total seagrass” under FLUCCS code 9110. From 1988 onwards, seagrass meadows were further broken down into the categories of patchy and continuous seagrass, corresponding to FLUCCS codes 9113 and 9116. Patchy seagrass meadows are characterized as having no more than 75 percent of a polygon occupied by seagrass, while continuous meadows are characterized by having more than 75 percent of a polygon occupied by seagrass. All seagrass coverage data, both quantities and GIS shapefiles, discussed below were provided by SWFWMD.

Current Status

The most current (2018) estimate of total seagrass meadow coverage in Tampa Bay, as provided by SWFWMD, is **40,653 acres**, slightly exceeding the estimated 1950 coverage. **Map 2-3** shows the current (2018) spatial distribution of seagrasses in Tampa Bay. In 1996, the TBEP established a bay-wide seagrass restoration goal of 38,000 acres, which was based on attaining 95 percent of the estimated seagrass coverage in the bay circa 1950, minus non-restorable areas (e.g., dredged channels, turning basins, etc.). The recovery of seagrass in Tampa Bay over the past three decades is an international success story, and due almost entirely to water clarity improvements primarily attained through a reduction in nitrogen loads and the associated decrease in phytoplankton turbidity.

Bay-wide Trends

Over the period of record, estimated seagrass coverage throughout Tampa Bay has varied substantially. **Figure 2-1** shows seagrass coverage in Tampa Bay over the period 1950 to 2018.

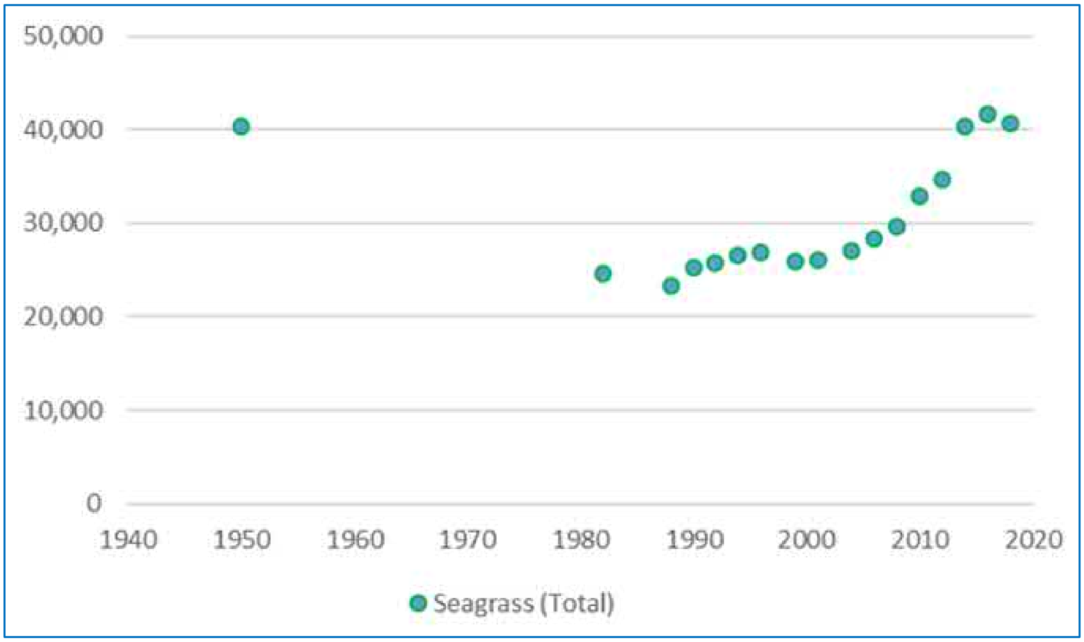
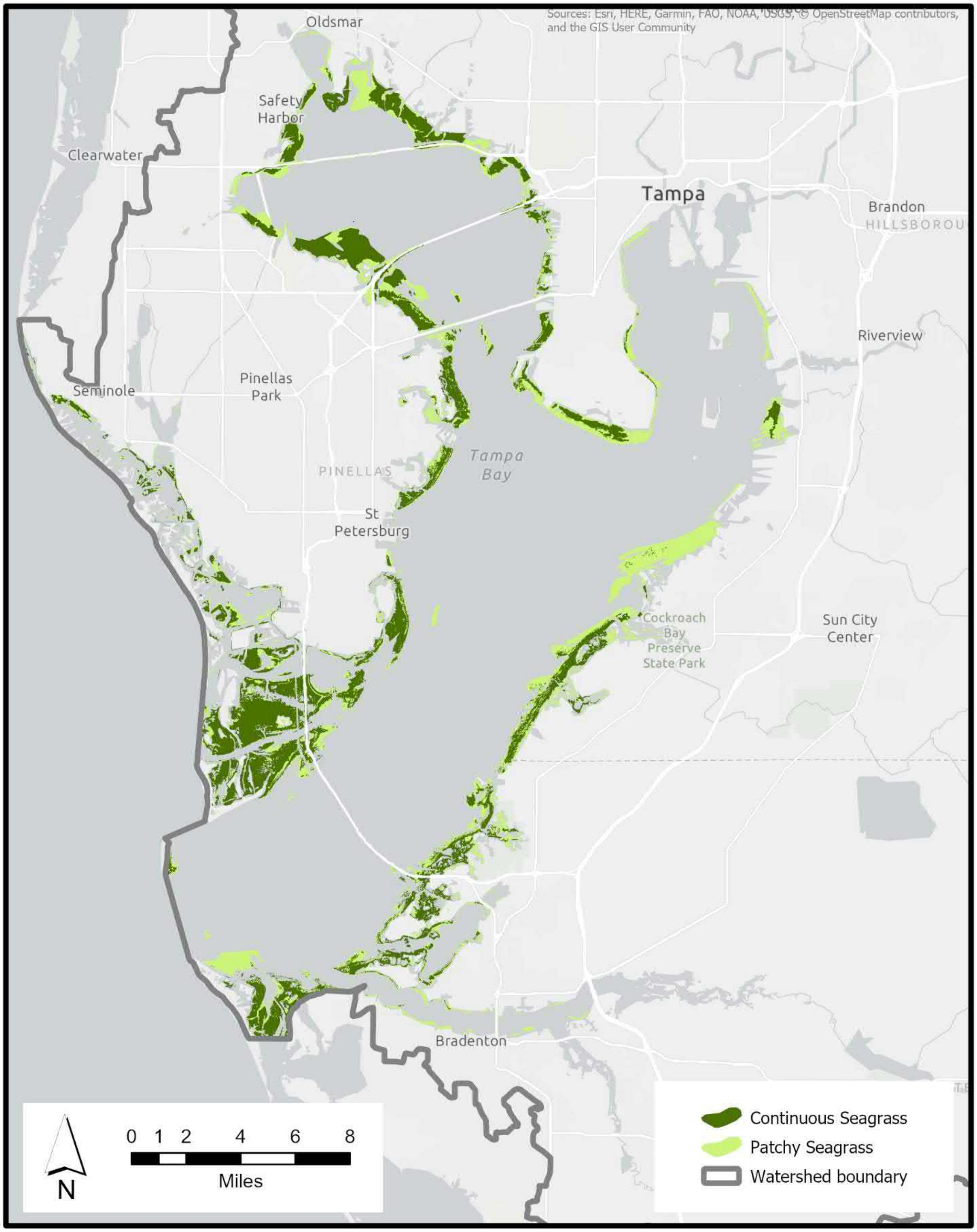


Figure 2-1
Seagrass Coverage (acres) in Tampa Bay for the Period 1950 – 2018

Between 1950 and 1988, seagrass coverage declined by 17,132 acres, a decrease of 42 percent. This period was followed by a general pattern of increase between 1988 and 1996, as seagrass coverage increased by 3,650 acres.

Following the 1997-1998 El Niño event, seagrass coverage decreased by 4 percent in 1999, a loss of 1,091 acres. This was then followed by a period of increasing coverage between 2001 and 2016, as 15,575 acres of seagrasses were added to the bay. Perhaps associated with the passage of Hurricane Irma in September 2017, seagrass coverage bay-wide again decreased by 1,003 acres, a 2 percent decline. These two events show that seagrass meadows in Tampa Bay are sensitive to meteorological perturbations, especially those involving heavy rainfall and associated increases in runoff and freshwater inflows.

The three most recent (2014, 2016, and 2018) estimates of total seagrass meadow coverage in Tampa Bay have exceeded historic, 1950s estimates (40,400 acres), as well as the established goal of 38,000 acres.



Source: SWFWMD, 2018

2020 Tampa Bay Habitat Master Plan Update

Map 2-3
2018 Distribution of Seagrasses

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Bay Segment Trends

The spatial distribution of seagrass meadows among the seven bay segments has also changed over time. **Figure 2-2** shows a pie chart of relative seagrass distribution by bay segment in 1950, 1982, and 2016.

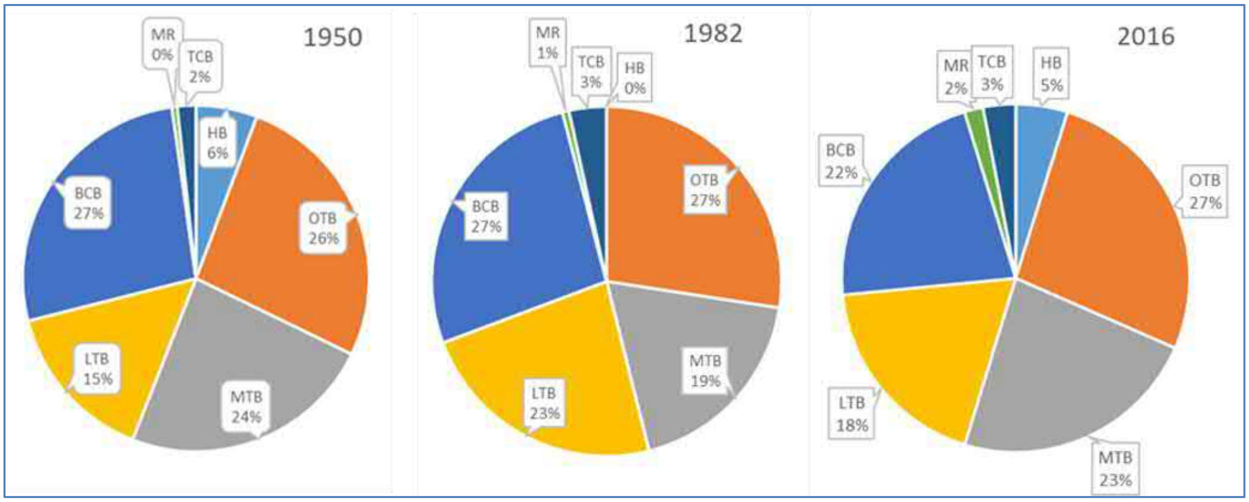


Figure 2-2
Relative Seagrass Distribution by Bay Segment in 1950, 1982 and 2016

In 1950, seagrass meadows were fairly evenly distributed between Old Tampa Bay, Middle Tampa Bay, and Boca Ciega Bay, followed by smaller abundances in Lower Tampa Bay. Hillsborough Bay had only 6 percent of the bay's total seagrass coverage. By 1982, the spatial distribution of seagrass coverage had changed significantly. Between 1950 and 1982, Hillsborough Bay accounted for 12% of bay wide losses, and seagrass meadows had effectively disappeared from Hillsborough Bay, at least in terms of their ability to be detected on aerial photography. Overall, Hillsborough Bay was disproportionately impacted by seagrass losses between 1950 and 1982, while Lower Tampa Bay was less impacted than the bay as a whole. Old Tampa Bay and Boca Ciega Bay lost seagrass at rates that were roughly proportional to the overall bay-wide losses.

Just as Hillsborough Bay was disproportionately impacted by seagrass losses between 1950 and 1982, the increase in seagrass coverage in Hillsborough Bay between 1982 and 2016 was much greater on percentage basis than increases in other bay segments. On the other hand, Old Tampa Bay had 27 percent of bay-wide coverage in 1982, and accounted for 26 percent of the bay-wide recovery between 1982 and 2016. These results suggest that Old Tampa Bay has both lost and gained seagrass at rates that are not greater or lesser than the rates for the bay as a whole, while Hillsborough Bay has both lost and gained seagrass at rates greater than the bay in total. Boca Ciega Bay accounted for 27 percent of bay-wide coverage in 1982, but only 1 percent of bay-wide increases between 1982 and 2016, suggesting a slower rate of recovery than the bay as a whole. A similar pattern was found for Lower Tampa Bay; however, Lower Tampa Bay did not lose as much coverage between 1950 and 1982 as did Boca Ciega Bay. Overall, following the bay-wide recovery of seagrasses between 1950 and 2016, the spatial distribution of seagrass meadows across the seven bay segments in 2016 was remarkably similar to the 1950 distribution.

Future Management Issues

As discussed above, the seagrass losses observed between 2016 and 2018 were disproportionately high in two bay segments - Hillsborough Bay and Terra Ceia Bay. The 543-acre decline in Hillsborough Bay during this period represents 54 percent of total bay-wide loss of 1,003 acres, even though Hillsborough Bay only contained approximately 5 percent of bay-wide coverage in 2016. Similarly, the 124-acre decrease in Terra Ceia Bay between 2016 and 2018 represents 12 percent of bay-wide losses, even as Terra Ceia Bay only contained 3 percent of bay-wide coverage in 2016. In contrast, Old Tampa Bay accounted for 31 percent of seagrass losses between 2016 and 2018, but it also represented 27 percent of total coverage in 2016.

In should be noted that the only species of seagrass recorded in Hillsborough Bay is *Halodule wrightii*, which is also the dominant species of seagrass in Terra Ceia Bay (Sherwood et al., 2017). This species typically occurs as sparse patchy coverages in shallower areas. **Figure 2-3** shows a time series plot of seagrass (*H. wrightii*) coverage in Hillsborough Bay, with a sharp downward trend in 2016. The disproportionate seagrass losses in these two segments appear to have mostly affected *H. wrightii*, possibly indicating a species-specific response to the passage of Hurricane Irma, likely related to increased freshwater inputs and associated turbidity.

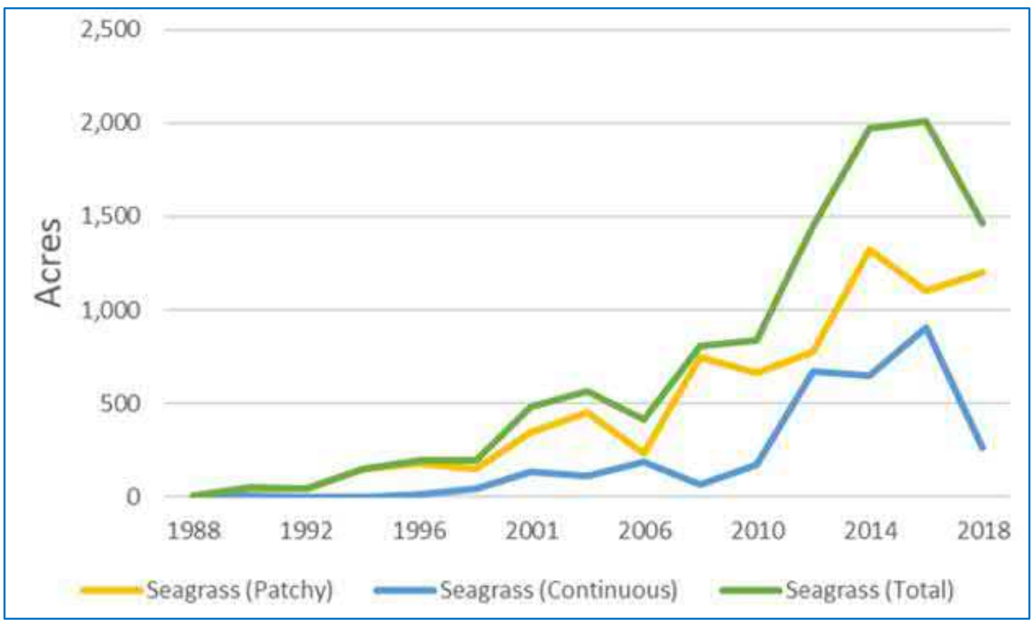


Figure 2-3
Seagrass Coverage Trends in Hillsborough Bay

Target light requirements used in the management paradigm for Tampa Bay were derived based on in situ studies of *Thalassia testudinum* meadows in Lower Tampa Bay (Dixon and Leverone, 1995). The disproportionately high decreases in seagrass coverage in parts of the bay dominated by *H. wrightii*, may require additional research and management attention, if that species proves to be more ephemeral and sensitive to meteorological perturbations than *T. testudinum*.

In the area of Hillsborough Bay called “The Kitchen” the amount of light found at the deep edge of *H. wrightii* meadows was determined to be in excess of 38 percent of immediately sub-surface irradiance (Anastasiou et al., 2010) a value substantially higher than the values of 20-25 percent developed as minimum light requirements for *T. testudinum* in Lower Tampa Bay (Dixon and Leverone, 1995). Minimum light requirements of 50 to 60 percent irradiance have been suggested as more appropriate light targets for those portions of Hillsborough Bay close by the area of loss between 2016 and 2018 (Pacowta et al., 2010). The greater light requirements for *H. wrightii* in Hillsborough Bay has been postulated to be due to exposure to higher wave energy and associated turbidity than occurs in areas with deeper depth limits, as well as the reduction in blue wavelengths of light in an area where high volumes of freshwater inflow can bring about large loads of colored dissolved organic matter (Pacowta et al., 2010).

While the 2016-2018 seagrass losses in Hillsborough Bay and Terra Ceia Bay may have been related to the relatively rare event of a passing hurricane, the severe red tide that plagued the Lower Tampa Bay and Boca Ciega Bay segments in the spring and summer of 2018 could be an additional stressor on the bay’s seagrass meadows. The combination of low water clarity and hotter water temperatures is more stressful to seagrass meadows than low water clarity and cooler water temperatures, and the 2018 red tide reached its peak in Tampa Bay during the summer and early fall. While the linkage between the 2018 red tide bloom and seagrass impacts is unknown at this time, the results from the seagrass mapping programs (e.g., photography completed in December 2019 and 2019-2020 transect data) should be reviewed carefully to determine if areas of loss in Hillsborough Bay and Terra Ceia Bay have recovered, and to see if other bay segments affected by the recent red tide represent newer areas of concern for seagrass loss.

Over the next few decades, seagrass coverage will change in response to accelerated rates of sea level rise. Along the shorelines of eastern Tampa Bay and other locations without hardened shorelines, seagrass meadows are expected to migrate upslope into areas that are not dominated by beaches, mangroves and/or salt marshes (Sheehan et al., 2016). However, gains in these areas might be offset by losses in deeper areas, if water quality remains static, or if the gains in seagrass coverage seen over the past 30 years are subsequently impacted by increasing storm or algal bloom frequency. Mapping and monitoring of this habitat, including both biennial aerial surveys and annual transects, will need to continue into the foreseeable future, to determine if the overall positive trajectories are showing signs of prolonged decline.

2.3.3 Tidal Flats

Tidal flats can be generally defined as non-vegetated bay bottoms that are predominantly subtidal. They occur below the Mean Low Water (MLW) line, but are exposed several times per month during very low tides. Tidal flats are typically found along low energy shorelines and in sheltered backwaters with low tidal velocities. For this reason, they tend to have high rates of deposition of organic sediments. High rates of organic deposition along with subtle elevation differences are important factors preventing the establishment of rooted emergent and/or submerged vegetation (Eisma, 1998). Although the lack of rooted vegetation is a primary characteristic of tidal flats, they may at times support dense algal mats.

Despite the lack of rooted vegetation, tidal flats typically support high levels of secondary and tertiary productivity (Moore et al., 1968). The organic rich sediments support dense populations of benthic invertebrates, which in turn provide an abundant food source for shorebirds and wading birds. Although it has not been documented, the presence of tidal flats in the mosaic of estuarine habitats may be critical to the maintenance of some shorebird and wading bird populations in Tampa Bay and throughout Florida (Sprandel et al., 2000).

The areal extent of tidal flats in Tampa Bay is relatively small compared to seagrass and emergent tidal wetlands. The extent of tidal flat habitat in Tampa Bay is mapped and quantified as part of the routine SWFWMD seagrass mapping program with a FLUCCS category 6510 (Tidal Flats). Beginning in 2016 SWFWMD started mapping a FLUCCS category 7210 (Sand Other Than Beaches – Submerged). These areas are distinguished from tidal flats in that they are non-vegetated areas that are always submerged. The 2018 estimate of the total coverage of tidal flats and sand other than beaches in Tampa Bay was **16,220 acres**, as determined by SWFWMD. The 2018 spatial distribution of tidal flats (FLUCCS category 6510) in Tampa Bay is shown in **Map 2-4** below.

The SWFWMD data also show a large amount of variability in tidal flat habitat, and a 94 percent decline in tidal flat coverage between 1988 and 2018. This can be partially attributed to differences in mapping methodologies and classifications throughout the period of record. It should be noted that tidal flats are typically dynamic and ephemeral habitats. Sediment erosion and/or deposition can change the wave energy level, and non-vegetated tidal flats can subsequently become vegetated with subtidal or intertidal species. Accordingly, the loss of tidal flat coverage in Tampa Bay is not necessarily an indicator of ecological decline. Rather, areas that were previously mapped as tidal flats have likely become vegetated in more recent years, and are now being classified as seagrass or some type of emergent tidal wetland.

2.3.4 Oyster Bars

The Eastern Oyster (*Crassostrea virginica*) is a reef-forming bivalve that is found along nearshore habitats in Tampa Bay. Their predominant niche is shallow areas with firm substrates such as mud/shell bottom, usually near the mouths of tidal tributaries. Eastern oysters are found along salinity gradients ranging from near freshwater conditions (salinity of 5 ppt) to oceanic salinities (salinity of 35 ppt); however, their greatest abundance is typically at intermediate salinities, with the adult physiological optimum posited to be as narrow as salinities of 15–18 ppt (Shumway, 1996).

Factors such as salinity and food availability are influenced by the quantity, timing, and quality of riverine or other freshwater inputs. This filter-feeding, sedentary invertebrate depends on unicellular algae and suspended particulate organic matter for sustenance and growth. Spawning occurs in estuarine areas primarily during late spring, summer and early fall, and the planktonic larvae require a firm substrate for further development as “spat.” Oyster shell is the preferred substrate for spat settlement; therefore, oyster populations increase primarily through the additive accretion of new oysters on existing oyster shell (Shumway, 1996).

Oysters provide food and habitat for a variety of estuarine species, including various boring sponges, gastropod mollusks (*Thais haemastoma*), polychaete worms, and decapod crustaceans (*Menippe mercenaria*). Low and variable salinity limits predation on oysters by organisms such as *Menippe* and *Thais*. Oysters over 5 cm long are relatively rare in areas of high salinity, in large part because of predation by offshore species. In addition, the incidence of certain diseases of oysters may be related to high salinities and chronic stress due to pollution. Thus, freshwater discharges not only provide food for oysters in the form of particulate organic matter, but also provides for some protection from predation and disease through salinity limitation. However, long-term exposure to freshwater can also result in substantial oyster mortality (Shumway, 1996).

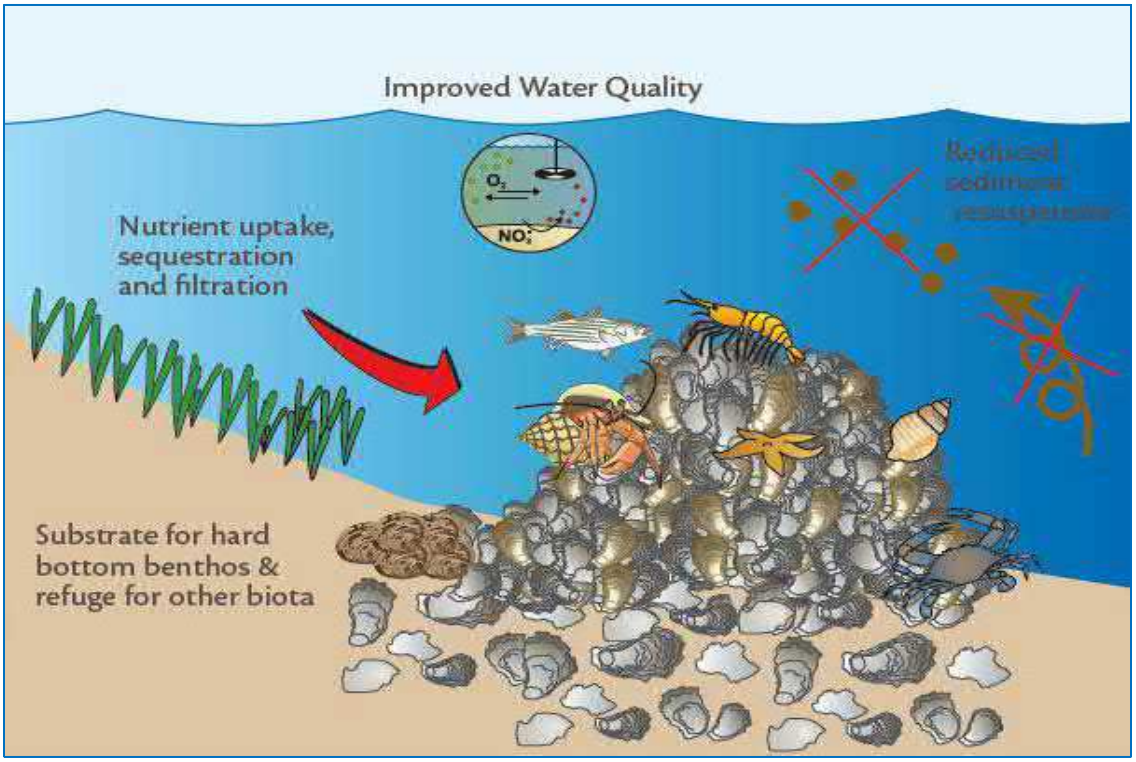
Oysters provide numerous ecosystem services and economic benefits (Coen et al., 2007). As noted above, oysters are filter feeders, and are very efficient at removing phytoplankton and other suspended organic matter from the water column. Based on recent data from Apalachicola Bay, 1 hectare (2.47 acres) of oyster bar coverage can filter up to 6,407 cubic meters (1,709,180 gallons) per hour (zu Ermgassen et al. 2013). This filtration rate will vary as a function of several variables including temperature, and the density and size frequency of the oysters; but the effect of filter feeding on water clarity can be substantial. Considering filtration rate relative to the volume and residence time of a particular estuary provides a useful indicator of the potential for oysters to have ecologically significant impacts on water clarity. It is estimated that the entire volume of Apalachicola Bay can be filtered by oysters by up to twice per hour (zu Ermgassen et al. 2013).

Oysters also alter the sediments below them through bio-deposition, including feces and pseudo-feces, which adds organic matter. These bio-deposits are then subject to decomposition by aerobic bacteria. The resulting dissolved nutrients are assimilated by seagrass and benthic microalgae, or settle into the anaerobic sediments that lie under the aerobic layer. Once dissolved nitrogen reaches the anaerobic layer, bacteria there can use it in denitrification, which converts it to nitrogen gas, removing it from the aquatic system entirely.

In addition to water quality benefits, oyster bars provide substrate for additional oyster recruitment as well as other hard both bottom benthos. And the vertical structure and interstitial complexity of oyster bars provide habitat and refuge for a wide variety of fish and other invertebrates. Finally, if located within areas approved for shellfish harvesting, oyster bars provide for a sustainable fishery that generates substantial local socioeconomic benefits. **Figure 2-4** below shows a graphic of the ecosystem benefits provided by oyster bars.

Unfortunately, the historical distribution of oyster bars in Tampa Bay is poorly documented. Anecdotal accounts of the distribution of oysters in Florida indicate that Tampa Bay was once rich in oyster abundance (Ruge, 1898). However, beginning in the late 1800's oyster shell was dredged from the most extensive oyster bars in Tampa Bay, and used primarily for construction and road bed material. Documentation and quasi-regulation of oyster shell dredging in Florida began in 1923, and between 1931 and 1974 an estimated 23.5 million tons of oyster shell was dredged from Florida oyster bars (Whitfield, 1975).

Based on dredging permits issued during this time period, the areas of oyster shell dredging in Tampa Bay were concentrated in the Manatee River, Hillsborough Bay, Old Tampa Bay, and portions of Middle Tampa Bay intersected by the federal shipping channel (Whitfield, 1975; Fig. 4). This information indicates that the historical abundance and distribution of oyster bars in the open waters of Tampa Bay was likely far greater than what exists today. The most concentrated extant oyster bars are limited primarily to the mouths of tidal tributaries and lower salinity reaches of the bay including: Weedon Island and Cross Bayou in Pinellas County; Double Branch Creek, McKay Bay, and Cockroach Bay Hillsborough County; and Terra Ceia Bay, Frog Creek, and the Manatee River in Manatee County.

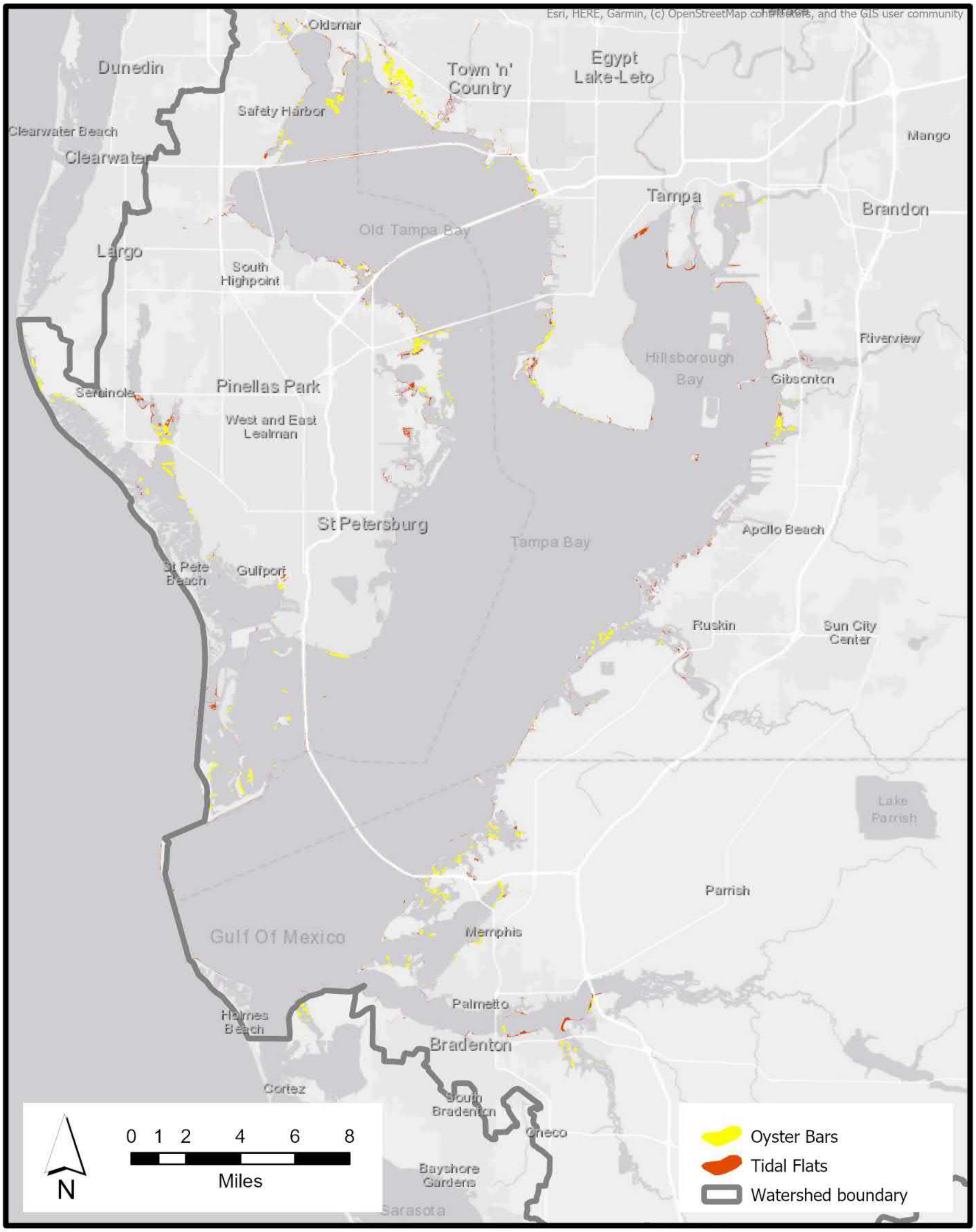


SOURCE: NOAA

Figure 2-4
Ecosystem Benefits Provided by Oysters

The extent of oyster bars in Tampa Bay has been mapped and quantified as part of the routine SWFWMD seagrass mapping program since 2014. However, oyster bars have proven to be difficult to map and quantify due to the fact that they are small submerged features, and their signature on aerial photography can be difficult to distinguish from seagrass and other benthic features. The seagrass mapping program only maps oyster bars that can be seen in open water, and underestimates the total coverage of oysters, not accounting for clusters along mangrove shorelines and in the mouths of tidal tributaries. Nonetheless, oyster bars do not appear to be major component of the current estuarine habitat complex in Tampa Bay. The most current 2018 estimate of oyster bars coverage in Tampa Bay is **171 acres**, as determined by SWFWMD. The 2018 spatial distribution of oyster bars in Tampa Bay is shown in **Map 2-4** (combined tidal flats and oyster bars).

Techniques for oyster bar restoration are well-proven, and have been successfully implemented in numerous locations in Gulf of Mexico estuaries (La Peyre et al., 2014). The simplest approach involves the placement of cleaned oyster shell (cultch) in nearshore and subtidal areas with a suitable bottom substrate and salinity, typically on relic oyster bars. This restoration technique places cultch material in areas with appropriate conditions to provide a hard substrate for oyster recruitment and to restore or create three-dimensional oyster bar habitat. This technique can be used to restore lost oyster bar habitat, expand existing oyster bar habitat, or enhance oyster abundance at existing bars. Cultch material can consist of either loose or contained oyster or other bivalve shell, limestone rock, crushed concrete, and other similar material that, when placed in areas with adequate larval supply, provides a substrate on which free-floating oyster larvae can attach and grow (La Peyre et al., 2014).



Source: SWFWMD, 2018

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Map 2-4
2018 Distribution of Tidal Flats and Oyster Bars

ESA

2.3.5 Artificial Reefs

Artificial reefs are one type of "artificial habitat" considered in this 2020 Habitat Master Plan Update, the other being living shorelines (see Section 2.3.5 below). The term "artificial habitat" refers to man-made materials and structures placed in the marine and estuarine environment to create or enhance habitat functions, and to provide other ecosystem services (e.g., erosion control). The primary distinction between artificial reefs and living shorelines is that the former is a subtidal habitat while the latter is typically an intertidal habitat.

Artificial reefs provide hard-bottom substrate to increase biological diversity and productivity, and enhance recreational fishing opportunities in Tampa Bay. They are typically constructed from cleaned concrete material, usually derived from the demolition of bridges, roadways, etc. There are 12 documented artificial reefs within the open waters Tampa Bay. These in-bay artificial reefs are typically smaller in size, and located in shallower water, than offshore reefs, ranging in depth from less than 10 feet to approximately 30 feet.

Of the 12 artificial reefs in Tampa Bay, eight (8) are managed by Hillsborough County, three (3) are managed by Manatee County, and one (1) is managed by Pinellas County. Hillsborough County has deployed over 50,000 tons of material across their eight reefs since 1986, creating approximately 124.5 acres of artificial reef habitat. Surface area estimates were not available for the Manatee County and Pinellas County reefs, but assuming an average size of 10.4 acres, based on the Hillsborough County reefs, the total acreage of artificial reefs in Tampa Bay is estimated to be approximately **166 acres**. The locations of the 12 in-bay artificial reefs are shown in **Map 2-7** (combined subtidal and intertidal artificial habitats).

2.4 Intertidal Habitats

Natural intertidal habitats addressed in this 2020 Habitat Master Plan Update include mangroves, salt marshes and salt barrens. Together, these three habitats comprise the mosaic of "emergent tidal wetlands" in Tampa Bay. In addition, tidal tributaries are included as a type of intertidal habitat, as they experience the full range of tidal fluctuation and support the emergent tidal wetland communities. Finally, living shorelines, which encompass a range of artificial habitats constructed in the intertidal zone, are addressed.

Emergent tidal wetlands occur primarily along a natural intertidal shelf which rims the bay and its tidal tributaries, and to a lesser extent, along filled intertidal areas created by urban and port development. Mangrove forests and herbaceous salt marsh communities compete for space within the estuarine intertidal zone which occurs along low energy and low gradient shorelines, as well as tidal creek margins.

Collectively, emergent tidal wetlands form an important habitat complex in Tampa Bay. They provide critical habitats for much of the bay's wildlife, are an important component of nutrient cycles, stabilize submerged shoreline sediments thereby minimizing shoreline erosion, and assimilate pollutants carried in runoff from upland urban areas. Emergent tidal wetlands provide attachment sites for algal and invertebrate communities, and provide habitat below the water surface for hundreds of recreational and commercially important species of fish, shrimp, crabs and other shellfish. Such species include pink shrimp, menhaden, blue crabs, mullet, red drum, tarpon, and snook. The marsh grasses and mangrove trees also provide critical feeding, nesting and sheltering habitat for a variety of birds such as pelicans, cormorants, herons, ibises, spoonbills and egrets.

Salinity is an important factor in the distribution of emergent tidal wetlands. In Tampa Bay, the polyhaline zone (18-30 ppt) is typically composed of red mangroves and fringing cordgrass marshes; while the mesohaline zone (5-18 ppt) is dominated by black mangroves and black needlerush marshes. The oligohaline zone (0.5-5 ppt) is usually restricted to small reaches within tidal tributaries often supports a range of herbaceous species including leather fern, sawgrass, and saltgrass. Finally, hypersaline regimes (>35 ppt) caused by seawater ponding and evaporation, and are characterized by halophytic shrubs such as saltwort (Lewis and Robison, 1996).

Although these salinity-driven distributional patterns are well documented, it should be noted that most estuarine plant species have broad salinity range tolerances, and can withstand extremes on both ends of the scale. In addition to salinity, the observed zonation of estuarine plant communities represents an integration of numerous factors, including: elevation; wave energy; sediment grain size and nutrients, freshwater inputs; exposure to freezing temperatures; and interspecific competition. Therefore, the overall coverage and relative composition of the various types of emergent tidal wetlands in the bay are in a constant state of flux due to both natural and anthropogenic factors (Lewis and Robison, 1996).

Although emergent tidal wetlands often co-exist as complex assemblages, each of the three major components is a distinct community with unique characteristics. The species composition and spatial distribution of the mangrove forest, salt marsh, and salt barren communities of Tampa Bay are discussed below.

2.4.1 Mangrove Forests

Mangrove forests in Florida are composed of four species of trees: red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erecta*).

Mangroves are facultative halophytes, meaning that saltwater is not required for good growth. While Florida mangroves can grow quite well in fresh water, mangrove ecosystems do not develop in strictly freshwater environments, apparently because of ecological competition from freshwater plant species. Therefore, salinity clearly plays a key role in mangrove ecosystem development and distribution; and within the intertidal zone salinity is often closely related to topographic elevation. Accordingly, the four species are generally distributed along a salinity and elevation gradient in the intertidal zone with the red mangrove at the lowest elevations (highest salinity) and the buttonwood at the highest elevations (lowest salinity). However, mangrove forest structure in Florida is not uniform and many variations on the classic zonation are described in the literature (Odum and McIvor, 1990).

Water fluctuations – both tidal and freshwater runoff – are also important to mangrove forest development. Tidal action carries mangrove propagules into the upper portion of the estuary, thus facilitating reproduction and recruitment. Water fluctuations transport nutrients and relatively clean water to the mangroves while flushing out accumulations of hydrogen sulfide and salts from sediment pore waters. Mangrove forests reach their greatest extent in height and biomass where they can intercept significant quantities of freshwater and nutrients from terrestrial runoff. Because of these factors, mangrove ecosystems often reach their greatest areal extent in low-lying regions with relatively large tidal ranges and annual rainfall (Odum and McIvor, 1990).

Mangrove forests are mapped as part of SWFWMD's routine land use/cover mapping program. It is usually not possible to distinguish between the various species of mangroves via aerial photointerpretation, so they are typically classified as a single FLUCCS (6120 – Mangrove Swamps). As determined in the 2017 land use/cover update, the most current estimate of the extent of mangrove forests in Tampa Bay is **15,300 acres**. The 2017 spatial distribution of mangrove forests in Tampa Bay is shown in **Map 2-5** below (combined emergent tidal wetlands).

2.4.2 Salt Marshes

Salt marshes are plant communities composed of non-woody, salt-tolerant rushes, sedges, and grasses occupying intertidal zones that are at least occasionally inundated with saltwater. Salt marshes in Tampa Bay are dominated by black needlerush (*Juncus roemerianus*). Several other plant species are common minor components of local needlerush marshes including cordgrass (*Spartina alterniflora* and *Spartina patens*), saltgrass (*Distichlis spicata*), and salt jointgrass (*Paspalum vaginatum*). In Tampa Bay, salt marshes typically occur within tidal tributaries and embayments where mesohaline salinity regimes are maintained most of the time.

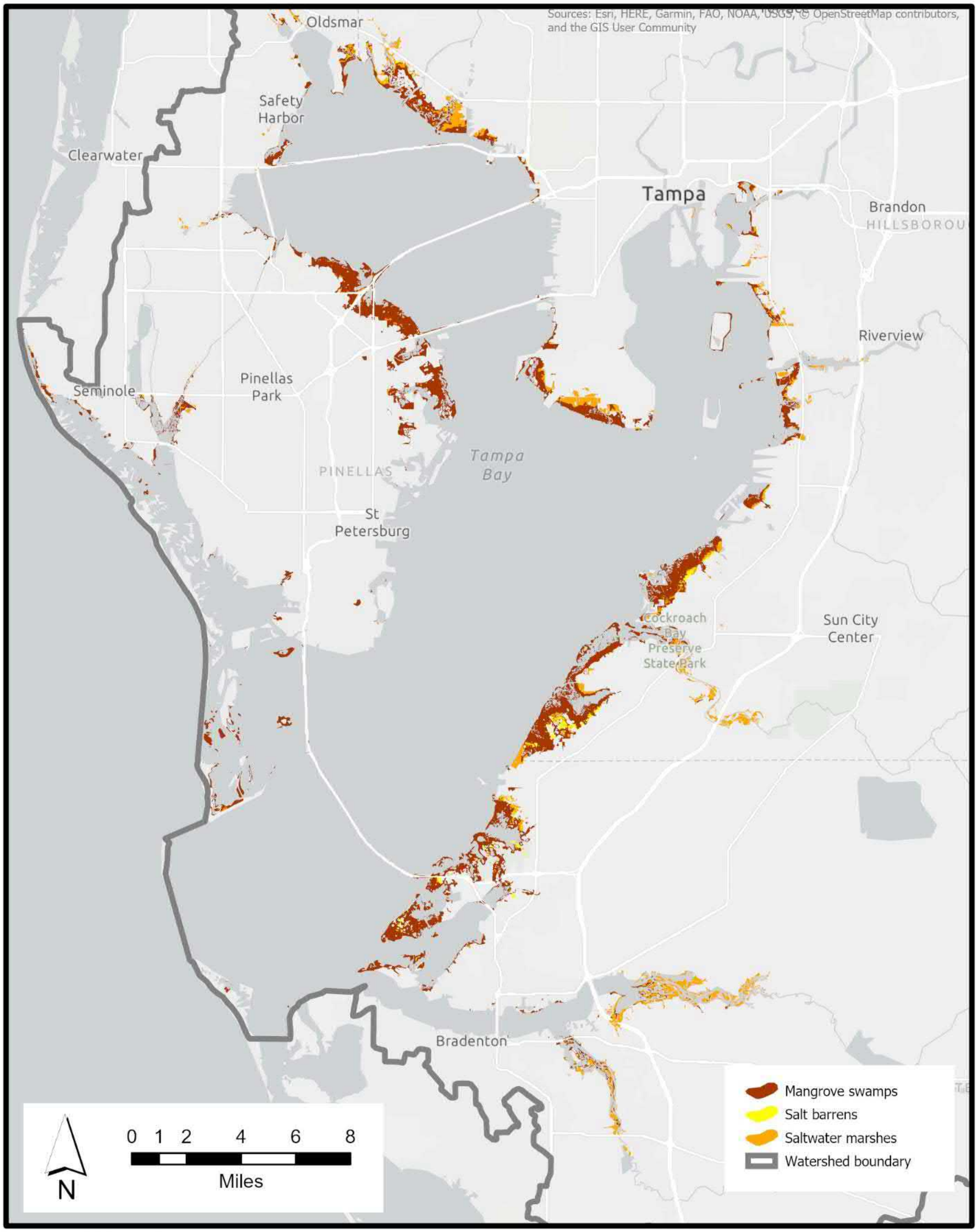
Salt marshes, previously the dominant habitat in Tampa Bay, have been overtaken by mangroves. Over a 125-year period from the ca. 1874 until ca. 2000, the Tampa Bay mangrove-to-marsh ratio reversed from 86:14 to 27:75 (Raabe et al. 20102). From 1990 to 2017, it is estimated that 540 acres of salt marshes have been converted to mangrove habitat (Janicki Environmental, 2020, unpublished data). This trend has also been well-documented throughout the Gulf of Mexico, with climate change and sea level cited as the factors most responsible for this ecological shift (Comeaux et al., 2012).

The conversion of Tampa Bay's salt marshes to mangrove forests may have potential consequences for carbon sequestration that have been a recent focus of investigation (Sheehan et al., 2016). In terms of carbon fixation and sequestration in Tampa Bay, mangrove forests appear to be twice as efficient as salt marshes (Radabaugh et al., 2018). However, assessing the full range of impacts of this ecological shift on the habitat requirements of other estuarine dependent species, and the overall estuarine food web, needs further investigation.

Salt marshes are mapped as part of SWFWMD's routine land use/cover mapping program. It is usually not possible to distinguish between the various species in salt marsh communities via aerial photointerpretation, so they are typically classified as a single FLUCCS (6420 – Saltwater Marshes). As determined in the 2017 land use/cover update, the most current estimate of the extent of salt marshes in Tampa Bay is **4,557 acres**. The 2017 spatial distribution of salt marshes in Tampa Bay is shown in **Map 2-5**.

2.4.3 Salt Barrens

Salt barrens, also referred to as salt flats or salterns, occupy the upper edge of the intertidal flat which is inundated typically only by higher high tides several times per month. The pooling and evaporation of tidewater results in hypersaline conditions. In Tampa Bay, expansion of succulent, salt-tolerant groundcover vegetation occurs during the dry season, followed by retreats during the wet season caused by higher rainfall amounts and more dilute salt concentrations in the interstitial pore water of marsh sediments. This salinity stress produces the characteristic open non-vegetated patches of the salt barren substrate.



Source: SWFWMD, 2017

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Map 2-5
2017 Distribution of Emergent Tidal Wetlands

Salt barrens are typically located behind a mangrove forest or tidal marsh at a slightly higher elevation, and often occurs on exposed rock outcrops with shallow sandy sediments. Salt barrens represent a distinct plant community, with common species consisting of: annual glasswort (*Salicornia bigelovii*), saltwort (*Batis maritima*), perennial glasswort (*Salicornia virginica*), key grass (*Monoanthochloe littoralis*), sea lavender (*Limonium carolinianum*), samphire *(Blutaparon vermiculare*), and sea purslane (*Sesuvium portulacastrum*). Black and white mangroves can also occur in salt barrens, generally in dwarfed forms.

Due to their low structural complexity and relative paucity of macro-fauna, salt barrens are often assumed to have low ecological value. However, salt barrens concentrate juvenile fish in tide pools, which provides rich feeding areas for wading birds, and for carnivorous fish (e.g., snook and tarpon) when these habitats become accessible during king tides and other tidal surges. In addition, salt barrens are important habitat for fiddler crabs (*Uca spp*.), burrowing detritivores that play an important role in salt marsh predator-prey dynamics, as well as sediment aeration and salt marsh nutrient recycling (Bertness, 1985).

Salt barrens have been properly mapped as part of SWFWMD's routine land use/cover mapping program since 2004, and are classified as a single FLUCCS code (6600 – Salt Flats). It should be noted that prior to 2004, the SWFWMD land use/cover mapping did not distinguish intertidal salt barrens from subtidal tidal flats and other non-vegetated beaches along estuarine shorelines. However, with the 2004 land use/cover update the program started consistently mapping intertidal salt barrens, and relegated the mapping of subtidal habitats, including tidal flats, to the seagrass mapping program. As determined in the 2017 land use/cover update, the most current estimate of the extent of salt barrens in Tampa Bay is **496 acres**. The 2017 spatial distribution of salt barrens in Tampa Bay is shown in **Map 2-5** above.

2.4.4 Tidal Tributaries

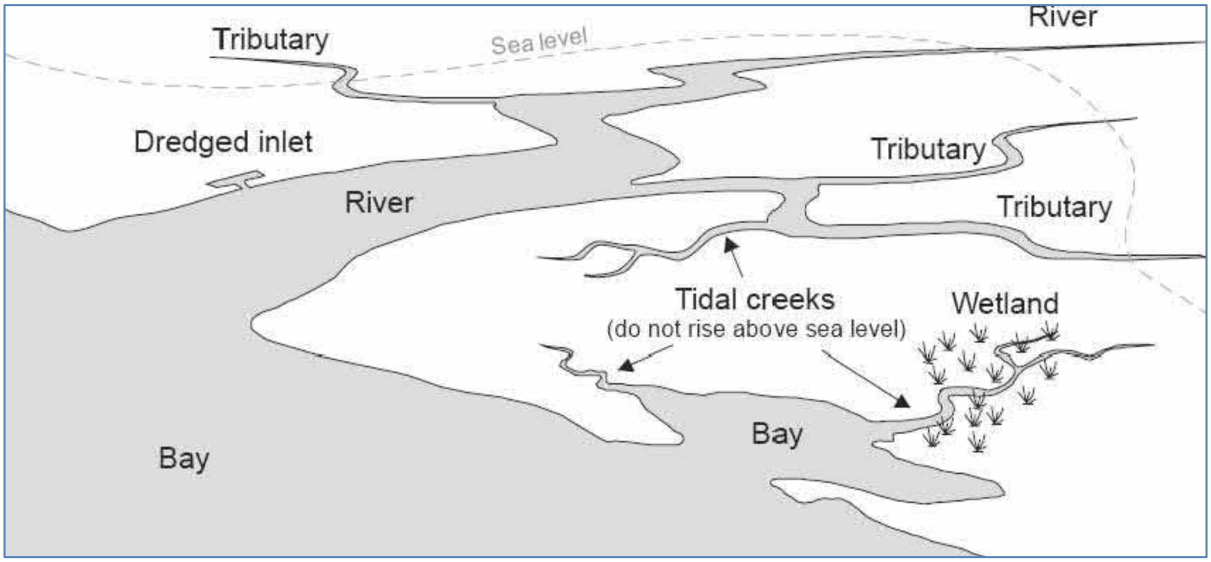
Tampa Bay has four major tidal rivers – the Hillsborough, Alafia, Little Manatee, and Manatee Rivers – as well as dozens of smaller tidal tributaries and creeks (Estevez et al., 1991). While the four major river systems have been well-studied, relatively little is known about the hydrology, water quality, and biology of the smaller tidal tributaries. Cumulatively, these smaller tidal tributaries probably account for a substantial percentage of the total linear distance of estuarine lotic (e.g., flowing) habitat in Tampa Bay.

While the ecological importance of the smaller tidal tributaries in Tampa Bay has been recognized since the early 1980's, defining what distinguishes a tidal creek from a tidal river has been problematic. In a study titled *Ecological Assessment, Classification, and Management of Tampa Bay Tidal Creeks* (TBRPC, 1986), tidal creeks were defined as "small streams of the Pamlico Terrace in which tidal prisms are equal to or larger than the average discharge." Using this definition, the TBRPC mapped 44 named tidal creeks in the region, 37 of which are in the Tampa Bay watershed.

This issue was further studied by the Tampa Bay Tidal Tributary Project Team (TBEP, 2008), as well as the Sarasota Bay National Estuary Program (Janicki Environmental and Mote Marine Laboratory, 2016 and 2020). As part of the latter effort, Technical Advisory Committee members from both the TBEP and SBNEP jointly developed a definition for "tidal creeks." as stated below:

> *A tidal creek is a manmade or natural water conveyance channel (typically Strahler third order or less) with fluctuations in salinity caused by exchange of fresh and estuarine waters that is thought to result in brackish water conditions at some point during the course of a typical meteorological year.*

It should be noted that the terms “tidal tributary” and “tidal creek” are not equivalent. Pursuant to the definition above, tidal tributaries have contributing watersheds and deliver adequate freshwater volumes to create brackish water conditions; whereas, tidal creeks typically do not deliver significant freshwater volume, and thus do not rise above sea level (TBEP, 2008). To illustrate these differences, **Figure 2-5** shows a graphical depiction of tidal rivers, tidal tributaries, and tidal creeks in a typical estuary.

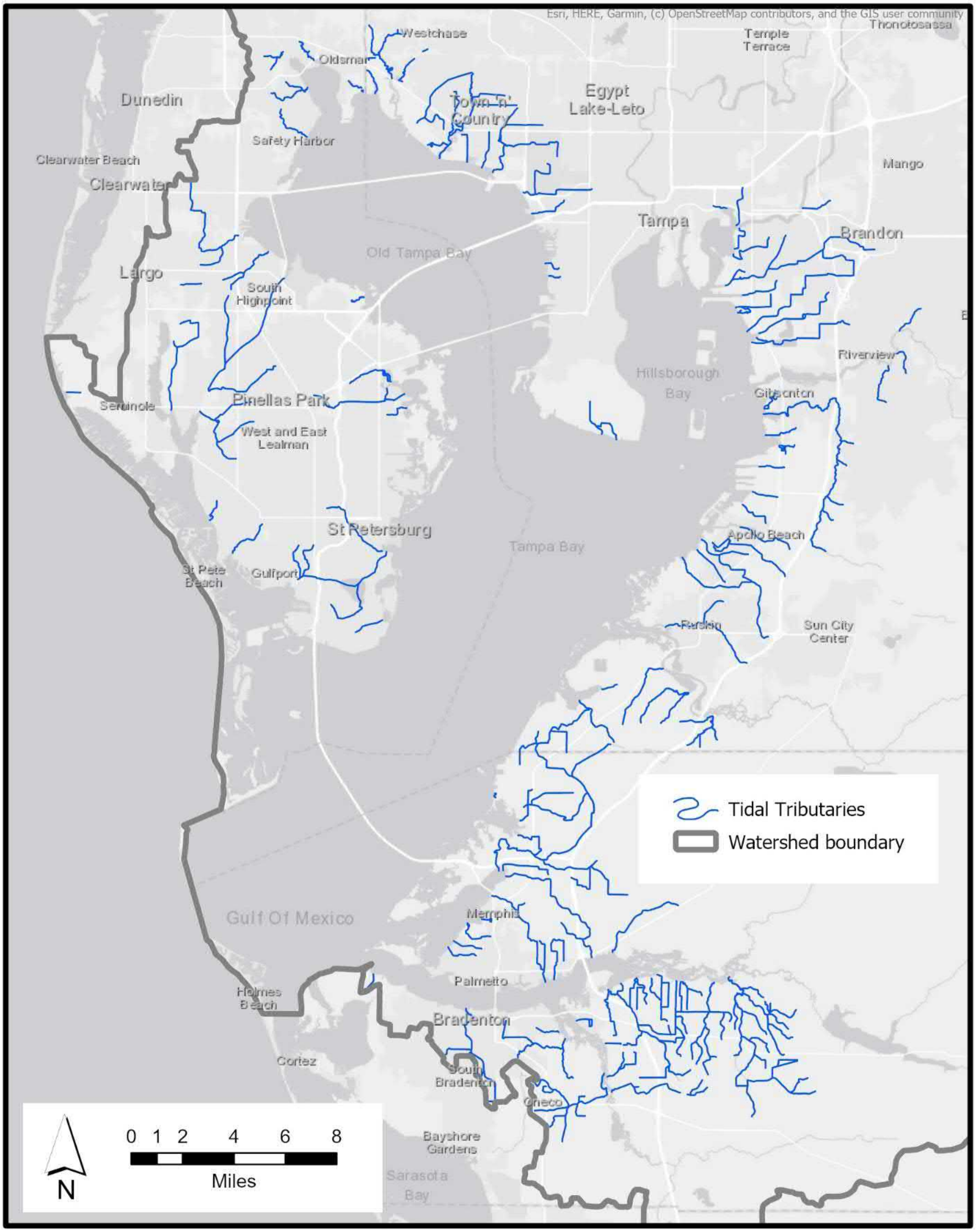


SOURCE: TBEP, 2008

Figure 2-5
Graphical Depiction of Tidal Tributaries in a Typical Estuary

Based on the above definition, the universe of smaller tidal tributaries in the Tampa Bay, Sarasota Bay, and Charlotte Harbor watersheds was inventoried, and a GIS data layer of tidal creeks was developed. For this Habitat Master Plan Update, the Southwest Florida Tidal Creek GIS data layer was clipped to the Tampa Bay watershed boundary to quantify the extent of tidal creek.

A review of this data layer was conducted to ensure that the extent of the tidally-influenced stream segments was properly accounted for. This review involved an overlay of Water Body Identification (WBID) polygons delineated by FDEP onto the tidal creek data layer and then clipping the stream segments to only include those that occurred in an “estuarine” WBID. Using this approach, the extent of tidal creek habitat in the Tampa Bay watershed is 2,041,820 linear feet, or about **387 linear miles**. The current extent and spatial distribution of tidal creeks in the Tampa Bay watershed is shown in **Map 2-6**.



Source: Janicki Environmental, Inc. and Mote Marine Laboratory, 2019

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Map 2-6
Distribution of Tidal Tributaries

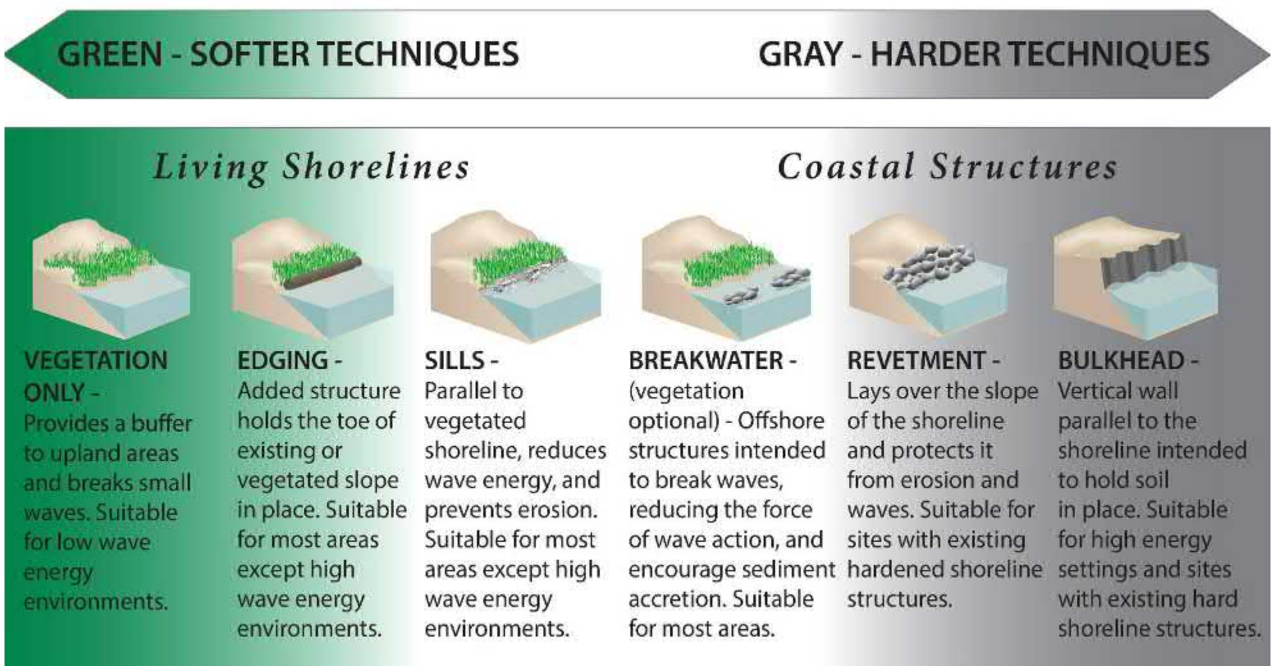
ESA

2.4.5 Living Shorelines

As discussed in Section 2.2.4 above, living shorelines are a type of artificial habitat placed or constructed within the intertidal zone to create or enhance habitat functions, and to provide other ecosystem services including erosion control and the enhancement of coastal resilience. The term “living shoreline” has been defined by Restore America’s Estuaries (RAE, 2015) as:

> *Any shoreline management system that is designed to protect or restore natural shoreline ecosystems through the use of natural elements and, if appropriate, manmade elements. Any elements used must not interrupt the natural water/land continuum to the detriment of natural shoreline ecosystems.*

As defined by RAE, living shorelines are encompassed within the continuum of shoreline stabilization and enhancement alternatives - ranging from “green-softer” techniques, to “grey-harder” techniques – as shown in **Figure 2-6** below (NOAA, 2015).



SOURCE: NOAA, 2015

Figure 2-6
Continuum of Shoreline Stabilization and Enhancement Techniques

Living shorelines incorporate vegetation or other living, natural “soft” elements alone or in combination with some type of harder structure for added stability and erosion protection. They attract epibenthic fauna including encrusting filter-feeding invertebrates, and benthic microalgae. Depending on the breadth of the intertidal zone, salinity, and wave energy these habitats may also recruit diverse subtidal sponge and macroalgal populations, as well as mangrove in intertidal crevices. These structures directly contribute to localized improvements in water quality (due to the removal of suspended matter by filter feeding organisms) as well as increased fish and avifaunal abundance and diversity (RAE, 2015). In addition, because living shorelines incorporate vegetation, they can expand both horizontally and vertically over time through sediment accretion and the growth of living resources, thus they have the potential to keep pace with sea level rise. It is the living component of living shorelines that make them more resilient than other greyer techniques.

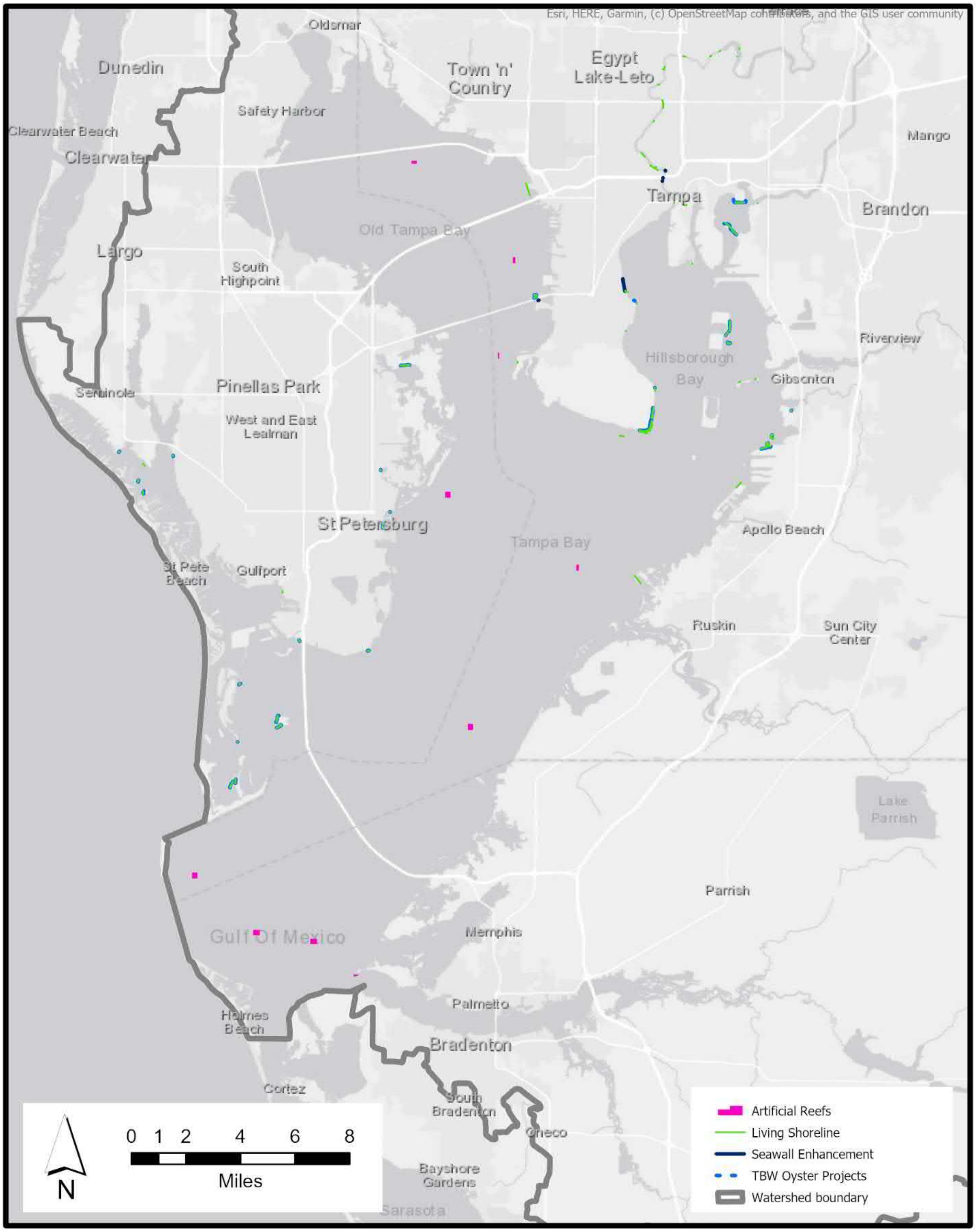
While living shorelines are the preferred option, if the complete transition to a living shoreline is not practical in a given location, there are other options incorporating living shoreline components that can substantially enhance habitat structure and substrate richness. In these locations, enhancements consisting of rock rip-rap and oyster reef modules are typically placed along the toe of vertical seawalls to increase structural and biological complexity as well as to absorb wave energy and prevent undercutting and scouring. The latest design approach is to embed a sediment “bag” within the rip-rap at the appropriate elevation so marsh grasses or even mangrove trees can be planted within the sediment layer. These narrow planters have demonstrated that they can sustain productive vegetative communities that provide microhabitat for a variety of crustaceans and fish, which also attracts wading birds. These seawall enhancements reduce wave energy and extend the lifespan of the seawall structure, while also providing ecological functions and some fisheries and benthic habitat. These improvements are typically referred to as “seawall enhancement” projects.

In the Tampa Bay area, the earliest nature-based shorelines were not called living shorelines, but they did employ natural materials to absorb wave energy in conjunction with gently sloped banks and native vegetation. The SWIM program experimented with these designs in the mid 1990’s, implementing projects such the Lowry Park shoreline stabilization project in Tampa and the Ribbon of Green, USF property, on the Hillsborough River. Also, the TBEP funded a seawall enhancement project near the Gandy boat ramp with the installation of MacBlock™. These were stackable cement blocks with a partially hollowed out center for sediment to be added and then planted with mangrove seedlings.

The biggest push for nature-based shorelines was implemented by the City of Tampa in 2004-2005 under a program called the Tampa Shoreline Restoration Initiative (TSRI). This innovative program assessed 30 City-owned waterfront properties for sites that could be better protected with nature-based designs. Twelve sites, many along the Hillsborough River and the shores of Hillsborough Bay, were permitted and implemented by the TBEP program. Since then, other entities (SWIM, Ecosphere Restoration Institute, and Tampa Bay Watch) have implemented living shorelines and seawall enhancement projects throughout the region.

Until now there has been no comprehensive inventory or mapping effort to document the types and locations of living shoreline projects completed to date in Tampa Bay. Living shoreline projects were extracted from the inventory of habitat restoration projects completed in Tampa Bay (see Section 3.4 below). Based on this analysis, the best estimate for coverage of living shoreline projects, including oyster reef modules and other seawall enhancement as described above, is **11.3 miles**. The current spatial distribution of artificial reef and living shorelines in Tampa Bay is shown in **Map 2-7** (combined artificial reefs and living shorelines).

It should be noted that **Map 2-7** depicts living shoreline and seawall enhancement projects as continuous straight lines which approximate locations and linear extent of projects, as reported by lead partners and/or aerially interpreted, combined with institutional knowledge. In reality, these projects may curve or contain gaps. This inventory includes 89 living shoreline and seawall enhancement projects which have been successfully installed within the Tampa Bay watershed since 1979. There are at least 10 more currently in the design or permitting phase as of this writing.



Source: EPCHC, 2020; Tampa Bay Watch, 2020; ESA 2020

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Map 2-7
2020 Distribution of Artificial Reefs and Living Shorelines

ESA

2.5 Supratidal Habitats

Supratidal habitats include freshwater wetland and native upland plant communities. Both of these general habitat classifications can be further subdivided into forested and non-forested types. The native uplands classification also includes "coastal uplands," a generic term that has been used to describe a relatively small group of native terrestrial plant communities that occur immediately above the high tide line. The basic tenet of the watershed approach is that all water that falls within the boundaries of the watershed is interconnected and expressed through the continuum of natural plant communities that extend from the headwaters to the estuary. Therefore, supratidal habitats are an important component of this Habitat Master Plan Update.

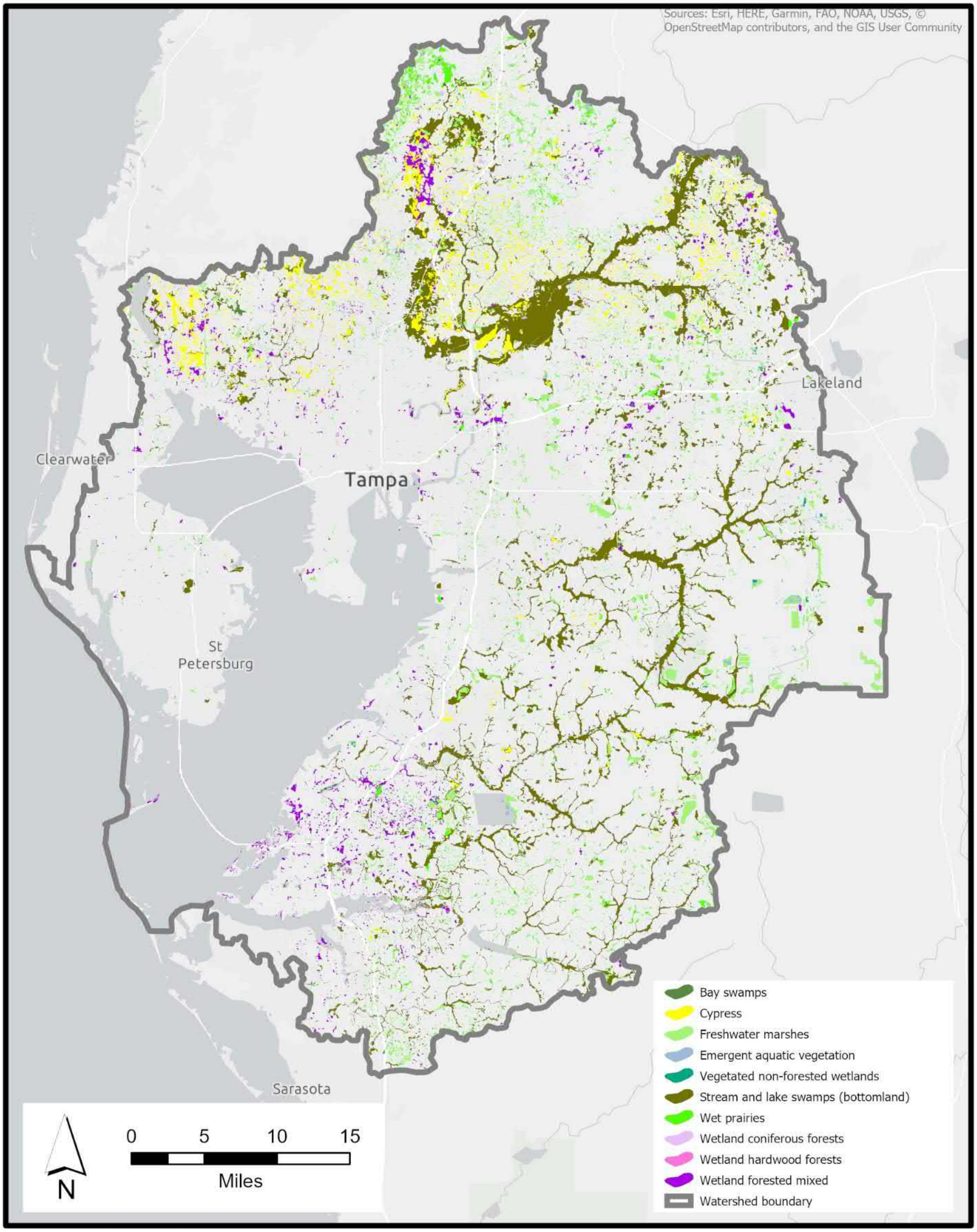
2.5.1 Freshwater Wetlands

Both natural freshwater waterbodies (e.g., streams and lakes), and various types of native freshwater wetlands are mapped, as part of SWFWMD's routine land use/cover mapping program. There are numerous FLUCCS codes that describe a range of freshwater wetland communities, including specific species assemblages (e.g., bay swamp); however, the photointerpretation of specific wetland types is often very difficult. Nonetheless, it is possible to very accurately distinguish forested wetlands from non-forested wetlands; and to a somewhat lesser degree hardwood forests from coniferous forests. Therefore, for the purposes of this analysis all applicable FLUCCS codes representing the suite of natural freshwater wetlands were rolled up to Level 2 classifications as follows:

- 5100 - Streams and Waterways;
- 5200 - Lakes;
- 6100 - Wetland Hardwood Forests;
- 6200 - Wetland Coniferous Forests;
- 6300 - Wetland Forested Mixed;
- 6400 - Vegetated Non-Forested Wetlands.

It should be noted that the mapping of streams and waterways in the SWFWMD land use/cover program does not accurately reflect the stream hydrologic network in the Tampa Bay watershed, but rather just the visible signatures of stream channels and associated vegetation. Additionally, while a distinction is made in the FLUCCS code between Reservoirs (man-made lacustrine surface waters) and Lakes (natural lacustrine surface waters), those distinctions can be difficult to make via photointerpretation for smaller waterbodies (e.g., stormwater ponds), leading to misclassifications. For this reason, the SWFWMD land use/cover mapping program is not considered to be reliable for determining the extent of natural freshwater open water habitats (5000 FLUCCS series). However, for the forested and non-forested wetland classifications listed above (6000 FLUCCS series), the SWFWMD land use/cover program generally provides consistent and reliable information for the assessment of status and trends.

As determined in the 2017 land use/cover update, the most current estimate of the extent of freshwater wetlands in the Tampa Bay watershed is **219,719 acres** (exclusive of the 5000 FLUCCS series). Of this total, forested freshwater wetlands comprise **152,132 acres** (69%), while non-forested freshwater wetlands comprise **67,587 acres** (31%). The 2017 spatial distribution of freshwater wetlands in Tampa Bay is shown in **Map 2-8** below.



Source: SWFWMD, 2017

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Map 2-8
2017 Distribution of Freshwater Wetlands

ESA

2.5.2 Native Uplands (Non-Coastal)

The vast majority of development in the Tampa Bay watershed occurred via the clearing and conversion of native uplands to other land use/cover types. The term "native uplands" is used herein to distinguish natural, unaltered terrestrial plant communities from a wide variety of disturbed or altered terrestrial land use/cover types. For example, while pine plantations are forested areas, they are also highly altered and managed plant communities composed of introduced species as opposed to native species (e.g., slash pine vs. longleaf pine). Accordingly, pine plantations are not considered to be native uplands.

Various types of native upland plant communities are mapped as part of SWFWMD's routine land use/cover mapping program. There are numerous FLUCCS codes that describe the range of native upland plant communities, including specific species assemblages (e.g., xeric oak hammock); however, the photointerpretation of specific community types is often difficult. Nonetheless, it is possible to very accurately distinguish non-forested prairie and rangeland from forests; as well as coniferous forests from hardwood forests. Therefore, for the purposes of this analysis all applicable FLUCCS codes representing the suite of native uplands were rolled up to Level 2 classifications as follows:

- 3100 – Dry Prairie;
- 3200 – Shrub and Brushland;
- 3300 – Mixed Rangeland;
- 4100 – Upland Coniferous Forests;
- 4200/4300 – Upland Hardwood Forests.

The photointerpretation and mapping of the various types of non-forested native uplands – Dry Prairie, Shrub and Brushland, and Mixed Rangeland - is apparently very subjective. A review of the acreage totals for the 3000 series FLUCCS codes listed above over the past several SWFWMD land use/cover updates shows a great deal of variability, and perhaps inconsistency in the photointerpretation of these communities. For this reason, the SWFWMD land use/cover mapping program is not considered to be highly reliable for determining the extent of non-forested native upland habitats. However, for the forested native upland classifications listed above (4000 FLUCCS series), the SWFWMD land use/cover program appears to provide consistent and reliable information for the assessment of status and trends.

Native coastal uplands are distinguished from native non-coastal uplands, as discussed in the following section. As determined in the 2017 land use/cover update, the most current estimate of the extent of non-coastal native upland habitats in the Tampa Bay watershed is **140,600 acres**.

2.5.3 Coastal Uplands

The term "coastal uplands" does not refer to a distinct habitat type such as mangrove forests or salt marshes. Rather, the term is used herein as a generic catch-all term for the variety of native terrestrial plant communities that occur immediately landward of the emergent tidal wetlands complex, typically on sandy soils within the coastal stratum (see Section 4.5.2 below).

In level, poorly drained areas the vegetation is characterized by cabbage palm (*Sabal palmetto*), slash and/or longleaf pine *(Pinus spp.*), and a variety of grasses and sedges that are generally tolerant of salt spray, such as seashore paspalum (*Paspalum vaginatum*). However, in well-drained areas the vegetation is characteristic of the coastal scrub community, which represents a wide variety of species found in the coastal zone. A few of the more common components of the coastal scrub community include saw palmetto (*Serenoa repens*), sand live oak (*Quercus geminata*), myrtle oak (*Quercus myrtifolia)*, yaupon holly (*Ilex vomitoria.*), railroad vine (*Ipomea pes-caprae*), sea oats (*Uniola paniculata*), sea purslane (*Sesuvium portulacastrum*), sea grape (*Coccoloba uvifera*), Spanish bayonet (*Yucca aloifolia*) and prickly pear (*Opuntia* spp.). This community is generally found on remnant dunes and well-drained sandy areas.

Coastal uplands buffer emergent tidal wetlands from agricultural lands and urban development, and provide important transitional habitats for reptiles such as the diamondback terrapin (*Malaclemys terrapin*) and the mangrove water snake (*Nerodia clarkia)*. Coastal uplands are also dynamic habitats that are impacted periodically by storm surge, resulting in coastal flooding, salinity stress, and both sediment erosion and deposition. Furthermore, based on sea level rise projections developed for the Tampa Bay region (Burke et al., 2019), native coastal upland habitats are expected to slowly transition to emergent tidal wetlands over the next 50 years and beyond.

Coastal uplands, as a distinct habitat type, are not mapped as part of SWFWMD's routine land use/cover mapping program. However, to derive an estimate of the current extent of coastal uplands, the native upland FLUCCS roll up codes listed in Section 2.4.2 above were clipped to land area encompassed by the 5-foot contour extending around the Tampa Bay shoreline. As determined in the 2017 land use/cover update, the most current estimate of the extent of "coastal uplands" in the Tampa Bay watershed is **3,619 acres**.

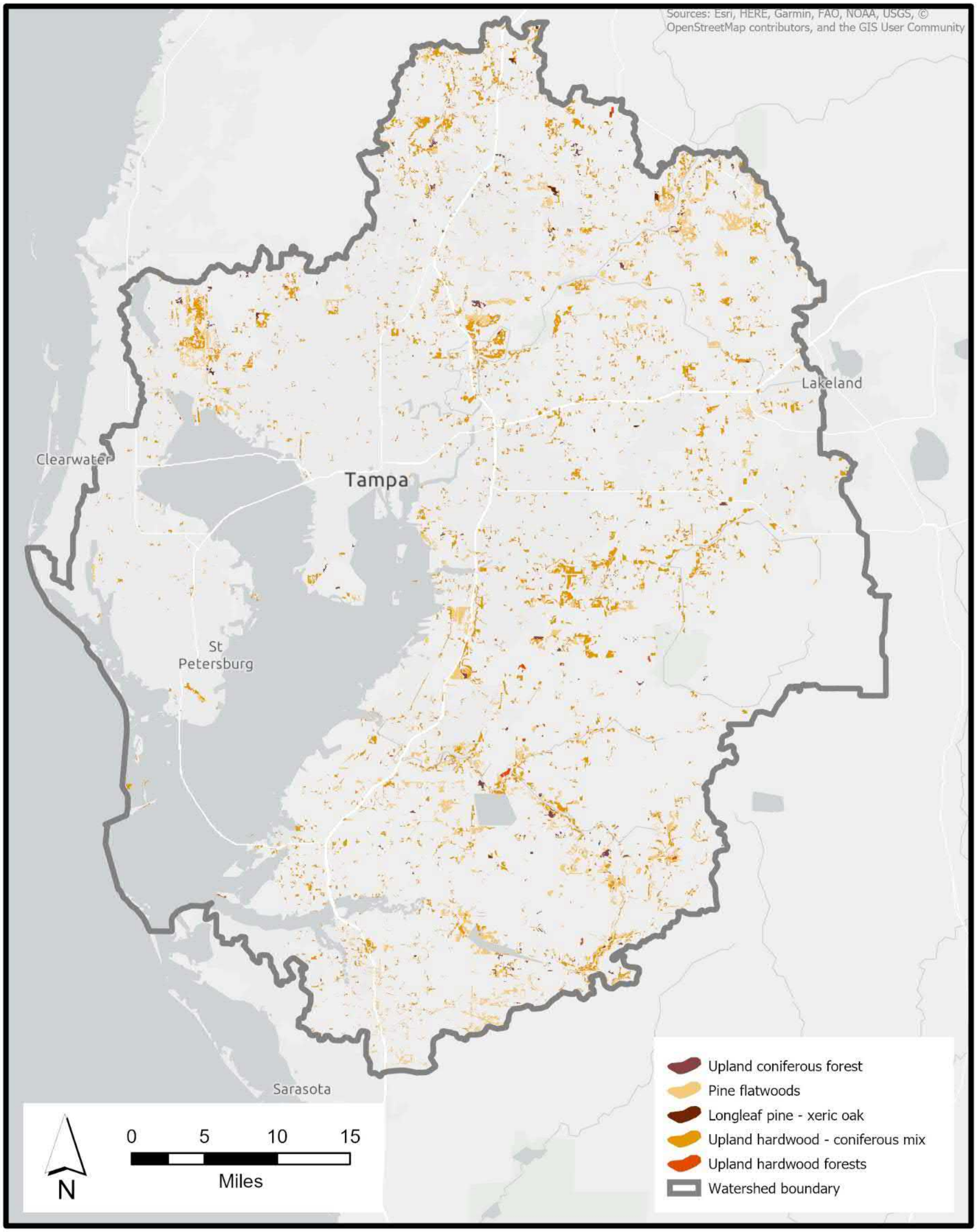
Map 2-9 shows the 2017 distribution of both native non-coastal and coastal uplands in the Tampa Bay watershed.

2.6 Habitat Status and Trends Summary

This section provides a summary and discussion of the status and trends analysis for the TBEP habitats of interest.

2.6.1 Current Status

The current status, or best estimate of the extent (e.g., acres or linear feet) of the habitats discussed in the previous sections, is summarized in **Table 2-1**, including the data year(s) and source(s) from which the estimate was derived.



Source: SWFWMD, 2017

2020 Tampa Bay Habitat Master Plan Update

Map 2-9
2017 Distribution of Native Upland Habitats

ESA

Table 2-1
Summary of Current Extent of TBEP Habitats

Habitat Type		Current Extent	Data Year	Data Source(s)
	Subtidal Habitats			
Hard Bottom		423 acres	2017 - 2019	SWFWMD, 2017; CSA Ocean Sciences, 2019
Artificial Reefs		166 acres	2019	EPCHC, 2020; ESA, 2020
Tidal Flats		16,220 acres	2018	SWFWMD, 2018
Seagrasses		40,653 acres	2018	SWFWMD, 2018
Oyster Bars		171 acres	2018	SWFWMD, 2018
	Intertidal Habitats			
Living Shorelines		11.3 miles	2020	ESA, 2020; Tampa Baywatch, 2020
Mangrove Forests		15,300 acres	2017	SWFWMD, 2017
Salt Barrens		496 acres	2017	SWFWMD, 2017
Salt Marshes		4,557 acres	2017	SWFWMD, 2017
Tidal Tributaries		387 miles	2019	Janicki Environmental./Mote Marine Lab, 2019
	Supratidal Habitats			
Coastal Uplands		3,619 acres	2017	ESA, 2020
Non-Forested Freshwater Wetlands		67,587 acres	2017	SWFWMD land use/cover mapping
Forested Freshwater Wetlands		152,132 acres	2017	SWFWMD land use/cover mapping
Native Uplands (Non-Coastal)		140,600 acres	2017	SWFWMD land use/cover mapping

2.6.2 Habitat Trends

The term “trend” is used herein to describe changes in habitat extent and percent over time. For this report, it is not specifically being used to connote statistical trend analysis and significance testing. As such, temporal trends in the Tampa Bay habitats of interest are discussed below.

Subtidal Habitats

Table 2-2 shows changes in the subtidal habitat acreage over time, as compiled from the SWFWMD seagrass mapping program over the period 1988 to 2018. Key observations are:

- **Seagrasses** - Total seagrass coverage has increased by 17,365 acres (75%) during the 30-year period of record. As shown in **Figure 2-3**, this increase has been more or less linear other than two brief periods of decline: an 8 percent loss from 1996 to 1999 (-2,075 acres); and a more recent 2 percent loss from 2016 to 2018 (-1,003 acres). These declines followed an El Niño event and a hurricane, respectively, indicating the sensitivity of seagrasses to excessive rainfall events, and associated changes in salinity, nutrient loads, and turbidity. As discussed above, these declines have been disproportionately suffered in certain bay segments. Nonetheless, overall seagrass coverage in Tampa Bay has exceeded the previously established goal of 38,000 acres for the past three assessment events (2014, 2016, and 2018).
- **Tidal Flats –** Assessing trends in the coverage of tidal flats is difficult because of changes in mapping methods used by SWFWMD over time. From 1988 through 2014,

all non-vegetated subtidal areas were mapped as Tidal Flats (FLUCCS 6510). However, in 2016 SWFWMD began distinguishing Tidal Flats from Sand Other Than Beaches (FLUCCS 7210), and mapped them as separate habitat types. The Tidal Flats category is now intended to cover flats that are periodically exposed during low tides, and provide foraging habitat for wading birds while the Sand Other Than Beaches category is intended to cover non-vegetated subtidal areas. When data for both classifications are combined, the non-vegetated total has decreased by 11,111 acres (55%) during the 30-year period of record. It is surmised that much of this decline is associated with the expansion of seagrass on to previously non-vegetated bottom area, thus representing a positive ecological trend.

- **Oyster Bars** – Oyster bars have been mapped by SWFWMD since 2014. Over the 2014-2018 period of record, oysters have increased by 40 acres (30%). This increase is likely not a significant trend, and probably represents improved ground-truthing and photointerpretation of oyster bar signatures from aerial photography. As discussed in Section 2.2.3, this assessment of oyster bar coverage probably underestimates actual oyster bar coverage, and a more comprehensive oyster assessment in Tampa Bay is warranted.

With regard to hard bottom habitats and artificial reefs there are no previous data points to meaningfully compare with the current estimates (**Table 2-2**). The extent of hard bottom is largely determined by underlying geology (e.g., rock outcrops), and is impacted by storm events that cover and uncover limestone fields with sediment. This ephemeral habitat should be monitored on a long-term basis to better understand changes over time (CSA Ocean Sciences, 2019). On the other hand, the extent of artificial reefs is expected to increase somewhat over time as the horizontal boundaries and vertical profiles of existing reefs are expanded with the addition of new material.

Intertidal Habitats

Table 2-3 shows changes in intertidal habitat acreage over time, as compiled from the SWFWMD land use/cover mapping program over the period 1990 to 2017. Key observations from this table include the following.

- **Mangrove Forests** – Mangrove forest coverage has increased by 1,689 acres (12%) during the 27-year period of record. The largest increase occurred between the 1999 and 2004 mapping periods, and since then mangrove coverages has been more or less stable.
- **Salt Marshes –** Salt marsh coverage has increased by 74 acres (2%) during the 27-year period of record. While this is a modest increase, it is probably overshadowed by the invasion of salt marshes by mangrove forests – a phenomenon that has not been captured and quantified in the SWFWMD land use/cover mapping program. As noted above, it is estimated that 540 acres of salt marshes have been invaded by, and at least partially converted, to mangrove habitat (Janicki Environmental, unpublished data). This phenomenon has been observed throughout the Gulf of Mexico, and has been attributed to both climate change (e.g., fewer freeze events) and sea level rise (Comeaux et al., 2012). Field data collected as part of the TBEP Critical Coastal Habitat Assessment (Price et al., 2017) suggests that mangrove invasion of salt marshes tends to first occur along tidal creek margins, followed by encroachment into larger contiguous *Juncus* marshes.

- **Salt Barrens** - Salt barren coverage has increased by 34 acres (7%) during the 27-year period of record. This modest increase can be explained by the landward expansion of salt barrens in response to sea level rise. An examination of historical aerial imagery conducted as part of this 2020 Habitat Master Plan update indicated that the extent of salt barrens has clearly expanded landward into undeveloped coastal uplands in areas where the land surface slope is very flat and there are no physical or hydrologic impediments to more frequent tidal inundation.
- **Emergent Tidal Wetlands** – As discussed above, the suite of emergent tidal wetlands includes mangrove forests, salt marshes, and salt barrens, which exist in a dynamic equilibrium controlled by factors such as storm surge and flood damage, periodic freezes, and sea level rise (Robison, 2010). Over the 27-year period of record, the suite of emergent tidal wetlands experienced a net gain of 1,791 acres (10%). This overall gain is likely a reflection of: 1) the effectiveness of state and federal wetland regulatory programs; 2) the cumulative gains resulting from publicly-funded habitat restoration projects; 3) prevention of wetland loss through regulatory mitigation for development; and 4) the aggregate effects of climate change and sea level rise.

With regard to tidal tributaries, there are no previous data points to compare with the current estimate, as shown in **Table 2-3**. Tidal tributaries are protected under state and federal wetland regulations, and the major alterations (e.g., impoundment, channelizing, hardening) to tidal tributaries in the Tampa Bay watershed mostly took place prior to these regulations being in place. Accordingly, the extent of tidal tributaries is not expected to change much over time. However, protecting the full suite emergent tidal wetlands that occur within tidal tributaries is largely dependent on the continued delivery of adequate freshwater inflows to maintain salinity gradients along the tidally influence reaches.

There are no previous data points to compare with the current estimate of living shorelines, as shown in **Table 2-3**. However, the extent of living shorelines is expected to increase with the construction of recreational, habitat restoration, and coastal resilience projects over time.

Supratidal Habitats

Table 2-3 also shows changes in supratidal habitat acreage over time, as compiled from the SWFWMD land use/cover mapping program over the period 1990 to 2017. Key observations from this table include the following.

- **Freshwater Wetlands** – The suite of freshwater wetlands includes: natural streams, waterways and lakes; wetland hardwood forests (e.g., bay swamps); wetland coniferous forests (e.g., cypress swamps); wetland forested mixed; and vegetated non-forested wetlands (e.g., freshwater marshes). As noted previously, the SWFWMD land use/cover mapping program is not considered to be highly reliable for determining the extent of natural freshwater open water habitats (5000 FLUCCS series). However, for the forested and non-forested wetland classifications listed above (6000 FLUCCS series), the SWFWMD land use/cover program generally provides consistent and reliable information for the assessment of status and trends. Over the 27-year period of record, the suite of freshwater wetlands (exclusive of the 5000 FLUCCS series) has experienced a net gain of 6,040 acres (3%). This overall gain is likely a reflection of: 1) cumulative gains resulting from publicly-funded habitat restoration projects by multiple partners; 2) the effectiveness of state and federal wetland regulatory programs; and 3) regulatory

Table 2-2
Summary of Subtidal Habitat Change Analysis

Habitat Descriptor	FLUCCS Codes	1988	1990	1992	1994	1996	1999	2001	2004	2006	2008	2010	2012	2014	2016	2018	1988-2018 Change	
																	Acreage	Percent
Seagrass (Patchy)	9113	8,726	9,203	9,664	11,810	13,473	11,208	8,190	10,975	10,021	9,200	11,434	12,629	16,367	17,152	17,349	8,623	99%
Seagrass (Continuous)	9116	14,562	16,027	16,094	14,719	13,465	14,639	17,891	16,053	18,279	20,446	21,464	22,014	23,928	24,504	23,304	8,742	60%
Seagrass Total		**23,288**	**25,230**	**25,758**	**26,529**	**26,938**	**25,847**	**26,081**	**27,028**	**28,300**	**29,646**	**32,898**	**34,643**	**40,295**	**41,656**	**40,653**	**17,365**	**75%**
Tidal Flats	6510	27,388	25,617	26,098	25,465	25,927	32,695	31,238	36,153	36,285	33,292	28,786	25,601	17,560	2,346	2,116	-25,242	-92%
Sand Other Than Beaches - Submerged	7210	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11,767	14,103	NA	NA
Non-Vegetated Total		**27,388**	**25,617**	**26,098**	**25,465**	**25,927**	**32,695**	**31,238**	**36,153**	**36,285**	**33,292**	**28,786**	**25,601**	**17,560**	**14,113**	**16,277**	**-11,111**	**-55%**
Oyster Bars	6540	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	131	167	171	40	30%
Oysters Total		**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**131**	**167**	**171**	**40**	**30%**

Table 2-3
Summary of Intertidal and Supratidal Habitat Changes Analysis

Habitat Descriptor	FLUCCS Codes	1990	1995	1999	2004	2007	2011	2014	2017	1990-2017 Change	
										Acreage	Percent
Mangrove Swamps	6120	13,611	14,446	14,409	15,739	15,690	15,688	15,611	15,300	1,689	12%
Salt Marshes	6420	4,483	4,437	4,443	4,641	4,634	4,607	4,798	4,557	74	2%
Salt Barrens	6600	468	479	492	488	456	502	529	496	28	6%
Tidal Wetlands Total		**18,562**	**19,362**	**19,344**	**20,868**	**20,780**	**20,797**	**20,938**	**20,353**	**1,791**	**10%**
Stream & Waterways	5100	3,728	2,482	2,509	2,824	2,763	2,758	2,794	2,641	-1,086	-29%
Lakes	5200	13,242	13,491	13,986	13,502	13,296	12,631	13,011	13,212	-30	0%
Wetland Hardwood Forests	6100	101,548	101,486	99,666	104,972	103,788	103,688	105,585	103,147	1,599	2%
Wetland Coniferous Forests	6200	29,930	29,752	29,512	29,829	29,639	29,421	29,922	29,487	-443	-1%
Wetland Forested Mixed	6300	27,798	26,035	25,522	20,795	20,072	19,952	21,734	19,498	-8,300	-30%
Vegetated Non-Forested Wetlands	6400	54,404	51,413	51,102	58,395	65,043	68,837	68,906	67,587	13,183	24%
Freshwater Wetlands Total		**230,649**	**224,659**	**222,297**	**230,318**	**234,600**	**237,289**	**241,952**	**235,572**	**4,923**	**2%**
Dry Prairie	3100	2,393	807	699	463	627	688	7,729	628	-1,765	-74%
Shrub and Brushland	3200	85,993	83,645	71,460	56,031	54,839	53,153	45,998	48,340	-37,653	-44%
Mixed Rangeland	3300	3,304	2,872	2,588	7,077	7,318	7,219	9,191	6,758	3,454	105%
Upland Coniferous Forests	4100	70,664	50,904	46,230	37,466	33,293	33,105	36,773	31,776	-38,888	-55%
Upland Hardwood Forests	4200/4300	72,920	74,578	70,166	62,438	59,068	58,523	65,875	56,717	-16,203	-22%
Native Uplands Total		**235,274**	**212,806**	**191,144**	**163,476**	**155,145**	**152,689**	**165,565**	**144,219**	**-91,055**	**-39%**

mitigation. The results of the present work indicate that there has been a substantial increasing trend in vegetated non-forested freshwater wetlands since 1990, with a gain of 13,183 acres (24%), while forested freshwater wetlands have decreased by 7,144 acres (4%). The vast majority of forested wetland losses have been Wetland Forested Mixed.

It should be noted that these contemporary trends differ from those presented in the *Master Plan for the Protection and Restoration of Freshwater Wetlands in the Tampa Bay Watershed, Florida* (Rains et al., 2012; Ries and Scheda, 2014). Those studies conducted change analyses of freshwater wetland coverage in the Tampa Bay watershed over the period circa 1950 to 2007, and determined that while there had been substantial decreases in both forested and vegetated non-forested freshwater wetlands (55,426 and 47,395 acres, respectively), vegetated non-forested freshwater wetlands had been disproportionately lost on a percentage basis (-43% versus -27%). The authors speculated that the disproportionate loss of vegetated non-forested wetlands may have been due to several factors which, combined, may have resulted in a regulatory system that favored the development of non-forested wetlands.

Prior to the mid-1990s, regulations made it less costly to impact non-forested wetlands, as mitigation ratios for impacts to non-forested wetlands were lower than those for forested wetlands. Mitigation areas for non-forested wetlands were also easier to design, construct, and maintain, and success criteria (e.g., percent cover) were relatively easy to achieve. In addition, construction costs associated with clearing and filling non-forested wetlands were lower than for forested wetlands. Therefore, there were economic incentives, in the form of lower mitigation and construction costs, to develop site plans that impacted less forested wetlands and more non-forested wetlands. In addition, construction costs were lower. Furthermore, the disproportionate loss in non-forested wetlands may have been partially attributable to the suppression of natural forest fires in association with increasing development in the watershed, resulting in the conversion of non-forested wetlands to forested wetlands over time (Ries and Scheda, 2014).

The data presented above indicate that the trend in freshwater wetland losses and gains has reversed since 1990, with a gain in vegetated non-forested wetlands and a loss in forested wetlands. This trend can be at least partially explained by the increased development of native upland and forested wetland habitats followed by the creation of herbaceous mitigation areas and surface water management system features (e.g., ponds and swales). However, current gains in herbaceous wetlands have not greatly altered the ratio of loss observed since the 1950s between herbaceous and forested wetlands.

- **Native Uplands** – The suite of native upland habitats includes: dry prairies; shrub and brushland (native grasslands); mixed rangeland; upland coniferous forests (e.g., pine flatwoods) and upland hardwood forests (e.g., oak hammocks). Over the 27-year period of record, the suite of native upland habitats has experienced a net loss of 91,055 acres (39%). Particularly hard hit were the Upland Coniferous Forest (e.g., pine flatwoods - 55% loss), Upland Hardwood Forests (e.g., oak hammocks - 22% loss), and Shrub and Brushland (e.g., native grasslands - 44% loss).

This substantial loss in native upland habitats is almost entirely due to land development activities in the watershed, with virtually all areas of native upland habitat loss being converted to urban land uses, with residential development being the primary conversion.

Summary

When viewed as a whole, the most significant and meaningful trends in the TBEP habitats of interest over the periods of record examined include: 1) the 75 percent gain in seagrasses since 1988; 2) the slight gains in both emergent tidal wetlands (10% gain) and freshwater wetlands (2% gain) since 1990; and 3) the 39 percent loss in native upland habitats since 1990. The increasing trend in seagrass coverage is a testament to improved bay water quality resulting from focused reductions in both point and non-point sources of pollution. Improved domestic wastewater treatment by local government utilities – as required by the Grizzle-Figg legislation (Section 403.086, Florida Statutes) – was responsible for the most significant improvements in Tampa Bay water quality. Pollutant load reduction commitments made by permittees represented in the TBEP Nitrogen Management Consortium have also led to additional improvements in bay water quality (Greening et al., 2016).

As discussed above, the observed gains in both emergent tidal wetlands and freshwater wetlands are likely a reflection of: 1) the effectiveness of state and federal wetland regulatory programs; and 2) the cumulative gains resulting from publicly-funded habitat restoration projects and, 3) to a lesser extent, regulatory mitigation. Gains in emergent tidal wetlands are also likely due to the landward expansion of the complex suite of these habitats associated with climate change and sea level rise. Since 1990 there has been a gain in vegetated non-forested freshwater wetlands. In 2017, non-forested freshwater wetlands covered approximately 59% of the area they existed on in 1950 while forested wetlands were estimated to occur on approximately 75% of the area covered in 1950. It is surmised that this shift is related to the clearing of forested wetlands associated with development, mining, and silviculture followed by the creation of herbaceous mitigation areas and surface water management system features (e.g., ponds and swales).

The decreasing trend in native upland habitats is the result of continued human population growth and urban development in the Tampa Bay watershed, combined with the lack of state and federal regulatory protection of native upland habitats. The responsibility for protecting native upland habitats resides mostly with local governments through the implementation of their planning, zoning, and land development regulations. Federal and state regulations related to listed species management impart some protection to certain rare habitats (e.g., scrub jay habitat); however, common and historically abundant native habitats, such as pine flatwoods, are left largely unprotected. Local governments in the Tampa Bay watershed must improve local protections for native upland habitats, or this trend will to continue.

2.7 Threats to Tampa Bay Habitats of Interest

This section provides a discussion of the primary ongoing and future threats to the Tampa Bay habitats of interest, with a focus on climate change and sea level rise, and watershed development.

2.7.1 Climate Change and Sea Level Rise

Growing international scientific consensus regarding global warming and climate change led to the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988 (IPCC, 1996). Since then, observed and potential adverse effects of climate change and sea level rise on marine and estuarine ecosystems were increasingly documented in the scientific literature (Scavia et al., 2002). With regard to estuarine habitats he primary concerns are that sea level rise is now occurring at such a rapid rate that the landward migration of tidal wetlands in response cannot keep pace; or that the upland slope has already been lost to urban development and hardening, leaving no place for tidal wetlands to migrate to (Titus et al., 2009). This latter effect is colloquially referred to as the “pinching out” or drowning of tidal wetlands. **Figure 2-7** shows a conceptual schematic of the effect of sea level rise on a natural upland slope versus a developed upland slope with a bulkhead.

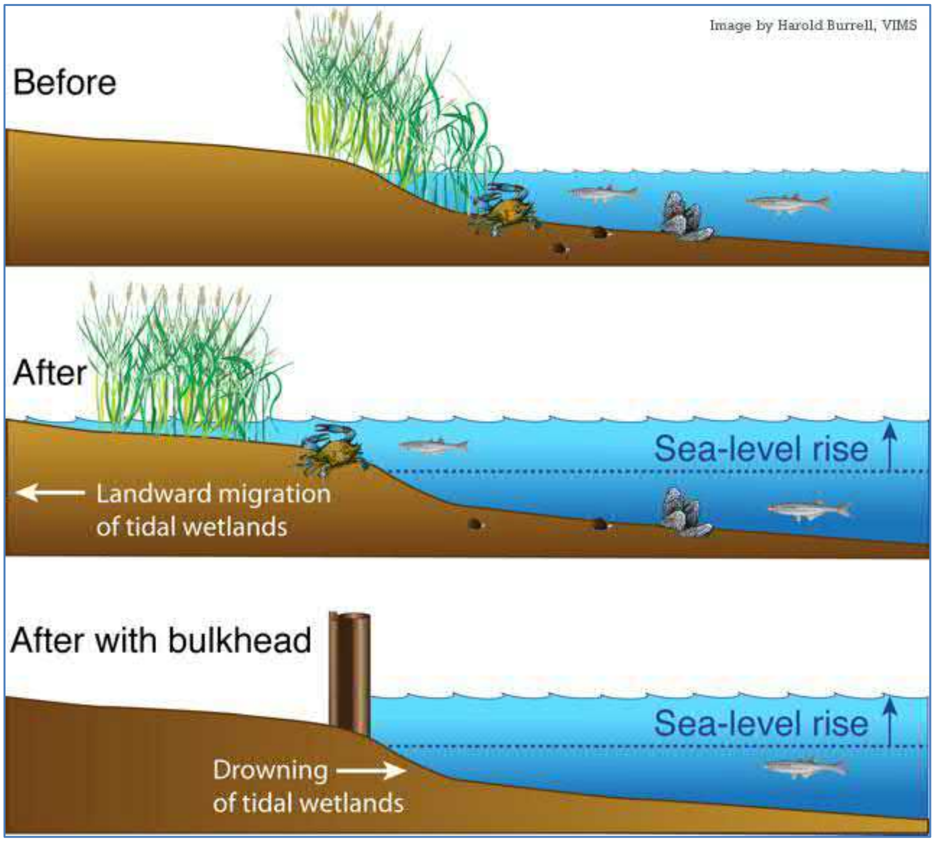
Given the degree to which the Tampa Bay shoreline is developed, this phenomenon is a major concern. Anticipated changes in the suite of Tampa Bay emergent tidal wetlands in response to sea level rise include the following:

- Landward migration of mangroves into salt marshes;
- Upstream migration of salt marshes within tidal tributaries;
- Landward migration of salt barrens into coastal uplands;
- Corresponding geological, physical and chemical changes;
  - Sediment deposition/erosion
  - Micro-topography
  - Interstitial salinity.

These changes pose a significant risk to salt marshes and salt barrens in Tampa Bay. Even though black needle rush (*Juncus roemerianus*) can tolerate a wide salinity range (Eleuterius and Eleuterius, 1979; Stout, 1984), the largest remaining *Juncus* marshes in Tampa Bay are located in the lower-salinity reaches of tidal rivers and creeks, with the greatest extent occurring in the Manatee River bay segment where both the Manatee River and the Braden River are impounded for public water supplies. Spatial restriction in these hydrologically truncated rivers may make these *Juncus* marshes particularly vulnerable to the “pinching out” phenomenon, as upstream migration in response to sea level rise will be cut off by the impoundments. Similarly, landward migration of salt barrens in response to sea level rise will be restricted by the filling and hardening of coastal uplands associated with urban development.

Furthermore, sea level rise and disturbances from increased storm activity are expected to diminish the extent of coastal ecosystems available to nesting coastal bird species by reducing the extent of available habitat and inundating nesting areas during incubation (Von Holle et al., 2019). In Tampa Bay, particularly vulnerable species include the brown pelican (*Pelecanus occidentalis*) as well as cormorants, herons, egrets, ibis, spoonbills, terns, and skimmers.

To monitor changes in emergent tidal wetlands in response to sea level rise, the TBEP initiated the *Critical Coastal Habitat Assessment* (CCHA) project (Price et al., 2017; Moyer and Radabaugh, 2017). The CCHA project established nine long-term monitoring transects - from the open water edge through emergent tidal wetlands to coastal uplands - on both natural and developed portions of the Tampa Bay coastline. Ecological data (primarily vegetation) and high-resolution vertical elevation data are collected along the transects at varying time intervals (approximately every 3 and 10 years, respectively). The long-term objectives of the CCHA are to: 1) determine the vertical elevation (relative to sea level) preferences of emergent tidal wetland species/communities; and 2) determine the sensitivity and response of these tidal wetland species/communities to incremental changes in sea level. Results from the initial data collection effort indicate that the spatial distribution of emergent tidal wetland species can be determined by micro-topographic differences of as little as one-tenth of a foot, as well as small differences in freshwater flows from adjacent terrestrial areas.



SOURCE: NOAA, 2019

Figure 2-7
Conceptual Schematic of Sea Level Rise on
Natural vs. Hardened Coastline

To model potential changes in Tampa Bay coastal habitats in response to sea level rise the Habitat Evolution Model (HEM) was developed as part of the *Tampa Bay Blue Carbon Assessment* project conducted for TBEP (Sheehan et al., 2016). The HEM model utilizes micro-elevation and emergent tidal wetland species distribution data derived from the CCHA project, as well as local sediment accretion data and bay bathymetry, to simulate a range of scenarios using different rates of sea level rise and accretion. The HEM model predicts that the suite of tidal wetlands in Tampa Bay could look very different by the year 2100, compared to current conditions, depending on the rate of sea level rise. **Figure 2-8** shows an example of the HEM model GIS output simulating mangrove and seagrass habitat changes in the Middle Tampa Bay segment for the intermediate high sea-level rise (51.1 inches by 2100) and low accretion rate model scenario.

These results indicate that: 1) existing, large contiguous stands of mangroves will be sufficiently inundated to convert to shallow subtidal areas that could potentially support colonization by seagrasses; and 2) mangroves will expand landward in areas where the slope, elevation, and land use/cover are suitable. The various runs of the HEM model indicate that, depending on the degree of sea level rise, Tampa Bay could be either a mangrove dominated system (lesser sea level rise) or a seagrass dominated system (greater sea level rise).

However, there are many uncertainties in modeling the long-term effects of sea level rise on coastal habitats. For example, unless water clarity in Tampa Bay is improved it is likely that existing seagrass beds at deeper elevations could be drowned out by reduced light penetration caused by a deeper water column associated with sea-level rise. In addition, sediments in areas previously occupied by mangroves may not be suitable to support landward expansion of seagrasses in all areas. Furthermore, the landward expansion of mangroves could be limited by the extent of suitable coastal uplands, potentially resulting in a net loss in mangrove coverage.

With respect to sea level rise, the greatest concern is the potential loss of salt marsh habitat, and the resulting overall reduction in emergent tidal wetland diversity in Tampa Bay. Conservation of existing salt marsh habitat will necessitate the provision of adequate freshwater discharges to maintain proper salinity regimes in the tidal tributaries where most of the remaining stands occur. Furthermore, the conservation of remaining natural coastal uplands will also be needed to accommodate the landward migration of salt barrens and mangroves.

In addition to sea level rise, there are other effects of climate change that could potentially impact the Tampa Bay habitats of interest, including: increasing air temperatures (e.g., decreased freeze events); altered rainfall patterns; increased tropical storm intensity; and ocean acidification (EPA, 2020). The reduction of annual freezes is clearly a factor in the expansion of mangroves in Tampa Bay (Comeaux et al., 2012); however, an analysis of other effects of climate change is beyond the scope of this study.

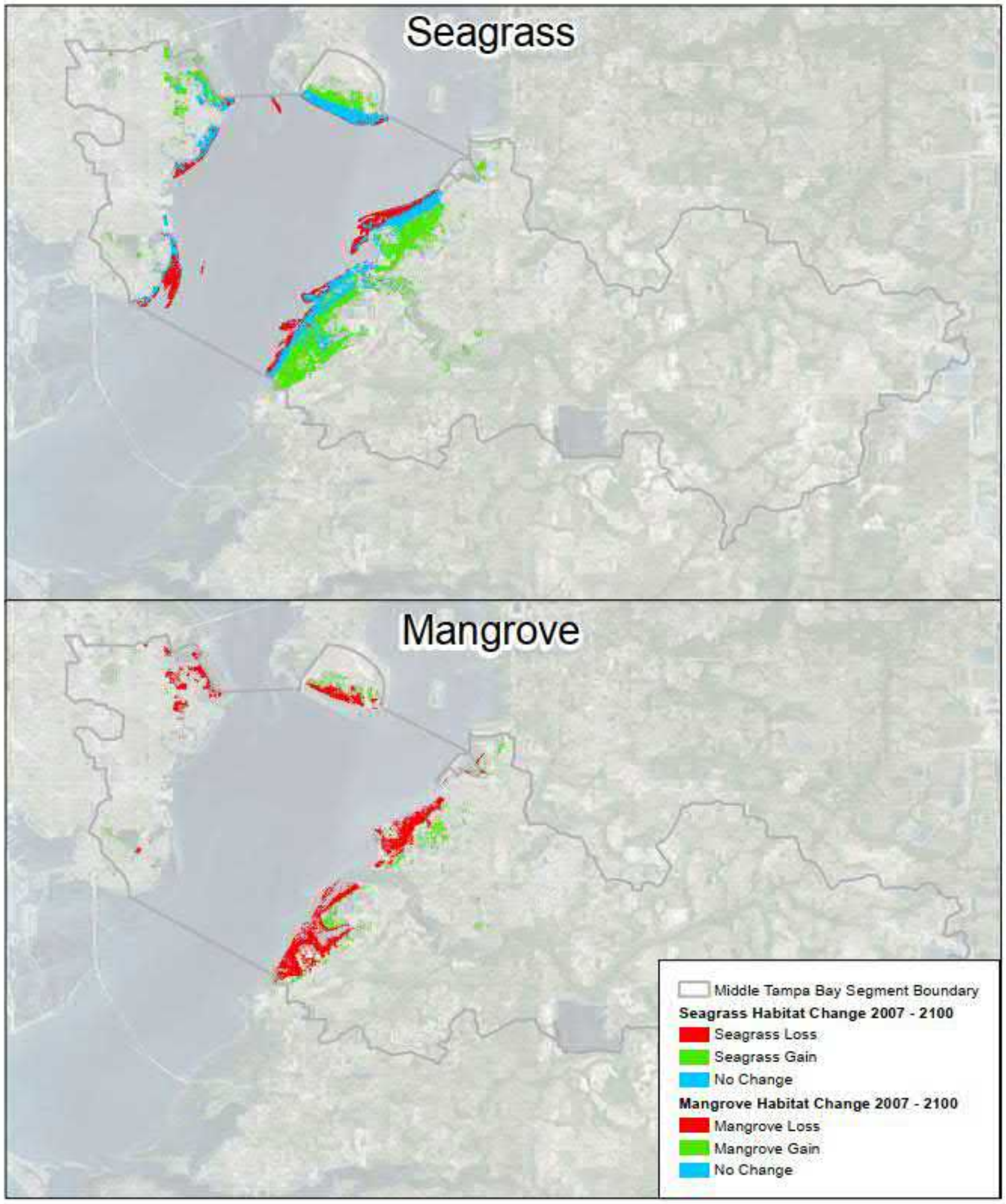
2.7.2 Watershed Development

Existing Development

In the context of this 2020 Habitat Master Plan Update, the term “development” refers to the conversion of the natural landscape and its native habitats to land uses that directly support human habitation and commerce. Furthermore, it should be noted that a distinction is made between more intensive “hard development” that includes urban land uses that would be difficult to convert back to natural habitats (e.g., residential; commercial; industrial) and port facilities, and less intensive “soft development” that includes various types of agriculture, recreational facilities (e.g., golf courses and parks), and mining.

The primary distinction is that hard development involves dredging, filling and/or hardening. The term “hardening” refers to the construction of impervious surface (e.g., roadways; parking lots) and permanent buildings and other structures that result in a loss of landscape permeability. Soft development may also involve topographic and/or drainage alterations, but the land surface remains generally pervious, allowing for groundwater recharge. Both types of development result in the alteration, degradation or complete loss of native habitats; however, the potential for restoration and/or enhancement differ substantially.

Hard development can result in a permanent loss of native habitats, and these land uses are considered to be “non-restorable” for all practical purposes. Nonetheless, there are extensive opportunities to enhance habitat functions in hard development areas, especially along urban shorelines and tidal creeks (see Section 6.8.4). Conversely, soft development typically results in only a partial and/or temporal loss of native habitats, and these land uses are considered to be “potentially restorable” where and when opportunities to do so exist. Soft development areas could potentially support the recovery of native habitats through the restoration of more natural hydrology, soils and/or topography.



SOURCE: Sheehan et al., 2016

Figure 2-8
Simulated Seagrass and Mangrove Migration in Middle Tampa Bay

Throughout the remainder of this document, the term "development" is synonymous with hard development land uses. As with other land use/cover types described above, the source data used to estimate and map existing development in the Tampa Bay watershed is was the *Land Use Land Cover 2017* geospatial database (SWFWMD, 2019b). Various FLUCCS codes were compiled, as listed in **Table 2-4** below, to define, quantify and map existing development in the Tampa Bay watershed. These classification codes are to be distinguished from other non-native classification codes used to define soft development, or "restorable" areas, as discussed in Section 5.1.1.

Table 2-4
Existing Development FLUCCS Codes

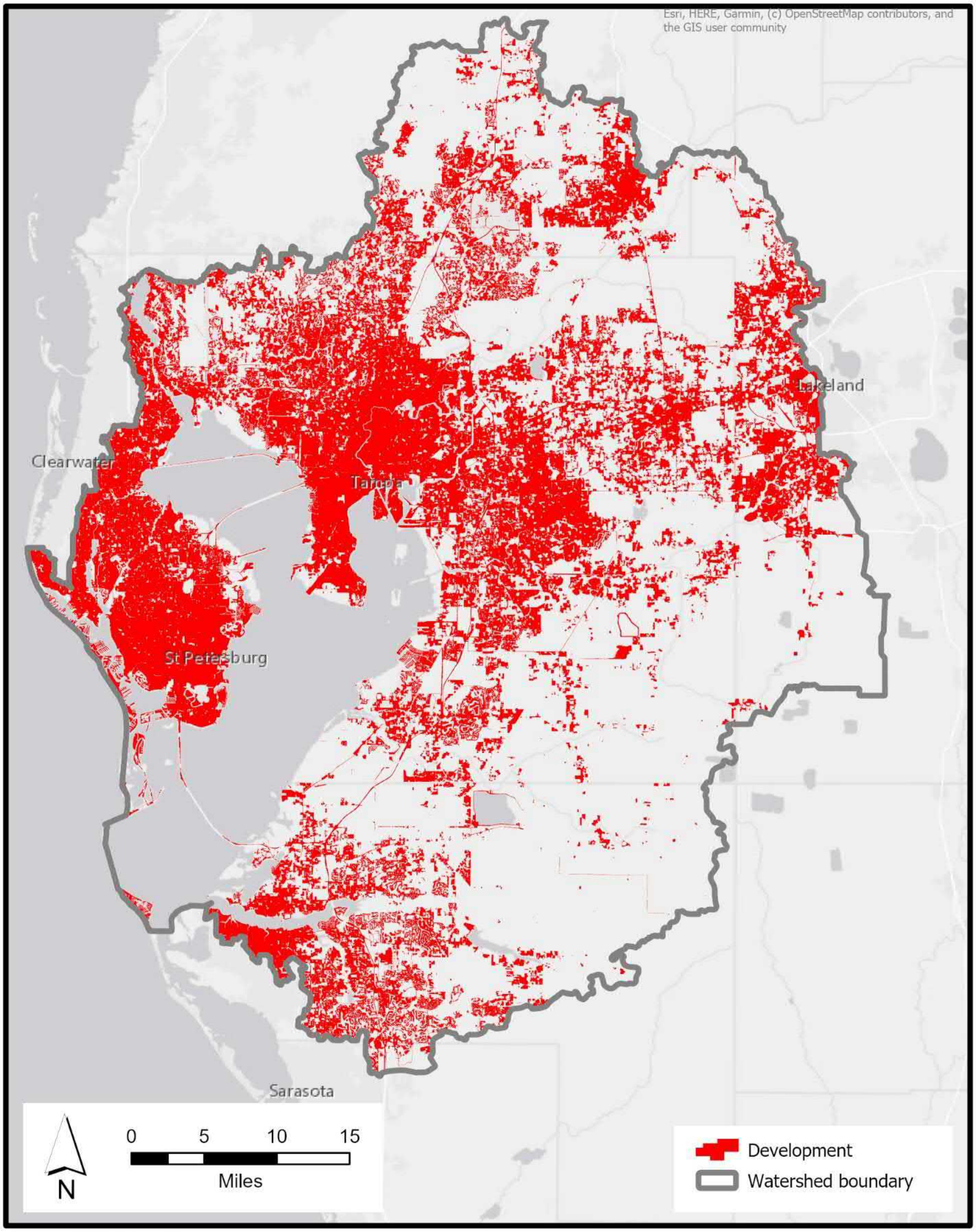
Level 1 Descriptor	Level 1 Code	Level 2/3 Descriptor	Level 2/3 Code
Urban and Built Up	1000	Residential Low Density (All Level 3 codes)	1100
		Residential Medium Density (All Level 3 codes)	1200
		Residential High Density (All Level 3 codes)	1300
		Commercial and Services (All Level 3 codes)	1400
		Industrial (All Level 3 codes)	1500
		Institutional (All Level 3 codes)	1700
		Recreational	1800
		Stadiums	1870
Transportation, Communication and Utilities	8000	Transportation (All Level 3 codes)	8100
		Communications (All Level 3 codes)	8200
		Utilities (All Level 3 codes)	8300

Map 2-10 shows existing (2017) development in the Tampa Bay watershed. Existing development encompasses 536,805 acres, or about 37 percent of the 1,450,883 acres of total watershed area that occurs above the MLLW line in Tampa Bay, which encompass the intertidal and supratidal habitats. An analysis of the SWFWMD *Land Use Land Cover 2014* dataset showed that development increased by seven percent (7%) between 2014 and 2017.

In 2019, the total population of the four counties that comprise the Tampa Bay watershed – Pasco, Pinellas, Hillsborough, and Manatee – was 3,337,451 (Rayer and Wang, 2020). As shown on **Map 2-10**, the most intense development occurs in Pinellas County, the City of Tampa, eastern Hillsborough County (e.g., Brandon, Riverview), and the City of Bradenton. The most sparsely developed portions of the watershed include the upper Hillsborough River basin, the eastern Alafia River basin, most of the Little Manatee basin, and the eastern Manatee River basin. However, it should be noted that much of the upper reaches of the Alafia River basin have been extensively mined for phosphate and are not currently suitable for urban development.

Future Development

There are many variables and uncertainties involved in the development of multi-decadal future human population projections. For this reason, projections are typically provided as a range – low, medium, and high. For the four counties comprising the majority of the Tampa Bay watershed (Hillsborough, Manatee, Pasco, and Pinellas Counties), the medium projected population estimate for the year 2045 is 4,293,000, or an increase of 955,549 (29%) over the 2019 population of 3,337,451 (Rayer and Wang, 2020). Low and high 2045 population estimates for the four-county area are 3,586,500 and 5,025,700, respectively (Rayer and Wang, 2020).



Source: SWFWMD, 2017

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Map 2-10
2017 Development
in the Tampa Bay Watershed

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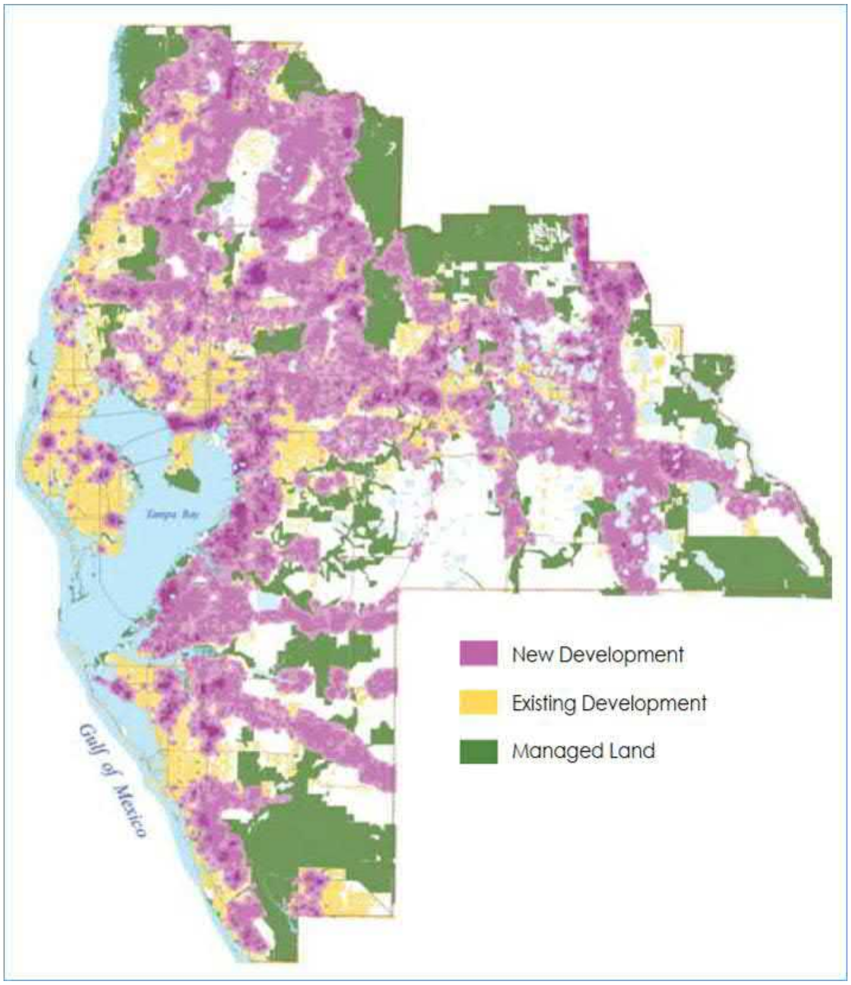
Figure 2-9 shows a projection of the anticipated new development areas in the Tampa Bay region in 2050 (TBP/RREF, 2010). This projection is based on past regional growth patters as well as existing and planned infrastructure (e.g., roadways). New urban development and increasing population densities are projected to occur in the north Tampa area, eastern Hillsborough County along existing major highway corridors (e.g., I-4, SR-60), the bay coastal areas of southeastern Hillsborough and Manatee counties, and eastward along the Manatee River corridor.

The range of environmental impacts associated with urban development in Florida have been well documented and include: direct habitat and species population losses from dredge and fill activities; increased landscape impervious surface area; altered hydrology (e.g., decreased groundwater recharge; increased peak flows and decreased base flows); and degraded water quality. In addition, continued population growth in the Tampa Bay watershed will increase public drinking water demand, and put greater pressure on the regional wastewater treatment infrastructure, potentially increasing pollutant loads.

With respect to future human population growth and development in the Tampa Bay watershed, the challenge will be to establish a sustainable balance between continued economic growth and quality of life, and the protection of natural habitats and water resources. This balance will likely require more aggressive environmental land acquisition in strategically important locations, such as reservation areas (**Map 4-1**), combined with new approaches to land use planning and regulation that encourage infill or more “compact” growth patterns (Sim and Mesev, 2014).



SOURCE: TBP/RREF, 2010

Figure 2-9
Projected New Development in the Tampa Bay Region by 2050

Section 3.0: Update of Existing Habitat Protection and Restoration Activities

This section presents updated information on the status and extent of existing and proposed conservation lands, and existing habitat enhancement and restoration sites in the Tampa Bay watershed.

3.1 Existing Conservation Lands

Geospatial databases of existing conservation lands throughout the State of Florida are compiled and published by the Florida Natural Areas Inventory (FNAI).

> "In order for a property to be considered "conservation lands" by the FNAI, a significant portion of the property must be undeveloped and retain most of the attributes that existed in its natural condition. In addition, the managing agency or organization must demonstrate a formal commitment to the conservation of the land in its natural condition (https://www.fnai.org/conlands_faq.cfm)."

This definition encompasses preservation areas and other lands set aside for natural resource protection and management.

Information on the description, distribution and status of conservation lands are provided on the FNAI website (https://www.fnai.org/conservationlands.cfm), and updated quarterly, with summary reports updated annually. The FNAI website includes a Florida Conservation Lands Map Viewer, as well as the underlying Florida Managed Areas (FLMA) geospatial database which are available for download (FNAI, 2020). The FLMA database includes the following information:

- Florida Conservation Lands;
  - federal
  - state
  - local
  - private
- Florida Forever Acquisitions;
- Florida Forever Board of Trustees (FFBOT) Projects;
- Conservation Easements;
- State Aquatic Preserves (subtidal lands).

The FLMA database is the primary source for information on Florida's conservation lands. The Inventory database includes boundaries and statistics for more than 2,600 federal, state, local, and private managed areas, all provided directly by the managing agencies. National parks, state forests, wildlife management areas, local and private preserves are examples of the managed areas included. The FLMA database is updated quarterly.

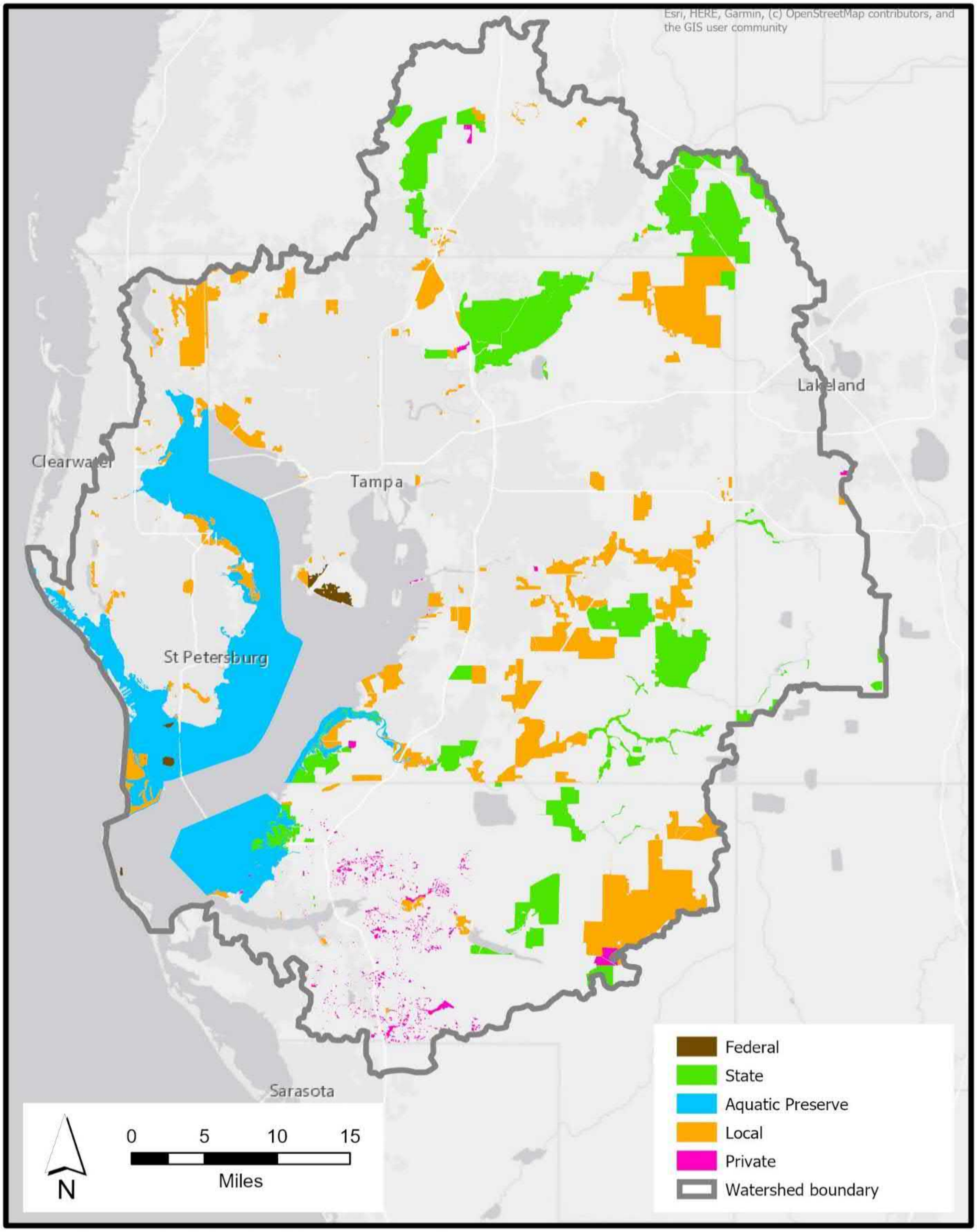
The FLMA database includes lands acquired through the State's Florida Forever Program, which began in 2001. The Florida Forever Acquisitions data layer contains parcel-specific information pertaining to lands purchased with Florida Forever funding. It currently includes parcels acquired by all programs that receive Florida Forever monies. Most of the Florida Forever parcels are incorporated into the FLMA data layer, either as new managed areas (i.e., conservation lands), or additions to existing managed areas.

The FLMA database also maintains the boundaries of all current Florida Forever environmental land acquisition projects approved by the State's Acquisition and Restoration Council and administered by the Florida Department of Environmental Protection, Division of State Lands, for the State Board of Trustees (FFBOT). These lands have been proposed for acquisition because of outstanding natural resources, opportunity for natural resource-based recreation, and/or historical and archaeological resources. The boundaries of each FFBOT project are for the entire project, including areas that have already been acquired. However, the database does not necessarily include all Florida Forever projects proposed by Florida Water Management Districts, or by other state agencies or local governments.

Map 3-1 shows existing (2019) conservation lands in the Tampa Bay watershed. Users of the FLMA database are cautioned by FNAI to review the information for local accuracy and applicability. For example, in the Tampa Bay watershed, the entirety of MacDill Air Force Base (AFB), including runways and other facilities, is shown as conservation lands. Through consultations with MacDill AFB environmental management staff, a GIS shapefile was created to accurately depict those portions of the base that are currently protected and managed for conservation purposes. In addition, consultations were also conducted with staff from Hillsborough, Pinellas, and Manatee counties to ensure that local conservation lands are updated and accurately depicted. The FLMA database also includes private mitigation banks permitted by the U.S. Army Corps of Engineers, as well as conservation lands managed by non-government organizations such as the National Audubon Society.

While the FLMA database is extensive, it does not include all conservation lands within the Tampa Bay watershed. As part of various development orders and agreements for Developments of Regional Impact (DRI's) and Planned Unit Developments (PUD's) local governments frequently require the delineation and recording of conservation easements of wetlands and other environmentally-sensitive lands within the project boundaries. In addition, the SWFWMD records both conservation and drainage easements in association with its water management and flood control facilities. These types of conservation easements are widely dispersed throughout the Tampa Bay watershed, generally as small slivers amongst developed areas, but are not included in the FLMA database. As part of this project, an inventory and review of local government and SWFWMD conservation easements was conducted, and the best available information derived from this review has been incorporated into **Map 3-1**.

There are four State Aquatic Preserves in Tampa Bay including the Pinellas County, Boca Ciega Bay, Cockroach Bay, and Terra Ceia Aquatic Preserves. The Pinellas County Aquatic Preserve extends into the Gulf of Mexico, whereas the other three are wholly contained within the boundaries of the TBEP. The Aquatic Preserve designation (Florida Statutes 258.35-258.46; Florida Administrative Code 18-20) confers greater regulatory protection of submerged lands within the boundaries of these areas. Other large coastal conservation parcels include: Upper Tampa Bay Park, Bower Tract Preserve, and Weedon Island Preserve in Old Tampa Bay; Kitchen Preserve, Wolf Branch Preserve, Cockroach Bay Preserve, and the Rock Ponds Management Area in Middle Tampa Bay; and Fort DeSoto Park and Robinson Preserve in Lower Tampa Bay.



Source: FNAI, 2020; SWFWMD, 2019; Hillsborough County, 2019; Pinellas County, 2019; Manatee County, 2019; Pasco County, 2019

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Map 3-1
Existing Conservation Lands in the Tampa Bay Watershed

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Table 3-1 below shows the acres and relative proportions of federal, state, local, and private conservation lands in the Tampa Bay watershed, *exclusive* of the subtidal portions of the State Aquatic Preserves (e.g., area below MLW). The Tampa Bay watershed now includes a total of **311,285 acres** of existing conservation lands, or about 21.4 percent of the total Tampa Bay watershed area of 1,450,883 acres. State-owned lands, including the intertidal and supratidal portions of the Aquatic Preserves, comprise the greatest percentage (63.6%) of the total acreage of conservation lands in the watershed, followed closely by lands acquired and managed by local governments (33.2%). Federal and private lands constitute a much smaller percentage of the total.

Table 3-1
Acres and Relative Proportions of Federal, State, Local, and Private Conservation Lands in the Tampa Bay Watershed

Owner/Manager	Acres	Percent of Total
Federal	2,110	0.7%
State Aquatic Preserves	109,769	35.3%
State Other	88,525	28.4%
Local	103,522	33.2%
Private	7,359	2.4%
Totals	**311,285**	**100%**

With regard to habitat contiguity and wildlife corridors, SWFWMD and Hillsborough County have made substantial strides in acquiring conservation lands within the river floodplain corridors of the Little Manatee and the Alafia Rivers. In particular, the strategic assemblage of conservation land parcels along the Little Manatee River has created the potential for a comprehensive riverine corridor protection and restoration program for that system. Building on this progress, Hillsborough County and other entities are currently investigating the designation of the Little Manatee River as a federal Wild and Scenic River. However, there are still substantial gaps in the protection of the river floodplain corridors of the Hillsborough River and the Manatee River, and these major tributaries to Tampa Bay are impounded and used for raw drinking water sources. Furthermore, the headwaters of the Alafia River have been substantially impacted by phosphate mining, and over one third of the Alafia River watershed is left as reclaimed mined lands. Although highly disturbed, these reclaimed mined lands offer the potential for substantial headwater stream, wetland, and upland restoration (see Section 5.8.4).

3.2 Proposed Conservation Lands

Created by the Florida Legislature in 2005, the Century Commission for a Sustainable Florida called for an identification of those lands and waters in the state that are critical to the conservation of Florida's natural resources. In response, the Florida Natural Areas Inventory, University of Florida Center for Landscape Conservation Planning, and Florida Fish & Wildlife Conservation Commission collaborated to produce CLIP - the Critical Lands and Waters Identification Project (Oetting et al., 2016). CLIP is a GIS database of statewide conservation priorities for a broad range of natural resources, including biodiversity, landscape function, surface water, groundwater, and marine resources.

Many of the natural resource data layers included in CLIP were derived from the Florida Forever Conservation Needs Assessment developed by FNAI to support the Florida Forever environmental lands acquisition program. CLIP is also being used to inform the Cooperative Conservation Blueprint, a statewide conservation planning effort led by the Florida Fish & Wildlife Conservation Commission. The Blueprint is a key action called for in the FWC Wildlife Legacy Initiative.

The FNAI website provides public access to the CLIP 4.0 GIS database, which integrates nine core GIS data layers that are combined under three resource categories: Biodiversity; Landscapes; and Surface Water. **Figure 3-1** shows the core data layers integrated under the three resource categories. This information represents the most comprehensive compilation and integrated analysis of Florida-specific geospatial natural resource data, and can be reliably used to identify critical lands and waters in priority need of protection in any Florida watershed.

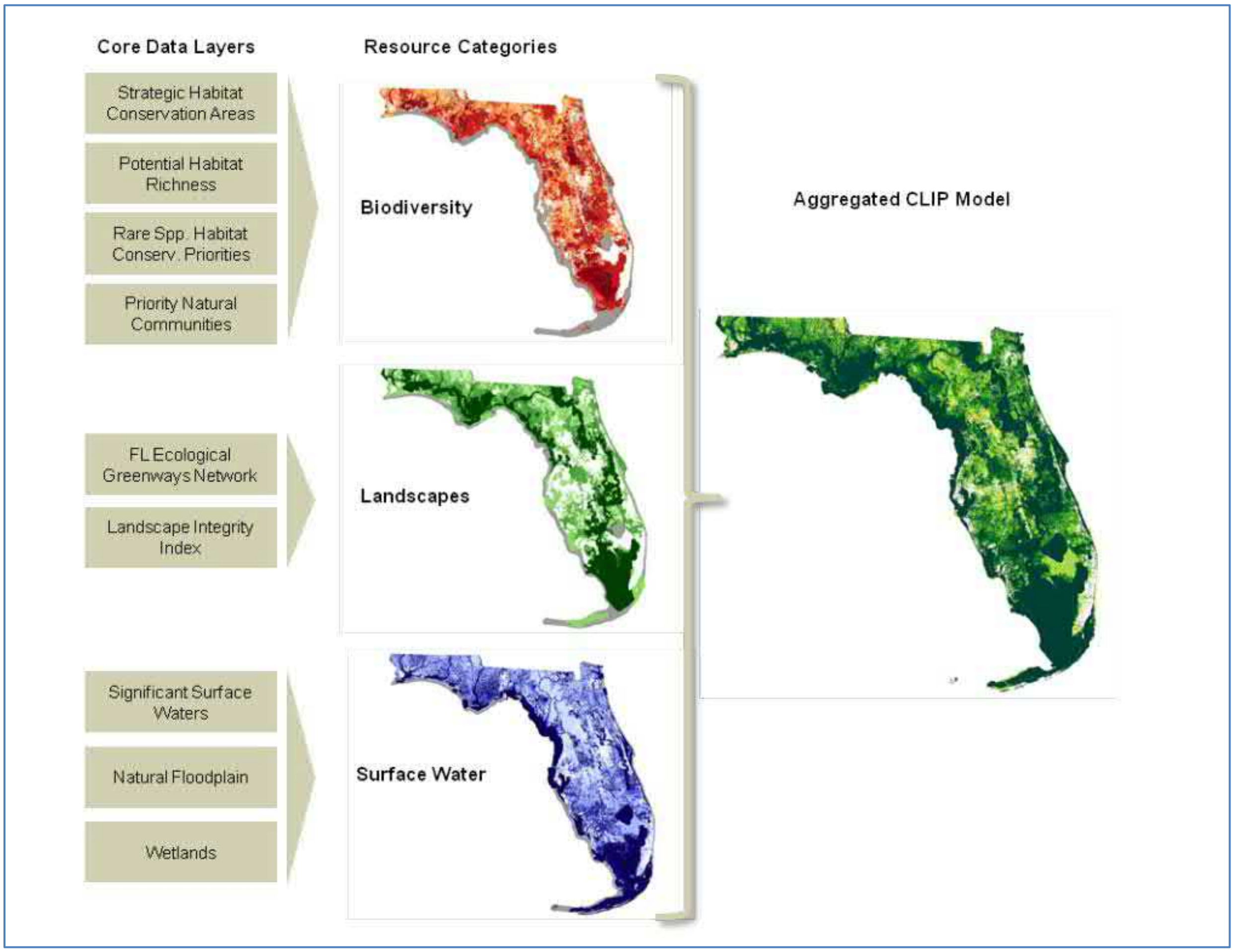


Figure 3-1
CLIP Version 4.0 Database Hierarchy (Oetting et al., 2016)

For the purposes of this 2020 Habitat Master Plan Update the core data layers included in the Aggregated CLIP model were used to identify proposed conservation lands in the Tampa Bay watershed. The Aggregated CLIP Model integrates priorities based on: maintenance of biodiversity; landscape integrity and contiguity; and surface water protection and management. The CLIP Surface Water resource category is perhaps the most critical and appropriate with respect to maintaining the health of the Tampa Bay estuarine ecosystem and associated wetland and watershed functions.

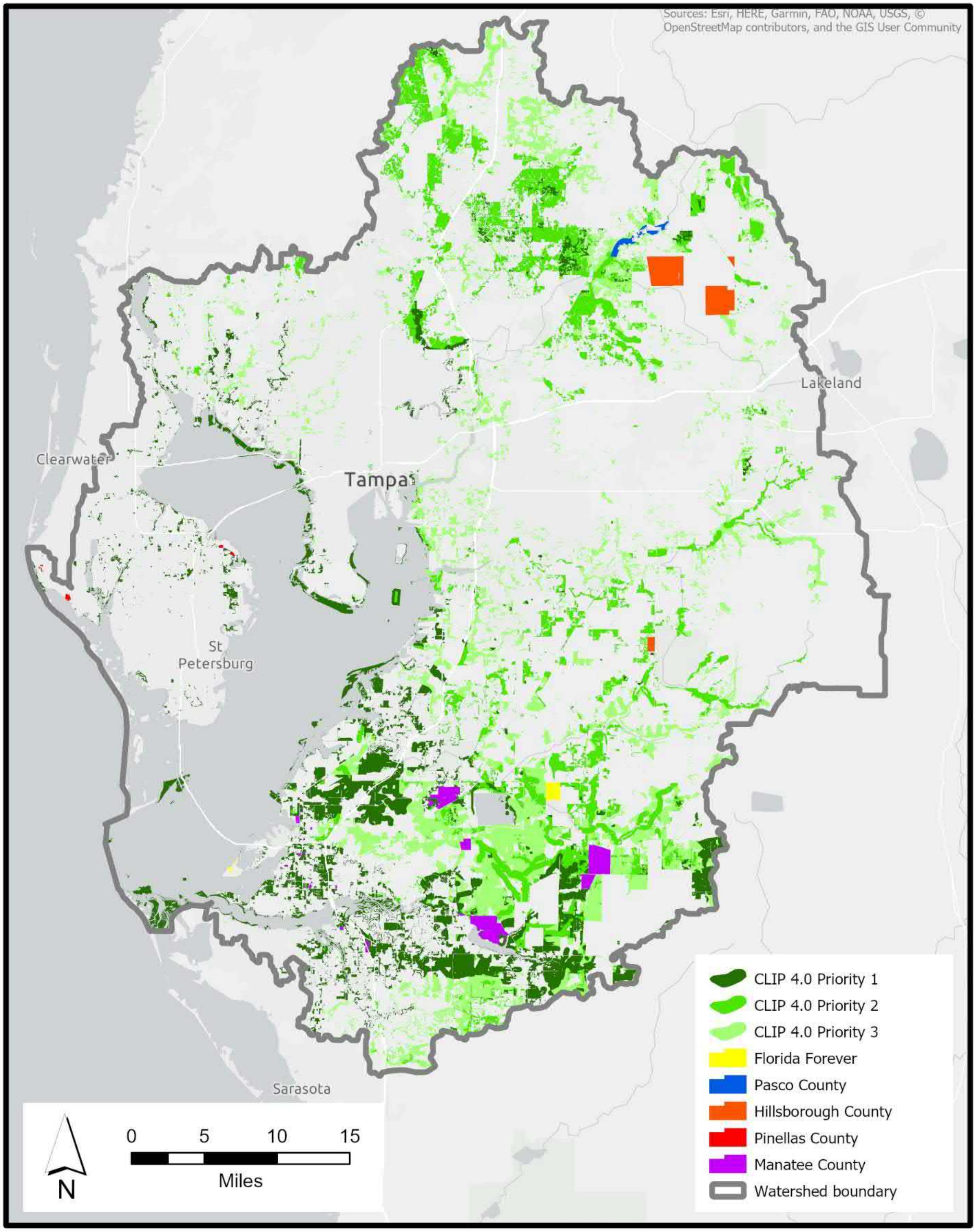
This Surface Water resource category is comprised of three core GIS data layers: Significant Surface Waters; Natural Floodplain; and Wetlands. This resource category is intended to identify areas important for protecting surface water resources, especially the integrity of remaining high-quality aquatic ecosystems. The category is not intended to directly address priorities for restoration of degraded aquatic resources, but rather priorities for the protection of existing aquatic habitats and water resources. The three core GIS data layers were created by FNAI in consultation with state water resource experts, specifically for the Florida Forever statewide environmental land acquisition program. These data layers are described below.

- **Significant Surface Waters** - This data layer is intended to show areas that have statewide significance for the purpose of land acquisition to protect significant surface waters with good water quality. This data layer is not intended to address surface waters with substantial restoration needs, only surface waters that are currently in a relatively natural condition and are a priority for protecting Florida's water resources.
- **Natural Floodplain** – This data layer is intended to show areas that have statewide significance for land acquisition to protect natural floodplains and their various ecological functions. This layer utilizes FEMA 100-year floodplain statewide, based on the latest D-FIRM floodplain maps where available.
- **Wetlands** - This data layer is intended to show areas that have statewide significance for land acquisition to protect large contiguous wetlands. Wetlands were identified based on the Cooperative Land Cover Map version 3.1 (FWC, 2015). Wetlands are prioritized based on the CLIP Land Use Intensity Index and FNAI Potential Natural Areas into six priority classes.

Five priority levels are distinguished in the Aggregated CLIP Model, with Priority 1 capturing the highest priority areas, and Priority 5 capturing the lowest priority areas. Priority areas identified by the Aggregated CLIP Model represent the best professional judgement of state natural resource management agencies and associated academic experts. To identify proposed conservation lands in the Tampa Bay watershed, geospatial data for priority levels 1-3 in the Aggregated CLIP Model were utilized. A detailed review of the areas captured under these priority levels indicated a reasonable subset of the most sensitive and critical native and potentially restorable habitats remaining in the Tampa Bay watershed, while allowing for anticipated human population growth and development in the region. Furthermore, areas captured using this approach included floodplains wetlands of the four major Tampa Bay tidal river corridors. These river floodplain corridors provide the primary connectivity between the Tampa Bay watershed and the Florida Wildlife Corridor (2020).

Map 3-2 below shows proposed conservation lands in the Tampa Bay watershed as derived from the most current FNAI GIS data layers, as well as supplemental information provided by the following agencies with regard to priority environmental lands targeted for acquisition:

- Southwest Florida Water Management District;
- Pasco County Environmental Lands Acquisition and Management Program (ELAMP);
- Hillsborough County Environmental Lands Acquisition and Protection Program (ELAPP);
- Manatee County Environmental Land Management and Acquisition Advisory Committee (ELMAAC).



Source: FNAI, 2020; SWFWMD, 2019; Hillsborough County, 2019; Pinellas County, 2019; Manatee County, 2019; Pasco County, 2019

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Map 3-2
Proposed Conservation Lands in the Tampa Bay Watershed

Using this approach, a total of **309,783 acres** of proposed conservation lands are shown in **Map 3-2**. The mapped areas represent priority land acquisition areas in the Tampa Bay watershed, on a regional scale. As noted above, the mapped proposed conservation lands generally link eastward and provide wildlife connectivity to the Florida Wildlife Corridor. However, the protection of remaining smaller, non-contiguous coastal upland areas is also of critical importance in the Tampa Bay watershed.

3.3 Habitat Restoration/Enhancement Database Update

The Tampa Bay watershed has been the focus area of substantial habitat restoration and enhancement activity over the past 40 years. However, accurately documenting this activity has been difficult. As part of this Habitat Master Plan Update, various sources of information regarding past and current habitat restoration and enhancement activities in the Tampa Bay area were compiled, reviewed, and consolidated into a single, consistent geospatial database. The methodology used in this effort is described below.

3.3.1 Methodology

Project data for recorded environmental restoration and enhancement efforts within the Tampa Bay region were gathered from the following sources:

- SWFWMD Surface Water Improvement and Management (SWIM) Program;
- Federal Government Performance and Results Act (GPRA) reporting;
- The Tampa Bay Water Atlas website as of June, 2019; and
- Solicited input from the Technical Advisory Committee (TAC) of the TBEP.

The categories of information on the Tampa Bay Water Atlas restoration sites GIS data layer were used and expanded upon for this data collection effort. This effort added the following categories:

- ID Number (based on activity and year);
- Category (estuarine, freshwater, upland, or a mix of habitats);
- Activity (restoration versus enhancement); and
- Area or linear extent (acreage or linear feet).

The four primary data sources contained extensive informational voids and inconsistencies. Some categories were accepted as having voids; however, where possible data gaps were supplemented by researching the project and/or visiting the project site, contacting the responsible entities, and documenting the knowledge of local professionals working on the project. The following data categories were populated in the database.

- ID number;
- Project name;
- Year;
- Category;

- Project description;
- Activity;
- Lead partner;
- Acreage or linear feet; and
- Latitude/longitude.

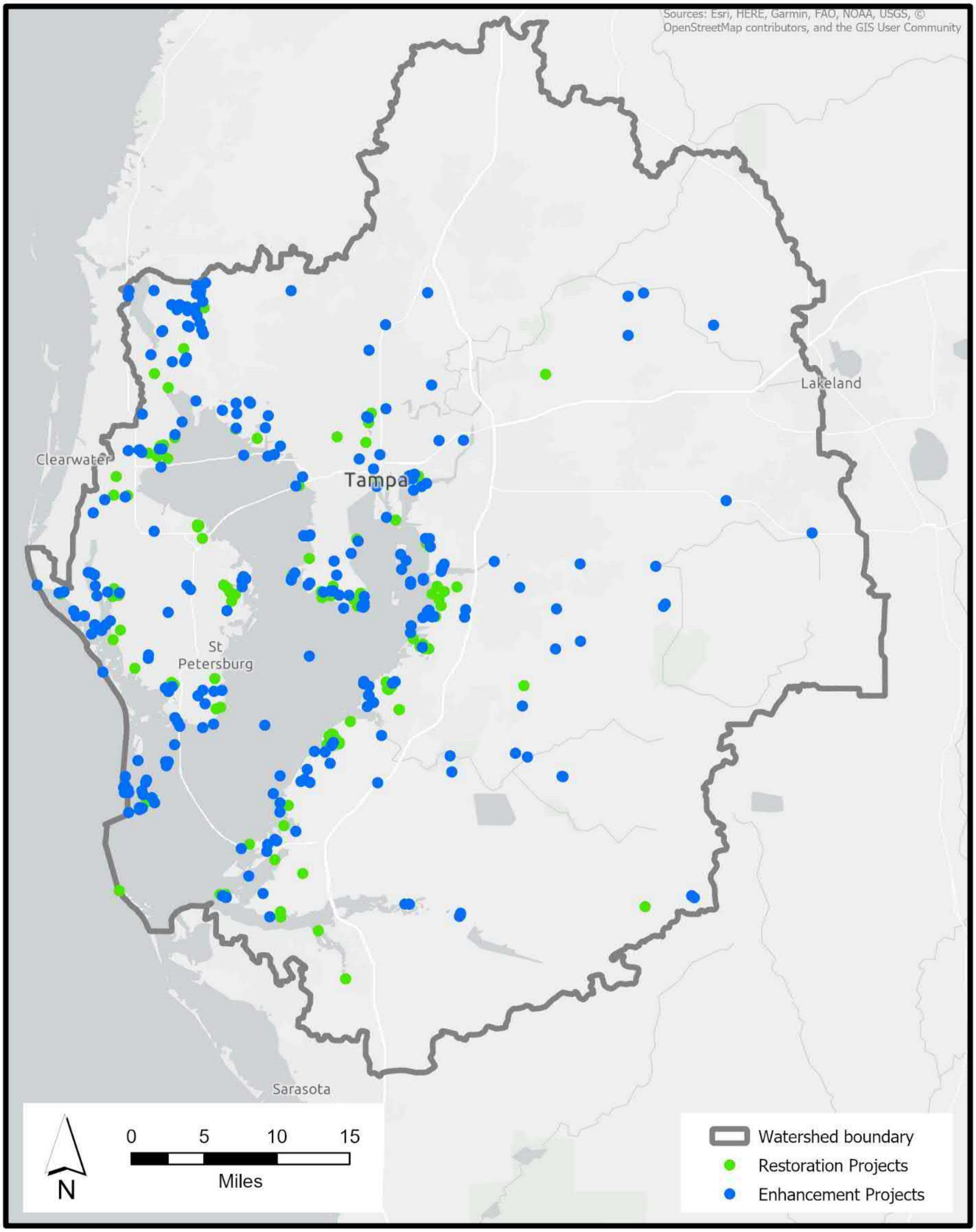
For this assessment a thorough review was conducted of all entries to ensure that: 1) no duplicate entries existed; 2) no regulatory mitigation sites were included; 3) projects occurred within the Tampa Bay watershed boundary; and 4) each project qualified as an enhancement or restoration activity. Eighty-nine (89) living shoreline projects including seawall enhancements and oyster reef modules, were inventoried separately and are not included in this summary of restoration and enhancement projects. These living shorelines cover a total of **11.3 miles** of shoreline and are discussed in more detail in Section 2.3.5.

Projects were classified as restoration if a component involved earthwork to reshape the land or the addition of structural elements (e.g., rock). Projects were classified as “enhancement” if they did not involve earthwork or physical changes, but rather improved the environment of an area (e.g., planting native vegetation, removing invasive vegetation, removing debris, conducting prescribed burns, etc.). Furthermore, projects were classified as either estuarine, freshwater, mixed, or upland based on project descriptions and local professional knowledge. When a project was classified as mixed, the mix was described in the data category. The majority of project extents were reported in acreage; however, some enhancement projects were reported in linear feet where appropriate for the work conducted.

When possible, each site was mapped in GIS using the latitude/longitude coordinates provided. When latitude/longitude coordinates were not provided, or locations were obviously incorrect, information from the project description was coupled with local knowledge and aerial interpretation to assign the project’s best location. Project entries were reviewed for true duplicates, which were subsequently eliminated. For project locations with multiple phases of work in different years, all entries were kept on the list. Finally, the number of data fields was consolidated from 18 to 11 so all the information sources had a common set of data categories.

Total acreage and linear feet were calculated for estuarine, freshwater, mixed, and upland habitats under both the restoration and enhancement categories. All projects with mixed habitats were calculated together rather than being spliced into subcategories such as freshwater, upland, or estuarine acreages. The 2019 GPRA entries were also included as part of this overall summary. For future updates, the annual GPRA entities should be vetted using these same protocols and added to this database to provide a living document for future assessments.

The revised and updated habitat restoration/enhancement and living shoreline databases are provided as a spreadsheet table in **Appendix A** of this document. The spreadsheet document is sortable by the various fields. **Map 3-3** shows the locations and affected habitat types of completed restoration and enhancement projects in the Tampa Bay study area, as compiled in the revised and updated habitat restoration/enhancement database.



Source: ESA, 2020

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Map 3-3
Existing Habitat Restoration Sites in the Tampa Bay Watershed

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3.3.2 Findings

Key summary information and findings derived from this data synthesis and analysis include the following:

- The period of record for habitat restoration/enhancement activities includes projects completed between the years of 1971 through 2019. Data from 2010 through 2019 reflects restoration projects reported since the previous Habitat Master Plan (Robison et al., 2010).
- A total of 460 projects have been documented over the period of record, addressing the full range of habitat types:
  - Estuarine = 228
  - Freshwater = 53
  - Mixed = 60
  - Uplands = 119.
- A total of 36,837.1 acres and 140,367.8 linear feet have been restored or enhanced:
  - Enhancement = 321 projects totaling 31,949.8 acres and 140,367.8 linear feet
  - Restoration = 139 projects totaling 4,887.3 acres.
- Forty (40) lead partners have been documented as responsible for the projects. However, some of these lead partners are departments within the same overall agency.
- There was a wide range in the size of projects reported:
  - Enhancement: 0.003 acres to 7,000 acres (Duette exotic treatment)
  - Restoration: 0.1 acre to 450 acres (Fort DeSoto recirculation phase 2).
- Sites with most projects include:
  - MacDill AFB = 20
  - Cockroach Bay = 16.

Table 3-2 provides a summary of the number of projects, and the restored acres and linear feet, for each of the four major habitat types.

Table 3-2
Enhancement and Restoration Projects in Tampa Bay (1970-2019 and 2010-2019)

Habitat Type	No. Projects	Enhancement		Restoration (1970-2019)	Restoration (2010-2019)
		Acres	Linear Feet	Acres	Acres
Estuarine	228	3,147.6	99,501	2,074.0	862.6
Freshwater	53	449.1	23,156.8	1,191.1	903.0
Mixed	60	5,924.5	0	1,195.4	252.0
Upland	119	22,428.6	17,710	426.9	31.9
Totals	460	31,949.8	140,367.8	4,887.3	2,049.4

Table 3-3 summarizes only restoration efforts as performed by the various lead partners identified in the database. In terms of project numbers, the three lead partners with the most projects are:

- SWFWMD/SWFWMD SWIM (79 projects);
- Ecosphere Restoration Institute (17 projects);
- FDEP/FDNR/FDER (12 projects).

In terms of total area restored, the three lead partners with the most acres restored are:

- SWFWMD/SWFWMD SWIM (2,540.5 acres);
- Pinellas County/Pinellas County Parks and Conservation Resources (720.6 acres); and
- Manatee County/Manatee County Natural Resources (623.0 acres).

Table 3-3
Restoration Project Number and Coverage by Lead Partner

Lead Partner	No. of Restoration Projects	Acres
BAEAT	1	7.0
City of Clearwater	2	34.2
City of Safety Harbor	1	0.2
City of St. Petersburg	3	51.0
City of Tampa	3	5.0
Ecosphere Restoration Institute	17	242.1
FDEP/FDNR/FDER	12	242.2
Hillsborough County/Hillsborough County Expressway Authority	2	327.0
MacDill Air Force Base	2	3.0
Manatee County/Manatee County Natural Resources	3	623.0
Mosaic	1	49.7
Pinellas County/ Pinellas County Parks and Conservation Resources	8	720.6
SWFWMD/SWFWMD SWIM	79	2,540.5
TBEP	2	28.0
Tampa Bay Watch	2	13.0
TECO	1	0.8
TOTAL	**139**	**4,887.3**

While this data synthesis and analysis represents the best estimate of habitat restoration and enhancement efforts compiled to date for the Tampa Bay watershed, there are clearly substantial gaps and inconsistencies in the way this information is documented and reported. Currently, SWFWMD is in the process of developing a GIS data layer of project area polygons, which will allow for much more accurate information on the areal extent of restoration and enhancement activities for their projects. A similar effort is needed for projects completed by the other lead partners to better assess total restoration and enhancement activity within the Tampa

Bay watershed. Going forward, a coordinated reporting platform and template is needed to document and quantify future restoration and enhancement activities.

Despite the data gaps and inconsistencies, this synthesis provides useful information for habitat restoration target setting. As shown in **Table 3-3** a total of about 4,887 acres of habitat restoration was completed over an approximate 29-year period of record, which equates to an average annual of over 168 acres for all habitat types combined. Over the past decade (2010-2020) this rate of restoration project completion has increased to over 200 acres/year. Assuming that funding levels remain in the same range as the past decade, this annual average can be used to set reasonable limits on restoration potential and targets.

Finally, it is notable that in the habitat change analysis summarized in **Table 2-3**, emergent tidal wetlands have increased by a total of 2,152 acres since 1990. This total is remarkably similar to the estimated 2,074 acres of estuarine habitats restored through publicly-funded habitat restoration activities (**Table 3-2**), which constitutes 96 percent of the total gain in emergent tidal wetlands. While no geospatial analysis was conducted as part of this project to determine if the gains in emergent tidal wetlands correspond to documented restoration projects, it seems likely that publicly-funded restoration activities account for a significant percent of these gains.

3.4 Habitat Restoration Best Practices Manual

As part of this Habitat Master Plan Upate, a compendium of lessons learned and habitat restoration best practices has been prepared and is provided as a standalone document titled *Tampa Bay Habitat Restoration: Best Management Practices Manual (Ries 2020)*.

This document was prepared to address the restoration of critical coastal habitats represented in the Tampa Bay study area and describes habitat restoration techniques that have been successfully utilized over the past four decades to restore coastal ecosystems specifically in Tampa Bay. This guidance manual also recommends approaches to effectively implement future habitat restoration projects in Tampa Bay, by integrating lessons-learned from over one hundred projects within the watershed. Finally, this manual includes recommendations for monitoring protocols and emerging technologies to facilitate future coastal habitat restoration efforts in consideration of climate change and sea level rise.

Section 4.0: Habitat Protection and Restoration Paradigms

The term "paradigm" has been generally defined as a framework containing the basic assumptions, ways of thinking, and methodologies that are commonly accepted by members of a scientific community (Dictionary.com). The TBEP has previously used a "retrospective" approach to setting habitat protection and restoration targets. In addition, several related paradigms have evolved over the years to guide both watershed-level habitat planning and site-level restoration design activities. This section provides a summary of the various paradigms that have been applied to habitat management in the Tampa Bay watershed, and recommends a new more eclectic approach that integrates multiple types of information into a comprehensive and repeatable method for developing habitat protection and restoration targets – in both this and future Habitat Master Plan updates.

4.1 Restoring the Balance

Previous TBEP Habitat Master Plans have utilized a habitat protection and restoration target setting approach based on the "Restoring the Balance" (RTB) paradigm. This paradigm was first introduced in the document titled *Setting Priorities for Tampa Bay Habitat Protection and Restoration: Restoring the Balance – TBEP Technical Publication #09-95* (Lewis and Robison, 1996).

Within the RTB paradigm, ten faunal guilds were identified, representing ecologically important estuarine-obligate species in Tampa Bay (**Table 4-1**). The theory underlying the RTB paradigm assumed that these guilds developed successful life history strategies during their evolution based on the distribution of the various habitat types that existed in Tampa Bay prior to major anthropogenic impacts. However, disproportionate habitat losses have produced a relative abundance of some habitats, and a scarcity of other habitats, due to differential rates of loss. The theory posited that if the most impacted habitat type is essential to the life history requirements of a species, then this differential habitat loss could create a "choke point" or limiting factor on the overall population size of that species.

The rationale for the RTB paradigm was that the relative proportions, or balance, of the various habitat types that existed in a defined "pre-development" benchmark period should be replicated since the restoration of the total acreage of the various habitat types that existed in the benchmark period was not economically feasible. By restoring the balance of critical habitats to their historical ratios, the habitat requirements of estuarine dependent species would be supported throughout their full life histories, even though the total extent of habitats is less than what existed in the benchmark period. Therefore, under this paradigm, priority is given to restoration activities that are focused on those habitat types that have been disproportionately lost or degraded compared to the benchmark period.

The RTB approach was subsequently used as the target setting paradigm in the *Tampa Bay Estuary Program Habitat Master Plan Update* (Robison, 2010), as well as the *Master Plan for the Protection and Restoration of Freshwater Wetlands in the Tampa Bay Watershed, Florida* (Ries and Scheda, 2014).

Table 4-1
Faunal Guilds Identified for the Restoring the Balance Paradigm (Lewis & Robison, 1995)

Guild No.	Type	Life History Stage	Common Name	Scientific Name
1	Open water filter feeder	Adult	Bay anchovy Atlantic menhaden Atlantic threadfin herring	*Anchoa mitchilli* *Brevoortia spp.* *Opisthonema oglinum*
2	Shallow water Forage fish	Adult	Striped killifish Sheepshead killifish Silver perch Spot Clown goby Lined sole Hogchoker	*Fundulus similis* *Cyprinodon variegatus* *Bairdiella chrysoura* *Leiostomus xanthurus* *Microgobius gulosus* *Achirus lineatus* *Trinectes maculatus*
3	Recreationally and commercially important fish and shellfish	Juvenile	Tarpon Red drum Snook* Spotted seatrout Striped mullet Blue crab Pink shrimp	*Megalops atlanticus* *Sciaenops ocellatus* *Centropomus undecimalis* *Cynoscion nebulosus* *Mugil cephalus* *Callinectes sapidus* *Farfantepenaeus duorarum*
4	Subtidal invertebrates	Adult	Soft bottom deposit feeders Caridean shrimp	*Capitiella capitata* *Paleomonetes pugio*
5	Intertidal invertebrates	Adult	Fiddler crabs Horn shells Marsh snails	*Uca spp.* *Cerithium spp.* *Melampus spp.*
6	Estuarine molluscs	Adult	Marsh clam Crown conch	*Rangia spp.* *Melongena corona*
7	Estuarine dependent birds	Adult	Brown pelican* Least tern** Reddish egret* American oystercatcher Roseate spoonbill* Willet Laughing gull	*Pelecannus occidentalis* *Sterna antillarum* *Egretta rufescens* *Haematopus palliatus* *Ajaia ajaja* *Catoptrophorus semipalmatus* *Larus atricilla*
8	Estuarine dependent birds requiring freshwater foraging habitat (during nesting season)	Adult	White ibis* Snowy egret* Little blue heron*	*Eudocimus albus* *Egretta thula* *Egretta caerulea*
9	Estuarine reptiles	Adult	Diamondback terrapin Mangrove water snake	*Malaclemys terrapin macrospilota* *Nerodia clarkii compressicauda*
10	Marine mammals	Adult	Manatee*** Bottlenose dolphin	*Trichechus manatus* *Tursiops truncates*

*Listed as Species of Special Concern (Florida Fish & Wildlife Conservation Commission)
**Listed as Threatened (Florida Fish & Wildlife Conservation Commission)
***Listed as Endangered (Florida Fish & Wildlife Conservation Commission and U.S. Fish & Wildlife Service)

Application of the RTB paradigm in habitat target setting required quantification of the areal extent and relative proportions (percentage of the total) of each habitat type for both a benchmark and current time period. For Tampa Bay, the benchmark period was defined as circa-1950, based on the less developed and impacted conditions that existed then, as well as the availability of a digital habitat polygon map prepared from the photointerpretation of high quality aerial photography representing this time period. The formula for calculating restoration targets for disproportionately impacted habitats was as follows:

If: x = restoration target for habitat of interest
a = current acreage of least impacted habitat
b = benchmark proportion of habitat of interest
c = benchmark proportion of least impact habitat

Then,
$c/a = b/x$, and
$x = (ab)/c$

The RTB paradigm has generally been accepted by the Tampa Bay environmental community as a useful conceptual model for guiding habitat restoration and land acquisition activities. It has been an attractive model largely because the targets derived from this approach are resource-based (e.g., tied to the habitat needs of ecologically and economically important species), and because its expectations are realistic (e.g., recognizes the infeasibility of restoring the Tampa Bay ecosystem to pre-development conditions).

Since its initial adoption, the RTB paradigm has had a significant influence on habitat restoration project designs and, to a lesser extent, on public land acquisition decisions. RTB established a clear priority to restore low salinity tidal marshes and high salinity salt barrens, which were determined by the RTB analysis to have been disproportionately impacted compared to mangroves. In response, most publicly funded habitat restoration projects conducted during the past two decades have attempted to incorporate a “salinity gradient” component into the design using available freshwater sources, thus emphasizing low salinity habitats to be consistent with the paradigm (Henningsen, 2003).

While the RTB paradigm provided a theoretical basis for the development of numeric habitat protection and restoration targets, the relevance of the underlying theory has come under criticism. As recognized in the 2010 Habitat Master Plan Update (Robison, 2010), all species in the identified faunal guilds have ranges that extend far beyond the boundaries of Tampa Bay. Therefore, it is probably more accurate to argue that their life history strategies evolved within the pre-development proportional distribution of critical habitats that existed across their entire range, rather than just Tampa Bay. Given the significant differences in the latitude, geomorphology, and hydrology of Gulf of Mexico and south Atlantic estuaries, the pre-development proportional distribution of critical habitats must have been extremely variable across these species’ ranges.

In addition, the RTB paradigm assumed that, other than development-related impacts, critical coastal habitats are generally stable; and that once restored, habitat ratios would be naturally self-sustaining. RTB did not explicitly recognize sea level rise as a dynamic driver of changes in the extents, distributions, and relative proportions of emergent tidal wetlands in Tampa Bay. However, there is now clear evidence that coastal habitats are changing rapidly in response to sea level rise and, to a lesser extent, climate change, and that populations of estuarine-dependent wildlife are being significantly affected by these changes (Van Holle et al., 2019).

The landward expansion of mangroves into lower salinity salt marshes of Tampa Bay tidal tributaries is an indicator of sea level rise that has been anecdotally observed by numerous resource managers over the past two decades (Robison, personal communication). **Figure 4-1** shows a photograph of recent mangrove expansion into a once monotypic *Juncus* marsh in the Manatee River.

Figure 4-1
Landward Expansion of Mangroves into a Historically Monotypic *Juncus* Marsh

In addition to sea level rise, warmer winter temperatures, and the relative lack of hard freezes over the past two decades have allowed black mangroves to expand their range northward in the Gulf of Mexico, where they are also outcompeting native salt marshes (Comeaux et al., 2012). Given the increasing pressures of sea level rise and climate change on Tampa Bay, the establishment of coastal habitat protection and restoration targets based on past ecological conditions no longer seems valid.

Finally, the RTB approach utilized a formula that calculates numeric habitat restoration targets independent of what is actually feasible on the ground. The approach did not factor in the availability of adequate land to conduct restoration activities on, as needed to meet the targets; nor did it consider other stressors such as land development trends. Therefore, habitat restoration targets developed using the RTB could never be “reality tested” with respect to feasibility. Therefore, for the reasons discussed above, it is recommended that RTB no longer serve as the sole guiding paradigm for the development of Tampa Bay habitat protection and restoration targets.

4.2 Other Habitat Protection and Restoration Paradigms

Other paradigms that have been used to guide habitat protection and restoration activities in the Tampa Bay watershed, and elsewhere, are briefly discussed in the following subsections. These approaches are still highly relevant to habitat restoration activities in Tampa Bay.

4.2.1 The Watershed Approach

The term “watershed” refers to a drainage basin, or a hydrologically-defined geographic area in which all rainfall falling within it eventually flows to a common receiving water, such as a river or estuary. Watersheds themselves consist of all surface water, and include lakes, streams, and wetlands; as well as all groundwater and aquifers.

In the mid-1990’s the U.S. Environmental Protection Agency (EPA) developed the *Watershed Approach Framework* (EPA, 1996). This document defined the “watershed approach” as a coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within a watershed-based geographic area. Watershed approaches aim to treat and prevent pollution, achieve and sustain other environmental improvements, and meet other goals important to the community. Although watershed approaches may vary in terms of specific objectives and priorities, all should be based on the guiding principles of: partnerships; watershed geographic focus; and sound management techniques based on strong science and data.

The TBEP has used an integrated watershed approach since its inception to diagnose and manage water quantity and quality problems throughout the Tampa Bay watershed. However, the first two Tampa Bay Habitat Master Plans did not fully apply a watershed approach. Rather, those plans focused on coastal subtidal and intertidal habitats without much consideration of their intrinsic linkages to freshwater wetlands and native upland habitats extending to the upper reaches of the Tampa Bay watershed. This issue was partially addressed with the development of the *Master Plan for the Protection and Restoration of Freshwater Wetlands in the Tampa Bay Watershed, Florida* (Ries and Scheda, 2014); although, this latter document did not integrate tidal and freshwater habitats, and did not address upland habitats.

The basic tenet of the watershed approach is that all water that falls within the boundaries of the watershed is interconnected and expressed through the continuum of natural plant communities that extend from the headwaters to the estuary. Native upland habitats in the Tampa Bay watershed constitute important aquifer recharge areas converting rainfall to groundwater, or to surface water runoff that flows into and through freshwater wetlands and streams. These freshwater habitats transition into tidal rivers and tributaries, which in turn flow to through emergent tidal wetlands to the bay and its subtidal habitats of the bay. This 2020 Habitat Master Plan Update acknowledges this interconnectedness, and addresses the full mosaic of all habitats in the Tampa Bay drainage basin.

4.2.2 Habitat Mosaics

The term “habitat mosaic” generally refers to an area or site comprised of multiple habitat types. Habitat mosaics can form naturally through an ecological disturbance, such as fire; or they can be artificially created on a restoration site. Either way, habitat mosaics are ecologically important as they typically result in an increase in species biodiversity, either temporarily or over the long-term (Henningsen, 2003).

Early attempts at emergent tidal wetland restoration in Tampa Bay were limited to small (<1 acre) salt marsh plantings focused on achieving success criteria based primarily on plant survival and percent cover. Over time, however, coastal habitat restoration projects have become increasingly more complex as the science of restoration ecology has evolved. The “habitat mosaic approach” to habitat restoration generally refers to a design approach where an attempt is made on each individual restoration site to incorporate a diversity of habitat types and functions, as opposed to a single habitat type (Henningsen, 2003).

In the Tampa Bay region, the habitat mosaic approach has evolved largely out of necessity. The vast majority of restoration projects are conducted on publicly-owned lands, as outright ownership of the parcel(s) involved allows for the greatest degree of control over project implementation, monitoring, and long-term maintenance. Most public restoration sites are acquired opportunistically, as they become available on the real estate market. As a result, there is a limit on new restoration opportunities in the watershed, and the sites that do become available are typically smaller in size (<100 acres). Therefore, the overarching goals of the habitat mosaic approach have been to incorporate, as feasible, the widest variety of habitat types and functions on a site.

Coastal habitat restoration projects completed by the SWFWMD Surface Water Management and Improvement (SWIM) Department in recent years have become increasingly more complex, incorporating such habitat elements as:

- Undulating shorelines;
- Coves and embayments;
- Shallow subtidal flats;
- Deep subtidal pools;
- Artificial reefs;
- Living shorelines;
- Oyster bar substrates;
- Semi-isolated brackish ponds;
- Complementary freshwater wetlands;
- Coastal upland buffers;
- Braided tidal channels;
- Salinity gradients.

Where practical, attempts are usually made to provide for “polishing” of stormwater runoff from adjacent urban and agriculture land uses (e.g., additional sediment and/or nutrient removal), and to incorporate these freshwater discharges into the creation of tidal creeks with salinity gradients. In addition, designs have increasingly emphasized high marsh and coastal upland components.

There is now a broad consensus in the Tampa Bay area scientific community that sea level rise and climate change will continue to exert dynamic changes upon coastal habitats, and that sea level rise adaptation will need to be incorporated into future habitat restoration designs for them to be successful. Future projections of the rate of sea level rise have a high level of uncertainty; therefore, envisioning what the coastal landscape will look like in 50 years, and designing restoration projects that are optimized for future conditions, is very difficult. For these reasons, an adaptive management approach will be needed.

4.2.3 Adaptive Management

Many unsatisfactory habitat restoration efforts – both large and small scale – have resulted from a failure to recognize and address the inherent complexity, uncertainty and dynamics of natural systems, and from a focus on inappropriate time scales (Hilderbrand et al., 2005). Habitat restoration is trying to do in a matter of years what usually takes decades or centuries, under natural conditions. Expecting complete restoration of ecosystems on human time scales is usually unreasonable, even when full restoration may eventually occur. Nonetheless, many of the underlying beliefs in restoration ecology tacitly assume that systems will return to a natural state in fairly short order if they are just “nudged” in the right direction through adjustments to physical attributes (e.g., elevation, tidal flushing), or by regulating species composition (e.g., prescribed plantings). Additional problems arise in defining what is “natural,” and in our inability to accept that systems are dynamic and may have multiple trajectories leading to numerous possible outcomes (Hilderbrand et al., 2005).

The term “adaptive environmental assessment and management” was the original name given to this approach, which was first applied to the science of fisheries management (Holling, 1978). The concept of adaptive management is based on the understanding that ecosystems are inherently complex and dynamic with a high degree of unpredictability. This approach was more broadly applied in the late 1990’s, primarily by federal environmental agencies on large scale ecosystem restoration projects such as the Comprehensive Everglades Restoration Program (CERP).

As originally described, adaptive management is a structured, iterative process of optimal decision making in the face of uncertainty, with the aim of reducing uncertainty over time via system monitoring and feedback loops to redirect future actions (Holling, 1978). In this way, decision making simultaneously maximizes one or more resource objectives and, either passively or actively, accrues information needed to improve future management. Adaptive management is often characterized as “learning by doing.” Key elements of the adaptive management approach include the following:

- Embracing risk and uncertainty as a way of building understanding;
- Explicit characterization of system uncertainty through conceptual model development and statistical inference;
- Feedback between monitoring and decisions (learning);
- Iterative decision-making (evaluating results and adjusting actions based on what has been learned).

These elements can be applied to both watershed-level habitat restoration planning and management programs, as well as the implementation of site-level restoration projects. At the watershed level, the TBEP effectively utilized the adaptive management elements listed above to successfully restore seagrasses in Tampa Bay by: 1) setting a restoration target based on conceptual, statistical and mechanistic models; 2) implementing management actions to effectuate seagrass restoration; 3) monitoring the system response; and 4) fine-tuning management actions based on monitoring inputs.

At the site level, SWFWMD has been implementing a “lessons learned” approach to habitat restoration designs for over two decades, utilizing post-construction monitoring data to inform future design elements (Henningsen, 2003). As part of this 2020 Habitat Master Plan Upate, a compendium of lessons learned and habitat restoration best practices has been prepared and is provided as a standalone document titled *Tampa Bay Habitat Restoration Best Management Practices Manual* (Ries, 2020).

Given the insidious challenges of sea level rise and climate change, future habitat restoration programs and projects should be designed for long-term resilience and sustainability, requiring an even greater commitment to adaptive management. Accordingly, project designs should incorporate monitoring and decision points along the way to allow for critical assessment, and possible intervention with contingency plans, if succession is not proceeding appropriately. Assessing the performance of multiple restoration approaches and methods may increase cost, but will allow for the testing of multiple hypotheses and adaptive learning, thus improving cost-efficiency over time.

4.3 The “Maximizing the Potential” Approach

Given the limitations of the RTB paradigm, a more diversified approach is recommended that integrates multiple and disparate types of information into a comprehensive and repeatable method for developing and updating habitat protection and restoration targets – in both this and future Habitat Master Plan updates. Furthermore, this approach should establish a broader framework that guides both watershed-level habitat master planning and site-level restoration design activities; and should incorporate elements of the other habitat restoration paradigms discussed above, where applicable. This recommended approach is herein termed as “Maximizing the Potential” (MTP).

The MTP approach differs from the RTB approach in that it integrates the whole watershed, and is both retrospective and prospective. Accordingly, the MTP approach:

1. Integrates all native habitats in the watershed including coastal, freshwater and upland habitats;
2. Is informed by contemporary trends in both habitat changes and restoration performance;
3. Considers both current and future stressors – especially land development, sea level rise and climate change; and
4. Focuses on existing opportunities, and what is realistically possible in the future, rather than replicating past ecological conditions.

These four key elements of the MTP approach are discussed further below.

4.3.1 Integrates All Native Habitats

Previous TBEP habitat master planning efforts have focused separately on coastal habitats and freshwater wetland habitats. Not addressed in these previous efforts are native upland habitats. The MTP approach focuses on all native habitats in the Tampa Bay watershed in an integrated manner. To frame the recommendations of this 2020 Habitat Master Plan Update, it is recommended that the Tampa Bay watershed be viewed in terms of four spatial strata, or action areas, as described and shown below.

- **Subtidal Stratum:** The subtidal stratum includes all habitats below the Mean Lower Low Water (MLLW), and encompasses hard bottom, seagrasses, tidal flats, oyster reefs, and artificial reefs.
- **Coastal Stratum:** The coastal stratum encompasses the intertidal zone and nearshore coastal uplands, and extends from MLLW elevation to elevation 5-feet, NAVD 88 - which is approximately 5-feet above the local Mean Sea Level (MSL) elevation. MSL-based elevation data are most appropriate for use in construction and topographic surveys, in particular those involving flood control, shoreline protection, and shoreline improvement and restoration (NOAA website https://vdatum.noaa.gov/docs/datums.html). The coastal stratum is the zone where emergent tidal wetland restoration would be conducted. In addition, extending this stratum to the 5-foot contour also encompasses low-lying coastal uplands which are currently important as tidal wetland buffers; and will be critically important in the future as coastal “reservation” areas, or lands reserved to accommodate ideal wetland migration in response to sea level rise.
- **River Floodplain Stratum:** The river floodplain stratum encompasses the 100-year river floodplain, as defined by FEMA. This stratum includes all hydrologically-contiguous forested and non-forested wetlands within the river and stream corridors of the Tampa Bay watershed. Floodplain corridors provide vital watershed functions including: migratory fish and wildlife habitat; floodwater attenuation and storage; erosion control; water quality treatment (e.g., removal of suspended sediments and dissolved nutrients); and delivery of complex organic matter to the estuarine food web (FEMA, 2019). In addition, river floodplain corridors provide excellent recreational opportunities The river floodplain stratum is to be distinguished from the 100-year coastal floodplain: the former describes the watershed area flooded by a 100-year rainfall event; while the latter describes the coastal area flooded by the storm surge associated with a 100-year coastal storm event.
- **Upland Stratum:** The upland stratum encompasses the remaining areas within the Tampa Bay watershed not included in the coastal and river floodplain strata. This stratum includes all native upland habitats as well as hydrologically-isolated wetlands. These habitats provide important aquifer recharge and wildlife habitat functions.

Map 4-1 below shows a graphical depiction of the habitat spatial strata in the Tampa Bay watershed, as described above. Specific habitat protection and restoration strategies and policies are summarized for each of the “action areas” later in this document.

4.3.2 Informed by Contemporary Trends

The RTB target setting approach was based on replicating coastal habitat ratios that existed in the circa-1950 benchmark period. While changes in habitat extents and distributions since the benchmark period provide important perspective, the MTP approach is focused primarily on habitat changes that have occurred during more contemporary time periods. Period-of-record data vary depending on habitat type, and there are relatively consistent extent and distribution data for most Tampa Bay habitats of interest extending from 1988 to 2018. This 30-year period-of-record represents a time period during which most of the current federal Clean Water Act wetland and water quality regulations, and associated state regulations, were in effect. In addition, during this time period the effects of sea level rise and climate change began to be reported in the scientific literature.

The habitat change analysis discussed in Section 2.5 above showed that there has been a 10 percent increase in emergent tidal wetlands from 1990 to 2017, with gains in mangroves and salt barrens being partially offset by smaller losses in salt marshes - changes that can be partially explained by sea level rise. However, if this trend continues the extent of salt marshes in Tampa Bay could be substantially reduced, as mangroves exploit higher tidal and salinity levels in the major tidal rivers. The habitat change analysis also showed that while the overall extent of freshwater wetlands has been more or less stable over the past two decades – an observation that can be explained by effective wetland regulations – there has been a significant conversion of forested wetlands to non-forested wetlands; and there have been greater losses of headwater streams to mining and development. Furthermore, there has been a substantial loss (30%) in the extent of native upland habitats, with these losses almost entirely attributable land development.

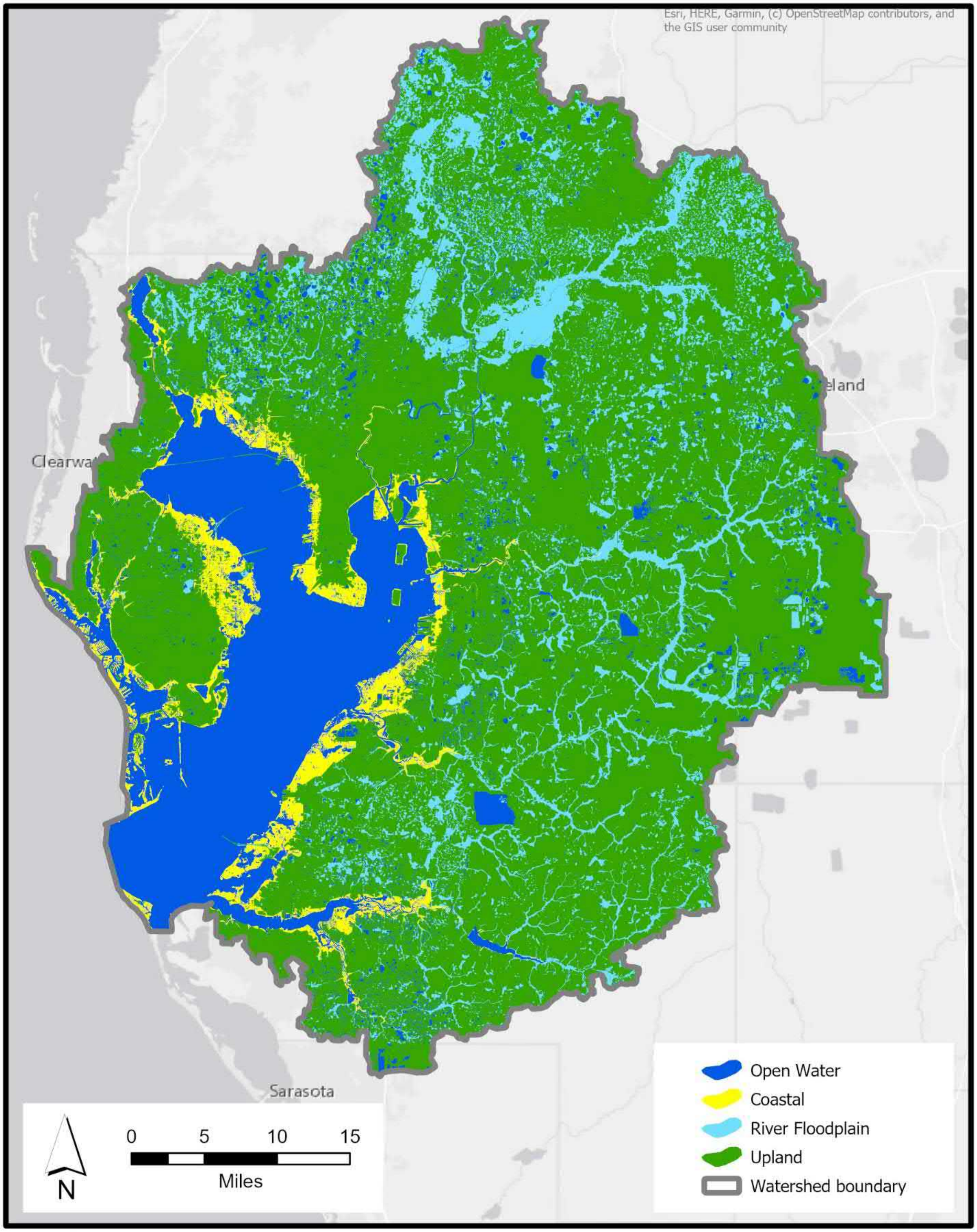
In addition to these habitat changes, the documentation and quantification of habitat protection and restoration activities over the same contemporary time period is also important. Based on work conducted as part of this 2020 Habitat Master Plan Update, the vast majority of publicly-funded habitat restoration projects in the Tampa Bay watershed were completed after 1988; and results indicate that the total area restored is very significant when compared to observed habitat changes over the same time period. For example, as shown in **Table 2-3** above, approximately 2,092 acres of emergent tidal wetlands have been restored, accounting for 97 percent of the total gains in emergent tidal wetlands (2,152 acres) since 1990.

Under the MTP approach, the target setting process considers both habitat trajectories and habitat restoration metrics, measured over a contemporary time period. It is recommended that a moving 30-year time period be used for trend analyses and target setting in future Habitat Master Plan Updates, as a 30-year period of record provides a reasonable representation of the effects of current and future stressors, as well as trends in governmental resource allocations for habitat protection and restoration activities.

4.3.3 Considers Current and Future Stressors

The MTP approach explicitly considers projected impacts from the primary stressors currently affecting Tampa Bay habitats of interest: land development, sea level rise, and climate change.

Future trends in land development activity are difficult to predict and are largely driven by regional economic conditions. As discussed in Section 2.5 above, current wetland regulatory programs have been effective at forestalling losses in both tidal and freshwater wetlands. Therefore, future development impacts in the watershed are expected to disproportionately affect native upland habitats. Greater recognition of the importance of these habitats in the context of the watershed approach, as well as improved local government protection of native upland habitats, are needed.



Source: ESA, 2020

2020 Tampa Bay Habitat Master Plan Update

Map 4-1
Habitat Spatial Strata
in the Tampa Bay Watershed

Conversely, future trends in sea level rise and, to a lesser extent, climate change are more predictable. There is now a broad consensus in the scientific community that sea level rise is currently exerting dynamic changes on Tampa Bay coastal habitats, and will continue to do so well into the future. Although there is a high level of uncertainty with regard to the future rate of sea level rise, the trajectory is in only one direction. Therefore, sea level rise adaptation needs to be incorporated into future conservation land acquisition priorities, as well as habitat restoration project designs.

Land acquisition for coastal habitat restoration must prioritize adjacent low-lying coastal uplands to serve as buffers to accommodate future landward migration of tidal wetlands in response to sea level rise. Where public acquisition is not possible, other conservation mechanisms such as the “rolling easement” concept need to be explored. Coastal setbacks, buffers, or public easements are traditionally used to restrict development within a given distance from the shoreline. However, a rolling easement is a dynamic mechanism that “rolls” landward as sea levels rise and cause tidal encroachments onto low-lying coastal uplands (Titus, 2011). The application of rolling easements in Tampa Bay could restrict more intense urban development (e.g., prevent up-zoning) of low-lying coastal uplands that may be currently in less intense agricultural or recreational (e.g., golf courses) land uses. Under a rolling easement, landowners would be able to maintain their current economic uses, while “reserving” such lands to accommodate tidal wetland migration with advancing sea level rise.

With regard to habitat restoration projects, the design approach must envision not only what is possible today, but also what the coastal landscape will look like in 50 years and beyond. Design features should continue to utilize the “habitat mosaic” approach, but should also include design features on coastal uplands to accommodate tidal inundation and the landward advance of emergent tidal wetlands. Such features could include topographic and drainage pattern alterations to create future tidal creek channels with salinity gradients, and variable micro-elevations to support the full assemblage of emergent tidal wetland communities. This approach will ensure that the estuarine-dependent species and faunal guilds throughout the watershed, as defined in the original RTB approach, will continue to be supported.

4.3.4 Focused on What is Achievable

Habitat protection and restoration priorities should be tempered and “reality tested” by what is actually possible today, and what is possible in the future. There are only so many acres of native and potentially restorable habitats remaining in the Tampa Bay watershed, and there will always be limitations on the financial resources that can be dedicated to public conservation land acquisition and habitat restoration activities. Therefore, habitat protection and restoration targets should be based on what is actually achievable within those limitations, rather than a formulaic approach that calculates ratio targets based on the attainment of past ecological conditions.

In the context of this 2020 Habitat Master Plan Update, the term “opportunity areas” refers to geographic areas where habitat protection and restoration activities are possible, and where they should best be focused to attain defined targets. Defining and mapping opportunity areas is the first step in quantifying the “restoration potential” for a particular habitat type, which is a measure of what is actually possible under current and future projected conditions.

It should be noted that the concepts of “opportunity areas” and “restoration potential” were utilized by the TBEP in the establishment of seagrass restoration targets in Tampa Bay. In the case of seagrass, the opportunity areas were those portions of the bay bottom that had not been affected by dredge and fill activities. The “restoration potential” of seagrasses was determined through the development of an optical model that was used to predict the subset of bay bottom that would occur within the photic zone under various water clarity scenarios related to nitrogen load and chlorophyll-a reductions. Similarly, the assessment of opportunity areas and estimates of restoration potential can be used to develop protection and restoration targets for the other habitats of interest in Tampa Bay.

As with seagrass, it is necessary to first assess realistic spatial boundaries for where habitat protection and restoration activities can best be implemented before realistic targets can be set for other bay and watershed habitats. An important feature of the MTP approach is that opportunity areas, and the subsequent assessment and quantification of restoration potential, are “place-based.” That is, they can be mapped. The ability to graphically map where recommend habitat protection and restoration targets can actually be attained provides for an improved level of credibility and public transparency in the target setting process.

There is a general consensus amongst restoration practitioners and natural resource managers that habitat restoration and management is most cost-effectively conducted on publicly-owned conservation lands. Being in public ownership, or otherwise under a perpetual conservation easement, confers a high level of control, security, and predictability with respect to long-term habitat management, enhancement, and restoration activities. For this reason, it is recommended that these activities be focused primarily on existing publicly-owned conservation lands. Furthermore, given current development trends in the Tampa Bay watershed, public acquisition of remaining critical lands (e.g., coastal uplands; river floodplain wetlands) is a high priority.

While habitat management, enhancement, and restoration activities can best be accomplished on publicly-owned conservation lands, it is important to note that other land conservation mechanisms will also likely be needed to meet the targets recommended herein. Public-private partnerships have proven to be a beneficial mechanism in the Tampa Bay watershed (e.g., Mosaic, TECO, and a private mitigation bank) to secure conservation easements and cooperative funding to implement habitat management and enhancement activities. However, there are a limited number of property owners with the land and financial resources to commit to such agreements. The concept of the “rolling easement” is explored further in this document as a means to effectuate a gradual “managed retreat” from the coastal zone as sea levels rise, with minimum adverse economic impacts to private property owners.

Section 5.0: Habitat Protection and Restoration Opportunities

This section presents the methods used to map and quantify "opportunity areas" for habitat protection and restoration activities in the Tampa Bay watershed. In addition, the concept of habitat "reservation" is introduced, and the methods used to map and quantify reservation opportunity areas are also discussed. Finally, other special habitat protection and restoration opportunity areas in the Tampa Bay watershed are presented and discussed.

5.1 Opportunity Assessment Methodology

Pursuant to the MTP approach described in Section 4.3 above, the term "opportunity areas" refers to geographic areas where habitat protection and restoration activities are possible, and where they should best be focused to attain defined targets and longer-term goals. Defining and mapping opportunity areas is the first step in quantifying the "restoration potential" for a particular habitat type, which is a measure of what is actually possible under current and future projected conditions.

An important feature of the MTP approach is that opportunity areas, and the subsequent assessment and quantification of restoration potential, are "place based." That is, they can be mapped. The ability to graphically map where recommend habitat protection and restoration targets can actually be attained provides for an improved level of credibility and public transparency in the target setting process.

The mapping and quantification of opportunity areas for habitat protection and restoration activities involved a stepwise geospatial analytical process. The steps in this process are described in the following subsections. The culmination of this work was the development of a GIS model that was used to estimate opportunity areas and restoration potentials for the Tampa Bay habitats of interest. The GIS model and all associated geospatial datasets were provided as a separate project deliverable.

5.1.1 Step 1 - Binning of Land Use/Land Cover Codes

The *Land Use Land Cover 2017* geospatial database (SWFWMD, 2019b) was used as the basis for mapping opportunity areas and quantifying restoration potential for intertidal and supratidal habitats in the Tampa Bay watershed. It should be noted that this process did not address subtidal habitats because the vast majority of the tidal bay bottom is under state ownership as sovereign submerged lands, with some submerged lands having the additional protections afforded by the Aquatic Preserve designation.

Figure 5-1 shows the flow chart for step 1 in the opportunity assessment process. Step 1 involved the binning of all applicable FLUCCS classification codes used in this dataset into one of three categories:

- Existing development;
- Restorable habitats; or
- Native habitats.

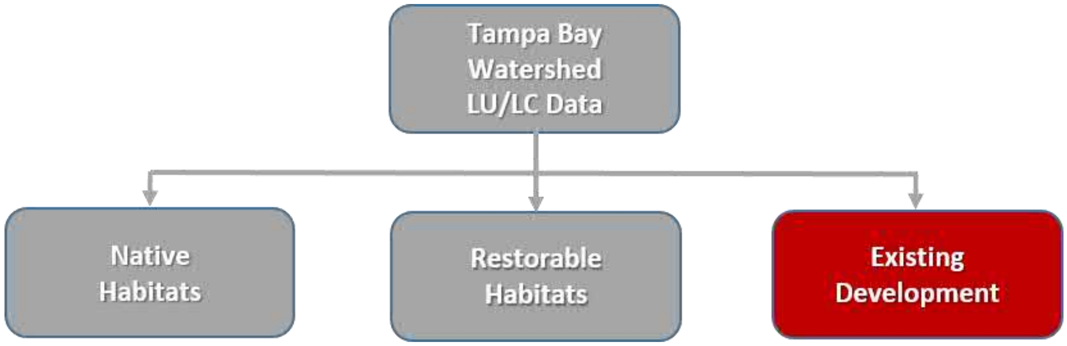


Figure 5-1
Flow Chart for Step 1 of the Opportunity Assessment Process

The **existing development** category includes developed land use/cover types that are mostly hardened and impervious (e.g., structures and pavement). Examples include residential, commercial, and industrial development; transportation facilities such as roadways and airports; and utilities such as power plants, wastewater treatment plants, etc. These land use/cover types are also generally referred to as "hard development" throughout this document, and are considered not suitable for habitat restoration activities. **Table 2-4** in Section 2.6.2 above lists the FLUCCS codes that were categorized as existing development, while accompanying **Map 2-10** shows the extent of existing development in the Tampa Bay watershed. Existing development occurs primarily on private lands but also includes public infrastructure.

With respect to mapping opportunity areas for habitat protection and restoration activities, existing development was deleted from further consideration in the opportunity analysis, as it is generally not feasible to deconstruct developed areas to restore native habitats. However, this assumption may change over time. The ability to insure coastal areas with repetitive wind and flood damage losses resulting from more intense and/or frequent tropical storm events may become cost-prohibitive. Furthermore, climate change and sea level rise may eventually lead to the outright abandonment of some low-lying developed areas as the cost of continued adaptation measures (e.g., elevating roadways and structures; construction of pump-assisted drainage systems) becomes less economically justifiable. In such cases, public acquisition of repetitive flood loss areas combined with the coastal habitat restoration are likely to become economically viable options for improving both community resilience and ecosystem sustainability (Calil et al., 2015).

While existing development areas are not considered feasible for major habitat restoration activities at this time, there are many opportunities to enhance and restore habitat functions and improve coastal resilience in such areas. Examples include the construction of living shorelines, and/or the placement submerged habitat modules, along developed urban shorelines and seawalls. Habitat enhancement and restoration opportunities in developed and previously impacted areas are discussed in Section 5.3 below.

The **restorable habitats** category includes existing altered but non-hardened and pervious land use/cover types that could potentially support native habitats through the restoration of more natural hydrology, soils strata, and/or topography. Examples include: reclaimed mine lands; golf courses and parklands; cropland and pastureland; and borrow/spoil areas. Such land use/cover types are also referred to as "soft development" throughout this document. **Table 5-1** shows the list of restorable FLUCCS codes. Restorable habitats occur on both publicly-owned and private lands, and include a wide range of land use/cover types.

Table 5-1
Restorable Habitats FLUCCS Codes

Level 1 Descriptor	Level 1 Code	Level 2/3 Descriptor	Level 2/3 Code
Urban and Built Up	1000	Extractive	1600
		Reclaimed Land	1650
		Recreational	1800
		Golf Courses	1820
		Open Land	1900
Agriculture	2000	Cropland and Pastureland	2100
		Improved Pastures	2110
		Unimproved Pastures	2120
		Row Crops	2140
		Tree Crops	2200
		Feeding Operations	2300
		Nurseries and Vineyards	2400
		Specialty Farms	2500
		Aquaculture	2540
		Other Open Lands Rural	2600
		Tree Plantations	4400
Wetlands	6000	Non-Vegetated	6500
		Shorelines	6520
		Intermittent Ponds	6530
Barren Land	7000	Beaches Other Than Swimming Beaches	7100
		Sand Other Than Beaches	7200
		Disturbed Lands	7400

The **native habitats** category covers the full range of natural plant communities and other habitats that are endemic to the Tampa Bay watershed. The native habitats classified in the FLUCCS code represent the habitat resources targeted for preservation, conservation, management and/or enhancement. For target setting purposes, the various FLUCCS codes that describe native habitats were further grouped into three major habitat types including:

- Tidal wetlands;
- Freshwater wetlands; and
- Uplands.

Table 5-2 shows the list of native habitats FLUCCS codes, grouped by the major habitat types. Native habitat areas occur on both publicly-owned and private lands. It should be noted that the SWFWMD land use/land cover datasets only include intertidal and supratidal watershed habitats. Subtidal habitats in Tampa Bay are assessed and quantified separately as part of the SWFWMD seagrass mapping program.

Table 5-2
Native Habitats FLUCCS Codes

Level 1 Descriptor	Level 1 Code	Level 2/3 Descriptor	Level 2/3 Code
Tidal Wetlands			
Wetlands	6000	Mangrove Swamps	6120
		Saltwater Marshes	6420
		Non-Vegetated	6500
		Oyster Bars	6540
		Tidal Flats (Salt Barrens)	6510/7210
		Salt Flats	6600
Freshwater Wetlands			
Wetlands	6000	Wetland Hardwood Forests	6100
		Bay Swamps	6110
		Stream and Lake Swamps (Bottomland)	6150
		Mixed Wetland Hardwoods	6170
		Wetland Coniferous Forests	6200
		Cypress	6210
		Cypress Pine Cabbage Palm	6240
		Wetland Forested Mixed	6300
		Vegetated Non-Forested Wetlands	6400
		Freshwater Marshes	6410
		Wet Prairies	6430
		Emergent Aquatic Vegetation	6440
		Submerged Aquatic Vegetation	6450
		Mixed Scrub-Shrub Wetland	6460
		Non-Vegetated	6500
Native Uplands			
Rangeland	3000	Herbaceous Dry Prairie	3100
		Shrub and Brushland	3200
		Coastal Scrub	3220
		Mixed Rangeland	3300
Upland Forests	4000	Upland Coniferous Forests	4100
		Pine Flatwoods	4110
		Longleaf Pine/Xeric Oak	4120
		Upland Hardwood Forests	4200/4300
		Upland Hardwood - Coniferous Mix	4340

5.1.2 Step 2 – Overlay Native and Restorable Habitat Polygons on Existing Conservation Lands

As discussed previously, habitat restoration and management is most cost-effectively conducted on publicly-owned conservation lands. Being in public ownership, or otherwise under a perpetual conservation easement, confers a high level of control, security, and predictability with respect to long-term habitat management, enhancement, and restoration activities. Hence, the opportunity assessment process is focused on existing and proposed conservation lands.

Step 2 in the opportunity assessment process involved the overlay of the native habitat and restorable habitat land use/cover polygons onto the existing conservation lands data layer (exclusive of subtidal areas). The development of the existing conservation lands data layer is discussed in Section 3.1 above. The extents of each of the Tampa Bay habitats of interest that occur on existing conservations lands were then quantified. **Figure 5-2** shows the flow chart for step 2 in the opportunity assessment process.

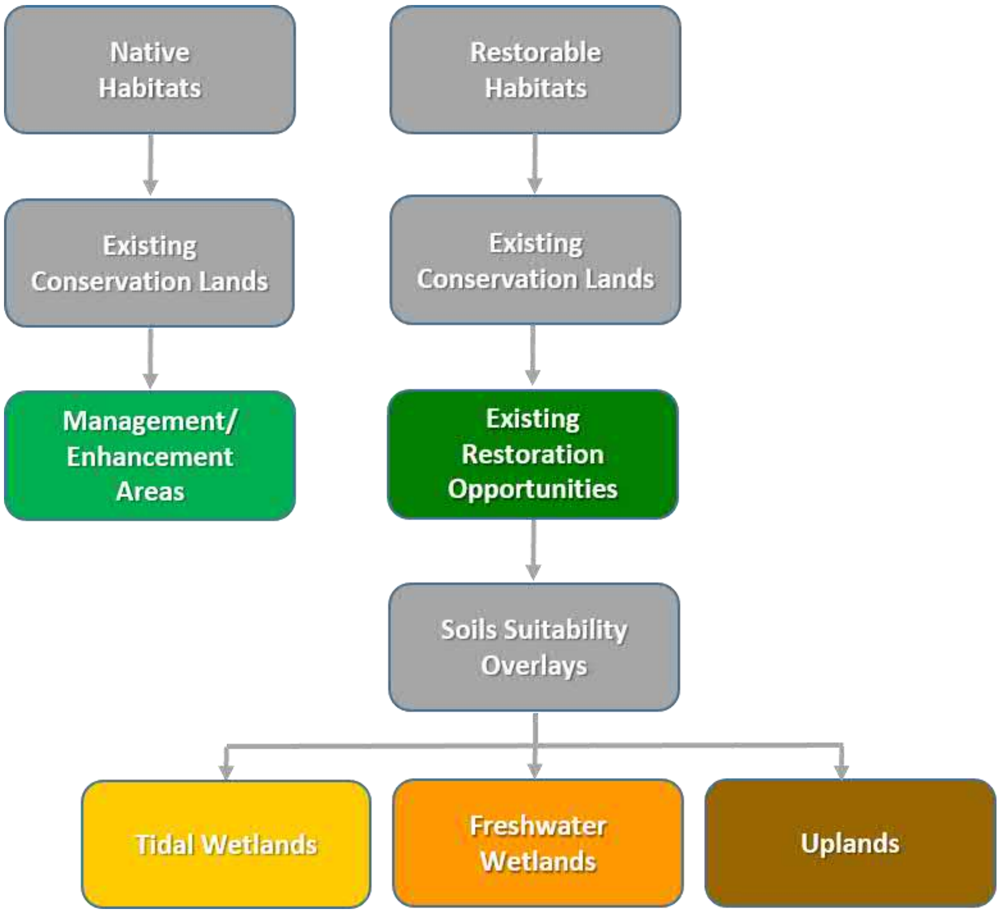
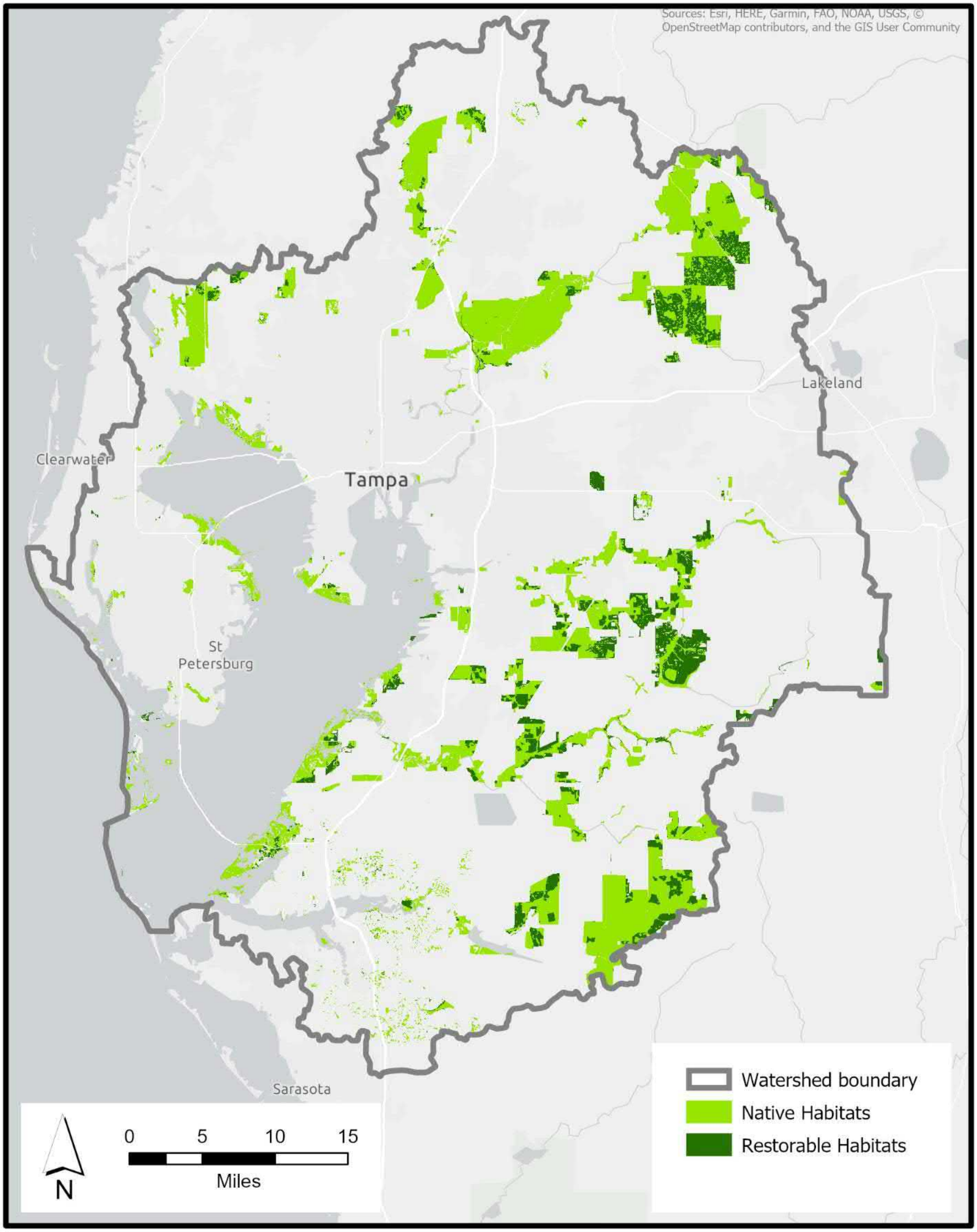


Figure 5-2
Flow Chart for Step 2 of the Opportunity Assessment Process

Map 5-1 shows native habitats (light green) and restorable habitats (dark green) that occur on existing conservation lands in the Tampa Bay watershed. Native habitats on existing conservation lands must be actively managed in perpetuity to maintain the optimal ecosystem services provided by these areas. Management activities include: prescribed burns; chemical and physical exotic and nuisance species control; controlling human disturbances from recreational uses; and fish wildlife management actions targeting the maintenance or recovery of species listed as rare, threatened, or endangered. While it is assumed that mapped native habitats on existing conservation lands are not in need of restoration, certain enhancement activities may also be needed in these areas, such as hydrologic modifications (e.g., ditch blocks) or replanting native species in areas where exotic and nuisance plants have been removed.



Source: ESA, 2020

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Map 5-1
Native and Restorable Habitats on Existing Conservation Lands

The overlay of restorable habitat land use/cover codes onto existing conservation lands shows the subset of this area that could potentially be restored back to native habitats. However, without knowing the distributions of native habitat types that occurred pre-human development in the potentially-restorable polygons it is not possible to determine with certainty the restoration potential by specific habitat type.

Nonetheless, it is possible to estimate the restoration potential by major habitat type (e.g., tidal wetlands, freshwater wetlands, and native uplands) using soils data. Compared to vegetation communities, soil characteristics typically change slowly (e.g., decades to centuries) in response to hydrologic impacts, unless physically disturbed by excavation, filling, mining, etc. Therefore, soils distributions can be used to generally represent historical distributions of upland and wetland habitats

As part of the *Master Plan for the Protection and Restoration of Freshwater Wetlands in the Tampa Bay Watershed, Florida* (Ries and Scheda, 2014), a soils suitability analysis for wetland mitigation and restoration was conducted. The base soils data used for this analysis was obtained from the Web Soil Survey (WSS) (https://websoilsurvey.sc.egov.usda.gov) which provides public access to geospatial soils data compiled and managed by the Natural Resources Conservation Service (NRCS). The site is updated and maintained online as the single authoritative source of soil survey information nationwide.

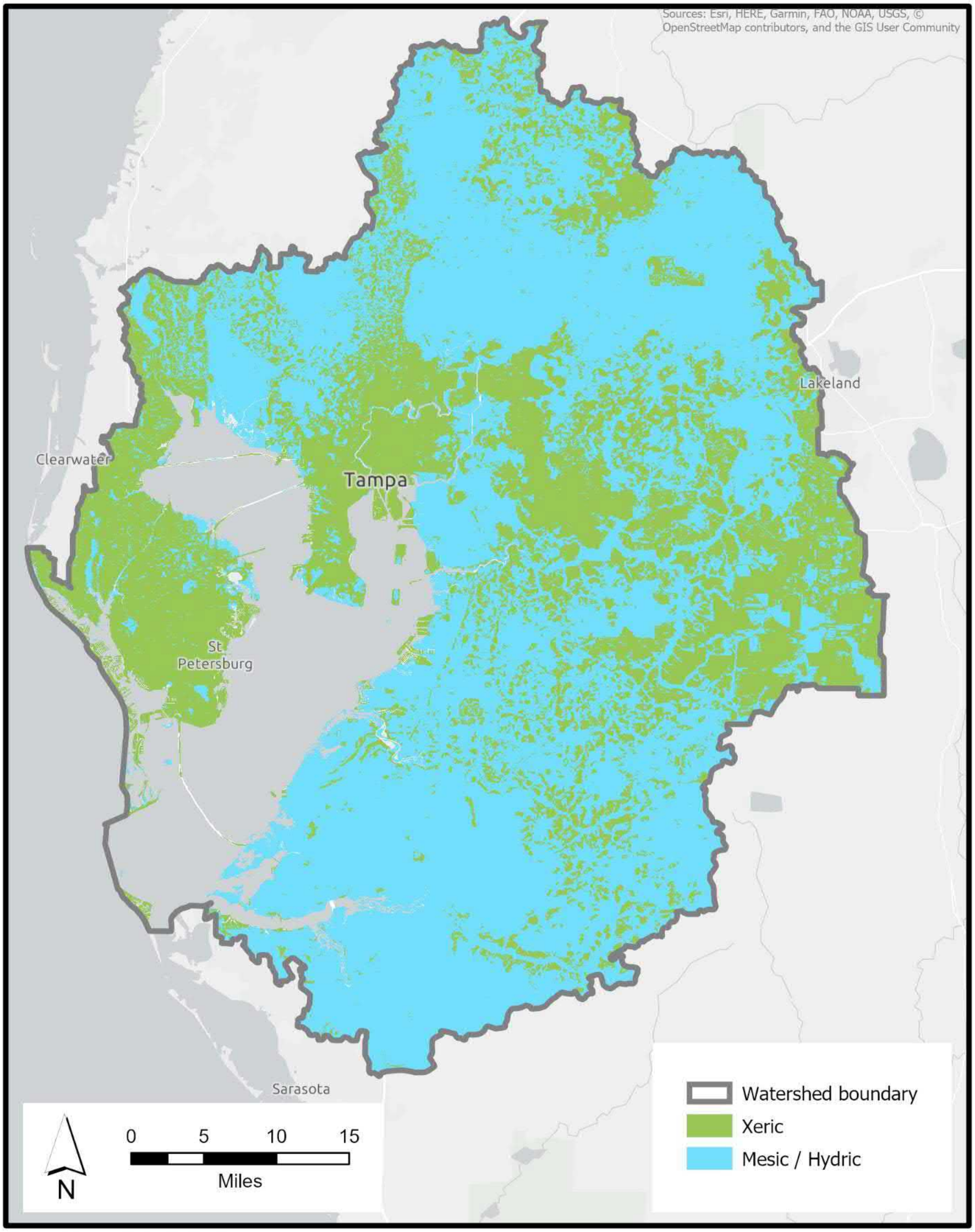
The soils suitability analysis involved the classification of all mapped soil types within Tampa Bay watershed into three categories using NRCS soils characteristics and criteria. Given that the focus was on wetland restoration potential, the three categories included:

- Xeric (suitable for upland restoration);
- Mesic (mostly suitable for wetland restoration);
- Hydric (highly suitable for wetland restoration).

A geospatial data layer was developed for the distribution of these three soils classifications in the Tampa Bay watershed, which is shown in **Map 5-2**.

As shown in **Figure 5-2**, step 2 in the opportunity assessment process also involved the intersection of restorable habitat polygons on existing conservation lands with the soils suitability GIS data layer developed by Ries and Scheda (2014). However, for this opportunity assessment the Mesic and Hydric categories were combined to represent wetland restoration potential, while the Xeric category was used to represent upland restoration potential. A geospatial data layer was developed for the distribution of xeric and mesic/hydric soils classifications in the Tampa Bay watershed, which is shown in **Map 5-2**.

Furthermore, a distinction was made between tidal and freshwater wetland restoration potential by intersecting the combined Mesic/Hydric soils polygons with the coastal stratum. Mesic/Hydric soils that occur below the 5-foot contour were classified as having tidal wetland restoration potential, while Mesic/Hydric soils occurring above the 5-foot contour were classified as having freshwater wetland restoration potential. **Map 5-3** shows the restoration potential by major habitat type on existing conservation lands, as derived from step 2 of the opportunity assessment process.



Source: Ries and Scheda, 2014

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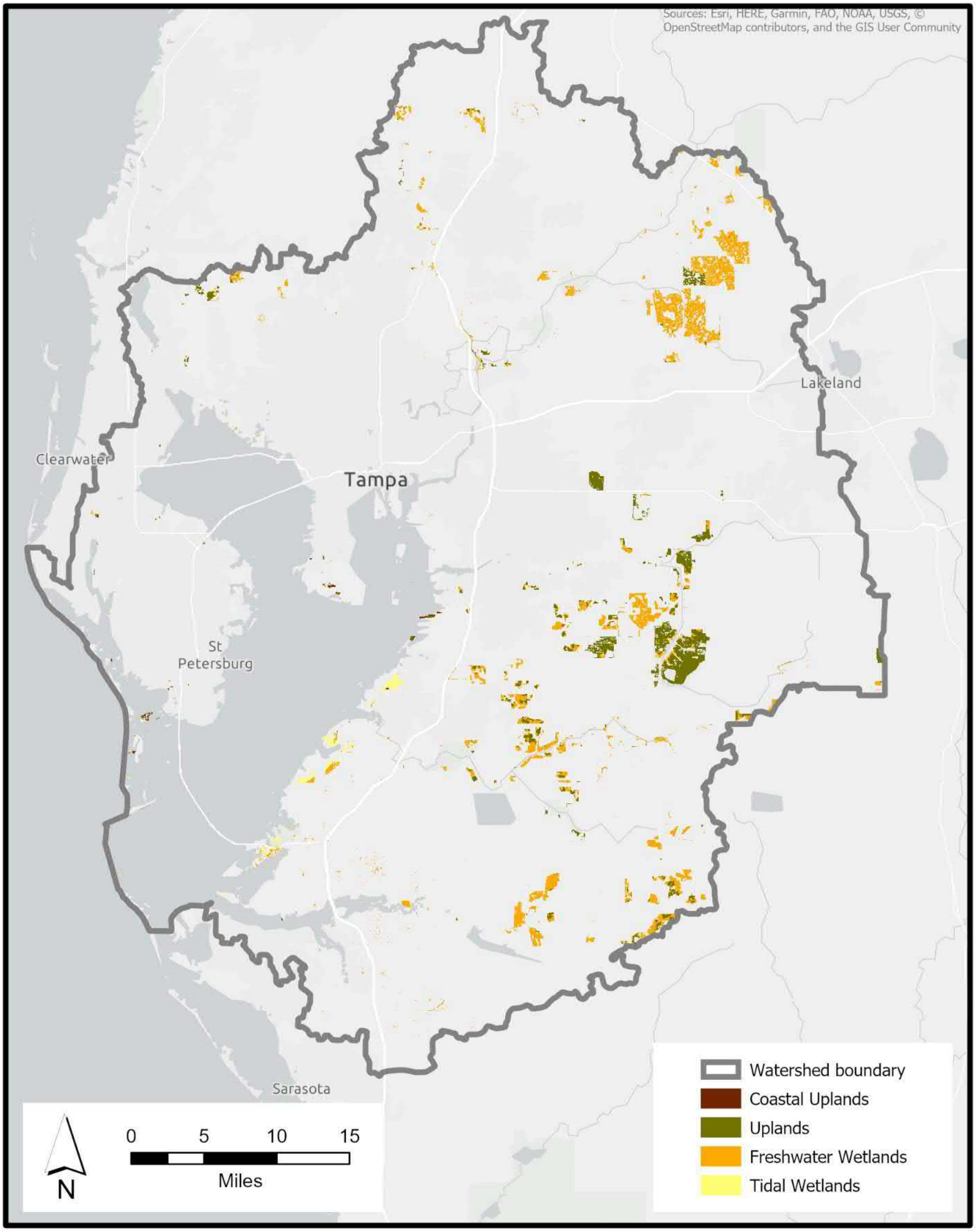
Map 5-2
Distribution of Xeric, Mesic and Hydric Soils in the Tampa Bay Watershed



Source: ESA, 2020

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Map 5-3
Restoration Potential by Major Habitat Type on Existing Conservation Lands

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5.1.3 Step 3 - Overlay of Native and Restorable Habitat Polygons on Proposed Conservation Lands

Step 3 involved the overlay of the native habitat and restorable habitat land use/cover polygons onto the proposed conservation lands data layer. **Figure 5-3** shows the flow chart for step 3 in the opportunity assessment process.

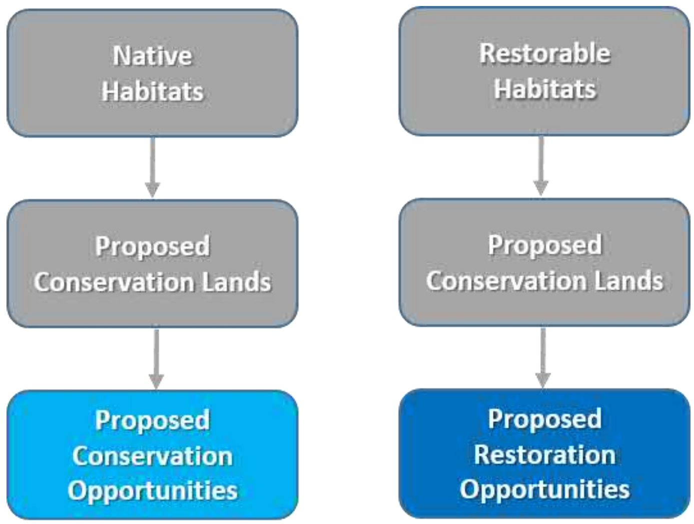


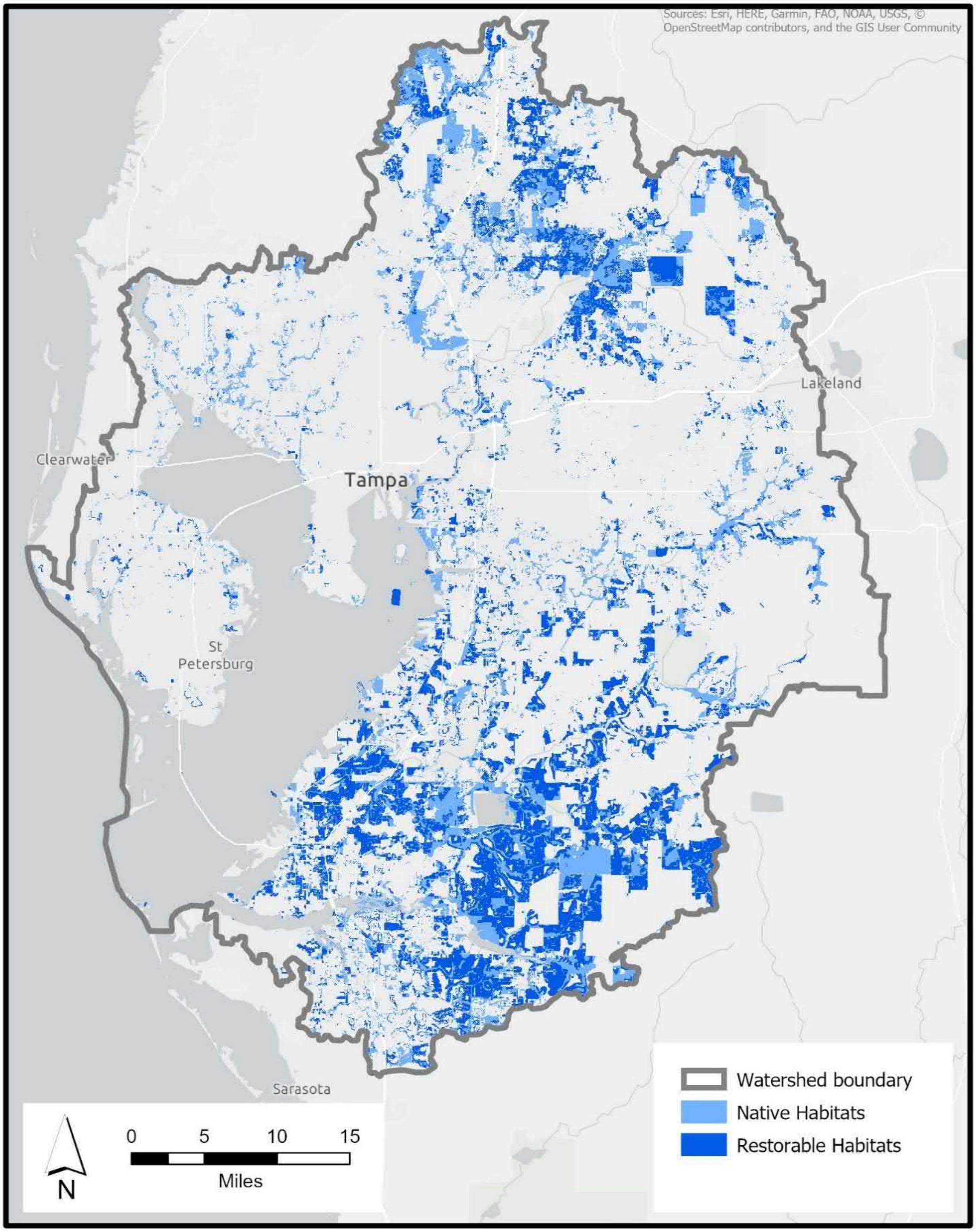
Figure 5-3
Flow Chart for Step 3 of the Opportunity Assessment Process

As discussed in Section 3.2 above, the proposed conservation lands data layer developed as part of this Habitat Master Plan Update was derived from the most current FNAI GIS data layers, as well as supplemental information provided by local county agencies. This data layer represents the best professional judgement of state and local natural resource management agencies, and associated academic experts, with regard to priority environmental lands parcels to be targeted for acquisition.

Step 3 in the opportunity assessment process was used to map and quantify habitat conservation and restoration opportunities on proposed conservation lands. **Map 5-4** shows native habitats (light blue) and potentially restorable habitats (dark blue) that occur on proposed conservation lands. This map represents the maximum conservation and restoration potential that could be attained in the Tampa Bay watershed by acquiring, restoring and managing the identified priority environmental lands.

5.1.4 Step 4 - Overlay of Native and Restorable Habitat Polygons on Unprotected Lands in the Coastal Stratum

Step 4 involved the overlay of the native habitat and restorable habitat land use/cover polygons onto unprotected lands in the coastal stratum. As described previously, the coastal stratum extends from the MLLW line landward to elevation 5-feet (NAVD 88), and represents low-lying lands that will likely experience impacts from sea level rise by 2070. **Figure 5-4** shows the flow chart for step 4 in the opportunity assessment process.



Source: ESA, 2020

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Map 5-4
Native and Restorable Habitats on Proposed Conservation Lands

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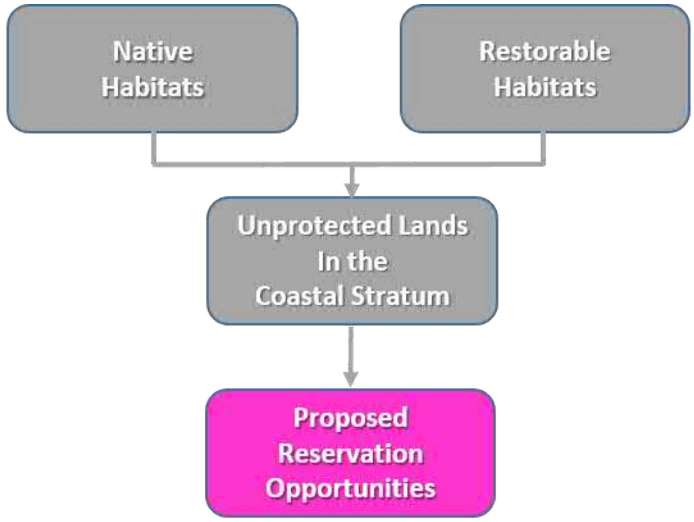


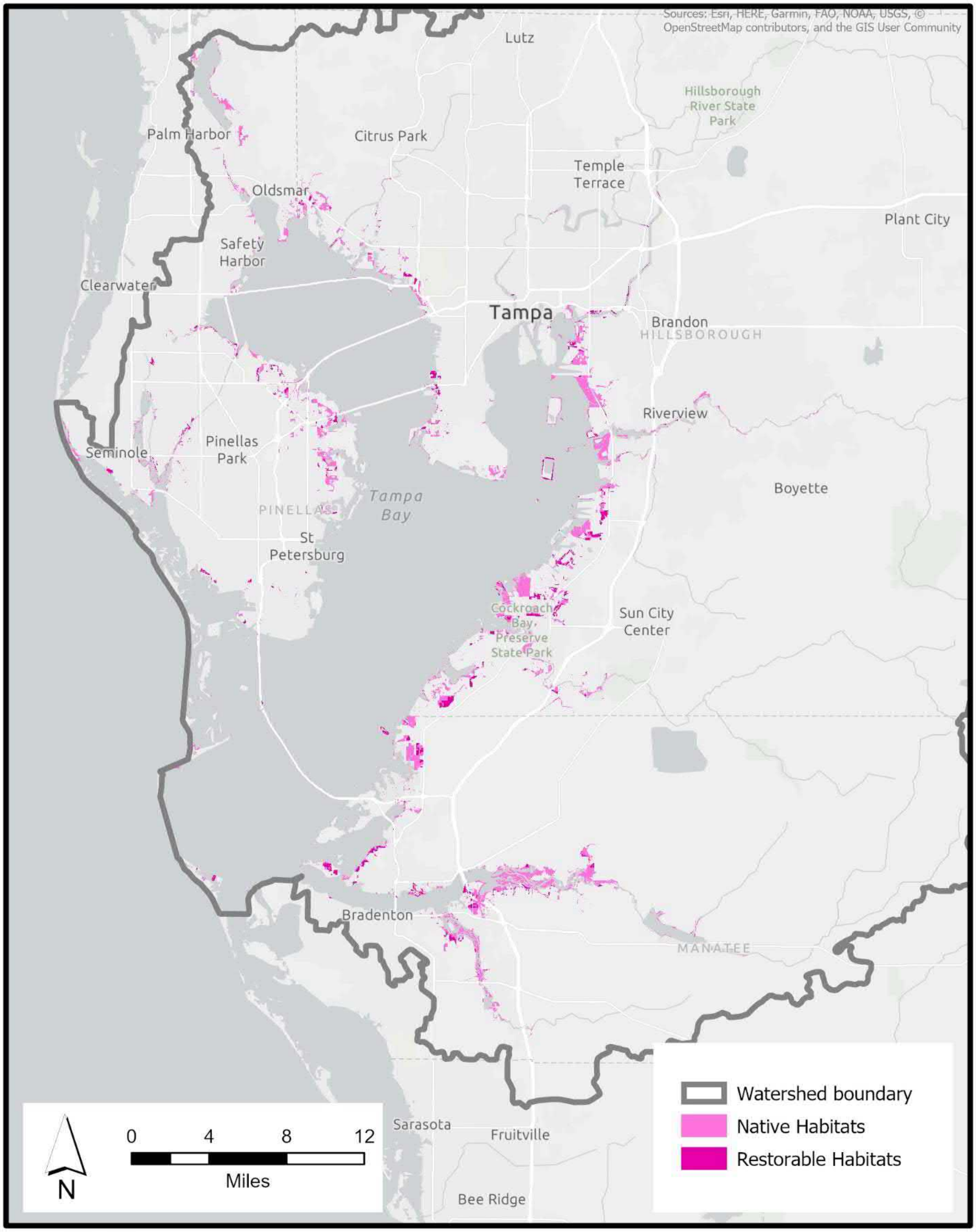
Figure 5-4
Flow Chart for Step 4 of the Opportunity Assessment Process

Map 5-5 shows native habitats and restorable habitats that occur on unprotected lands (e.g., not currently in conservation) within the coastal stratum. These areas are designated herein as "reservation lands" and represent priority areas within the coastal stratum for conservation through public acquisition, or for the implementation of other protective land use mechanisms such as rolling easements. Based on this analysis there are currently (2017) **16,158 acres** of reservation lands in the Tampa Bay watershed, which includes 12,898 acres of native habitats and 3,260 acres of restorable habitats.

The term "reservation" refers to the protection of native coastal habitats and "soft development" (e.g., restorable habitats) within the coastal stratum to allow for the natural adaptation and landward migration of coastal habitats in response to sea level rise. The reservation concept is based on the understanding that sea levels will continue to rise and cause substantial ecological changes in existing native coastal habitats, as well as repetitive coastal flood loss damages in low-lying developed areas, eventually rendering such areas as economically nonviable.

In practice, reservation entails various land use planning and related legal mechanisms to ensure that beaches and coastal wetlands can migrate inland as low-lying agricultural lands, buildings, roads, and other structures are gradually removed. Titus (2011) provides a thorough inventory of various planning and legal approaches to implementing "rolling easements" in coastal areas subject to the impacts of sea level rise. Such approaches are aimed at providing incentives to private land owners to prevent "up-zoning" and more intense development of their properties, and to allow for a gradual "managed retreat" from the coastal zone as sea levels rise, with minimum adverse economic impacts.

The public acquisition or protection of identified reservation lands should be a high priority for TBEP and its stakeholders. Native emergent tidal wetlands in these areas should be protected under public ownership; while restorable habitats in these areas could be restored to emergent tidal wetlands or native coastal uplands, or simply protected from more intense development.



Source: ESA, 2020

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Map 5-5
Native and Restorable Habitats on Reservation Lands

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5.2 Opportunities Assessment Summary

Map 5-6 shows the combination of existing conservation lands, proposed conservation lands, and proposed reservation lands, on a single map. It should be noted that there is some overlap between proposed conservation lands and proposed reservation lands, as the reservation polygons include unprotected native habitats within the coastal stratum, some of which have been identified as priority acquisition parcels in the CLIP dataset. This combination of polygons, derived from the different sources and analyses described above, represents the universe of opportunity areas in the Tampa Bay watershed where potential habitat protection, management and enhancement, and restoration activities should be focused, and where targets can best be attained.

Table 5-3 provides a summary of the opportunities assessment analysis for each of the TBEP habitats of interest. The “Native Habitats” columns show the current extent as well as the portion of the current extent occurring on existing conservation lands and proposed conservation lands, respectively. For habitats, the current extent includes coverages that occur in areas that are neither existing nor proposed conservation lands. The “Restorable Habitats” columns show the “total restoration opportunity” as well as the portion of the total restoration opportunity on existing and proposed conservation lands, respectively.

Because they are already under public ownership, existing conservation lands clearly offer the greatest immediate opportunities for improved management and enhancement of native habitats, as well as restoration of restorable habitats. When proposed conservation lands are considered, the restoration potential of the Tampa Bay watershed is substantially increased; however, most of restoration opportunities on proposed conservation lands are also for native uplands and freshwater wetlands.

It should be noted subtidal habitats are considered to be under some level of conservation as the vast majority occur on sovereign submerged lands which are owned by the State of Florida. The Aquatic Preserve designation confers an even higher level of protection. As shown in **Table 5-3,** seagrasses are the only subtidal habitat for which a restoration opportunity has been estimated. The SWFWMD seagrass mapping program assesses a cover classification “Sand Other Than Beaches – Submerged” (FLUCCS 7210). The 2018 extent of this cover type was 14,131 acres, which is assumed to represent a maximum restoration potential for seagrasses, as the portion of this area that occurs below the euphotic for seagrasses is not known at this time.

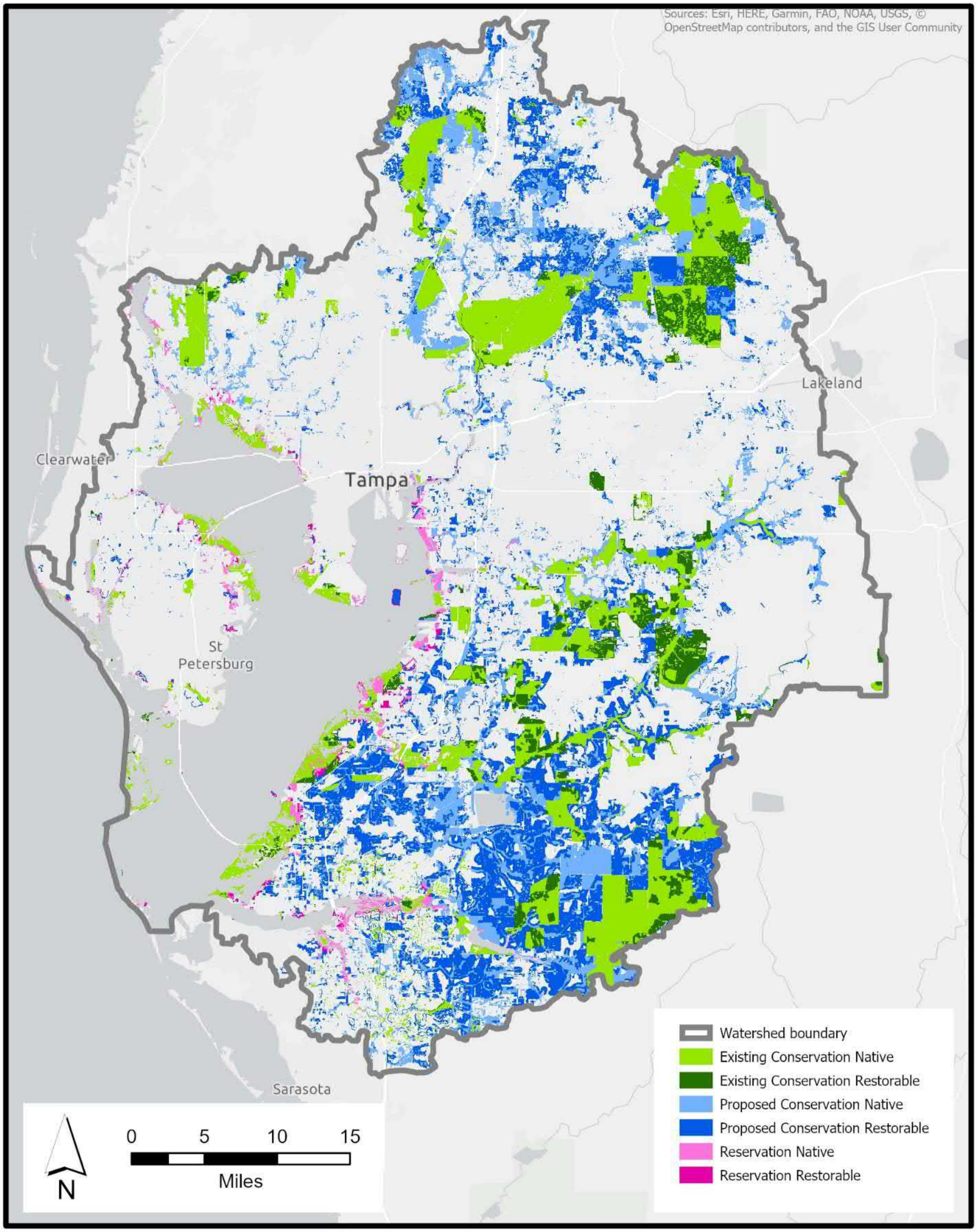
The total area of existing conservation lands in the Tampa Bay watershed is 201,516 acres, exclusive of the subtidal portions of the Aquatic Preserves. As shown in **Table 5-3** below, the majority of restoration opportunities on existing conservation lands (Existing Conservation Lands Restoration Opportunity column) is for native uplands and freshwater wetlands. However, there are approximately 1,550 acres of emergent tidal wetland restoration opportunities on existing conservation lands; with about 1,309 acres applicable to higher salinity mangrove forests and salt barrens, and about 241 acres applicable to lower salinity salt marsh (e.g., *Juncus roemerianus* marshes) restoration and creation.

The best estimates of total restoration opportunities for urban shorelines and tidal tributaries are currently provided by the Tampa Bay Living Shoreline Suitability Model (LSSM) prepared by the Florida Fish and Wildlife Conservation Commission (Boland and O’Keife, 2018), discussed further in Section 5.3.2.

Table 5-3
Summary of the Opportunity Assessment Analysis

Habitat Type	Native Habitats			Restorable Habitats		
	Current Extent	Existing Conservation Lands	Proposed Conservation Lands	Total Restoration Opportunity	Existing Conservation Lands Restoration Opportunity	Proposed Conservation Lands Restoration Opportunity
Subtidal Habitats						
Hard Bottom	423 ac.	423 ac.	N/A	N/A	N/A	N/A
Artificial Reefs	166 ac.	166 ac.	N/A	N/A	N/A	N/A
Tidal Flats	16,220 ac.	16,220 ac.	N/A	I/D	I/D	N/A
Seagrasses	40,653 ac.	40,653 ac.	N/A	14,131 ac.	14,131 ac	N/A
Oyster Bars	171 ac.	171 ac.	N/A	I/D	I/D	N/A
Intertidal Habitats						
Living Shorelines	11.3 mi.	LSSM	N/A	LSSM	N/A	N/A
Mangrove Forests	15,300 ac.	10,864 ac.	4,078 ac.	2,757 ac.	1,309 ac.	1,448 ac.
Salt Barrens	496 ac..	430 ac.	62 ac.			
Salt Marshes	4,557 ac.	2,104 ac.	2,316 ac.	1,092 ac. (JU)	241 ac. (JU)	851 ac. (JU)
Tidal Tributaries	387 mi.	N/A	N/A	LSSM	N/A	N/A
Supratidal Habitats						
Coastal Uplands	3,619 ac.	1,725 ac.	1,706 ac.	1,272 ac.	311 ac.	961 ac.
Non-Forested Freshwater Wetlands	67,587 ac.	11,482 ac.	25,971 ac.	159,836 ac.	27,447 ac.	132,389 ac.
Forested Freshwater Wetlands	152,132 ac.	58,222 ac.	56,505 ac.			
Native Uplands (Non-Coastal)	140,600 ac.	64,374 ac.	52,834 ac.	43,928 ac.	13,265 ac.	30,663 ac.

N/A – Not Applicable; I/D – Insufficient Data; LSSM – Living Shoreline Suitability Model; JU – Low Salinity (*Juncus*) Marsh Restoration



Source: ESA, 2020

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Map 5-6
Combined Opportunities
in the Tampa Bay Watershed

To estimate the relative restoration potential of mangrove/salt barrens and salt marshes, the regional long-term water quality data set, using all stations monitored by EPCHC, PCDEM, MCEMD, and Tampa Bay Water, was used to determine mean salinity levels throughout Tampa Bay. This data was used to create salinity isohalines throughout the open water of Tampa Bay, including the tributaries, as a geospatial dataset. The salinity isohaline data layer was then binned into two salinity categories: greater than 18 psu; and less than 18 psu. This salinity cutoff was determined based on the observed and documented salinity and elevation the preferences of *Juncus* marshes (Eleuterius and Eleuterius, 1979).

By intersecting this salinity data layer with the 2017 restorable habitats on reservation lands, it was possible to estimate the relative restoration opportunities for emergent tidal wetlands. Lands adjacent to waters with average salinity values greater than 18 psu are considered most appropriate for higher salinity mangrove/salt barren restoration, while lands adjacent to waters with average salinity values less than 18 psu are considered most appropriate for lower salinity salt marsh restoration.

Most of the coastal stratum around the Tampa Bay coastline is developed, and what is not currently developed will be under intense pressure to be developed over the next decade. The combined and converging stressors of development and sea level rise on the coastal stratum of Tampa Bay are major challenges requiring urgent action. It is critical that steps be taken by regional partners to first protect – via acquisition, easements, or other mechanisms - and then restore habitats within the coastal stratum, as the available acreage of potentially restorable tidal wetlands is expected to decrease rapidly.

5.3 Opportunities in Developed Areas

A narrative discussion of habitat enhancement and restoration opportunities in developed and previously impacted areas is provided in the following subsections.

5.3.1 Dredged, Filled, and Excavated Areas

Four major types of disturbed sites around the Tampa Bay coastline have been identified as priority estuarine habitat restoration sites by TBEP stakeholders over the past two decades, including:

- Dredged holes;
- Filled and spoil disposal areas;
- Abandoned aquaculture ponds;
- Coastal borrow pits and stormwater ponds.

Past and ongoing projects, and continued restoration opportunities at each of these types of disturbed sites are discussed briefly below.

Dredged Holes

Numerous dredged holes and cuts, created prior to environmental regulations enacted in the early 1970s, occur along the Tampa Bay coastline. In most cases these areas are the remaining benthic scars created by dredging to provide fill material for adjacent development. The major documented dredged holes around the Tampa Bay coastline have been mapped and assessed for restoration potential (Griffen and Greening, 2005; Raulerson et al., 2019), including benthos

(Karlen et al., 2005; Karlen et al., 2018) and fisheries (Sherwood 2004; Tyler-Jedlund and MacDonald 2018).

Dredged holes have been targeted for restoration through the deposition of clean fill material, similar in grain size and organic matter content to adjacent sediments, to raise the bottom elevation to that equal to the nearby undisturbed bottom. If water clarity is suitable, the restored area could be either planted with seagrass or allowed to recolonize through natural recruitment from adjacent areas.

In 2014, a 78-acre dredged hole restoration project was completed in McKay Bay by the Tampa Port Authority with funding support by SWFWMD. The project was conducted concurrently with the excavation of an adjacent filled upland site to create emergent tidal wetlands for port mitigation. The excavated fill material was placed into the dredge hole to bring the area up to the approximate depth of the adjacent non-dredged area. **Figure 5-5** shows the project under construction in 2012.

SOURCE: Tampa Port Authority

Figure 5-5
McKay Bay Dredge Hole Restoration Project Under Construction

Pre- and post-restoration monitoring of this project was conducted to determine changes in water quality and benthic conditions (Karlen et al., 2015). The filling of the McKay Bay dredge hole was successful in reducing the depth and improving the bottom dissolved oxygen concentrations; however, the composition of the sediments did not change substantially over pre-fill conditions. The benthic community within the restoration area indicated recovery as reflected by increases in key biological metrics and an increase in the similarity to the control sites, but the restoration area, had not reached the same level of species richness as the surrounding control sites as of 2015. Continued monitoring is ongoing, and this project should be used as a reference for the design and assessment of future dredge hole restoration projects.

Filled and Spoil Disposal Areas

Areas that have been filled via illicit spoil disposal activities, or old filled development areas that may no longer be economically viable, offer opportunities for restoration via “scrape down” and topographic re-contouring. Using this approach - which is well-proven through the completion of numerous SWIM projects - it is possible to create variable micro-elevations to support the full assemblage of emergent tidal wetland communities, as well as tidal creek channels with salinity gradients resulting from freshwater drainage from adjacent uplands. The Fred and Idah Shultz Nature Preserve created from the Port Redwing fill peninsula is a notable example of this type of project. There are numerous existing opportunities for this type of restoration around the Tampa Bay shoreline, many of which likely occur on proposed reservation lands. Restoration of filled and spoil disposal areas should continue to be a major focus for TBEP stakeholders.

Abandoned Aquaculture Ponds

Abandoned tropical fish farm ponds are abundant in the Tampa Bay area, especially in southern Hillsborough County. These aquaculture ponds are typically located near the bay coastline, or adjacent to a contiguous tidal tributary, and are characterized by a series of narrow rectangular ponds placed in closely packed rows. This geographic placement offers the opportunity to hydrologically connect these freshwater ponds to nearby tidal waters to create a series of interconnected tidal wetlands with variable salinity gradients. This approach is currently being used to restore an abandoned tropical fish farm adjacent to the “Kitchen” area of Hillsborough Bay, and numerous other opportunities exist for similar restoration. **Figure 5-6** is an aerial photograph of this site showing the abandoned aquaculture ponds prior to commencement of restoration activities.

Abandoned aquaculture ponds are a type of “restorable habitat” (FLUCCS Code 2540 – Aquaculture) that frequently occurs on proposed reservation lands. Other tropical fish farms in the Tampa Bay watershed should be inventoried and assessed for restoration potential, and then ranked as habitat restoration project sites.

Coastal Borrow Pits and Stormwater Ponds

As with abandoned aquaculture ponds, the approach of hydrologic interconnection with tidal waters followed be topographic contouring can be applied to coastal borrow pits and rock mining ponds. The *Rock Ponds Ecosystem Restoration Project* managed by SWFWMD and Hillsborough County converted old agricultural fields and rock mining pits into 1,043 acres of various coastal habitats including 645 acres of uplands such as pine flatwoods and hardwood hammocks, and 398 acres of various estuarine and freshwater habitats (SWFWMD, 2015).

The estuarine habitats include: open water tidal channels and lagoons; low and high intertidal marshes, islands, sand/mud flats, deeper water “holes,” natural limestone artificial reefs, and more than 16 miles of new Tampa Bay shorelines. Cascading freshwater wetlands include both permanent pools as well as ephemeral freshwater habitats. This project is a showcase for the “habitat mosaic” approach to restoration. **Figure 5-7** shows an aerial photograph of the Rock Ponds restoration site showing the interconnection of open water features with the tidal waters of Cockroach Bay.

Figure 5-6
Tropical Fish Farm Restoration Site in Hillsborough Bay

Similarly, older stormwater retention ponds, impoundments, and drainage canals constructed near the coastline prior to current stormwater treatment regulations also offer substantial restoration potential. By removing impoundments and hydrologically connecting these areas to tidal waters, it is possible to create a network of smaller tidal ponds and wetlands interconnected by tidal creeks that support a range of salinity regimes. This approach assumes that stormwater treatment (e.g., sediment and nutrient removal) requirements can be met upstream of these areas. There are numerous opportunities for this type of restoration around the Tampa Bay coastline. Alligator Lake in Clearwater is an example of an old stormwater impoundment that could be restored to native tidal wetlands through the removal of the existing impoundment.

5.3.2 Hardened Urban Shorelines

There are existing development areas are not considered feasible for major habitat restoration activities at this time. However, there are many opportunities to enhance habitat functions and improve resilience in such areas. Examples include the construction of living shorelines, and/or the placement submerged habitat modules, along developed urban shorelines and seawalls. Many such projects have been completed in Tampa Bay, as summarized in **Appendix A** and depicted in **Map 2-7**.

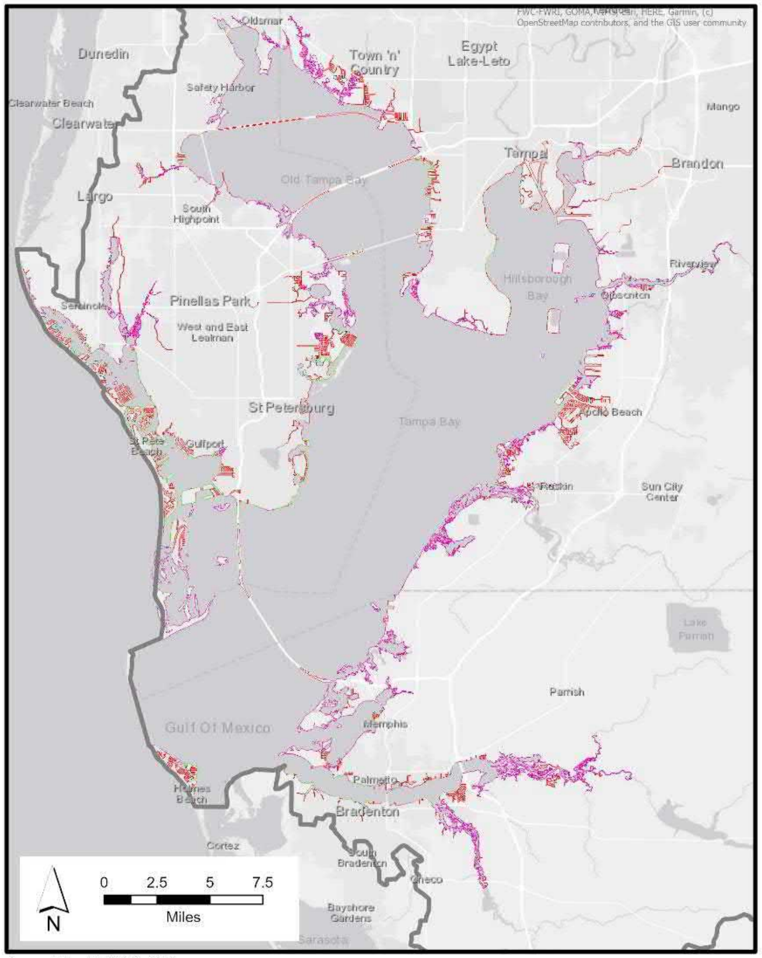
Urban shorelines need protection from damage caused by intense storms, wave erosion, and sea level rise. Shoreline stabilization does not need to create a barrier between land and water, as happens with hard shoreline stabilization structures like seawalls and bulkheads. New stabilization options, like living shorelines, are gaining attention as an alternative to traditional shoreline stabilization techniques. Living shorelines can reduce damage and erosion while simultaneously providing important ecosystem services to society, including enhanced fishing opportunities, nutrient and sediment removal, and water quality improvement.

SOURCE: SWFWMD

Figure 5-7
The Rock Ponds Ecosystem Restoration Project

As discussed in Section 2.3.5 above, the term “living shoreline” is a broad term that encompasses a range of shoreline stabilization techniques along estuaries, bays, tributaries, and other sheltered shorelines, and are not typically used on beaches on the open ocean. A living shoreline has a footprint that is made up mostly of native material that incorporates natural vegetation and other living, natural “soft” elements alone or in combination with some type of harder shoreline structure, like oyster reefs, rock sills, or anchored wood structures for added stability. Living shorelines connect the land and water to stabilize the shoreline, reduce erosion, and provide wildlife habitat. Furthermore, living shorelines capture and accrete sediment, and tend to expand both their footprint and vertical profile over time, thus providing long-term resilience.

Living shorelines projects should continue to be promoted by the TBEP and its stakeholders; however, since these types of projects are not suitable for every location. In those cases, TBEP encourages seawall enhancements. The Florida Fish and Wildlife Conservation Commission recently developed a Living Shoreline Suitability Model (LSSM) for Tampa Bay (Boland and O’Keife, 2018). The LSSM integrated available information about existing environmental characteristics along the entire shoreline of Tampa Bay, and then applied a decision tree, including existing habitat, slope of coastal sediments, environmental conditions, and potential construction barriers as model components. The results of the LSSM decision tree were then prepared as a geospatial data layer that shows a graphical representation of appropriate urban shoreline enhancement techniques around the coast of Tampa Bay (**Map 5-7**).



Source: Boland & O'Keife, 2018

Legend

Tampa Bay Living Shoreline Suitability Model Results

- Ecological Conflicts. Seek regulatory advice.
- Highly Modified Area. Seek expert advice.
- Special Geomorphic Area. Seek expert advice.
- Land Use Management
- Land Use Management. Ecological Conflicts. Seek regulatory advice.
- Land Use Management. Groin Field with Beach Nourishment
- Land Use Management. Maintain Beach OR Offshore Breakwaters with Beach Nourishment
- Land Use Management. Maintain/Enhance/Create Marsh
- Land Use Management. Plant Marsh with Sill
- Maintain/Enhance/Restore Riparian Buffer
- Maintain/Enhance/Restore Riparian Buffer. Ecological Conflicts. Seek regulatory advice.
- Maintain/Enhance/Restore Riparian Buffer. Groin Field with Beach Nourishment
- Maintain/Enhance/Restore Riparian Buffer. Maintain Beach OR Offshore Breakwaters with Beach Nourishment
- Maintain/Enhance/Restore Riparian Buffer. Maintain/Enhance/Create Marsh
- Maintain/Enhance/Restore Riparian Buffer. Plant Marsh with Sill
- Maintain/Enhance/Restore Riparian Buffer. Revetment
- Replace Structure with Vegetation Buffer
- Remove or repair structure. Plant Marsh with Sill
- Repair/replace groins, add Beach Nourishment
- Grade Bank, Install Revetment with Vegetative Toe; OR Install Bulkhead Toe Revetment
- Install Bulkhead Toe Revetment
- Shoreline less 200ft, Install Revetment with Vegetative Toe; Greater 200ft, Install Breakwaters with Beach Nourishment
- Grade Bank , Reconstruct Revetment with Vegetative Toe; OR Repair Revetment in same Alignment
- Shoreline less 200ft, Repair Revetment Maintain/Enhance/Restore Riparian Buffer; Greater 200ft, Replace with Offshore Breakwater and Beach Nourishment
- No Action Needed
- Watershed boundary

2020 Tampa Bay Habitat Master Plan Update

Map 5-7
Living Shoreline Suitability Model
for Tampa Bay

ESA

5.3.3 Altered Tidal Creeks and Tributaries

As discussed in Section 2.3.4 there are over 2,041,820 linear feet, or about 387 miles, of tidal tributaries in the Tampa Bay watershed (**Map 2-6**), and many have been physically altered (through dredging, filling, straightening, hardening, and/or impoundment) and chemically impacted (by point and non-point source pollution). Such impacts have resulted in impaired water quality and benthic conditions (Janicki Environmental and Mote Marine Laboratory, 2016).

Impacted tidal tributaries offer tremendous restoration potential, with numerous opportunities to reverse many of the adverse habitat and water quality impacts. Most of these opportunities occur in urbanized areas, and ecological restoration of urban tidal creek segments can be integrated with aesthetic landscaping improvements and recreational features (e.g., kayak trails) to enhance other community development activities. Booker Creek in St. Petersburg is an example of an impacted urban tidal tributary that could be restored to provide multiple recreational, aesthetic and ecological benefits.

The City of St. Petersburg has proposed a contiguous recreational bicycle and pedestrian trail, including aesthetic landscaping and public education kiosks, extending from Tropicana Field downstream to its confluence with Bayboro Harbor. The project could be enhanced with additional funding to include habitat improvements including the removal of salt barriers and hardened shorelines, the restoration of straightened channel segments, planting of riparian areas with native vegetation, and the construction of trash skimmers and other stormwater treatment facilities. With these habitat improvements, this project could serve as a template for other urban tidal creek restoration projects around the Tampa Bay coastline.

In addition to the extensive network of smaller tidal tributaries, there are also several major flood control canals and flow diversion alterations in the Tampa Bay watershed that have the potential to be at least functionally restored. The two most significant projects are the Palm River/Tampa Bypass Canal and the Lake Tarpon Outfall Canal. These two water bodies represent extremes in terms of hydrologic alterations.

The Palm River was once a small natural tidal tributary with modest freshwater flows discharging to McKay Bay. As part of the Four River Basins Project (FRBP) implemented by the U.S. Army Corps of Engineers (USACE) in the 1960's and 1970's, an approximate 8-mile section of the Palm River was deepened and channelized to create a system of flood conveyance structures - now renamed as the Tampa Bypass Canal (TBC) - to divert high flows from the Hillsborough River around the City of Tampa. During normal flows, virtually all of the freshwater in the TBC is consumptively used for public water supplies. Therefore, the tidal reaches receive very little freshwater inflow, except during extreme flood flow discharges (SWFWMD, 2005).

The Lake Tarpon Outfall Canal (LTOC), also a component of the FRBP, was constructed mostly through uplands to create a flood conveyance structure to divert water from Lake Tarpon to Old Tampa Bay, a discharge to the bay that did not historically exist. Unlike the TBC, freshwater flows in the LTOC far exceed historical flows to this segment of the bay. However, like the TBC the salinity regime in the LTOC is extremely variable ranging from completely fresh during high flows to as high as 60 ppt during extreme droughts (PBS&J, 2001).

Both the TBC and LTOC are major flood control projects that must be managed and maintained for this purpose; therefore, large scale restoration of more natural freshwater inflows from these systems to the Tampa Bay estuarine system is not feasible. However, it is possible to improve ecological conditions in these waterbodies through “functional” restoration that involves the creation of emergent tidal wetlands interconnected by tidal creeks that support salinity gradients. The majority of the riparian lands along both waterways are publicly owned by the SWFWMD as drainage easements transferred from the USACE. Given these conditions, the opportunity exists to combine habitat restoration with appropriate hydrologic modifications to create contiguous tidal wetland systems providing for salinity gradients and diversified habitats while maintaining the intended design flood control capabilities. The primary objectives of this type of restoration would be to: 1) improve hydrologic connectivity between freshwater and tidally influenced waters; 2) restore salinity gradients wherever feasible; 3) improve migratory pathways for aquatic species; and 4) reduce “flashiness” of freshwater discharges to tidal waters.

An example of such a project in the LTOC is conceptually depicted in **Figure 5-8**. This project would involve the grading and creation of a series of meandering channels and terraced tidal lagoons surrounded by emergent tidal wetlands within an approximate 60-acre parcel along the east side of the LTOC. This parcel is owned by SWFWMD and is contiguous to structure S-551, extending from the upstream freshwater segment of the LTOC southward to the downstream tidally influenced segment. SWFWMD also owns property straddling S-551 on the west side of the LTOC.

As envisioned, a small volume of fresh water would be continuously discharged from the upper segment of the LTOC into the interconnected system of tidal creeks and lagoons where it would gravity flow southward and discharge to the lower tidally influenced segment. During higher tides saline water would push up into the created tidal creeks and lagoons, allowing for the migration of estuarine dependent fish and invertebrate species seeking lower salinity waters during their early life history stages. Currently, S-551 precludes any such migration. Under extreme flood conditions the flood conveyance functions of the LTOC would not be affected by this habitat improvement project, and high flows in the canal could be diverted away from the created tidal creeks and lagoons by simple slot board control structures.

Similar functional restoration opportunities exist for numerous other major drainage alterations around Tampa Bay. For example, Channels A and G are major drainage canals in Hillsborough County, both of which are part of the greater Rocky/Brushy Creek and Upper Sweetwater Creek watershed flood control system. Both channels are remnants of natural tidal tributaries that were dredged, channelized, and impounded. However, the TBEP and SWFWMD have implemented projects to open the impoundments to address the functional restoration objectives listed above objectives. Based on post-project monitoring, the raising of the control structure gates in June 2014 has resulted in a system that functions more similarly to unimpounded tidal creeks in Tampa Bay, as evidenced by changes in salinity, biotic assemblages, and habitat types (GPI, 2016).

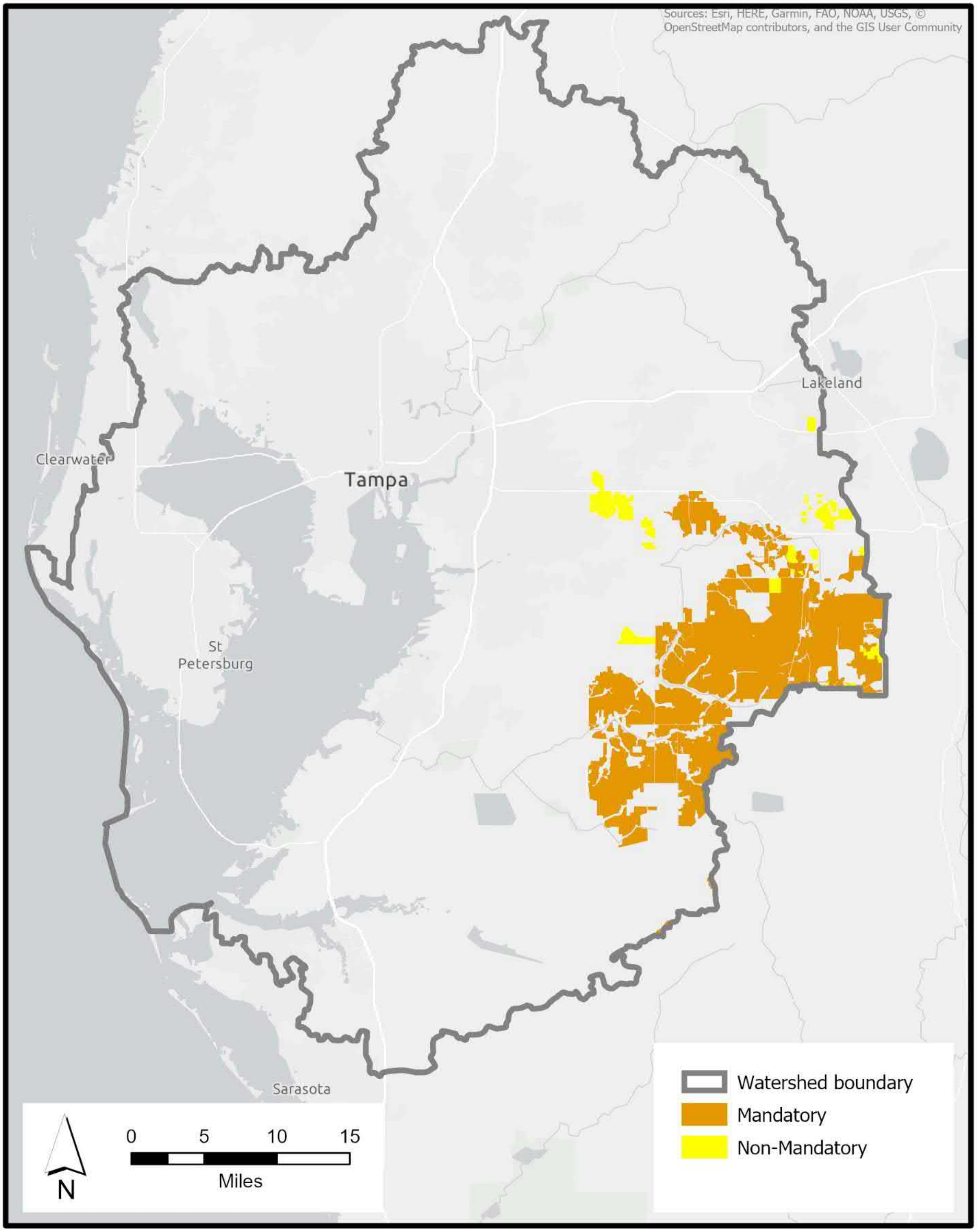
There are numerous opportunities around Tampa Bay to conduct similar types of functional restoration. It is recommended that the TBEP and its stakeholders continue to assess and evaluate restoration opportunities in altered tidal creeks and tributaries, including major flood control canals.

SOURCE: Robison, 2010

Figure 5-8
Conceptual Plan for the Lake Tarpon Outfall Canal
Habitat Improvement Project

5.3.4 Reclaimed Mined Lands

There are extensive opportunities for the restoration of headwater streams, forested floodplain wetlands, isolated forested and non-forested wetlands, and native upland communities on reclaimed mined lands in the Alafia River watershed, and the Little Manatee River watershed to a lesser extent. **Map 5-8** shows reclaimed mined lands in the Tampa Bay watershed.



Source: FDEP, 2020 Unpublished Data

2020 Tampa Bay Habitat Master Plan Update

Map 5-8
Reclaimed Mine Lands
in the Tampa Bay Watershed

ESA

The headwaters of the Alafia River and the Little Manatee River, two of the four major rivers systems discharging to Tampa Bay, originate in Florida's bone valley. In the Alafia River watershed approximately 85,850 acres have been historically mined for phosphate, while another 24,911 acres are currently being mined (FDEP Mining and Mitigation Program, 2019). Reclaimed mined lands comprise about one-third of the entire Alafia River watershed, primarily in the upper reaches and headwaters of the North and South Prongs. Comparatively, a relatively small area of the Little Manatee River headwaters has been mined. Overall, reclaimed mined lands and areas currently being mined, comprise about 8 percent of the Tampa Bay watershed.

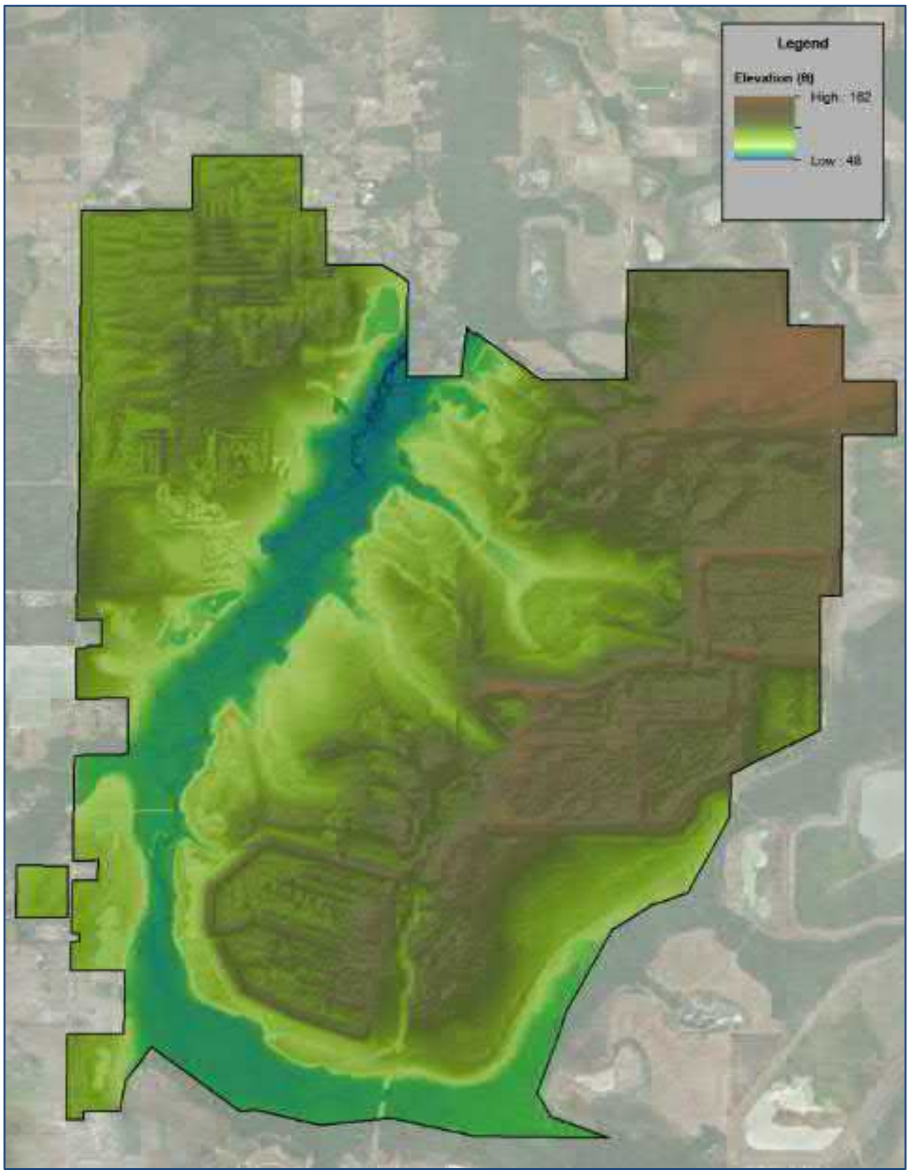
Mined phosphate lands have been "reclaimed" to various levels of economic and ecological viability, depending on the regulatory requirements in place at the time of mining completion. Significant portions of the Alafia River watershed were mined prior to the establishment of mandatory reclamation requirements in 1975, and these areas are termed "non-mandatory" lands. There were no standards for reclamation other than to return mined lands back to an "economically viable" condition. Areas mined after 1975 were required by Florida law restoration (F.A.C. 62C-16) to be reclaimed pursuant to standards that at least minimally addressed ecological conditions, and these areas are termed "mandatory" lands. Beginning in the early 1990's phosphate mining activities were regulated under the state Environmental Resource Permit (ERP) program, and were subject to wetland and stream channel mitigation requirements.

While the direct physical impacts of mining on wetlands and headwater streams have been well-documented, the hydrologic and water quality characteristics of reclaimed lands remain poorly understood (Lewelling and Wylie, 1993). Pollutant loads associated with surface water runoff and/or shallow groundwater seepage from these areas have not been adequately assessed, and the potential contributions of pollutant loads discharged from reclaimed lands to water quality impairments in the Alafia River have not been determined.

Historical land disturbances caused by phosphate mining may result in increased concentrations of dissolved and suspended water quality constituents in surface and ground waters, including nutrients, metals, and dissolved minerals. The mechanisms involved include: erosion of soils and mine wastes into surface waters; impacts of tailings impoundments and heap leaching; and acid mine drainage and contaminant leaching. Once mining of the phosphate ore is complete, the hydrologic effects of reclamation can vary substantially depending on the types of backfill materials used, and the relative proportions and distribution of those materials over the reclaimed area. Reclamation commonly involves backfilling mined areas with either clay, sand-tailings, or a mixture of both, as well as overburden displaced during mining. As a result, legacy reclaimed mined lands exhibit a highly variable mix of soil types that have been redistributed in unnatural vertical and horizontal patterns that can significantly alter surface water percolation and runoff characteristics (Lewelling and Wylie, 1993).

Most mandatory reclaimed lands are currently under ownership by the mining industry, primarily The Mosaic Company, and many of these areas shave regulatory mitigation requirements that still need to be met. However, many of the older non-mandatory and mandatory tracts have been transferred to other private and public-sector owners. Reclaimed lands on publicly-owned conservation lands offer the greatest restoration potential due to long-term control of the affected parcels. An excellent example of historical headwater stream restoration on publicly-owned reclaimed mined lands is the Balm Boyette Scrub Preserve "hydro-carving" and ecosystem restoration project recently implemented by SWFWMD.

Opportunities for large scale ecosystem restoration also exist on Alafia River State Park, which encompasses 7,718 acres in the upper Alafia River watershed. Almost the entire park boundary, which straddles the South Prong of the Alafia River, is comprised of both non-mandatory and mandatory reclaimed mined lands (FDEP, 2004). **Figure 5-9** shows a LiDAR topographic map of Alafia River State park, on which the extensive topographic alterations caused by phosphate mining activities can clearly be seen. Restoration activities on this site could include the scraping down of old clay settling pond berms and re-contouring, and the establishment of native upland and plant communities. In addition, hydro-carving techniques could be used to reestablish historical headwater streams on the site, as determined from pre-mining aerial photography.



SOURCE: FDEP, 2004

Figure 5-9
LiDAR Topographic Map of Alafia River State Park

Section 6.0: Habitat Protection and Restoration Targets

This section presents and discusses recommended habitat protection and restoration targets for each of the Tampa Bay habitats of interest.

6.1 Target Setting Methodology

In comprehensive and environmental planning jargon, the term “goal” generally refers to a desired outcome or result that an organization envisions, plans for, and commits to achieve. Goals are typically broad aspirational statements lacking numeric specificity. For example, in the 2017 Comprehensive Conservation and Management Plan (CCMP) update, the TBEP defined the following goal for Bay Habitats:

Increase and preserve the number and diversity of healthy bay habitats.

In contrast, the term “target” refers to the desired attainment of a specific numeric value of a key indicator (e.g., acres of salt marsh). With respect to ecological restoration it is often useful to also include a temporal component as part of the target setting process (Hobbs, 2007). Therefore, habitat protection and restoration targets should include both a numeric value and a time horizon within which that value can feasibly be attained, based on the best available status and trends information.

The habitat protection and restoration targets recommended herein were developed using the “Maximizing the Potential” (MTP) approach. As discussed in Section 4.3, the MTP approach differs from the RTB approach used previously in that it:

- Integrates all native habitats in the watershed including coastal, freshwater and upland habitats;
- Is informed by contemporary trends in both habitat changes and restoration performance;
- Considers both current and future stressors – especially land development, sea level rise and climate change; and
- Focuses on existing opportunities, and what is realistically possible in the future, rather than replicating past ecological conditions.

Recommended targets are based specifically on the analyses presented in previous sections of this Habitat Master Plan Update, including: 1) the habitat status and trends analysis (Section 2.5); 2) the habitat restoration database update (Section 3.3); and 3) the opportunities assessment summary (Section 5.2). With regard to the latter, recommended targets are consistent with estimated opportunity areas and restoration potential for each respective habitat type. Finally, in addition to the supporting technical analyses, targets are also based on “best professional judgement” with respect to anticipated future trends in development, available funding, regulations, etc. The recommend targets presented and discussed below represent 10-year targets, or those that can be reasonably be attained by 2030.

6.2 Subtidal Habitat Targets

This section presents and discusses recommended targets for Tampa Bay subtidal habitats including: hard bottom; seagrasses; tidal flats; oyster bars; and artificial reefs.

6.2.1 Hard Bottom

Based on two recent studies (Kaufman, 2017; CSA, 2019), the best current minimum estimate of the extent of hard bottom in Tampa Bay is 423 acres. However, these studies only assessed approximately 28 percent of the bay bottom, so this number is likely an underestimate of the total actual coverage of hard bottom.

Native hard bottom communities exist primarily on limestone outcroppings, which are natural geological features that cannot be replicated. Accordingly, the "restoration" of hard bottom habitat is only possible through artificial reef creation, which is a different habitat type. Therefore, a 2030 hard bottom "interim protection" target of **423 acres** is recommended. It is further recommended that this protection target be reevaluated as additional mapping of hard bottom habitat in Tampa Bay is completed.

6.2.2 Seagrasses

As described in Section 2.3.2, since 2014 at least 40,000 acres of seagrasses have been delineated by SWFWMD in three separate assessments. The previous target of 38,000 acres may have underestimated the restoration potential, or water quality conditions may have improved beyond what was previously considered to be suitable for seagrass recovery. Regardless, the seagrass restoration target has been attained, and slightly exceeded, and it reasonable that the current coverage can be sustained over the next decade, assuming that current water quality conditions are maintained. Therefore, a 2030 seagrass "protection" target of **40,000 acres** is recommended, which represents a new lower limit for Tampa Bay.

Given that approximately 100 acres of seagrass is estimated to have been physically restored in Tampa Bay (TBEP, 2017), these efforts are relatively small compared to the seagrass increases due to water quality improvements. However, seagrass planting efforts can play an important role after catastrophic events, by providing an initial stimulus for areas that have not seen appropriate natural regeneration, and in cases of mitigation.

As discussed previously, the SWFWMD seagrass mapping program assesses a cover classification "Sand Other Than Beaches – Submerged" (FLUCCS 7210), which includes non-vegetated subtidal areas that could potentially support seagrass recovery. The 2018 extent of this cover type was 14,131 acres, which is assumed to represent a theoretic maximum restoration potential for seagrasses, as the portion of this area that occurs below the euphotic zone for seagrasses is not known at this time.

Pursuant to the MTP approach, anticipated future trends and stressors must also be considered in the target setting process. As discussed in Section 2.6.1, sea level rise and climate change are currently driving ecological changes in Tampa Bay subtidal and intertidal habitats, but the anticipated future trend for seagrasses is uncertain. Under some future sea level rise scenarios, the coverage of seagrasses in Tampa Bay could expand due to the inundation of shallow nearshore areas, thus creating more opportunity areas for seagrass expansion (Sheehan et al., 2016). Concurrent with these gains on the "shallow edge" of the existing seagrass coverage are potential losses on the "deep edge" of the existing coverage. If current water clarity conditions are maintained, these changes could potentially offset each other. However, if water clarity declines or improves over time, then predicting future changes in seagrass coverage will be difficult.

It is recommended that the TBEP reevaluate the seagrass target for 2040 and beyond. This reevaluation should utilize the best available modeling techniques to more accurately quantify current and future seagrass restoration potential, as well as predicted changes in overall seagrass coverage under various sea level rise scenarios. This analysis should include improved mapping and assessment of seagrass opportunity areas (e.g., non-vegetated subtidal areas in the appropriate photic zone). This analysis should also incorporate water quality analyses, especially the Tampa Bay optical model, to determine if water clarity targets can feasibly be improved in a manner that supports seagrass expansion on the deep edge of the existing coverage.

6.2.3 Tidal Flats

The most current (2018) estimate of the total coverage of tidal flats in Tampa Bay is 2,146 acres, as reported by SWFWMD. However, as discussed in Section 2.5.2, assessing status and trends in tidal flats difficult because of changes in mapping methods used by SWFWMD over time. From 1988 through 2014, all non-vegetated subtidal areas were mapped as Tidal Flats (FLUCCS 6510). However, in 2016 SWFWMD began distinguishing Tidal Flats from Sand Other Than Beaches (FLUCCS 7210), and mapped them as separate habitat types. The Tidal Flats category is now intended to cover flats that are periodically exposed during low tides, and provide foraging habitat for wading birds, while the Sand Other Than Beaches category is intended to capture other non-vegetated subtidal areas. When data for both classifications are combined, the non-vegetated total has decreased by 11,111 acres (55%) during the 30-year period of record. It is surmised that much of this decline is associated with the expansion of seagrass on to previously non-vegetated bottom areas.

As defined in Section 2.3.3, tidal flats are typically dynamic and ephemeral habitats. Sediment erosion and/or deposition can change the wave energy level, and non-vegetated tidal flats can subsequently become vegetated with subtidal or intertidal species. Accordingly, the loss of tidal flat coverage in Tampa Bay is not necessarily an indicator of ecological decline. Rather, areas that were previously mapped as tidal flats have likely become vegetated in more recent years, and are now being classified as seagrass or some type of emergent tidal wetland.

Given the high degree of variability with respect to what is currently mapped as “tidal flat” habitat (FLUCCS 6510), and the naturally dynamic nature of non-vegetated subtidal and intertidal areas, there is no justification for establishing a restoration target for tidal flats at this time. Therefore, a 2030 tidal flat “protection” target of **16,220 acres** is recommended, based on the apparent dynamic equilibrium that exists between seagrasses and tidal flats

6.2.4 Oyster Bars

The most current (2018) estimate of oyster bar coverage in Tampa Bay is 171 acres, as reported by SWFWMD. However, this is likely a significant underestimate of the total existing oyster bar coverage because the aerial imagery approach used by SWFWMD does not accurately assess oyster bar coverage under mangrove canopies, nor in the mesohaline reaches of tidal tributaries (O’Keife et al., 2006).

There is anecdotal evidence that Tampa Bay was once rich in oyster abundance (Ruge, 1898), with substantial coverage noted in the Manatee River (Whitfield, 1975). Oysters provide a range of both ecosystem and socioeconomic benefits (see Section 2.2.4), and the restoration of oyster bars in Tampa Bay is both feasible and highly recommended. Therefore, a 2030 oyster bar “interim restoration” target of **221 acres** is recommended. This target represents a 50-acre increase over the current best estimate of oyster bar coverage, and is considered to be feasible given the well-proven oyster bar restoration techniques used throughout the Gulf of Mexico (La Peyre et al., 2014). Increasing the target by 50 acres each subsequent decade provides a 2050 goal of **471 acres**, an increase of 300 acres from 2018 to 2050. The TBEP and partners are creating an oyster habitat suitability index, following protocols developed for Charlotte Harbor by Boswell et al. (2012), that will further inform the target and goal.

Manatee County has proposed over 100 acres of oyster restoration in the Manatee River as one of their major projects to be funded under the RESTORE Act. If implemented, this project could substantially exceed the recommended interim restoration target. It is anticipated that at least some phases of this project will be complete by 2030. Depending on monitoring of existing projects and implementation of lessons learned from this and other Tampa Bay oyster restoration projects , as well as the results of improved oyster bar assessment techniques recommended in Section 7.1.1 below, it is further recommended that the TBEP revisit the interim restoration target to reflect a more accurate assessment of oyster bar restoration opportunity areas.

6.2.5 Artificial Habitats

The term “artificial habitats” refers to man-made hard substrates placed in the marine and estuarine environment to provide habitat functions for fish and invertebrates. The most common types of artificial habitats in Tampa Bay include: artificial reefs; living shorelines; and oyster reef modules and other seawall enhancement projects. The current best estimate of the extent of artificial habitats in Tampa Bay include 166 acres of artificial reefs and 11.3 miles of living shorelines, which includes a range of enhancements along vertical bulkheads.

Artificial Reefs

Maintaining the current distribution of artificial reefs (**166 acres**) managed by Hillsborough, Manatee, and Pinellas counties to enhance fish and wildlife benefits in the bay remains a long-term goal. The permitted areas of the existing reefs have additional capacity, both horizontally and vertically, to accept more reef building material. Artificial reefs should continue to be maintained, and expanded as necessary, to benefit fish and wildlife resources.

Living Shorelines

Like oyster bars, living shorelines provide a range of ecosystem and socioeconomic benefits (RAE, 2015). In particular, living shorelines have the ability to grow and adapt in response to sea level rise, and thus are considered to be an essential element to increasing both resilience and sustainability in developed coastal areas. Accordingly, a 2030 living shoreline “creation” target of **21.3 miles** is recommended. This target represents a 1-mile annual increase over the current best estimate of living shoreline extent over the next decade. Increasing the target by 0.5 miles per year each subsequent decade provides a 2050 goal of **56.3 miles**, an increase of 25 miles from 2018 to 2050. The target and goal are considered feasible given the well-proven living shoreline construction techniques used in the Tampa Bay area elsewhere in Florida, and the extensive linear miles of hardened shoreline “opportunity areas” throughout Tampa Bay, as estimated by the Tampa Bay Living Shoreline Suitability Model (Boland and O’Keife, 2018).

6.3 Intertidal Habitat Targets

This section presents and discusses recommended targets for Tampa Bay intertidal habitats including mangrove forests, salt marshes, salt barrens, and tidal tributaries.

6.3.1 Mangrove Forests

As determined in the 2017 land use/cover update, the most current estimate of the extent of mangrove forests in Tampa Bay is 15,300 acres. As discussed in Section 2.5.2, mangrove forests in Tampa Bay have expanded by over 1,600 acres (12%) since 1990; and the landward encroachment and expansion of mangroves into salt marsh habitats has been well-documented in Florida and throughout the Gulf of Mexico (Comeaux et al., 2012). For these reasons, a 2030 mangrove forest “protection” target of at least **15,300 acres** is recommended, which represents a new lower limit for Tampa Bay.

Through 2070 the future trend for mangroves is positive, both in response to sea level rise as well as climate change, which in recent decades has been expressed as a reduction in hard freezes that historically resulted in periodic major mangrove die offs in Tampa Bay. Given the observed increases in coverage, and anticipated future trends, there is no scientific justification for establishing a restoration target for mangrove forests at this time. The intertidal zone in Tampa Bay is currently experiencing dynamic change, driven by sea level rise and climate change, whereby mangrove forests are outcompeting salt marshes and salt barrens for the available niche space. Without increasing the total area of the intertidal zone, restoring a greater coverage of mangroves would reduce the niche space available for salt marshes and salt barrens.

6.3.2 Salt Marshes

As determined in the 2017 habitat update (**Table 2-3**), the most current estimate of the extent of salt marshes in Tampa Bay is 4,557 acres. As discussed in Section 2.5.2, salt marshes in Tampa Bay have increased by 74 acres (2%) from 1990 to 2017. Between those two time periods, the LULC data identified 932 acres of salt marsh changing to mangroves, and 392 acres of mangroves re-classified as salt marsh, resulting in a net change of 540 acres from salt marshes to mangroves (M. Beck, unpublished data).

Without restoration intervention, the future trend for salt marshes is negative, with an anticipated gradual conversion to mangroves (Sheehan et al., 2016). This phenomenon has been observed throughout the Gulf of Mexico, and has been attributed to both climate change (e.g., fewer freeze events) and sea level rise (Comeaux et al., 2012). In Tampa Bay, field data collected as part of the TBEP Critical Coastal Habitat Assessment (Price et al., 2017) has indicated that mangrove invasion of salt marshes tends to first occur along tidal creek margins, followed by encroachment into larger contiguous *Juncus* marshes.

A 2030 salt marsh “restoration” target of **4,807 acres** is recommended, which represents a 250-acre increase (~5%) over the current best estimate of salt marsh extent. This target would be attained by scraping down low-lying coastal uplands and creating new salt marsh habitat at appropriate locations adjacent to mesohaline tidal tributary segments. The estimated opportunity area for salt marsh restoration on existing conservation lands (see **Table 5-3** above) is 241 acres, but an additional 851 acres of proposed conservation lands may be suitable for *Juncus* marsh restoration. Increasing the target by 50 acres each subsequent decade provides a 2050 goal of **5,457 acres**, an increase of 900 acres from 2017 to 2050. The target and goal are considered to be feasible only if additional lands are purchased or otherwise protected to allow restoration activities to occur.

It is further recommended that salt marsh restoration be the primary focus of coastal habitat restoration efforts over the next decade; and that salt marshes be recognized as a primary aquatic resource to be protected through future MFL reevaluations. To maintain the existing balance of emergent tidal wetlands in Tampa Bay, the protection and restoration of salt marshes should be a major priority for TBEP and its stakeholders. This effort will require coordination with the SWFWMD Minimum Flows and Levels (MFL) program to ensure that appropriate salinity gradients are maintained well into the future.

6.3.3 Salt Barrens

As determined in the 2017 land use/cover update, the most current estimate of the extent of salt barrens in Tampa Bay is 496 acres. Salt barrens in Tampa Bay have increased by 28 acres (6%) since 1990 (Section 2.5.2). Salt barrens are very dynamic habitats, and photointerpretation of their coverage can be difficult. This increase may simply be attributed to improvements in photointerpretation but may also reflect the influence of sea level rise and the associated landward migration of salt barrens where adequate undeveloped uplands exist.

The future trend for salt barrens is uncertain. In areas where a gradual undeveloped upland slope exists to accommodate landward migration with sea level rise, the extent of salt barrens could actually increase over time under modeled sea level rise scenarios (Sheehan et al. 2016). However, in areas where landward migration is cut off by bulkheads or hard development, salt barrens will decline with sea level rise.

A 2030 salt barren “restoration” target of **546 acres** is recommended. This target represents a 50-acre (10%) increase over the current best estimate of salt barren coverage. Increasing the target by 50 acres each subsequent decade provides a 2050 goal of **796 acres**, an increase of 300 acres from 2017 to 2050. There are more than adequate opportunity areas within the coastal stratum to attain this target; therefore, this target is considered to be very feasible. Furthermore, as with salt marshes, it is scientifically justifiable with respect to maintaining the existing balance of emergent tidal wetlands in Tampa Bay.

The restoration of salt barrens requires the maintenance or creation of a flat upland slope, preferably with sandy soils, to allow for infrequent but periodic inundation by high tides and the associated establishment of hypersaline conditions that support the characteristic succulent vegetation. Salt barren restoration should be conducted in concert with coastal upland protection and restoration, as discussed below. This approach should be supported through the acquisition of priority coastal uplands within the 5-foot contour, as well as through the implementation of other reservation strategies.

6.3.4 Tidal Tributaries

The best current estimate of the extent of tidal creek habitat in the Tampa Bay watershed is 2,041,820 linear feet, or about 387 miles. This linear extent of tidal tributary habitat is characterized by a wide range of conditions – from highly urbanized (e.g., hardened and channelized) to more or less natural. A 2030 tidal tributary “restoration” target of **4 miles** is recommended. Increasing the target by 2 miles each subsequent decade provides a 2050 goal of **18 miles** from 2018 to 2050. The target represents the restoration of just 1 percent of the current tidal tributary extent, and is considered to be feasible and scientifically justified given the extent of highly urbanized tidal creek segments.

There are extensive opportunities to enhance or restore altered segments of tidal tributaries throughout the Tampa Bay watershed. Tidal tributary restoration could entail multiple improvements including: 1) removal of salinity barriers; 2) filling of dredged channel sections with low dissolved oxygen; 3) removal of hardened shoreline and restoration of native riparian vegetation; 4) and the establishment of living shorelines along vertical seawalls that cannot feasibly be removed. The next steps in refining this target would be to conduct an inventory and assessment of the mapped coverage of tidal tributaries, followed by the development of a priority ranking of tidal creek segments for restoration, with appropriate restoration criteria and success metrics for the top ranked segments.

6.4 Supratidal Habitat Targets

This section presents and discusses recommended targets for Tampa Bay supratidal habitats including: freshwater wetlands; native uplands; and coastal uplands.

6.4.1 Freshwater Wetlands

As determined in the 2017 land use/cover update, the most current estimate of the extent of freshwater wetlands in the Tampa Bay watershed is **219,799 acres**. The suite of freshwater wetlands incorporated into this total includes: wetland hardwood forests (e.g., bay swamps); wetland coniferous forests (e.g., cypress swamps); wetland forested mixed; and vegetated non-forested wetlands (e.g., freshwater marshes).

As discussed in Section 2.5.2 above, over the 27-year period of record evaluated as part of this Habitat Master Plan Update, the suite of freshwater wetlands has experienced a net gain of 6,040 acres (3%). This overall gain is likely a reflection of: 1) the effectiveness of state and federal wetland regulatory programs; and 2) the cumulative gains resulting from publicly-funded habitat restoration projects and regulatory mitigation. The results of the present work indicate that there has been an increasing trend in vegetated non-forested freshwater wetlands since 1990, with a gain of 13,183 acres (24%), while forested freshwater wetlands have decreased by 7,144 acres (4%). This is in contrast with disproportionate losses of non-forested wetlands prior to 1990 (Ries and Scheda, 2014), and current gains in herbaceous wetlands have not greatly altered the ratio of loss observed since the 1950s between herbaceous and forested wetlands.

Based on these findings, a 2030 freshwater wetland “restoration” target of **221,219 acres** is recommended. This target represents a 1,500-acre (0.7%) increase over the current estimate of freshwater wetland coverage, with 1,350 acres allocated to herbaceous and 150 acres allocated to forested restoration. Increasing the target by 100 acres each subsequent decade provides a 2050 goal of **224,519 acres**, an increase of 4,800 acres from 2017 to 2050.There are extensive opportunities on existing conservation lands to accommodate the attainment of this target.

With regard to the protection of existing freshwater wetlands, it is recommended that future land conservation efforts upland of the coastal stratum focus primarily on the protection of the remaining contiguous forested wetlands that exist in the river floodplains of the four major rivers flowing to Tampa Bay – the Hillsborough, Alafia, Little Manatee, and Manatee Rivers. Riverine floodplain corridors provide vital watershed functions that are critical to the health of Tampa Bay including: migratory fish and wildlife habitat; floodwater attenuation and storage; erosion control; water quality treatment (e.g., removal of suspended sediments and dissolved nutrients); and delivery of complex organic matter to the estuarine food web (Opperman et al., 2010).

6.4.2 Native Uplands (Non-Coastal)

As determined in the 2017 land use/cover update, the most current estimate of the extent of native upland habitats in the Tampa Bay watershed is 140,600 acres. The suite of native upland habitats incorporated into this total include: dry prairie; shrub and brushland; mixed rangeland; upland coniferous forests (e.g., pine flatwoods); and upland hardwood forests (e.g., oak hammocks).

As discussed in Section 2.5.2, the suite of native upland habitats has experienced a very substantial loss of 91,055 acres (-39%) since 1990. This loss is almost entirely due to land development and conversion to urban land uses. Of the native forested habitats, Upland Coniferous Forests (FLUCCS 4100), primarily pine flatwoods, have been most severely impacted, losing 38,977 acres (55%) since 1990.

The more common native upland habitats like pine flatwoods are not protected by federal or state regulatory programs, which focus on wetlands, as well as rare habitats for listed species (e.g., sand pine scrub habitat for the scrub jay). Rather, the protection of native upland habitats falls primarily within the purview of local governments through their planning, zoning and land development policies and regulations.

Accordingly, a 2030 native upland restoration target of **141,050 acres** is recommended, an increase of 450 acres from 2017, and including a specific **56,717-acre** protection target for pine flatwoods. Increasing the target by 50 acres each subsequent decade provides a 2050 goal of **142,100 acres**, an increase of 1500 acres from 2017 to 2050. Attaining the target and goal will require concerted restoration of native upland habitats on the restorable portions of existing conservation lands, as well as new conservation lands, to offset the continued loss of these habitats to development. Substantial opportunities exist for upland restoration on reclaimed mined lands Attaining this goal will also require the TBEP and its stakeholder working closely with its member local governments to improve the protection of native habitats through amendments to existing planning, zoning and land development policies regulations. In particular, the protection of large contiguous stands of native pine flatwoods should be encouraged wherever feasible.

6.4.3 Coastal Uplands

Coastal uplands, as a distinct habitat type, are not mapped as part of SWFWMD's routine land use/cover mapping program. However, a customized technique was used to estimate the extent of coastal uplands in the Tampa Bay watershed based on data from the 2017 land use/cover update. Using this approach, the best current estimate of the extent of coastal uplands in the Tampa Bay watershed is 3,619 acres.

There is no readily available information to assess trends in coastal uplands; however, it is surmised that losses in native coastal uplands since 1990 have been very substantial due primarily to intense land development near the coast. For these reasons, a 2030 coastal upland "restoration" target of **3,769 acres** is recommended. This target represents a 150 acre (4%) increase over the current best estimate of coastal upland coverage. Increasing the target by 50 acres each subsequent decade provides a 2050 goal of **4,219 acres**, an increase of 600 acres from 2017 to 2050.

The total opportunity area for coastal uplands is estimated to be 1,272 acres, which includes 311 acres of restorable habitats on existing conservation lands, and 961 acres on proposed conservation lands (**Table 5-3**). While the 2030 target is considered to be feasible as it can be entirely attained on existing conservation lands, additional reservation areas need to be acquired (e.g., acquisition or conservation easement) before the 2050 goal can be achieved. It also scientifically justifiable with respect to maintaining or increasing the total area of coastal uplands to accommodate the landward migration of tidal wetlands in response to sea level rise.

6.5 Target Summary

Table 6-1 presents a summary of the recommended targets discussed above including a narrative of the restoration and protection rationale for each. The recommend targets represent 10-year targets, or those that can be reasonably be attained by 2030.

Table 6-1
Summary of Recommended 2030 Targets

Habitat Type	Current Extent	Total Restoration Opportunity	2030 Target	2050 Goal	Target Narrative and Restoration and Protection Rationale
Subtidal Habitats					
Hard Bottom	423 acres	N/A	>423 acres	>423 acres	Protect existing hard bottom; continue to identify new hard bottom area using proven mapping techniques
Tidal Flats	16,220 acres	N/A	16,220 acres	16,220 acres	Identify and protect existing persistent tidal flats; assess restoration potential of other non-vegetated subtidal areas
Seagrasses	40,653 acres	14,131 acres	>40,000 acres	>40,000 acres	Protect existing seagrasses; establish new HMPU lower limit of 40,000 acres; assess restoration potential of non-vegetated subtidal areas (FLUCCS 7210)
Oyster Bars	171 acres	I/D	221 acres	471 acres	2030: Protect existing oysters + restore 50 acres; increase target by 50 acres each out-decade; consider filtration rate to refine long-term goal; HSI will inform opportunity space
Artificial Reefs	166 acres	N/A	>166 acres	>166 acres	Protect existing artificial reefs; enhance habitat complexity where feasible; expand reef area to meet fishing demand
Intertidal Habitats					
Living Shorelines	11.3 miles	LSSM	21.3 miles	56.3 miles	2030: Construct 1 mile of LS each year; includes privately owned seawalls; need better definition of opportunity areas; increase target to 1.5 & 2 miles per year for out decades
Total Intertidal	**20,353 acres**	**3,849 acres**	**21,353 acres**	**23,803 acres**	**2030: Protect existing intertidal mosaic + restore 1,000 acres (based on hydric soils); increase target by 150 acres each out-decade; includes the mosaic of mangrove, salt barren, and salt marsh habitats**
Mangrove Forests	15,300 acres	2,757 acres	>15,300 acres	>15,300 acres	Protect existing mangrove forests; restore opportunistically within the intertidal mosaic
Salt Barrens	496 acres		546 acres	796 acres	2030: Protect existing salt barrens + restore 50 acres; increase target by 50 acres per out decade
Salt Marshes (low salinity)	4,557 acres	1,092 acres	4,807 acres	5,457 acres	2030: Protect existing low salinity salt marshes + restore 250 acres; increase target by 50 acres each out-decade; *land acquisition or Public Private Partnership required to achieve this 2030 target and 2050 goal*
Tidal Tributaries	387 miles	I/D	4 miles	18 miles	Inventory mapped tidal tributaries and assess/rank restoration potential; restore ~4 miles (1%) of urban tidal creek habitat where feasible; increase target to 6 and 8 miles for out decades

N/A – Not Applicable; I/D – Insufficient Data: LSSM – Living Shoreline Suitability Model

Table 6-1 (Cont.)

Supratidal Habitats					
Habitat Type	**Current Extent**	**Total Restoration Opportunity**	**2030 Target**	**2050 Goal**	**Target Narrative and Restoration and Protection Rationale**
Coastal Uplands	3,619 acres	1,272 acres	3,769 acres	4,219 acres	2030: Protect existing coastal uplands + restore 150 acres (upland restoration total 600 acres); increase target by 50 acres each out decade
Non-forested Freshwater Wetlands	67,587 acres	159,836 acres	68,937 acres	71,787 acres	2030: Protect existing non-forested freshwater wetlands + restore 1,350 acres; increase target by 50 acres each out decade
Forested Freshwater Wetlands	152,132 acres		152,282 acres	152,732 acres	2030: Protect existing forested freshwater wetlands + restore 150 acres; increase target by 50 acres each out decade
Native Uplands (non-coastal)	140,600 acres	43,928 acres	141,050 acres	142,100 acres	2030: Protect existing native uplands + restore 450 acres (upland restoration total of 600 acres); increase target by 50 acres each out decade; focus on pine flatwoods and protect current extent (56,717 acres)

Section 7.0: Habitat Assessment and Monitoring

This section presents a discussion of habitat assessment needs and recommended improvements to existing monitoring programs.

7.1 Habitat Assessment Needs

In the context of this Habitat Master Plan Update, monitoring is differentiated from assessment in that monitoring is an ongoing, routine process; whereas assessment activities are performed initially, and then repeated only periodically, as needed to fill data gaps. The assessment needs and recommended programs discussed below address informational gaps that currently limit the determination of status and trends, and the refinement of related management actions.

7.1.1 Hard Bottom

As discussed in Section 2.3.1, hard bottom communities have been assessed in Tampa in recent years using a similar side-scan sonar approach as that recommended above for oysters. (Kaufman, 2017; CSA, 2019). The method has proven to be cost-effective; however, to date only Lower Tampa Bay, the western portions of Middle Tampa Bay, and the southern portions of Old Tampa Bay have been mapped. To complete the hard bottom assessment, it is recommended that this same hard bottom mapping approach be applied to the remaining segments of Tampa Bay including: the eastern portions of Middle Tampa Bay; the remainder of Old Tampa Bay; Hillsborough Bay; Terra Ceia Bay; and Boca Ciega Bay. Depending on the compatibility of the methods to be utilized, it may be possible to combine the side-scan sonar oyster mapping project recommended above with the completion of the hard bottom mapping effort, implemented as a single comprehensive survey.

7.1.2 Oyster Bars

There are no studies or surveys documenting the historical extent and distribution of oyster bars in Tampa Bay. While there is some anecdotal information that oysters were once abundant in Tampa Bay, there are no reliable estimates of how much of their historical extent has been lost due to dredge and fill and hydrologic alterations (Lewis and Estevez, 1988).

The first attempt to map and quantify extant oyster bars in Tampa Bay was conducted in 2006 by the Fish and Wildlife Research Institute (O'Keife et al., 2006). The investigators utilized an experimental approach using hyperspectral aerial photography combined with a semi-automated photointerpretation technique, which was applied in several test areas. Due to the generally low relief of the oysters found in Tampa Bay, and the prevalence of mangrove islands with extensive canopy cover and abundant shadows, the investigators found this technique to be largely ineffective in mapping small disbursed oyster bars. However, using traditional manual photointerpretation methods, they achieved an 85 percent accuracy for the free-standing oyster bars, and 78 percent accuracy overall. They also concluded that extensive field reconnaissance was crucial to this effort. Due to the problematic nature of oysters within mangrove islands, and the prevalence of that form - estimated to be ~30 percent of the total of all oysters observed - the authors concluded that mapping oysters using oblique methods (side-scan sonar) may be more effective. In summary, they were unable to develop a quantitative estimate of total oyster bar coverage in Tampa Bay.

As discussed in Section 2.2.4, the assessment of oysters in Tampa Bay was incorporated into the SWFWMD seagrass mapping program beginning in 2014. This program utilizes traditional manual photointerpretation methods. The most current assessment conducted by SWFWMD in 2018 yielded an estimate of 171 acres of oyster bar coverage in Tampa Bay, likely a significant underestimate of the actual total coverage. As noted by O'Keife et al. (2006), the prevalence of oysters clustered under mangrove canopies makes a bay wide quantitative assessment very difficult, and these issues are not resolved in the SWFWMD program. Furthermore, the SWFWMD program only assesses portions of the bay where seagrasses are likely to occur, excluding most tidal tributaries where oyster abundance would be expected to be greatest.

In addition to the need to better quantify the extent and distribution of existing live oyster bars, the mapping of relic oyster bars, in both the open bay as well as within tidal tributaries, would provide a better understanding of the historical spatial extent and distribution of oysters in Tampa Bay. Both types of information should be used to assess the restoration potential for oyster bars, as well as to locate sites best suited for restoration.

Therefore, a comprehensive bay wide assessment of both extant and relic oyster bars in Tampa Bay is recommended to address these data gaps. These assessments would be conducted in both intertidal and subtidal habitats that likely support, or historically supported, oysters. An additional component of this effort would be to estimate the area of intertidal oyster reef habitat that has been lost due to the development (e.g., dredging and filling) of previously natural (mangrove) coastline. As previously described, the TBEP is preparing an oyster habitat suitability index that should be produced in 2020. Having this information would enable the TBEP to identify a scientifically-defensible oyster bar restoration target for Tampa Bay, as well as select locations for restoration projects.

As noted above, aerial approaches are limited by mangrove canopy; however, oblique methods combined with field reconnaissance offer the best potential (O'Keife et al. (2006). Therefore, the recommended approach would be to utilize a side-scan sonar system (e.g., Edgetech 272-TD dual frequency 100/400 kHz) having a 200 m swath width. The side-scan backscatter detects both bottom roughness and geometry. A low backscatter (lighter intensity signal) indicates flat, soft bottom consisting of finer grained sediments; whereas, a high backscatter (darker intensity signal) indicates the presence of harder bottom types (coarser sediments, seagrass, shellfish beds, or limestone) having some relief. Differential GPS receivers would provide real-time (sub-meter) positioning so that side-scan sonar tracks can be overlaid on aerial photographs, thus providing continuous coverage of bottom type. In addition, an acoustic seabed classification (QTC View Series 5) system operating at 50/200 kHz would be used to simultaneously record depth and substrate type (based on sediment grain size analyses).

Areas where relic oyster bars are indicated would be further investigated by obtaining grab samples for sediment grain size analysis. Visual confirmation of relic oyster bar communities would be made using SCUBA divers or underwater video cameras. Biotic communities associated with confirmed relic oyster bars (e.g., attached algae; benthic epifauna; fish) would be surveyed using non-destructive techniques, and dominant species would be quantified and identified. In shallow areas (e.g., near mangroves), this activity would be conducted at high tide. This approach has been shown to be effective for mapping bottom communities (including oyster reefs) in Old Tampa Bay, as well as Faka Union and Fakahatchee Bays (Locker, 2005). In areas where live oysters are encountered, data such as density, percent live and dead, size, and reef characteristics should be collected as part of the oyster assessment and monitoring efforts (zu Ermgassen et al, 2016).

This approach is also similar to that used to assess hard bottom habitat in Tampa Bay (Kaufman, 2017; CSA Ocean Sciences, 2019); however, the side-scan sonar surveys would be conducted both along the bay perimeter, as well as within the major river systems and select representative tidal creeks. Oysters are typically located within an optimal salinity zone that both maximizes food resources (e.g., phytoplankton) and excludes predators, and this optimal salinity zone is typically found in the mesohaline segments of the bay and its tidal tributaries. In particular, an extensive survey of relic oyster bars in the Manatee River is justified given the historical anecdotal evidence of extensive oyster bars in this portion of Tampa Bay.

7.1.3 Tidal Tributaries

As referenced previously, the Tampa Bay Tidal Tributary Research Team (TBEP, 2008) and the Sarasota Bay Estuary Program (Janicki Environmental and Mote Marine Laboratory, 2016) have conducted ecological assessment activities in several representative tidal creek systems. However, the vast majority of the mapped tidal tributary segments have not been characterized.

An inventory and field assessment of water quality and habitat conditions in other tidal tributaries and creeks is recommended, with the goal of developing a comprehensive ecological assessment of all mapped tidal tributaries in the watershed. The comprehensive ecological assessment should build on the previous work cited above, and utilize available water quality data and digital aerial photographic information wherever feasible to supplement field investigations and to minimize costs. It is further recommended that the comprehensive ecological assessment be used to develop an ecological index of tidal tributary health, and a ranking system of tidal tributary segments for potential restoration and/or enhancement.

7.1.4 Coastal Uplands

The term “coastal uplands” is used herein as a generic catch-all for the variety of native terrestrial plant communities that occur immediately landward of the emergent tidal wetlands complex, typically on sandy soils. However, as discussed in Section 2.4.3, it was possible to derive an estimate of the current extent of coastal uplands by combining all native upland FLUCCS codes and clipping them to the land area encompassed by the 5-foot contour extending around the Tampa Bay shoreline.

The assessment needs for coastal uplands include: 1) developing a consensus definition of what constitutes the natural coastal upland communities in the Tampa Bay watershed; and 2) mapping all remaining natural coastal uplands in the watershed. The former would best be addressed by convening a group of experts from the TBEP Habitat Subcommittee, like was done with the Tampa Bay Tidal Tributary Research Team. This group would conduct field reconnaissance of representative sites, and develop a consensus definition of the key plant species and ecological characteristics of natural coastal uplands. Once defined, existing land use/cover data would be used to map natural coastal upland communities, that could then be prioritized for public acquisition as conservation lands.

7.1.5 Reclaimed Mined Lands

There are extensive opportunities for the restoration and/or enhancement of reclaimed mined lands in the Alafia River watershed, and the Little Manatee River watershed to a lesser extent. Reclaimed lands on publicly-owned conservation lands offer the greatest restoration potential due to long-term control of the affected parcels.

The assessment needs with regard to reclaimed mined lands involves the development of a comprehensive ecological inventory and assessment of reclaimed mined lands that exist on publicly-owned conservation lands in the Tampa Bay watershed. The ecological assessment would evaluate the restoration potential of these areas with respect to various natural community types, including headwater streams, forested floodplain wetlands, isolated forested and non-forested wetlands, and native upland plant communities. Existing digital topographic and aerial photographic information, combined with field reconnaissance, would be used to develop restoration and enhancement priorities on reclaimed mined lands.

In addition to an evaluation of habitat restoration potential, it is recommended that an assessment of hydrologic and water quality conditions on reclaimed lands be conducted. As discussed in Section 5.3.4 above, the hydrologic and water quality characteristics of reclaimed lands remain poorly understood. In particular, pollutant loads associated with surface water runoff and/or shallow groundwater seepage from these areas have not been adequately assessed, and the potential contributions of pollutant loads discharged from reclaimed lands to water quality impairments in the Alafia River have not been determined.

The recommended assessment would include the establishment of long-term monitoring stations at representative sites on reclaimed lands. Data collection would include hydrologic (e.g., rainfall, streamflow, and groundwater seepage) and water quality (e.g., pH, nutrients, metals) indicators. This information could be used to develop pollutant loading estimates from reclaimed lands, which could be incorporated into the TBEP non-point source loading model for Tampa Bay.

7.2 Habitat Monitoring Recommendations

Recommended improvements to monitoring the status and trend of Tampa Bay habitats of interest are described within the 2017 CCMP Update (TBEP, 2017) and are discussed below. Some of these monitoring recommendations have been incorporated into the Critical Coastal Habitat Assessment process (Radabaugh et al., 2017) and the Monitoring and Indicators addendum to the 2017 CCMP (Raulerson, 2017). Results from these additional assessments will be incorporated into habitat indicators that will be developed by the TBEP and its partners over the next several years.

7.2.1 Subtidal Habitats

Subtidal habitats of interest in Tampa Bay – including seagrasses, tidal flats, and oysters - are monitored every two years under the SWFWMD seagrass mapping program, which utilizes photointerpretation and field reconnaissance of high-resolution aerial photography, and the creation of digital data layers. This program has proven to be very reliable for assessing changes in the coverage of both patchy and continuous seagrasses; however, the data reported for tidal flats and oysters are problematic. As discussed previously, the aerial photographic approach to mapping oysters has significant problems in that it underestimates the coverage of oysters that occur under mangrove canopies. In addition, the SWFWMD seagrass mapping program does not extend fully into the major tidal rivers and smaller tidal creeks where oysters are more abundant due to their preference for a more mesohaline salinity regime.

The comprehensive oyster assessment project recommended in Section 7.1.1 addresses the need for an estimate of both extant and relic oyster bars throughout Tampa Bay, including its tidal tributaries. Once the comprehensive assessment is completed, ongoing monitoring of oysters as part of the seagrass mapping program could be supplemented with additional monitoring of critical oyster habitat in tidal tributaries. The TBEP, FWRI, and Tampa Bay Watch are conducting a two-year survey of restored and natural oyster reefs, with results expected in 2021, which will provide information towards this effort. Biological and reef characteristics should also be collected on a regular basis (zu Ermgassen et al., 2016) as part of the oyster monitoring program.

The mapping of tidal flats as part of the SWFWMD seagrass mapping program has also been problematic, but for different reasons. The aerial photographic approach to mapping tidal flats is very effective at detecting the resource; however, the distinctions between a persistent “tidal flat” and a dynamic non-vegetated subtidal area have not been clearly defined. Furthermore, prior to 2004, the SWFWMD land use/cover mapping program apparently lumped tidal flats and salt barrens into the same classification, thus grossly overestimating the coverage of salt barrens. As a result, the mapping and quantification of tidal flats coverages have varied significantly from one mapping period to the next.

Accordingly, it is recommended that SWFWMD develop a refined definition and a unique FLUCCS classification code for persistent tidal flats. These are subtidal, or infrequently intertidal, low energy areas that remain persistently non-vegetated due to sediments (e.g., mud vs. sand) and/or water quality conditions (e.g., high color or turbidity). These areas are to be distinguished from dynamic non-vegetated subtidal areas that can support seagrasses, and periodically exhibit seagrass coverages on aerial photography. The tidal flat FLUCCS classification code should then be incorporated into the SWFWMD routine monitoring and mapping program for subtidal habitats.

The research, comparison, and monitoring of physical seagrass restoration efforts should continue, incorporating successful examples from other systems. Transplant and longer-term monitoring studies, similar to one conducted by Tampa Bay Watch and the City of Tampa at MacDill Air Force Base, should be encouraged. Additionally, partners including Pinellas County, EPCHC, and SWFWMD have collected data documenting changes in scarring of protected areas, and these efforts should be expanded to other areas of interest. As described in the CCMP Update (TBEP, 2017), scarring ‘hot spots’ should be mapped and prioritized for protection and restoration.

7.2.2 Intertidal and Supratidal Habitats

The emergent tidal wetland complex in Tampa Bay – mangrove forests, salt marshes, and salt barrens – are monitored as part of the SWFWMD land use/cover mapping program. The periodicity of this program has varied somewhat since it was initiated in 1990, but mapping and the production of GIS data layers are typically conducted every three to five years.

The mapping of mangrove forests and salt marshes has generally been accurate over the years, and the quantification of these coverages has allowed for a reliable estimate of the status and trends of these two habitat types. However, as noted above, prior to 2004 salt barrens and tidal flats were apparently mapped as the same classification code, resulted in a substantial overestimate of salt barren coverages in the 1990, 1995, and 1999 mapping periods. As part of this Habitat Master Plan Update, salt barren coverages for these years were remapped by overlaying the 2004 salt barren GIS data layer onto the 1990’s aerial photography, and adjusting the polygons to quantify only the hypersaline salt barren habitat type. The status and trends data for salt barrens shown in **Table 2-3** reflects these adjusted coverages.

A new challenge in the mapping of intertidal habitats in Tampa Bay is the slow progressive invasion of existing *Juncus* salt marshes by mangroves that has occurred over the past three decades. There is much anecdotal and quantitative evidence for mangrove invasion of salt marshes in Tampa Bay and elsewhere in the Gulf of Mexico (Scheffel et al., 2017), and most of the existing salt marshes in Tampa Bay now exhibit some degree of mangrove encroachment. Similarly, salt barrens are migrating landward in response to sea level rise. These are important ecological phenomena that should be quantitatively monitored over time. However, SWFWMD land use/cover mapping program does not distinguish intertidal habitats in transition.

Accordingly, it is recommended that SWFWMD develop and implement a more detailed land use/cover mapping program specifically for emergent tidal wetlands in its jurisdiction. This would involve the development of unique FLUCCS classification codes for “salt marsh in transition” which includes a range of mangrove percent cover (e.g., <25%; 25-50%; 50-75%; and >75%). Similar classification distinctions for salt barrens in transition may also be needed. Finally, classification distinctions between red and black mangroves may also be appropriate, given the ongoing “tropicalization” of Gulf of Mexico estuaries. Mapping the suite of emergent tidal wetlands with this degree of precision will clearly require a focused field reconnaissance effort conducted by local experts to ground-truth and confirm aerial photographic signatures, similar to the SWFWMD seagrass mapping program.

The creation of a detailed land use/cover mapping program specifically for emergent tidal wetlands would be an excellent complement to the *Critical Coastal Habitat Assessment* (CCHA) program implemented by the TBEP in 2014. As discussed in Section 2.6.1 above, the long-term objectives of the CCHA are to: 1) determine the vertical elevation (relative to sea level) preferences of emergent tidal wetland species/communities; and 2) determine the sensitivity and response of these tidal wetland species/communities to incremental changes in sea level. Linking ground-level monitoring data with watershed-level geospatial data would allow for a deeper understanding and more accurate quantification of the effects of sea level rise on the emergent tidal wetland complex in Tampa Bay.

Given the importance of emergent tidal wetlands and native coastal uplands, and their ongoing transitions in response to climate change and sea level rise, it may even be desirable to use higher resolution aerial imagery, as well as automated classification algorithms verified by field reconnaissance, as part of a program designed specifically for the coastal stratum. Geospatial mapping technologies are advancing rapidly, and recent studies have shown that the SWFWMD land use/cover program for coastal wetland mapping could be improved upon.

For example, McCarthy et al. (2015) used two very high-resolution (2 m) WorldView-2 satellite images, and one (30 m) Landsat 8 Operational Land Imager (OLI) image, to assess wetland coverage in two coastal areas of Tampa Bay: Fort De Soto State Park and Weedon Island Preserve. Results for both study areas showed high accuracy in both wetland (82% at Fort De Soto State Park, and 94% at Weedon Island Preserve) and non-wetland vegetation classes (90% and 83%, respectively). They concluded that historical land use/cover data overestimated wetland surface cover by factors of 2–10 in the study areas. The use of improved satellite remote sensing technology to monitor intertidal habitats in transition should be further explored.

The full range of developed and natural land uses in the Tampa Bay watershed are also monitored as part of the SWFWMD land use/cover mapping program. This program is adequate for tracking the status and trends of developed lands uses, as well as major habitat types such as native forested uplands, and forested versus non-forested wetlands. However, the current methodology used in this program is not particularly accurate with respect to making distinctions between the various types of forested and non-forested wetlands (e.g., cypress swamp vs. mixed hardwood swamp).

As with intertidal habitats, it is recommended that SWFWMD evaluate the use of improved satellite remote sensing technology and automated classification algorithms to better distinguish, and monitor changes in, the various types of freshwater wetlands and native upland communities in the Tampa Bay watershed.

Section 8.0: Linking Habitat Restoration and Compensatory Mitigation

The TBEP 2010 Habitat Master Plan Update (Robison, 2010) presented and discussed an issue that is still relevant today: the linkage of publicly-funded habitat restoration activities with compensatory mitigation requirements. This section reviews this issue and provides an update on regulatory changes, as well as recommendations to improve coordination between regulatory and resource management programs in the Tampa Bay watershed.

8.1 Compensatory Mitigation

There have historically been three primary mechanisms for attaining habitat protection and restoration goals in the Tampa Bay watershed:

- Public conservation land acquisition;
- Publicly-funded habitat enhancement and restoration activities on public lands; and
- Public-private partnerships where public and private funds are pooled to conduct habitat protection and restoration activities on private lands.

An appropriate balance of all three mechanisms is needed to maximize the efficient use of resources available for habitat restoration, and this balanced approach has generally served the community well. However, there is a fourth mechanism – compensatory mitigation – that could potentially contribute significantly to the attainment of watershed-level habitat protection and restoration goals.

Compensatory mitigation involves actions taken to offset unavoidable adverse impacts to wetlands, streams and other aquatic resources authorized by Clean Water Act Section 404 permits issued by the U.S. Army Corps of Engineers (USACE). As such, compensatory mitigation is a critical tool in helping the federal government meet the longstanding national goal of “no net loss” of wetlands. For impacts authorized under Section 404, compensatory mitigation is typically not considered until after all appropriate and practicable steps have been taken to first avoid and then minimize adverse impacts to wetlands and wetland dependent wildlife. In Florida, these same basic provisions generally apply to Environmental Resource Permits (ERP’s) issued by the Florida Department of Environmental Protection (FDEP) and the five Water Management Districts.

Compensatory mitigation is typically conducted through the implementation of five basic activities:

- Restoration of a previously existing wetland or other aquatic site;
- Enhancement of an existing wetland or aquatic site’s functions;
- Establishment (i.e. creation) of a new wetland or aquatic site;
- Preservation of an existing wetland or aquatic site;
- Preservation, restoration and/or enhancement of an upland site providing habitat support for wetland dependent wildlife (e.g., migratory birds).

In Florida, there are currently four legal mechanisms for providing compensatory mitigation for impacts incurred by public and private permittees:

- Permittee-responsible compensatory mitigation;
- Mitigation banks;
- Regional off-site mitigation areas (ROMAs);
- In-lieu fee programs.

These four mechanisms are discussed in the subsections below.

8.1.1 Permittee-Responsible Mitigation

During the first two decades (circa 1972-1992) of federal and state wetland regulatory program implementation, permittee-responsible mitigation was virtually the only mechanism available for compensatory mitigation. As its name implies, the permittee retains responsibility for ensuring that required compensation activities are completed, monitored, and ultimately deemed successful. Permittee-responsible mitigation is typically located on or immediately adjacent to the impact site (i.e., on-site compensatory mitigation), or at another location generally within the same watershed or “basin” as the impact site (i.e., off-site compensatory mitigation).

By the early 1990’s many weaknesses or outright failures of permittee-responsible mitigation were widely recognized (FDER, 1991). Such failures and weaknesses included the following.

- Lack of financial commitment on the part of permittees to construct, monitor and ensure the success of mitigation projects;
- Small size and isolated location of most on-site mitigation projects (i.e., “postage stamp” mitigation);
- Rigid “type-for-type” regulatory requirements (i.e., the impacted wetland must be replaced with same type of wetland);
- Poor monitoring, follow-up documentation, and reporting of mitigation project success or failure.

Since the adoption of the mitigation bank rule in 1994, permittee-responsible mitigation has become somewhat rare. Today, mitigation banks and ROMAs have become the dominant compensatory mitigation mechanisms.

8.1.2 Mitigation Banks

Florida officially adopted mitigation banking in 1994 with the passage of the Mitigation Bank Statute, 373.4136, F.S., and the adoption of the Mitigation Bank Rule, 62-342, F.A.C. Mitigation banking is a practice in which an environmental enhancement or restoration project is conducted by a public agency or private entity (“banker”) to provide mitigation for unavoidable wetland impacts within a defined region (mitigation service area). Mitigation banks are authorized by a state permit, issued by either a Water Management District or the FDEP; and by the U.S. Army Corps of Engineers as a Mitigation Bank Instrument (MBI). The bank is the site itself, and the currency sold by the banker to the impact permittee is a credit, which represents the wetland ecological value equivalent to the complete restoration of one acre. The number of potential credits permitted for the bank and the credit debits required for impact permits are determined by the permitting agencies. The permittee purchases credits from the mitigation bank to mitigate for wetland impacts, but transfers the responsibility for implementation and success of the mitigation to the owner/manager of the bank.

The Uniform Mitigation Assessment Method (UMAM) was established to fulfill the mandate of subsection 373.414(18), F.S., which requires the establishment of a uniform mitigation assessment method to determine the amount of mitigation needed to offset adverse impacts to wetlands and other surface waters and to award and deduct mitigation bank credits. UMAM provides a standardized procedure for assessing the ecological functions provided by wetlands and other surface waters, the amount that those functions are reduced by a proposed impact, and the amount of mitigation necessary to offset that loss. This standardized methodology is also used to determine the degree of improvement in ecological value of proposed mitigation bank activities. The UMAM evaluates functions through consideration of an ecological community's current condition, hydrologic connection, uniqueness, location, fish and wildlife utilization, time lag and mitigation risk.

8.1.3 Regional Offsite Mitigation Areas

Chapter 373.4135, F.S. defines the framework for the establishment and management of Regional Offsite Mitigation Areas (ROMAs), which are environmental enhancement projects conducted by the FDEP, a Water Management District, or a local government that serve as mitigation for multiple impact projects. Impact permit applicants pay money to the ROMA sponsor, and the collected funds are used toward the implementation of the larger mitigation project. ROMA's that serve as mitigation for more than 5 permits or 35 acres of impact are operated under a Memorandum of Agreement (MOA), similar to a state mitigation bank permit.

The MOA must identify: the mitigation site(s); describe the work that will be conducted on the site(s), including a timeline for completing the work; define a geographic service area; provide environmental success criteria, monitoring and long-term management plans; and assess credit potential. In addition, ROMA instruments must ensure that mitigation costs provide for the full cost accounting of the project, including the project activities, land costs, and administration. Funds received for a ROMA project may only be used for that project, and no other purpose.

Although the rules governing the establishment and management of ROMAs allow for in lieu fee payments by private permittees for the mitigation of development impacts, the vast majority of ROMAs have been established by local governments to mitigate wetland impacts related to their own infrastructure improvements. Private permittees generally have relied upon private mitigation banks to meet their compensatory mitigation requirements. However, due to the limited number of local mitigation banks in south Florida, some local governments there have integrated ROMAs with in-lieu fee programs whereby private permittees can purchase mitigation credits in advance for wetland impacts anticipated as part of planned development projects.

8.1.4 In-Lieu Fee Programs

An in-lieu fee program involves the restoration, establishment, enhancement and/or preservation of aquatic resources through funds paid to a government or non-profit natural resources management entity to satisfy compensatory mitigation requirements for permits. An in-lieu fee program sells "advance credits" to permittees who purchase these credits in lieu of performing mitigation themselves (i.e., permittee-responsible mitigation). The legal obligation to provide compensatory mitigation is then transferred to the sponsor of the in-lieu fee program upon receipt of funds for sales of wetland and/or stream credits in a service area(s).

In Florida, the most significant in-lieu fee program is the Florida Department of Transportation (FDOT) mitigation program, established in 1995 under Chapter 373.4137, Florida Statutes (F.S.). This statute requires the FDOT to provide advance mitigation funding that is distributed statewide to pay for mitigation for various projects. FDOT annually provides an inventory of anticipated wetland impacts to the Water Management Districts, and escrows a specified amount of money (adjusted annually) for the mitigation needed to offset each acre of impact. This money is then used to reimburse the Water Management Districts for their direct costs to conduct the mitigation planning, design, construction, maintenance and monitoring. The intent of the FDOT mitigation program was to provide for more cost-effective and ecologically beneficial mitigation by utilizing regional, long-term planning rather than project-by-project permit decisions. The program has allowed transportation projects to be fast-tracked with respect to wetland regulatory permitting.

8.1.5 Linkage to Publicly-Owned Conservation Lands

Mitigation banks, ROMAs, and in-lieu fee programs all conduct consolidated wetland and upland habitat protection and restoration activities; however, under current practices, there are several important differences between these three off-site mechanisms. First, mitigation banks are usually, though not always, operated by private entities for profit; whereas, in-lieu fee and ROMA programs are generally administered by state or local government units, or non-profit organizations. Second, in-lieu fee and ROMA programs rely on fees collected from permittees to initiate compensatory mitigation projects, while mitigation banks usually rely on private investment for initial financing.

Third, and most importantly, ROMAs and mitigation banks must achieve certain milestones and approvals upfront - including site selection, conceptual plan development, and wetland credit value - and can generally sell most of their wetland credits only after the physical construction of compensation sites has begun. In contrast, in-lieu fee programs generally initiate compensatory mitigation projects only after collecting fees, and there has often been a substantial time lag between permitted impacts and the physical construction of compensatory mitigation projects.

The evolution of these third-party off-site mitigation mechanisms over the past two decades has streamlined the wetland regulatory process for both public and private sector permittees, and created a great deal of flexibility in how mitigation is funded and implemented. These mechanisms have allowed state, local and regional governments to better coordinate restoration and mitigation activities. However, there has never been a direct linkage between these mechanisms and publicly-owned conservation lands. That is, lands purchased by local governments for conservation purposes were expressly prohibited from being used for the establishment of ROMAs or in-lieu fee mitigation programs. In other words, the enhancement and/or restoration of conservation lands purchased by local governments could only be funded by general revenues or grants procured by the owning local government.

This situation changed in 2019 when the Florida Legislature amended Chapter 373.4135, F.S. to allow public entities to permit and sell credits to fund the enhancement and/or restoration of their conservation lands, even if those land were purchased with conservation dollars. Subsection (b) of this statute is excerpted below:

> *(b) The Legislature recognizes the importance of mitigation banks as an appropriate and allowable mitigation alternative to permittee-responsible mitigation. However, the Legislature also recognizes that certain timing and geographical constraints could result in the unavailability of mitigation bank*

> *credits for a certain project upon completion of the project's application. If state and federal mitigation credits are not available to offset the adverse impacts of a project, a local government may allow permittee-responsible mitigation consisting of the restoration or enhancement of lands purchased and owned by a local government for conservation purposes, and such mitigation must conform to the permitting requirements of s. 373.4136. Except when a local government has allowed a public or private mitigation project to be created on land it has purchased for conservation purposes pursuant to this paragraph, a governmental entity may not create or provide mitigation for a project other than its own unless the governmental entity uses land that was not previously purchased for conservation and unless the governmental entity provides the same financial assurances as required for mitigation banks permitted under s. 373.4136.*

The amended statute further states: "Mitigation banks and offsite regional mitigation should emphasize the restoration and enhancement of degraded ecosystems and the preservation of uplands and wetlands as intact ecosystems rather than alteration of landscapes to create wetlands. This is best accomplished through restoration of ecological communities that were historically present."

These amendments allow for greater flexibility by state, regional, and local governments in attaining watershed-level goals, as well as for potentially improved coordination between habitat restoration and compensatory mitigation activities. In essence, this new mechanism creates incentives for local governments to cooperate with private and public entities seeking mitigation credits by allowing those entities – at their cost - to enhance and restore degraded habitats on publicly-owned conservation lands, and to receive mitigation credits in return for that work.

This mechanism has the potential to accelerate both the public acquisition and enhancement and restoration of restorable habitats on lands targeted for conservation. For example, a local government could purchase a privately-owned golf course for conservation purposes, and then fund the restoration of the site by contracting with, or selling credits to, private entities seeking mitigation opportunities in the respective service area. Without this mechanism, the local government would be primarily dependent on the use of public dollars to fund the enhancement and restoration activities.

Critics of compensatory mitigation often state that it reduces the avoidance and minimization of environmental impacts, and results in an overall net loss of wetlands. However, federal Clean Water Act regulations are designed to attain a "no net loss" of wetlands (NRC, 2001). Furthermore, the implementation of the Florida Uniform Mitigation Assessment Method (UMAM) in 2005 (373.414(18), F.S.), provided a standardized procedure for assessing the ecological functions provided by wetlands and other surface waters, the amount that those functions are reduced by a proposed impact, and the amount of mitigation necessary to offset that loss. This standardized methodology is also used to determine the degree of improvement in ecological value of proposed mitigation bank activities. While wetlands are afforded these protections, other critical coastal habitats in the Tampa Bay watershed do not have the same level of "no net loss" regulations. Therefore, Tampa Bay resource managers have cautioned that when applying this approach, careful scrutiny should be employed to ensure that watershed-level habitat restoration targets are still following a recovery trajectory.

The results of habitat trend analysis presented in 2.5.2 show that for the period 1990-2017 there have been gains in the extent of both tidal wetlands (+12%) and freshwater wetlands (+2%) in the Tampa Bay watershed. Conversely, native upland habitats, which are for the most part not protected by federal or state regulations, suffered a substantial decline (-39%) over this same time period. These results indicate that public restoration efforts, in concert with that federal and state wetland regulatory programs and compensatory mitigation have been effective for wetland habitats, but that a coordinated watershed approach is needed to provide for improved protection of other Tampa Bay habitats of interest.

8.2 Development of a Coordinated Watershed Approach

Wetland impacts and associated compensatory mitigation projects authorized under wetland regulatory programs have historically been conducted independent of watershed-level planning and monitoring processes. This disconnect has contributed to fragmented implementation and inconsistent compliance monitoring of mitigation projects, as well as historically poor documentation of wetland losses and gains in the Tampa Bay watershed. However, if properly focused and coordinated, compensatory mitigation activities could potentially contribute significantly to the attainment of wetland habitat restoration goals and targets for the Tampa Bay estuarine system and its contributing watershed.

The TBEP is in a unique position to create a viable linkage between watershed-level planning goals for habitat restoration, and federal, state, and local wetland regulatory requirements for compensatory mitigation. Therefore, it is recommended that the TBEP pursue a federal-state-local-private partnership to provide the framework for the development of a coordinated approach to linking regulatory (compensatory mitigation) and resource management (publicly funded habitat enhancement, restoration, and establishment) programs in the Tampa Bay watershed.

The objective of this partnership would be to develop and implement a coordinated watershed approach to directing conservation land acquisition and compensatory mitigation activities to priority sites and projects identified in this Tampa Bay Habitat Master Plan Update, and future updates. In addition, while this Tampa Bay Habitat Master Plan Update is focused primarily on coastal and estuarine habitats, the proposed partnership would expand the scope and reach of habitat restoration planning up into the watershed to include both contiguous and isolated freshwater wetland habitats, as well as native upland habitats. In this manner, publicly-funded conservation land acquisition and habitat restoration programs would be coordinated with regulatory compensatory mitigation activities throughout the entire watershed, thus optimizing available resources directed towards attainment of adopted watershed-level wetland habitat restoration goals, and tracking losses through permitted activities.

It is recommended that this partnership be developed through the execution of an appropriate Memorandum of Agreement or Understanding (MOA and/or MOU) vehicle between the partners. Using the existing Tampa Bay Nitrogen Management Consortium as an effective model, the partnership could be formalized as the “Tampa Bay Habitat Management Consortium.” Recommended partners include, but are not limited to:

- Tampa Bay Estuary Program (lead entity);
- U.S. Army Corps of Engineers Tampa Regulatory Office;
- Florida Department of Environmental Protection;
- Florida Fish and Wildlife Conservation Commission;
- Southwest Florida Water Management District;

- Tampa Bay Water;
- Hillsborough County;
- Pinellas County;
- Manatee County;
- Pasco County;
- Smaller municipal governments (where practical);
- EPA Region IV Wetland Program (as advisor);
- Private mitigation banks; and
- Owners/managers of large land holdings in the watershed (e.g., port authorities; water authorities, electric utilities, agricultural interests, mining interests, etc.).

As envisioned, the Tampa Bay Habitat Management Consortium would serve as a coordinating body for watershed-level conservation land acquisition, as well as habitat management, enhancement, and restoration activities. Key functions of the Consortium would include the following.

- Develop quantitative wetland habitat protection and restoration targets for each bay segment and major basin in the watershed. Targets would be developed for both estuarine and freshwater habitats, including contiguous and isolated freshwater wetlands. Targets would be based on the extent and location of historic wetland losses, current functional restoration needs, and restoration potential.
- Identify and rank priority conservation land acquisition sites in each bay segment and major basin in the watershed, using existing regional information compiled by Florida Natural Areas Inventory (e.g., CLIP data layer discussed herein), as well as other local information. The determination of priority sites would be based on habitat protection and restoration targets established for the watershed, as well as by bay segment and major basin, where feasible and appropriate. The priority site list would be updated annually by the Tampa Bay Habitat Management Consortium.
- Identify and rank priority habitat restoration sites in each bay segment and major basin in the watershed, using local site-specific information. The determination of priority restoration sites would be based on habitat restoration targets established for the watershed, as well as by bay segment and major basin, where feasible and appropriate. The priority site list would be updated annually by the Tampa Bay Habitat Management Consortium.
- Refine and maintain a comprehensive watershed-level database of publicly-funded habitat restoration projects. This database would build on the existing habitat restoration database (**Appendix A**), and include polygon geospatial data for both site-level and linear projects (e.g., living shorelines), including appropriate metadata.
- Develop conceptual restoration plans for select high priority sites on publicly-owned conservation lands to determine the potential “lift” using the UMAM functional assessment methodology. This information could be used to develop credits on publicly-owned conservation lands.

- Develop and maintain a comprehensive watershed-level database for documenting permitted wetland losses and wetland gains achieved through both compensatory mitigation and publicly-funded restoration.
- Develop and maintain a comprehensive watershed-level database and ledger of mitigation credits available in mitigation banks, ROMAs, and publicly-owned conservation lands in the Tampa Bay watershed.
- Provide a clearinghouse for potential permit applicants to vet proposed major projects and to obtain initial comments and recommendations from Consortium members on how to reduce impacts and optimize mitigation credits.
- Provide a forum for sharing various habitat restoration techniques and best management practices implemented both locally and elsewhere.
- Develop a framework for implementing the concept of "rolling easements" to incentivize the protection and reservation of coastal uplands in the coastal stratum of Tampa Bay.

The potential benefits of a coordinated watershed-level approach linking publicly funded habitat protection and restoration activities with compensatory mitigation are worthy of further exploration. The Tampa Bay Nitrogen Management Consortium has been extremely successful at breaking down historical regulatory barriers related to "pollution trading," and has fostered a voluntary, non-regulatory approach to reducing nitrogen loads to Tampa Bay. Through the implementation of a Tampa Bay Habitat Management Consortium, similar benefits could be achieved with respect to optimizing and improving the cost-effectiveness of habitat protection, restoration and mitigation activities in the watershed.

Section 9.0: References

Anastasiou, C., J. Kunzelman, and J.O.R. Johansson. 2010. Understanding the underwater light field and its relevance to seagrass sustainability and resource management in Tampa Bay. Pp 97-104. In: Cooper, S.T., (ed.). Proceedings, Tampa Bay Areas Scientific Information Symposium, BASIS 5: 20-23 October 2009. St. Petersburg, FL. 538 pp.

Ash, T., and R. Runnels. 2003. Hard bottom habitats: an overview of mapping and monitoring needs on epibenthic communities in Tampa Bay, Florida. In: S.F. Treat (ed.), Proceedings of the Tampa Bay Area Scientific Information Symposium (BASIS 4), pp. 179-182. Tampa Bay Estuary Program, St. Petersburg, FL.

Bertness, M.D. 1985. Fiddler Crab Regulation of *Spartina alterniflora* Production on a New England Salt Marsh. Ecology. Vol. 66; Issue 3. Pgs. 1042-1055.

Boland, C.D., and K. O'Keife. 2018. Living Shoreline Suitability Model for Tampa Bay: A GIS Approach. Final Report to the Gulf of Mexico Alliance, Habitat Resources Priority Issue Team. Florida Fish and Wildlife Conservation Commission, Saint Petersburg, FL, USA. 49 pp.

Boswell, J.G., J.A. Ott, A. Birch, and D. Cobb. 2012. Oyster Habitat Restoration Plan. Charlotte Harbor National Estuary Program Technical Report. 91 pp.

Burdige, D.J., X. Hu, and R.C. Zimmerman. 2010. The widespread occurrence of coupled carbonate dissolution/re-precipitation in surface sediments on the Bahamas Bank. American Journal of Science. 310:492-521.

Burke, M. and M. Amaral. 2020. 2021-2025 Strategic Plan. Technical Report #12-20 of the Tampa Bay Estuary Program. 19 pp.

Burke, M., L. Carnahan, K. Hammer-Levy, and G. Mitchum. 2019. Recommended Projections of Sea Level Rise for the Tampa Bay Region (Update). Technical Report #05-19 of the Tampa Bay Estuary Program by the Tampa Bay Climate Science Advisory Panel. 14 pp.

Calil J., M.W. Beck, M. Gleason, M. Merrifield, K. Klausmeyer, and S. Newkirk. 2015. Aligning Natural Resource Conservation and Flood Hazard Mitigation in California. PLoS One: 10(7); e0132651. doi:10.1371/journal.pone.0132651.

Coen, L.D., R.D. Brumbaugh, D. Bushek, R. Grizzle, M.W. Luckenbach, M.H. Posey, S.P. Powers, and G. Tolley. 2007. Ecosystem services related to oyster restoration. Marine Ecology Progress Series: 341:303-307.

Comeaux, R.S., M.A. Allison, and T.S. Bianchi. 2012. Mangrove expansion in the Gulf of Mexico with climate change: Implications for wetland health and resistance to rising sea levels. Estuarine, Coastal and Shelf Science 96:81-95.

CSA Ocean Sciences. 2019. Tampa Bay Hard Bottom Mapping Project. Tampa Bay Estuary Program Technical Report #08-19. 47 pp.

Dixon, L.K. and J.R. Leverone. 1995. Light requirements of *Thalassia testudinum* in Tampa Bay, Florida. Prepared for: Southwest Florida Water Management District SWIM Program. Prepared by: Mote Marine Laboratory. 219 pp.

Duarte, C.M., N. Marba, E. Garcia, J.W. Fourqurean, J. Beggins, C. Barron, and E.T. Apostolaki. 2010. Seagrass community metabolism: Assessing the carbon sink capacity of seagrass meadows. Global Biogeochemical Cycles. 24, doi:10.1029/2010GB003793. 8 pp.

Eisma, D. 1998. Intertidal deposits: river mouths, tidal flats, and coastal lagoons. CRC Press, Marine Sciences Series. 507 pp.

Eleuterius, L.N. and C.K. Eleuterius. 1979. Tide levels and salt marsh zonation. Bull. Mar. Sci. 29(3): 394-400.

Estevez, E.D., R.E. Edwards, and D.M. Hayward. 1991. An ecological overview of Tampa Bay's tidal rivers. In: S.F. Treat and P.A. Clark (eds.), Proceedings of the Tampa Bay Area Scientific Information Symposium (BASIS 2), pp. 263-276. TEXT Publishing, Tampa, FL.

Florida Department of Environmental Protection (FDEP), Mining and Mitigation Program. 2019. Unpublished geospatial data for non-mandatory and mandatory reclaimed mined lands.

Florida Department of Environmental Protection (FDEP), Division of Recreation and Parks. 2004. Alafia River State Park – Unit Management Plan. 43 pp. plus appendices.

Florida Department of Environmental Regulation (FDER). 1991. Report of the effectiveness of permitted mitigation pursuant to Section 403.918(2)(b), Florida Statutes. Final report. Department of Environmental Regulation. Tallahassee, FL.

Florida Department of Transportation (FDOT). 1999. Florida Land Use, Cover and Forms Classification System. FDOT Surveying and Mapping Office Geographic Mapping Section. Third Edition. 95 pp.

Florida Natural Areas Inventory (FNAI). 2020. Florida Conservation Lands (FLMA) GIS dataset, March 2020. https://www.fnai.org/gisdata.cfm.

Florida Wildlife Corridor. 2020. Website map publication. http://floridawildlifecorridor.org/maps/.

Fonseca, M.S. and J.A. Cahalan. 1992. A preliminary evaluation of wave attenuation by 4 species of seagrass. Estuarine Coastal and Shelf Science. 35:565–576.

Fourqurean, J.W., C.M. Duarte, H. Kennedy, N. Marba, M. Holmer, M.A. Mateo, E.T. Apostolaki, G.A. Kendrick, D. Krause-Jensen, K.J. McGlathery, and O. Searrano. 2012. Seagrass ecosystems as a globally significant carbon stock. Nature Geoscience DOI: 10-1038/NGEO1477. 5 pp.

Grabe, S.A., DJ. Karlen, C. Holden, B. Goetting, S. Markham, and Thomas Dix. 2005. Ecological Assessment of Selected Dredge Holes in Tampa Bay: Hydrographic Conditions, Sediment Contamination and Benthic Macroinvertebrates. Prepared by the Environmental Protection Commission of Hillsborough County. Tampa Bay Estuary Program Technical Report #04-05a. 105 pp.

Greening, H., A. Janicki. 2006. Toward Reversal of Eutrophic Conditions in a Subtropical Estuary: Water Quality and Seagrass Response to Nitrogen Loading Reductions in Tampa Bay, Florida, USA. Environmental Management. 38: 163–178.

Greening, H., L. Cross, and E. Sherwood. 2011. A Multiscale Approach to Seagrass Recovery in Tampa Bay, Florida. Ecological Restoration. 29: 82-93.

Greening, H.S, A. Janicki, A., and E.T. Sherwood. 2016. Seagrass recovery in Tampa Bay, Florida. In: The Wetland Book, eds. Finlayson, C.M., Everard, M., Irvine, K., McInnes, R., Middleton, B., van Dam, A., Davidson, N.C. pp. 1–12. Netherlands: Springer.

Griffen, L., and H. Greening. 2005. Tampa Bay Dredged Hole Habitat Assessment Project. Technical Report #04-05 of the Tampa Bay Estuary Program. 55 pp. plus appendices.

Greenman-Pedersen, Inc. (GPI). 2016. Channels A, G, and Rocky Creek Pilot Monitoring Project Report. Final report prepared for the Southwest Florida Water Management District. 59 pp.

Heck, K., Hays, G., & Orth, R. .2003. Critical evaluation of the nursery role hypothesis for seagrass meadows. Marine Ecology Progress Series. 253: 123-136.

Henningsen, 2003. The maturation and future of habitat restoration programs for the Tampa Bay estuarine ecosystem. In: S.F. Treat (ed.), Proceedings of the Tampa Bay Area Scientific Information Symposium (BASIS 4), pp. 165-170. Tampa Bay Estuary Program, St. Petersburg, FL.

Hilderbrand, R.M., A.C. Watts, and A.M. Randle. 2005. The myths of restoration ecology. Ecology and Society, 10(1):19.

Hobbs, R.J. 2007. Setting Effective and Realistic Restoration Goals: Key Directions for Research. Restoration Ecology; Vol. 15, Issue 2. Pgs. 354-357.

Holling, C.S. 1978. Adaptive Environmental Assessment and Management. John Wiley & Sons. ISBN 9781932846072. 402 pp.

Intergovernmental Panel on Climate Change (IPCC). 1996. Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analysis. Cambridge University Press, New York. 852 pp. plus appendices.

Janicki Environmental, Inc. and Mote Marine Laboratory. 2016. Southwest Florida Tidal Creeks Nutrient Study. Final Report submitted to the Sarasota Bay Estuary Program. Tampa Bay Estuary Program Technical Report #02-16. 82 pp.

Janicki Environmental and Mote Marine Laboratory. 2020. Southwest Florida Tidal Creeks: Nutrient Management Framework and Indicator Development. Final Report submitted to the Sarasota Bay Estuary Program. Tampa Bay Estuary Program Technical Report #13-19. 127 pp.

Janicki Environmental, 2020. Unpublished GIS data available from the Tampa Bay Estuary Program.

Jaap, W.C., and P. Hallock. 1990. Coral reefs. pp. 574-618 in R.L. Myers and J.J. Ewel (eds.), Ecosystems of Florida. University of Central Florida Press, Orlando.

Karlen, D.J., T.L. Dix, B.K. Goetting, S.E. Markam, K.W. Campbell and J.M. Jernigan. 2015. McKay Bay Dredge Hole Restoration Monitoring: Post-Restoration Benthic Sampling Final Report. Final Report prepared by the Environmental Protection Commission of Hillsborough County. Southwest Florida Water Management Work Order: 11POSOW1349. 37pp.

Karlen, D., B. Goetting, T. Dix, S. Markham, K. Campbell, J. Jernigan, J. Christian, A. Chacour, K. Martinez, L. Grossmann, and L. LaMonica. 2018. Tampa Bay Dredge Hole Project: Benthic Assessment, Final Report. Technical Report #03-18 of the Tampa Bay Estuary Program. Final report prepared for the Tampa Bay Environmental Restoration Fund (2015). Prepared by the Environmental Protection Commission of Hillsborough County. 105 pp.

Kaufman, K. 2017. Tampa Bay Environmental Restoration Fund Final Report: Hard Bottom Mapping and Characterization for Restoration Planning in Tampa Bay. Prepared by the Southwest Florida Water Management District. Tampa Bay Estuary Program Technical Report #04-17. 58 pp.

Kushlan, J.A. 1990. Freshwater marshes. pp. 324-363 in: R.L. Myers and J.J. Ewel (eds.), Ecosystems of Florida. University of Central Florida Press, Orlando.

La Peyre, M., J. Furlong, L.A. Brown, B.P. Piazza, and K. Brown. 2014. Oyster reef restoration in the northern Gulf of Mexico: Extent, methods and outcomes. Ocean & Coastal Management 89:20-28.

Lewelling, B.R., and R.W. Wylie. 1993. Hydrology and Water Quality of Unmined and Reclaimed Basins in Phosphate-Mining Areas, West Central Florida. U.S. Geological Survey Water-Resources Investigations: Report 9304002. 93 pp.

Lewis, R.R. III, and E.D. Estevez, 1988. The Ecology of Tampa Bay, Florida: An Estuarine Profile. U.S. Fish and Wildlife Service Biological Report 85 (7.18). 132 pp.

Lewis, R. R., and D. E. Robison. 1996. Setting priorities for Tampa Bay habitat protection and restoration: restoring the balance. Final report prepared by Mangrove Systems, Inc. and Coastal Environmental Services, Inc. Tampa Bay Estuary Program Technical Report #09-95. 241 pp.

Locker, S.D., 2005. Establishing Baseline Benthic Habitat Coverages in Faka Union and Fakahatchee Bays for Present and Future Environmental Studies. Final Report to South Florida Water Management District, Big Cypress Basin Board. 60 pp.

McCarthy, M.J., Merton, E.J., & Muller-Karger, F.E. 2015. Improved coastal wetland mapping using very-high 2-meter spatial resolution imagery. International Journal of Applied Earth Observation and Geoinformation, 40:11-18.

Moore, H.B., L. Davies, T. Fraser, R. Gore, and N. Lopez. 1968. Some biomass figures from a tidal flat in Biscayne Bay, Florida. Bulletin of Marine Science, Volume 18, Number 2, pp. 261-279.

National Oceanic and Atmospheric Administration (NOAA). 2015. Guidance for Considering the Use of Living Shorelines. Final guidance document prepared by the NOAA Living Shorelines Workgroup. 36 pp.

National Oceanic and Atmospheric Administration (NOAA). 2015. The Coastal Squeeze: Changing Tactic for Dealing with Climate Change. https://www.fisheries.noaa.gov/feature-story/coastal-squeeze-changing-tactics-dealing-climate-change.

Odum, E.P. 1971. Fundamentals of Ecology. Third edition. W.B. Saunders Company, Philadelphia, PA. 574 pp.

Oetting, J., T. Hoctor and M. Volk. 2016. Critical Lands and Waters Identification Project (CLIP): Version 4.0. Technical Report funded by the U.S. Fish and Wildlife Service. Florida Natural Areas Inventory, Florida State University. Tallahassee, FL. 140 pp.

O'Keife, K.W., D. Arnold, and D. Reed. 2006. Tampa Bay Oyster Bar Mapping and Assessment: Final Report to Tampa Bay Estuary Program. Tampa Bay Estuary Program Technical Publication #03- 06. Tampa, Florida. 38 pp.

Opperman, J. J., R. Luster, B.A. McKenney, M. Roberts, and A.W. Meadows, 2010. Ecologically Functional Floodplains: Connectivity, Flow Regime, and Scale. Journal of the American Water Resources Association (JAWRA) 46(2):211-226. DOI: 10.1111/j.1752-1688.2010.00426.

Pacowta, J., Johansson, J.O.R., Avery, W., and K. Hennenfent. 2010. Nearshore water quality and seagrass depth limits in Upper Tampa Bay, Florida. P. 117. In: Cooper, S.T., (ed.). Proceedings, Tampa Bay Areas Scientific Information Symposium, BASIS 5: 20-23 October 2009. St. Petersburg, FL. 538 pp.

PBS&J, Inc. 2001. Evaluation of Beneficial Reuse Alternatives for Lake Tarpon Discharge Water. Final report prepared for the Pinellas County Department of Environmental Management Water Resources Division. Authors: D. Robison and T. Farkas. 121 pp. plus appendices.

Price, R., D. Loy, and D. Robison. 2017. Critical Coastal Habitat Assessment: Baseline Monitoring Report. Tampa Bay Estuary Program Technical Report #08-17. 131 p.

Raabe, E., L.C. Roy, and C. McIvor. 2012. Tampa Bay Coastal Wetlands: Nineteenth to Twentieth Century Tidal Marsh-to-Mangrove Conversion. Estuaries and Coasts 35:1145-1162. DOI: 10.1007/s12237-012-9503-1.

Radabaugh, K.R, R.P. Moyer, G. Raulerson, and E. Sherwood. 2017. Critical Coastal Habitat Assessment Training Manual. 2017. Technical Report #06-17 of the Tampa Bay Estuary Program. Prepared by the FWCC-FWRI. 29 pp.

Radabaugh, K.R., R.P. Moyer, A.R. Chappel, C.E. Powell, I. Bociu, B.C. Clark, and J.M. Smoak. 2018. Coastal Blue Carbon Assessment of Mangroves, Salt Marshes, and Salt Barrens in Tampa Bay, Florida, USA. Estuaries and Coasts. 41, 1496–1510.

Rains, M., S. Landry, V. Seidel, T. Crisman. 2012. Prioritizing Restoration Goals in the Tampa Bay Watershed. Final report submitted to the Tampa Bay Estuary Program. Tampa Bay Estuary Program Technical Publication #10-12. 74 pp.

Raulerson, G. 2017. Monitoring and Indicators Plan. Technical Report #10c-17 of the Tampa Bay Estuary Program. 19 pp.

Raulerson, G., A. Hershorin, D. Karlen, T. MacDonald, and A. Tyler-Jedlund. 2019. Tampa Bay Dredged Hole Assessment and Management Recommendations: 2019 Synthesis Report. Final report prepared for the Tampa Bay Environmental Restoration Fund. Tampa Bay Estuary Program Technical Report #02-19. 81 pp.

Rayer, S., and Y. Wang 2020. Projections of Florida Population by County, 2020–2045, with Estimates for 2019. Florida Population Studies 53, Bulletin 186. 9 pp.

Restore America's Estuaries (RAE), 2015. Living Shorelines: From Barriers to Opportunities, Restore America's Estuaries. Arlington, VA., 2015. 55 pp.

Ries, T. 2020. Tampa Bay Habitat Restoration - Best Management Practices Manual. Technical Report #08-20 of the Tampa Bay Estuary Program. Final report prepared by Environmental Science Associates. 60 pp. plus appendices.

Ries, T. and S. Scheda. 2014. Master Plan for the Protection and Restoration of Freshwater Wetlands in the Tampa Bay Watershed, Florida. Final report prepared by Scheda Ecological Associates. Tampa Bay Estuary Program Technical Report #05-14. 97 pp. plus appendices.

Robison, D.E. 2010. Tampa Bay Estuary Program Habitat Master Plan Update. Final report prepared by PBS&J. Tampa Bay Estuary Program Technical Publication #06-09. 153 pp. plus appendices.

Ruge, J.G. 1898. The oyster and oyster beds of Florida. Bull. U.S. Fish Commission – https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/fish-bull/fb17.27.pdf, accessed 7/7/2020.

Sargent, F.J., T.J. Leary, D.W. Crewz, and C.R. Kruer. 1995. Scarring of Florida's seagrasses: assessment and management options. FMRI Tech. Rep. TR-1. Florida Marine Research Institute, St. Petersburg, Florida. 37 pp. plus appendices.

Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M.Fogarty, M.A. Harwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate change impacts on U.S. coastal and marine ecosystems. Estuaries 25(2): 149-164.

Sheehan, L., S. Crooks, D. Robison, and D. Tomasko. 2016. Tampa Bay Blue Carbon Assessment: Summary of Findings. 2016. Final report prepared for the Tampa Bay Environmental Restoration Fund (2014) by ESA, Inc. for Restore America's Estuaries. Tampa Bay Estuary Program Technical Report #07-16. 331 pp.

Sherwood, E.T. 2004. Tampa Bay Dredge Hole Assessment Project: Fisheries Assessment Final Report. Prepared by the Florida Wildlife Research Institute. Tampa Bay Estuary Program Technical Report #04-05b. 237 pp.

Shumway, S.E. 1996. Natural environmental factors. The Eastern Oyster Crassostrea virginica. Edited by: V.S. Kennedy, R.I.E. Newell, R.I.E., A.F. Eble. College Park, Maryland: Maryland Sea Grant College Publication, 467-513.

Sim, S. and V. Mesev. 2014. Measuring and Modeling of Urban Growth and Its Impacts On Vegetation and Species Habitats in Greater Orlando, Florida," International Journal of Geospatial and Environmental Research 1:1-5.

Sprandel, J.A., D. Gore, and T. Cobb. 2000. Distribution of Wintering Shorebirds in Coastal Florida. Journal of Field Ornithology 71(4), 708-720.

Stout, J.P. 1984. Ecology of irregularly flooded salt marshes of the northeastern Gulf of Mexico: a community profile. USFWS Biological Report 85(7.1). 101 pp.

Southwest Florida Water Management District (SWFWMD). 2005. Minimum Flows for the Tampa Bypass Canal, Tampa, Florida. Prepared by the Southwest Florida Water Management District, Brooksville, FL. 129 pp.

Southwest Florida Water Management District (SWFWMD). 2014. Photo Interpretation Key for Land Use Classification. Updated: October 22, 2014.

Southwest Florida Water Management District (SWFWMD), 2015. Rock Ponds Ecosystem Restoration in Tampa Bay, FL. 2015. Technical Report #15-15 of the Tampa Bay Estuary Program. Final report prepared for the Tampa Bay Environmental Fund (2013) by the Southwest Florida Water Management District (Dr. B. Henningsen). 11 pp.

Southwest Florida Water Management District (SWFWMD), 2019a – *Seagrass in 2018.* Website public data: https://data-swfwmd.opendata.arcgis.com/datasets/seagrass-in-2018.

Southwest Florida Water Management District (SWFWMD), 2019b – Land Use Land Cover 2017. Website public data: https://data-swfwmd.opendata.arcgis.com/datasets/land-use-land-cover-2017.

Tampa Bay Estuary Program (TBEP). 2008. Tampa Bay Tidal Tributary Habitat Initiative: Integrated Summary Document. Tampa Bay Estuary Program Technical Report #02-08. Prepared by Tidal Tributaries Project Team (E. Sherwood editor). 83 pp.

Tampa Bay Regional Planning Council (TBRPC). 1986. Ecological Assessment, Classification, and Management of Tampa Bay Tidal Creeks. Final report prepared for the Florida Department of Environmental Regulation Coastal Management Grant Program. 174 pp.

Tampa Bay Partnership/Regional Research & Education Foundation (TBP/RREF). 2010. One Bay: Livable Communities – A Shared Regional Vision for Tampa Bay. Published by the Tampa Bay Regional Planning Council. 12 pp.

Titus, J.G., D.E. Hudgens, D.L. Trescott, M. Craghan4, W.H. Nuckols, C.H. Hershner, J.M. Kassakian, C.J. Linn, P.G. Merritt, T.M. McCue, J.F. O'Connell, J. Tanski, and J. Wang.

2009. State and local governments plan for development of most land vulnerable to rising sea level along the US Atlantic coast. Environmental Research Letters 044008 (doi: 10.1088/1748-9326/4/4/044008).

Tomasko, D. A. 2002. Status and trends of seagrass coverage in Tampa Bay, with reference to other Southwest Florida estuaries. Pages 11–20 in H.S. Greening (ed.), Seagrass management, It's not just nutrients! Tampa Bay Estuary Program. St. Petersburg, Florida.

Tomasko, D.A., Corbett, C.A., Greening, H.S., Raulerson, G.E. 2005. Spatial and temporal variation in seagrass coverage in southwest Florida: assessing the relative effects of anthropogenic nutrient load reduction and rainfall in four contiguous estuaries. Marine Pollution Bulletin. 50: 797–805.

Tomasko, D., Crooks, S., and D. Robison. 2016. Refining carbon sequestration estimates of seagrass meadows in Tampa Bay. Pp. 259-269. In: M. Burke (ed). Proceedings, Tampa Bay Area Scientific Information Symposium, BASIS 6. 28-30 September 2015. St. Petersburg, FL. 337 pp.

Tomasko, D., Alderson, M., Burnes, R., Hecker, J., Leverone, J., Gaulerson, G., and E. Sherwood. 2018. Widespread recovery of seagrass coverage in Southwest Florida (USA): Temporal and spatial trends and management actions responsible for success. Marine Pollution Bulletin 135: 112-1137.

Tyler-Jedlund, A. and T. MacDonald. 2018. Tampa Bay Dredge Hole Project: Fisheries Assessment, Final Report. 2018. Prepared by the Florida Fish & Wildlife Research Institute. Technical Report #02-18 of the Tampa Bay Estuary Program. Final report prepared for the Tampa Bay Environmental Restoration Fund (2015). 264 pp.

Unsworth, R.K.F., C.J. Collier, G.M. Henderson, and L.J. McKenzie. 2012. Tropical seagrass meadows modify seawater carbon chemistry: Implications for coral reefs impacted by ocean acidification. Environmental Research Letters 7 024026 (https://doi.org/10.1088/1748-9326/7/2/024026).

U.S. Environmental Protection Agency (EPA), 2020. Website publication: Climate Adaptations and Estuaries. https://www.epa.gov/arc-x/climate-adaptation-and-estuaries.

Virginia Institute of Marine Science (VIMS). 2009. Website publication: Wetland Threat. https://www.vims.edu/newsandevents/topstories/archives/2009/wetland_threat.php.

Von Holle, B., J.L. Irish, A. Spivy, J.F. Weishampel, A. Meylan, M.H., Godfrey, M. Dodd, S.H. Schweitzer, T. Keyes, F. Sanders, M.K. Chaplin, and N.R. Taylor. 2019. Effects of future sea level rise on coastal habitat. Journal of Wildlife Management 83(3):694–704.

Whitfield, W.K. Jr. 1975. Mining of Submerged Shell Deposits: History and Status of Regulation and Production of the Florida Industry. Fla. Mar. Res. Publ. No. 11. 49 pp.

Yates, K., Moyer, R., Moore, C., Tomasko, D., Smiley, N., Torres-Garcia, L., Powell, C., Chappel, A., and I. Bociu. 2016. Ocean acidification buffering effects of seagrass in Tampa Bay. Pp. 273-284. In: M. Burke (ed). Proceedings, Tampa Bay Area Scientific Information Symposium, BASIS 6. 28-30 September 2015. St. Petersburg, FL. 337 pp.

zu Ermgassen, P., B. Hancock, B. DeAngelis, J. Greene, E. Schuster, M. Spalding, and R. Brumbaugh. 2016. Setting objectives for oyster habitat restoration using ecosystem services: A manager's guide. The Nature Conservancy, Arlington VA. 76 pp.

zu Ermgassen, P.S.E., M.D. Spalding, M.D., and R.E. Grizzle. 2013. Quantifying the Loss of a Marine Ecosystem Service: Filtration by the Eastern Oyster in U.S. Estuaries. Estuaries and Coasts 36, 36–43.

Appendix A
Habitat Restoration Database

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-1	Howard Frankland West	1971		Estuarine			planting of red mangroves	planting of red mangroves		Enhancement	FDNR			0.01		27.941692	-82.549223
E-2	Terra Ceia Bird Key	1972		Estuarine			planting of red, black, and white mangroves	planting of red, black, and white mangroves		Enhancement	FDNR			0.003		27.616326	-82.565627
E-3	Mullet Key	1973		Estuarine			planting of red, black, and white mangroves	planting of red, black, and white mangroves		Enhancement	FDNR			0.03		27.647553	-82.715219
E-4	Fishhook Spoil	1974		Estuarine			planting of red mangroves	planting of red mangroves		Enhancement	FDNR			0.02		27.802673	-82.419169
E-5	Fishhook Spoil	1976		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.01		27.802673	-82.419169
E-6	Alafia Bank Sunken Island Extension-Phase 1	1978		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			2		27.844140	-82.419831
E-7	Alafia Bank Sunken Island Extension-Phase 2	1979		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.1		27.844140	-82.419831
E-8	Alafia Bank Sunken Island Extension-Phase 3	1979		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			2		27.846636	-82.419831
E-9	Palm River	1979		Estuarine			planting of Spartina alterniflora, Paspalum	planting of Spartina alterniflora, Paspalum		Enhancement	FDNR			0.17		27.941669	-82.408085
E-10	Alafia Bank Sunken Island Extension-Phase 4	1980		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.1		27.846636	-82.419831
E-11	Channel A	1980		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			2		27.999111	-82.616707
E-12	E.G. Simmons Park	1980		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			1.98		27.744798	-82.472225
E-13	Spoil Island CMDA-2D	1985		Estuarine			Planting of Spartina alterniflora			Enhancement	TPA			10		27.873951	-82.431234
E-14	Hendry Delta	1986		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.05		27.625461	-82.565525
E-15	Pinellas Point	1986		Estuarine			planting of Spartina alterniflora, red, white, and black mangroves	planting of Spartina alterniflora, red, white, and black mangroves		Enhancement	FDNR			0.04		27.700178	-82.652524
E-16	Regatta Point	1986		Estuarine			planting of Spartina	planting of Spartina		Enhancement	FDNR			0.03		27.511810	-82.576338
E-17	Apollo Beach Seawall	1987		Estuarine			planting of red mangroves	planting of red mangroves		Enhancement	FDNR			0.01		27.795975	-82.419831
E-18	Hendry Delta	1987		Estuarine			planting of Spartina alterniflora, red mangroves	planting of Spartina alterniflora, red mangroves		Enhancement	FDNR			0.1		27.652461	-82.565525
E-19	Largo Narrows Park	1987		Estuarine			planting of Spartina, mangroves	planting of Spartina, mangroves		Enhancement	FDNR			0.15		27.841342	-82.839250
E-20	Little Bird Key/Boca Ceiga	1987		Estuarine			planting of red mangroves	planting of red mangroves		Enhancement	FDNR			0.015		27.792967	-82.777867
E-21	Pinellas Point	1987		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.03		27.700178	-82.652524
E-22	Port Manatee (SR 92)	1987		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.05		27.634717	-82.573020
E-23	Rattlesnake Key (SR 96)	1987		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.05		27.579701	-82.608605
E-24	Regatta Point	1987		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.01		27.511810	-82.576338
E-25	Alafia Bank Bird Island	1988		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.06		27.848224	-82.405612
E-26	Hendry Delta	1988		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.15		27.625461	-82.565525
E-27	North Sunshine Skyway	1988		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			0.05		27.701470	-82.678273
E-28	Pinellas Point	1988		Estuarine			planting of red mangroves	planting of red mangroves		Enhancement	FDNR			0.05		27.700178	-82.652524
E-29	Regatta Point	1988		Estuarine			planting of Spartina alterniflora, white mangroves	planting of Spartina alterniflora, white mangroves		Enhancement	FDNR			0.02		27.511810	-82.576338
E-30	Alafia Bank Bird Island	1989		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.2		27.849760	-82.405660
E-31	Maximo Park	1989		Estuarine			planting of Spartina alterniflora, red mangroves	planting of Spartina alterniflora, red mangroves		Enhancement	FDNR			0.05		27.710042	-82.683665
E-32	Green Key	1990		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.03		27.818312	-82.399176
E-33	South Bayshore Boulevard	1990		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	SWFWMD-SWIM			1.5		27.874716	-82.486776
E-34	Terra Ceia Bird Key - Nina Griffith Washburn Bird Sanctuary	1990		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.1		27.552333	-82.600119
E-35	Whiskey Stump Key	1990		Estuarine			planting of Spartina alterniflora, 2,000 units	planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.5		27.813016	-82.402467

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-36	Port Manatee Parcel Restoration Project	1992		Mix (estuarine, freshwater, and upland)			Marsh and mangrove restoration, exotic plant removal, upland restoration	Exotic removal and restoration		Enhancement	TECO			700		27.634717	-82.573020
E-37	Abercrombie Park	1997		Upland			Exotic removal, planting of native species			Enhancement	City of St. Petersburg Parks Department			11		27.806242	-82.756938
E-38	Skyway Jacks	1998		Estuarine			planting of Spartina alterniflora	planting of Spartina alterniflora		Enhancement	FDNR			1		27.705961	-82.680808
E-39	Coquina Key Park	1999		Estuarine			Exotic removal			Enhancement	City of St. Petersburg Parks Department			1		27.737405	-82.631126
E-40	Desoto Park And Trailer Park In NW McKay Bay	1999		Estuarine			primarily a stormwater improvement project but some native plants installed			Enhancement	City of Tampa	SWFWMD		1		27.947546	-82.428339
E-41	Rocky/Brushy (Sheldon Road off Sheldon north of Fountain Avenue)	1999		Freshwater			Establishment of freshwater forested wetland	Control of exotics/invasive plants as Maintenance		Enhancement	Hillsborough County			0.955		28.011780	-82.580634
E-42	Tampa Bay Oil Spill - Boca Ciega Bay (Bird Island Salt Marsh Planting)	1999		Estuarine			marsh plants installed			Enhancement	NOAA			0.1		27.796500	-82.766500
E-43	Tampa Bay Oil Spill - Boca Ciega Bay (Cross Bayou Mangrove Restoration)	1999		Estuarine			marsh plants installed			Enhancement	NOAA			4.8		27.835000	-82.760000
E-44	Tampa Bay Oil Spill - Boca Ciega Bay (Turtle Crawl Point Saltmarsh Planting)	1999		Estuarine			Planting of Spartina alterniflora			Enhancement	NOAA			1.5		27.799700	-82.771200
E-45	Peri Island Salt Marsh Restoration	2000		Estuarine			marsh plants installed			Enhancement	Tampa Bay Watch			1		27.810800	-82.795400
E-46	Spoil Island Boca Ciega Bay Salt Marsh Restoration	2000		Estuarine			Planting of Spartina alterniflora			Enhancement	Tampa Bay Watch			1		27.816000	-82.798100
E-47	Fort Brooke Salt Marsh Restoration	2001		Estuarine			Planting of Spartina alterniflora			Enhancement	City of Tampa	NOAA, TBW, SWFWMD-SWIM		0.5		27.941700	-82.458300
E-48	Grandview Park	2001		Estuarine			Exotic removal			Enhancement	City of St. Petersburg Parks Department			2.5		27.736459	-82.640105
E-49	MacDill Airforce Base Salt Marsh Restoration	2001		Estuarine			Planting of Spartina alterniflora			Enhancement	Tampa Bay Watch			3		27.821500	-82.474700
E-50	Cypress Point Park Restoration	2002		Upland			Coastal upland enhancement			Enhancement	City of Tampa			12.7		27.950873	-82.541804
E-51	Dog Leg Key	2002		Estuarine			Planting of Spartina alterniflora	Planting of Spartina alterniflora		Enhancement	FDEP Aquatic Preserves			0.01		27.802259	-82.761683
E-52	E.G. Simmons Park Salt Marsh Restoration: Phase 1	2002		Estuarine			Planting of Spartina alterniflora			Enhancement	Tampa Bay Watch	NOAA		1.5		27.973100	-82.573600
E-53	Mckay Bay Nature Park	2002		Upland			Upland restoration, exotic restoration			Enhancement	City of Tampa Parks and Recreation Department			5		27.949402	-82.418145
E-54	Rocky/Brushy (Sheldon Road at Memorial Highway)	2002		Estuarine			Establishment of brackist forested wetland	Control of exotics/invasive plants as Maintenance		Enhancement	Hillsborough County			62		27.999670	-82.583789
E-55	Tarpon Key Salt Marsh Restoration	2002		Estuarine			intertidal wetland along shoreline of Southwest side of island	habitat establishment- Spartina alterniflora planted		Enhancement	USFWS			2.5		27.665612	-82.691069
E-56	Terra Ceia Aquatic and Buffer Preserve: Terra Ceia Uplands: Phase 1	2002		Upland			restoration of coastal uplands by clearing, mulching, planting, invasive removal and replanting along Terra Ceia Bay	Exotic removal, planting		Enhancement	SWFWMD-SWIM			121.3		27.597167	-82.547546
E-57	Terra Ceia Aquatic and Buffer Preserve: Terra Ceia Uplands: Phase 2	2002		Upland			Exotic removal, planting	Exotic removal, planting		Enhancement	SWFWMD-SWIM			28		27.587675	-82.568899
E-58	Whiskey Stump Key Salt Marsh Restoration	2002		Estuarine			Erosion control	Planting of Spartina alterniflora		Enhancement	Audubon of Florida			0.01		27.814200	-82.401900
E-59	Cockroach Bay Island Exotic Plant Removal	2003		Upland			primarily planting of estuarine and upland plants			Enhancement	Hillsborough County Environmental Lands and Acquisition			50		27.683000	-82.508000

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-60	E.G. Simmons Park Salt Marsh Restoration: Phase 2	2003		Estuarine			Planting of Spartina alterniflora			Enhancement	Tampa Bay Watch			1		27.733300	-82.466700
E-61	Ft. DeSoto Park Campground Salt Marsh Restoration	2003		Estuarine			Planting of Spartina alterniflora	Substrate modification, planting		Enhancement	Tampa Bay Watch			2		27.636700	-82.720300
E-62	Brooker Creek Preserve - Mt. Brooker exotics removal	2004		Upland	21375		exotics removal (Brazilian pepper, air potato removed by spraying)			Enhancement	Pinellas County	Suncoast Grant (FDEP), NOAA		100		28.065278	-82.675000
E-63	Cargill Park Salt Marsh Planting	2004		Estuarine			marsh plants installed			Enhancement	Hillsborough County			0.01		27.864400	-82.382400
E-64	Davis Island Beach Boat Ramp	2004		Estuarine			Planting of Spartina alterniflora			Enhancement	City of Tampa Parks and Recreation Department	TBW		0.5		27.910792	-82.447351
E-65	North Parcel West A	2004		Mix (estuarine and upland)			Parcel preservation and site specific land management plan, to restore ditched oligohaline marsh areas and coastal upland communities	Ditchblocks, prescribed burn, exotic plant species management, native tree and herb plantings		Enhancement	Mosaic			123.9		27.889939	-82.403398
E-66	Riverview Center	2004		Freshwater			marsh plants installed			Enhancement	FDEP			0.1		27.867207	-82.325954
E-67	Weedon Island Preserve Exotic Plant Removal	2004		Estuarine			exotic removal (Brazilian pepper, Australian Pine, Punk by spraying/burning)	exotic removal (Brazilian pepper, Australian Pine, Punk by spraying/burning)		Enhancement	Pinellas County			30		27.846975	-82.609493
E-68	Williams Park Salt Marsh Planting	2004		Estuarine			Planting of Spartina alterniflora	Planting of Spartina alterniflora		Enhancement	Hillsborough County Parks & Recreation			0.01		27.860900	-82.385100
E-69	Alafia River Boat Ramp	2005		Estuarine			Removal of exotic vegetation	Removal of exotic vegetation		Enhancement	Hillsborough County Parks & Recreation			1		27.860296	-82.384421
E-70	Alderman's Ford Park	2005		Freshwater			Invasive Removal - Vegetation	Invasive Removal _ Vegetation		Enhancement	Hillsborough County Parks & Recreation			75		27.862614	-82.144580
E-71	Brooker Creek Preserve-Flatwoods Restoration	2005		Upland			palmetto reduction to increase flora/fauna diversity: rollerchopped areas			Enhancement	Pinellas County			26		28.125278	-82.655000
E-72	Cockroach Bay Tidal Creek Marsh Planting	2005		Estuarine			Planting of Spartina alterniflora			Enhancement	Tampa Bay Watch			4.6		27.676500	-82.515100
E-73	CSX MacDill/Port Tampa	2005		Estuarine	220000		exotic removal (Brazilian pepper), restore mosquito ditches (project in planning phase)			Enhancement	Hillsborough County	City of Tampa		220	7920	27.948088	-82.424804
E-74	Largo Central Park	2005		Mix (freshwater and upland)	425000		freshwater wetlands and uplands	freshwater wetlands and uplands		Enhancement	City of Largo	SWFWMD-SWIM, USEPA, FPC, PCEF, Shell		22.5		27.913830	-82.776859
E-75	North Parcel East A	2005		Freshwater			Remove brazilian pepper thickets, restore natural hydrology, and promote native plant community development in historically connected freshwater wetland	Ditchblocks, exotic species mulching and herbicide treatment, native tree planting		Enhancement	Mosaic			12.8		27.889773	-82.398876
E-76	North Parcel West B	2005		Freshwater			Parcel preservation and site specific land management plan, to control exotic species coverage preserve native habitats.	prescribed burn, exotic plan species control.		Enhancement	Mosaic			123.9		27.881813	-82.397830

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E-77	Pinellas County Adopt-A-Pond Pilot Project	2005		Freshwater			freshwater pond planting			Enhancement	Pinellas County Department of Environmental Management			10.159		27.895800	-82.708300
E-78	Tampa Bay Oil Spill - Pinellas County (War Veterans Memorial Park Oyster Reef)	2005		Estuarine			marsh plants installed			Enhancement	Pinellas County			0.4		27.802278	-82.774442
E-79	Tampa Bay Oil Spill - Treasure Island Dune Vegetation Restoration	2005		Upland			marsh plants installed			Enhancement	FDEP Aquatic Preserves			0.9		27.755000	-82.764900
E-80	Upper Tampa Bay Park	2005		Freshwater			Removal of exotic vegetation - Brazilian pepper, Melaluca, Chinese tallow	Removal of exotic vegetation - Brazilian pepper, Melaluca, Chinese tallow		Enhancement	Hillsborough County Parks & Recreation			75		28.016907	-82.632400
E-81	Ben T. Davis Park	2006		Estuarine			Planting with native vegetation			Enhancement	City of Tampa				200	27.971297	-82.580877
E-82	Brooker Creek Preserve-Education Center Restoration	2006		Freshwater	51000		vegetation planting			Enhancement	Pinellas County			2		28.132053	-82.658019
E-83	City of Clearwater Exotic and Invasive Species Project - Cliff Stephens	2006		Freshwater	35567		Invasive Removal – Vegetation	Invasive Removal – Vegetation		Enhancement	City of Clearwater	PCEF, NFWF		2		27.974398	-82.722569
E-84	City of Clearwater Exotic and Invasive Species project - Northeast Coachman	2006		Freshwater	35567		Invasive Removal – Vegetation	Invasive Removal – Vegetation		Enhancement	City of Clearwater	PCEF, NFWF		17		27.976073	-82.737881
E-85	City of Clearwater Exotic and Invasive Species Project - Winding Woods	2006		Freshwater	35567		Invasive Removal – Vegetation	Invasive Removal – Vegetation		Enhancement	City of Clearwater	PCEF, NFWF		15		28.012631	-82.722343
E-86	Giants Camp Shoreline Restoration	2006		Estuarine			Removal of old docks			Enhancement	Mosaic			2	2	27.857000	-82.385594
E-87	Mobbly Bayou Wilderness Preserve North Addition	2006		Estuarine	213000		Invasive Removal – Vegetation	Invasive Removal – Vegetation		Enhancement	Pinellas County	City of Oldsmar		5		28.026143	-82.662079
E-88	Moccasin Lake Park Restoration	2006	Palustrine forested wetland, forest woodland	estuarine			The Moccasin Lake Park Restoration project consist exotic vegetation removal. Vegetation removed will include Brazilizan pepper plants and trees and enhancement using native plants.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			45		27.976876	-82.725675
E-89	Palm River Park (McKay Bay Bike Trail)	2006		Estuarine			Planting with native vegetation			Enhancement	City of Tampa				100	27.944847	-82.402403
E-90	Rivercove Park	2006		Freshwater			Planting with native vegetation			Enhancement	City of Tampa				100	28.019117	-82.448289
E-91	Riverside Garden Park	2006		Estuarine			Planting with native vegetation			Enhancement	City of Tampa				500	27.968959	-82.478158
E-92	Tampa Bay Oil Spill - Ft. DeSoto Dune Restoration	2006		Upland			marsh plants installed			Enhancement	Pinellas County			1.8		27.619500	-82.719800
E-93	Terra Ceia Aquatic and Buffer Preserve: Terra Ceia Uplands: Phase 3	2006		Upland			restoration of coastal uplands	Exotic removal, planting of natives, restoration of coastal uplands		Enhancement	SWFWMD-SWIM			217		27.587675	-82.568899
E-94	Alligator Lake Management Area	2007	Freshwater lake system with wetland and upland areas.	Freshwater	24000	30-Jun-07	Project consists of removal of invasive exotic vegetation within a freshwater lake system using a follow-up chemical treatment of mechanically treated areas at Alligator Lake in Pinellas County.	Invasive Removal – Vegetation		Enhancement	Pinellas County Environmental Lands Division	SWFWMD		31		27.978000	-82.700000
E-95	Ballast Point Park	2007		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area in Ballast Point Park in Hillsborough County to aid in erosion control and provide habitat for fish and wildlife.	Erosion Control		Enhancement	Tampa Bay Watch			0.01		27.887000	-82.479000
E-96	Boca Ciega Millennium Park	2007		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area at Boca Ciega Millennium Park in Pinellas County to aid in erosion control and provide habitat for wildlife.	Erosion Control		Enhancement	Tampa Bay Watch			0.05		27.833680	-82.814817
E-97	Boca Ciega Pond Restoration	2007		Freshwater			This project consists of removal of exotic invasive vegetation around the shoreline of a stormwater pond to promote habitat for wildlife in North Pinellas County.	Invasive Removal – Vegetation		Enhancement	Pinellas County				633.6	27.835000	-82.809000

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E-98	Brooker Creek Preserve - 1	2007	Pine flatwoods in south end of the preserve.	Upland	39000	31-Jul-07	Project consists of removing invasive exotic vegetation from a pine flatwoods area at the south end of Brooker Creek Preserve in Pinellas County to promote habitat for wildlife.	Invasive Removal – Vegetation		Enhancement	Pinellas County			64		28.069000	-82.673000
E-99	Brooker Creek Preserve - 3	2007	Flatwoods near Ridgemoor Gate at the Brooker Creek Preserve.	Upland	1650	31-Jul-07	Project consists of removing invasive exotic vegetation from a forested area near the gate of the Brooker Creek Preserve located in Pinellas County to promote wildlife habitat.	Invasive Removal – Vegetation		Enhancement	Pinellas County			2		28.100000	-82.670000
E-100	E.G. Simmons Park	2007		Estuarine			Project consists of planting of salt marsh plants at an intertidal shoreline area within E.G. Simmons Park in Hillsborough County to aid in erosion control and provide habitat for wildlife.	Erosion Control		Enhancement	Tampa Bay Watch			1		27.733000	-82.466000
E-101	Fantasy Island	2007		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area to aid in erosion control and provide wildlife habitat at Fantasy Island in Hillsborough County.	Erosion Control		Enhancement	Tampa Bay Watch			0.01		27.859000	-82.430000
E-102	Fort De Soto Park	2007		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area at Fort De Soto Park in Pinellas County to aid in erosion control and promote wildlife habitat.	Erosion Control		Enhancement	Tampa Bay Watch			0.09		27.645301	-82.716147
E-103	Fred and Idah Shultz Nature Preserve	2007		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area in the Kitchen to aid in erosion control and promote wildlife habitat at the Fred and Idah Shultz Nature Preserve.	Erosion Control		Enhancement	Tampa Bay Watch			0.5		27.811000	-82.406000
E-104	Lake Seminole Aquatic Habitat Restoration	2007		Freshwater			Project consists of removing exotic invasive vegetation, sediment removal and planting of native plant species to promote wildlife habitat along a littoral shoreline at Lake Seminole Park in Pinellas County.	Invasive Removal – Vegetation		Enhancement	Pinellas County				6283.2	27.854000	-82.779000
E-105	Lake Seminole Invasive Plant Control	2007		Upland			Project consists of removing exotic invasive vegetation in a pine flatwoods area to promote wildlife habitat located inside Lake Seminole Park in Pinellas County.	Invasive Removal – Vegetation		Enhancement	Pinellas County			35		27.852000	-82.775000
E-106	Little Bird National Wildlife Refuge	2007		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area near Tierra Verde on Boca Ciega Bay to aid in erosion control in the Little Bird National Wildlife Refuge.	Erosion Control		Enhancement	Tampa Bay Watch			0.02		27.683000	-82.684000
E-107	MacDill Air Force Base	2007		Estuarine			Project consists of planting of salt marsh plants to help control erosion and promote habitat along an intertidal shoreline of the Interbay Peninsula located in MacDill Air Force Base in Hillsborough County.	Erosion Control		Enhancement	Tampa Bay Watch			0.75		27.821000	-82.473000
E-108	Manatee Viewing Center	2007	Intertidal wetland shoreline in Apollo Beach	Estuarine	3000	30-Sep-06	Project consists of planting salt marsh plants along an intertidal wetland at the Manatee Viewing Center in Hillsborough County to help control erosion along the shoreline in Apollo Beach.	Erosion Control		Enhancement	Tampa Bay Watch	Tampa Electric Company		0.25		27.938000	-82.417000

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E-109	Palonis Park	2007		Estuarine			This project consists of planting salt marsh plants to aid in erosion control along the intertidal shoreline at Palonis Park in Hillsborough County and to promote habitat for wildlife.	Erosion Control		Enhancement	Tampa Bay Watch			0.5		27.892374	-82.540142
E-110	Pepper Busters at Fort DeSoto Park	2007		Mix (estuarine and upland)			This project consisted of removal of exotic invasive vegetation from the mangrove fringe and palm hammock to promote habitat for wildlife in the Fort De Soto Park in Pinellas County.	Invasive Removal – Vegetation		Enhancement	Tampa Bay Watch			15		27.620000	-82.723000
E-111	Sand Tube Restoration of Propellar Scars in Lower Tampa Bay	2007		Estuarine			This seagrass planting project in Hillsborough and Boca Ciega Bays aims to promote habitat for fish and shellfish using sediment sand tubes located in propeller scars.	Other		Enhancement	Tampa Bay Watch			0.01		27.677000	-82.527000
E-112	Weedon Island Burn - 2B	2007		Upland			This project consisted of a prescribed burn of overgrown scrub northwest of the Weedon Island Education Center to promote wildlife habitat in Pinellas County.	Prescribed Burn		Enhancement	Pinellas County			5		27.847000	-82.609000
E-113	Weedon Island Burn - 2E	2007		Upland			This project consisted of a prescribed burn of overgrown scrub northwest of the Weedon Island Education Center to promote wildlife habitat in Pinellas County.	Prescribed Burn		Enhancement	Pinellas County			8		27.841000	-82.609000
E-114	Whale Island NWR	2007		Estuarine			This project consisted of planting of salt marsh plants along an intertidal wetland area to aid in erosion control Southwest of Tarpon Key in Boca Ciega Bay.	Erosion Control		Enhancement	Tampa Bay Watch			0.25		27.662000	-82.693000
E-115	Whiskey Stump Key	2007		Estuarine			This project consisted of planting of salt marsh plants to help control erosion and promote wildlife habitat in a tidal wetland area at The Kitchen in Hillsborough Bay.	Erosion Control		Enhancement	Tampa Bay Watch			0.5		27.817000	-82.401000
E-116	Alligator Lake Wetland Creation and Stormwater Treatment Project	2008	Freshwater marsh south of Alligator Lake	Freshwater	650000	30-Sep-08	Project consists of planting and earth work along an area south of Alligator Lake in Pinellas County to provide habitat for wildlife and improve water quality.	Rehabilitation/Creation		Enhancement	City of Clearwater			6		27.978000	-82.703000
E-117	Shell Key Exotic Removal	2008		Estuarine			Project consists of removing invasive exotic vegetation from a forested area on Shell Key, an island located in Pinellas County to promote wildlife habitat	Invasive Removal - Vegetation		Enhancement	Pinellas County Department of Environmental Management			4		27.651000	-82.739000
E-118	Terra Ceia Nature Preserve	2008		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area in the Terra Ceia Nature Preserve in Manatee County to aid in erosion control and provide habitat for fish and wildlife	Planting		Enhancement	Tampa Bay Watch			32		27.577000	-82.580000
E-119	Terra Ceia Nature Preserve	2008		Estuarine			Project consists of planting of salt marsh plants along an intertidal wetland area in at the Terra Ceia Nature Preserve in Manatee County to aid in erosion control and provide habitat for fish and wildlife.	Planting		Enhancement	Tampa Bay Watch			9		27.577000	-82.580000

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E-120	Clam Bayou Marine Education Center Restoration Project II	2009		Estuarine			The Clam Bayou Marine Education Center restoration project consists of exotic plant removal, replanting with native plant species and installing educational signage and information.	Invasive Removal - Vegetation		Enhancement	University of South Florida, College of Marine Science				170	27.736000	-82.691000
E-121	Eagle Lake Park	2009	A freshwater wetland area within the 150 acre park in Pinellas County.	Freshwater	1522000	31-Jul-09	Project consists of removing non-native vegetation and replanting with native plants in an effort to improve habitat for wildlife.	Invasive Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources	SWFWMD		5		27.927000	-82.764000
E-122	East Lake Management Area	2009	The East Lake Management Area consists primarily of forested wetlands.	Freshwater	10040	31-Aug-09	The East Lake project consists of removal of invasive non-native vegetation to return the area to a primarily forested wetland habitat type.	Invasive Removal - Vegetation		Enhancement	Pinellas County Environmental Lands Division			3.7		28.095000	-82.701000
E-123	Weedon Island Preserve	2009		Upland			Removal of exotic non-native plants in addition to thinning of existing vegetation to improve habitat for wildlife and birds.	Prescribed Burn		Enhancement	Pinellas County Environmental Lands Division			14		27.851000	-82.608000
E-124	E.G. Simmons Park: Phase 2	2010		Upland			upland (coastal)	Planting		Enhancement	SWFWMD-SWIM			1		27.742297	-82.466202
E-125	Fort De Soto North Beach	2010		Estuarine			Salt marsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at the project location.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			0.22		27.640000	-82.741000
E-126	Give A Day for the Bay - Emerson Point Preserve	2010		Upland			More than 150 slash pine trees were planted within the Preserve in an effort to improve habitat in areas recently removed of invasive vegetation.	Planting		Enhancement	Tampa Bay Estuary Program			12		27.531000	-82.626000
E-127	Give A Day for the Bay - Joe's Creek Management Area	2010		Upland			Removal of Brazilian pepper trees and air potato vines in County-owned Management area.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			6.7		27.834142	-82.746771
E-128	Mac Dill Air Force Base	2010	Intertidal wetland habitat in Southern Hillsborough County.	estuarine			Salt marsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at he project location.	Shoreline Stabilization/Enhancement		Enhancement	SWFWMD-SWIM			0.5		27.831790	-82.471965
E-129	Mac Dill Air Force Base	2010		Estuarine			Salt marsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at he project location.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			0.5		27.821000	-82.473000
E-130	Mac Dill Phase III Seagrass Transplanting Project	2010		Estuarine			Enhance and restore seagrass in areas of historical presence by transplanting seagrass (Syringodium filiforme) from a donor location in Tampa Bay.	Other		Enhancement	Tampa Bay Watch			0.69		27.820000	-82.495000
E-131	Terra Ceia Aquatic Preserve	2010		Estuarine			Salt marsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at the project location.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			9.9		27.535000	-82.584000
E-132	Bi-Annual Bear Creek Clean-Up	2011		Freshwater			Volunteers participated in bi-annual debris removal events at the creek each year. More than three tons of debris is removed annually from the creek.	Debris Removal		Enhancement	Tampa Bay Estuary Program				5280	27.769000	-82.714000
E-133	Brooker Creek Preserve - Pine Ridge Area Invasive Plant Management	2011	Flatwoods and hammock being invaded by non-native invasive vegetation.	Upland	11621	31-Jul-11	Herbicide treatment of nuisance exotic vegetation; Air potato, Brazilian pepper, camphor.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			5.5		28.136100	-82.657300

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E-134	Brooker Creek Preserve - South Invasive Plant Management	2011	Forested upland edges along dirt access road in south end of Brooker Creek Preserve.	Upland	16211	31-Jul-11	Herbicide treatment of nuisance exotic vegetation; Brazilian pepper, cogongrass, guinea grass, Japanese climbing fern, torpedo grass, wedelia.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			14		28.136100	-82.657300
E-135	Brooker Creek Preserve Prescribed Burn (Unit North Diagonal West)	2011	Forested flatwoods and hammock in the north Coventry subdivision area.	Upland	4650	31-Mar-11	Prescribed burn used to control competing vegetation and maintenance of fire-dependent species.	Prescribed Burn		Enhancement	Pinellas County Parks and Conservation Resources			5		28.122000	-82.681000
E-136	Brooker Creek Preserve Prescribed Burn (Unit-Diagonal Ponds East)	2011	This area of habitat consists of flatwoods east of two ponds off the diagonal powerline.	Upland	3150	30-Sep-10	Prescribed burn used to control competing vegetation and maintenance of fire dependent species.	Prescribed Burn		Enhancement	Pinellas County Parks and Conservation Resources			21		28.120000	-82.673000
E-137	Brooker Creek Preserve Prescribed Burn (Unit-Glenridge)	2011	Flatwoods near the Glenridge subdivision.	Upland	2321	31-Mar-11	Prescribed burn and firebreak disking used to control competing vegetation and maintenance of fire-dependent species.	Prescribed Burn		Enhancement	Pinellas County Parks and Conservation Resources			8		28.101000	-82.672000
E-138	Cabbage Key Exotic Vegetation Removal	2011		Mix (estuarine and upland)			Removal of non-native vegetation such as Brazilian pepper that was impeding native plant growth.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			4.5		27.667000	-82.725000
E-139	Clam Bayou Native Planting	2011		Upland			Removed various invasive plants and replanted with native shrubs and trees. Slash pines, Sabal palms and small shrubs were planted in area cleared from invasive plants.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			0.25		27.741000	-82.687000
E-140	Cow Branch Invasive Plant Management	2011	Hammock area on eastern edge of the management area.	Upland	2492	30-Jun-11	Herbicide treatment of nuisance exotic vegetation; air potato, caesar weed, taro, guinea grass, cogon grass.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			1.4		28.072000	-82.713000
E-141	East Lake Management Area Invasive Plant Management	2011	Hammock area containing non-native vegetation on the edge of the property and internal berm.	Mix (freshwater and upland)	5881	30-Jun-11	Herbicide treatment of nuisance exotic vegetation; air potato, caesarweed taro, guinea grass, Brazilian pepper, banana, wedelia, arrowhead vine, castorbean, elephant ear.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			3.7		28.096000	-82.700000
E-142	Fort DeSoto Park Prescribed Burn	2011		Upland			A prescribed burn was performed in the overgrown coastal uplands area to fuel reduction of the uplands.	Prescribed Burn		Enhancement	Pinellas County Parks and Conservation Resources			29		27.625000	-82.706000
E-143	Give A Day for the Bay - Al Palonis Park	2011		Estuarine			Removal of invasive Brazilian pepper trees in County-owned park. Brazilian pepper trees identified with flags were cut down. Tree limbs were hauled and placed into large pile for disposal. Cut tree stumps were treated with herbicide.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			2.5		27.893000	-82.533000
E-144	Give A Day for the Bay - Emerson Point Preserve	2011		Upland			Planting of native sea oats and coral bean plants. Removal of invasive Brazilian pepper, Carrotwood, Rosary pea, air potato and Caesar weed.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			8.2		27.532466	-82.629522

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E-145	Give A Day for the Bay - Fort DeSoto Park	2011		Upland			Planting of more than 3,000 native plants within the Park. Plants included beach sunflower, railroad vine and sea oats.	Planting		Enhancement	Tampa Bay Estuary Program			2		27.635000	-82.740000
E-146	Give A Day for the Bay - Lost River/Cockroach Bay	2011		Freshwater			Volunteers planted more than 1,000 native marsh grass plants in an area recently cleared of invasive plants.	Planting		Enhancement	Tampa Bay Estuary Program			2		27.686000	-82.506000
E-147	Give A Day for the Bay - Moccasin Lake Nature Park	2011	Moccasin Lake Nature Preserve is a 51-acre nature preserve in the City of Clearwater, FL. The preserve features a 5-acre lake and more than a miles of natural and board walking trails.	Upland	188	30-Nov-10	Removal of air potato vines and tubers within the Moccasin Lake preserve area. The vines were thick on the ground and strangling the native trees.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program	City of Clearwater		1.45		27.976000	-82.724000
E-148	Give A Day for the Bay - Picnic Island Park	2011		Upland			Removal of Brazilian pepper trees in City owned park adjacent to beach access to Tampa Bay.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			3		27.855000	-82.550000
E-149	Lake Tarpon Management Area Invasive Plant Management	2011	Forested wetland on northern edge of property including non-native vegetation.	Upland	6224	30-Jun-11	Herbicide treatment of nuisance exotic vegetation; air potato, balsam apple, taro, Chinese tallow, hairy indigo, wedelia, sword fern, Guinea grass.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			7		28.136000	-82.710000
E-150	MacDill Invasive Species Control	2011		Estuarine			Chemical treatment of all invasive species within the project area. Invasive trees and grasses were treated through a mixture of foliar application and girdling to kill the plants in place. Following the initial herbicide applications, contractors were r	Invasives Control/Removal - Vegetation		Enhancement	MacDill Air Force Base			860		27.836000	-82.518000
E-151	MacDill Upland Forest Habitat Management	2011		Upland			Prescribed Burning: This burn block consists of shrub and brushland with hardwood overstory. Brazilian pepper and lead tree have inundated the area and evidence of chemical treatment is evident by the large amount of dead grasses and small trees. Some sc	Prescribed Burn		Enhancement	MacDill Air Force Base			16		27.833000	-82.489000
E-152	Restoration at Little Manatee River State Park	2011		Estuarine			Planting of 4,000 native trees by volunteer park visitors after completion of prescribed burn.	Planting		Enhancement	Tampa Bay Estuary Program			71		27.673000	-82.375000
E-153	Restoration of the Forest Conservation Area	2011	This project took place in a wetland conservation area which was overrun with Brazilian pepper trees, located within a neighborhood.	Estuarine	3400	30-Sep-10	Removal of Brazilian pepper trees and replanting with native plants after site cleaning had been completed.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program	The Forest of Countryway Homeowners Association		2.4		28.024000	-82.617000

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-154	Tarpon Key NWR Tidal Wetland Restoration	2011		Estuarine			The Tarpon Key National Wildlife Refuge is part of the Pinellas National Wildlife Refuge system and is managed by US Fish and Wildlife Service. Tampa Bay Watch will coordinate with USFWS to host Bay Grasses in Classes plantings. These planting projects a	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			1		27.666000	-82.694000
E-155	Terra Ceia Aquatic Preserve Tidal Wetland Restoration	2011		Estuarine			The Terra Ceia Aquatic Preserve is managed by Southwest Florida Water Management District-Surface Water and Improvement Program(SWFWMD-SWIM). Tampa Bay Watch will coordinate with SWFWMD-SWIM to host community and Bay Grasses in Classes plantings. These p	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			2		27.584000	-82.579000
E-156	Terra Ceia Uplands, Phase 6	2011		Upland			Non-native plant removal followed by installation of native plant species; predominantly restoration of coastal pine flatwoods with hardwood hammocks.	Planting		Enhancement	SWFWMD-SWIM			158		27.589000	-82.571000
E-157	Watershed Improvement Partnership between Shorecrest Preparatory School and Placido Bayou Community Association	2011		Freshwater			High school-aged students in partnership with the homeowners association used several of the ponds as study areas. Students took water quality samples and recorded data back at their school to track trends. Students also participated in several planting	Planting		Enhancement	Tampa Bay Estuary Program			4.8		27.817000	-82.626000
E-158	Weedon Island Preserve Prescribed Burn	2011		Upland			A prescribed burn was done in the flatwoods and oak hammock areas as fuel reduction in the flatwoods.	Prescribed Burn		Enhancement	Pinellas County Parks and Conservation Resources			4		27.849000	-82.605000
E-159	Bay Pines	2012		Estuarine			Invasive plant species such as Brazilian pepper and lead trees were removed through a contractor. Trees were cut and the stumps treated to prevent re-growth. Stump removal and maintenance of area is overseen by St. Petersburg College Seminole campus.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Watch			12		27.811000	-82.786000
E-160	Brooker Creek Preserve - South Invasive Plant Management	2012	Area within Brooker Creek Preserve consisting of flatwoods and hammock invaded by non-native vegetation.	Upland	22380	31-Aug-12	Herbicide treatment of nuisance exotic vegetation such as Brazilian pepper, air potato, cogon grass, guinea grass, Japanese climbing fern, torpedo grass, wedelia.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			20		28.065000	-82.689000
E-161	Brooker Creek Preserve Pine Ridge Invasive Plant Management	2012	Flatwoods and hammock areas within Brooker Creek Preserve that are being invaded by non-native invasive vegetation.	Upland	8567	31-Aug-12	Herbicide treatment of nuisance exotic vegetation such as air potato, Brazilian pepper, camphor.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			5.5		28.122000	-82.690000

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E-162	Brooker Creek Preserve Prescribed Burn (Unit-Lora Lane to Diagonal)	2012	The area within Brooker Creek is flatwoods located north of Lora Lane to the powerline intersection, in Pinellas County.	Upland	3000	31-Jul-12	Prescribed burn to restore or improve flatwood habitats within the Preserve area as well as control pests and improve ecosystem diversity.	Prescribed Burn		Enhancement	Pinellas County Parks and Conservation Resources	Florida Forest Service		22		28.116000	-82.672000
E-163	Brooker Creek Preserve Prescribed Burn (Unit-Worthington Cir)	2012	The area within Brooker Creek is flatwoods located north of Worthington Court near the Ridgemoor subdivision in Pinellas County.	Upland	3000	30-Jun-12	Prescribed burn to restore or improve flatwood habitats within the Preserve area as well as control pests and improve ecosystem diversity.	Prescribed Burn		Enhancement	Pinellas County Parks and Conservation Resources	Florida Forest Service		12		28.117000	-82.684000
E-164	Clam Bayou: Phase 2	2012		Upland			exotic removal	Invasive Removal - Vegetation		Enhancement	City of St. Petersburg			30		27.739464	-82.694677
E-165	Cockroach Bay Aquatic Preserve	2012		Estuarine			Planting of salt marsh is utilized for shoreline stabilization and habitat enhancement at the project location.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			10		27.822000	-82.472000
E-166	Cow Branch Invasive Plant Management	2012	Cow Branch Management Area located south of Lake Tarpon supports flatwoods, floodplain, swamps and hammock. Areas have been invaded by non-native vegetation.	Upland	2074	31-Aug-12	Herbicide treatment of nuisance exotic vegetation such as air potato, caesarweed, taro, guinea grass and cogon grass.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			1.4		28.072000	-82.713000
E-167	East Lake Management Area Invasive Plant Management	2012	East Lake Management Area is located between Brooker Creek and Lake Tarpon and contains a large continuous forested wetland system.	Upland	2074	31-Aug-12	Herbicide treatment of nuisance exotic vegetation such as air potato, Brazilian pepper, camphor, caesarweed, wedelia, castor bean and elephant ear.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			3.7		28.096000	-82.700000
E-168	Fort De Soto Native Coastal Planting - Site #2	2012		Freshwater			Community volunteers planted high marsh plants in stormwater swales in the north parking lot of Fort De Soto Park to control stormwater runoff.	Vegetation Buffer		Enhancement	Tampa Bay Watch			0.17		27.638000	-82.736000
E-169	Fort De Soto Native Coastal Planting - Site #4	2012		Freshwater			Community volunteers will plant high marsh plants in stormwater swales in the north parking lot of Fort De Soto Park to control stormwater runoff.	Vegetation Buffer		Enhancement	Tampa Bay Watch			0.19		27.635000	-82.735000
E-170	Give A Day for the Bay - Lake Seminole Park	2012		Upland			Community volunteers work with County park staff to remove invasive air potato vines and tubers.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			5		27.841000	-82.774000

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E-171	Give A Day for the Bay - Lake Seminole Park	2012		Upland			Community volunteers work with County park staff to remove invasive air potato vines and tubers.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			5		27.841000	-82.774000
E-172	Give A Day for the Bay - Little Manatee River State Park	2012		Upland			Community volunteers worked to remove invasive skunk vine along the The Florida National Scenic Trail located within the park.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			0.5		27.657000	-82.373000
E-173	Give A Day for the Bay - Rye Preserve	2012		Upland			Community volunteers removed one ton of debris and invasive plants along the hiking trails within the Park.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			0.5		27.513000	-82.364000
E-174	Give A Day for the Bay - Sawgrass Lake Park	2012		Upland			Community volunteers worked to remove invasive air potato tubers within the Sawgrass Lake Park, off the dirt trail. Volunteers collected several hundred pounds of invasive potatoes.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			0.5		27.838000	-82.667000
E-175	Give A Day for the Bay - South Gandy Park	2012		Estuarine			Community volunteers removed more than 5 tons of invasive Brazilian pepper from the area. Also removed other invasive plants such as lead tree and debris removal from shoreline.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			7.9		27.891788	-82.535472
E-176	Lake Tarpon Management Area Invasive Plant Management	2012	Lake Tarpon Management Area contains a mosaic of mature floodplain swamp, floodplain forest,and bottomland forest.	Upland	5664	31-Aug-12	Herbicide treatment of nuisance exotic vegetation such as air potato, balsam apple, taro, Chinese tallow, hairy indigo, wedelia, sword fern and Guinea grass.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County Parks and Conservation Resources			7		28.136000	-82.710000
E-177	Mac Dill Air Force Base	2012	Mac Dill Air Force Base is located in Hillsborough County. The project area is an intertidal wetland habitat area on the Base.	estuarine			Salt marsh is planted to stabilize the shoreline and provide habitat for wildlife.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			0.36		27.831790	-82.471965
E-178	Mac Dill Air Force Base	2012		Estuarine			Salt marsh is planted to stabilize the shoreline and provide habitat for wildlife.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			0.36		27.822000	-82.472000
E-179	MacDill Upland Forest Habitat Management	2012		Upland			Prescribed fire was used to control invasive species, improve wildlife habitat, reduce hazardous fuel loads, and promote new growth for foraging. A separate area was targeted for invasives control using herbicide application. This area had several spots	Prescribed Burn		Enhancement	MacDill Air Force Base			35		27.867000	-82.506000
E-180	Manatee River Environmental Stewardship Program	2012		Estuarine			As part of a day-long environmental stewardship experience, nearly 300 students participated in removing invasive plants from the preserve.	Invasives Control/Removal - Vegetation		Enhancement	Manatee County School for the Arts			3		27.531000	-82.625000
E-181	Rock Ponds Upland Restoration 1	2012		Upland			This project removed invasive vegetation followed by planting of native plants. Areas will be restored to coastal upland, pine flatwoods, hardwood hammocks and mixed pine/flatwood habitats.	Invasives Control/Removal - Vegetation		Enhancement	SWFWMD			264		27.646000	-82.532000

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E-182	Rock Ponds Upland Restoration 1	2012		Upland			This project removed invasive vegetation followed by planting of native plants. Areas will be restored to coastal upland, pine flatwoods, hardwood hammocks and mixed pine/flatwood habitats.	Invasives Control/Removal - Vegetation		Enhancement	SWFWMD-SWIM			264		27.646000	-82.532000
E-183	Bahia Beach Coastal Restoration	2013		Mix (freshwater and upland)			Saltmarsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at the project location The planting at the 148-acre parcel will help restore estuarine marshes to improve habitat for native fish, invertebrates, birds and	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			4		27.726000	-82.462000
E-184	Booker Creek Habitat Restoration at Campbell Park	2013	Booker Creek is a nine acre forested and open area park located in St. Petersburg. The Creek drains into Middle Tampa Bay.	Freshwater	4900		The restoration are included approximately 200 feet of steep banks near a pedestrian bridge in Campbell Park. Invasive plants were removed and volunteers installed native plants.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County				300	28.133074	-82.662367
E-185	Diamondback Terrapins in Tampa Bay - Tarpon Key Comprehensive Habitat Restoration Project	2013		Estuarine			Removal of invasive Bralizian pepper trees from mangrove fringe, placement of oyster shell bar along western shoreline, and planting of saltmarsh along western shoreline.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Watch				252	27.666000	-82.691000
E-186	Fort De Soto Native Coastal Planting Site 3	2013		Estuarine			Volunteers planted intertidal marsh plants in stormwater swales in the north parking lot of Fort De Soto Park to control stormwater runoff.	Vegetation Buffer		Enhancement	Tampa Bay Watch			0.27		27.636000	-82.736000
E-187	Fort DeSoto Native Coastal Planting Site 1	2013		Freshwater			Volunteers planted high marsh plants in stormwater swales in the north parking lot of Fort De Soto Park to control stormwater runoff.	Vegetation Buffer		Enhancement	Tampa Bay Watch			0.17		27.642000	-82.739000
E-188	Give A Day - Rye Preserve	2013		Upland			Community volunteers work with County park staff to remove invasive air potato vines and tubers, rosary pea, caesar weed, trash and debris.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			8		27.513000	-82.364000
E-189	Give A Day for the Bay - Al Palonis Park	2013		Estuarine			Community volunteers removed more than 4 tons of invasive Brazilian pepper from the area. Also removed other invasive plants such as lead tree and debris removal from shoreline.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			2		27.892000	-82.540000
E-190	Give A Day for the Bay - Joe's Creek Park	2013		Estuarine			Community volunteers removed thirty bags of debris and invasive plants along the creek shoreline and adjacent land areas.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			2		27.815000	-82.692000

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E-191	Give A Day for the Bay - Lowry Park Zoo	2013	Tampa's Lowry Park Zoo is today ranked the number one zoo in the U.S. (Parents magazine 2009 & Child magazine 2004) and recognized by the State of Florida as a center for Florida wildlife conservation and biodiversity (HB 457).Natural outdoor exhibits for	Upland	870		More than sixty (60) volunteers worked at various locations within the Zoo to remove invasive exotic plants such as air potato and skunk weed.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program	Lowry Park Zoo		4		28.011000	-82.470000
E-192	Give a Day for the Bay - Sawgrass Lake	2013		Upland			Volunteers spent the morning clearing out invasive air potatos, trash and debris from within the park. More than 400 pounds of air potatos were removed as well as 9 large bags of trash and 3 tires.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			11		27.842000	-82.671000
E-193	Hands-On Learning Through Coastal Habitat Restoration	2013		Upland			Plant sea oats, Uniola paniculata, along shoreline areas in Fort De Soto Park to expand sand dune area and sea oat coverage.	Beach Nourishment		Enhancement	Tampa Bay Watch					27.615000	-82.735000
E-194	Invasive Species Control	2013		Upland			Work in 2013 included the chemical treatment of Brazilian pepper and other non-native, invasive species across two quadrants of the base (1,011 acres). Invasive trees and grasses were treated through a mixture of foliar application and girdling to kill th	Invasives Control/Removal - Vegetation		Enhancement	MacDill Air Force Base			880		27.843000	-82.535000
E-195	Mac Dill Air Force Base	2013	Intertidal wetland habitat in Southern Hillsborough County.	estuarine			More than 3,000 salt marsh plants were planted by student and teacher volunteers. Salt marsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at the project location. Salt marsh has numerous benefits for Tampa Bay and its marine and shoreline inhabitants: stabilizes shorelines and protects against erosion, provides habitat for small fish and other creatures, traps sediments that would otherwise sweep into the bay. Salt marsh communities are critically important habitats that grow along the intertidal fringe of the bay, preventing erosion, absorbing pollutants, and providing habitat for important fish and wildlife species.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			0.36		27.831790	-82.471965
E-196	Mac Dill Air Force Base	2013		Estuarine			More than 3,000 salt marsh plants were planted by student and teacher volunteers. Salt marsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at the project location. Salt marsh has numerous benefits for Tampa Bay an	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch				1000	27.822000	-82.472000

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E-197	MacDill Seagrass Transplanting Project Phase IV	2013		Estuarine			Approximately 1,200 20cm x 20cm manatee grass sod units with sediment attached were harvested June thru September 2010 within a permitted donor area located in south-eastern Old Tampa Bay and transplanted along the southeastern shoreline of MacDill AFB wh	Planting		Enhancement	Tampa Bay Watch				3937	27.823000	-82.474000
E-198	NE 4th Avenue Wetlands Restoration	2013		Estuarine			The project is located on approximately 2.1 acres within the City of Mulberry in Polk County. The project site is bisected by the Ellis Branch, a tributary to the North Prong of the Alafia River, which drains to Tampa Bay. Approximately 310 linear feet of	Invasives Control/Removal - Vegetation		Enhancement	City of Mulberry				620	27.896000	-81.969000
E-199	Restoration of no-name retention pond at the Shores of Long Bayou	2013		Estuarine			Brazilian pepper trees were removed, as well as removal of cattails by the roots to prevent futher growth. Invasive vegetation was replaced with native plants.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			0.1		27.831000	-82.772000
E-200	Anderson Park Exotics	2014	Anderson Park in Pinellas County contains sandhill, scrub flatwoods and maintained areas throughout the park.	Upland	7660		Treatment of exotic vegetation including rosary pea, cogon grass, air potato, Japanese climbing fern, Boston fern, arrowhead vine and golden bamboo.	Invasives Control/Removal - Vegetation		Enhancement	Florida Fish and Wildlife Commission	Pinellas County		48		28.130000	-82.739000
E-201	Anderson Park-Melaleuca	2014	Anderson Park in Pinellas County. Freshwater wetland with some Melaleuca invasion in the non-public use area of the park.	Freshwater	6479		Pinellas County staff provided treatment for control of the invasive, exotic Melaleauca tree.	Invasives Control/Removal - Vegetation		Enhancement	Florida Fish and Wildlife Commission	Pinellas County		6		28.136000	-82.738000
E-202	Bahia Beach	2014		Mix (estuarine, freshwater, and upland)			This property was previously cleared of the citrus trees which in turn allowed some native and non-native plants and shrubs to grow.This project site will be properly graded to transition from oligohaline marsh to forested wetlands and mixed forested wetl	Vegetation Buffer		Enhancement	SWFWMD			148		27.726000	-82.461000
E-203	Do Good. Have fun. Bud Light Summer Project	2014	Project took place along the shoreline of the Courtney Campbell Causeway bridge where habitat mostly included non-native grasses and invasive plants.	Upland	10000		Created a sea dune habitat with Sea Oats, Railroad Vine, Gaillardia, and dune sunflower on the shoreline of Tampa Bay.	Sand Dune Restoration		Enhancement	Keep Tampa Bay Beautiful		Bud Light Corporate, Pepin Distributing, Keep America		1250	27.960000	-82.701000

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E-204	Fort Desoto North Beach Habitat Restoration	2014		Upland			Project consisted of removal of invasive Australian Pines, moving of beach sand, planting dunes and creating a pedestrian bridge.	Planting		Enhancement	Pinellas County				1900	27.636000	-82.736000
E-205	Give A Day for the Bay - Florida State Fairgrounds	2014	The Florida Learning Garden is a permanent, one-acre interactive experience at the Florida State Fairgrounds in Tampa. The Florida Learning Garden is designed to educate bay area residents and visitors on multiple growing techniques and sustainable practi	Upland	300		Volunteers worked to create and revitalize the Florida Learning Garden by planting native trees, shrubs and flowers, and removing non-native trees and vegetation.	Planting		Enhancement	Tampa Bay Estuary Program	Keep Tampa Bay Beautiful		1		27.988000	-82.361000
E-206	Give A Day for the Bay - Fort De Soto Park	2014		Upland			Volunteers removed invasive trees and plants from a forested section of the Park. More than 300 Australian pines and Brazilian pepper trees were removed.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			5		27.618000	-82.723000
E-207	Give A Day for the Bay - Lowry Park Zoo	2014	The Ha-Ha in the Elephant Bull Yard, behind the main exhibit in an area not accessible by the general public.	Upland	360		Volunteers removed invasive, non-native plants from areas surrounding the Elephant Bull Yard.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program	Lowry Park Zoo		1		28.010000	-82.468000
E-208	Give A Day for the Bay - Sawgrass Lake Park	2014		Upland			Volunteers spent the morning clearing out invasive air potatos, trash and debris from within the park. More than 400 pounds of air potatos were removed as well as 6 large bags of trash.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			8		27.842000	-82.671000
E-209	Gopher Tortoise Habitat Management	2014		Upland			Habitats were undergoing succession. Hardwoods and vines were altering the composition of the habitats. As a result, quality gopher tortoise habitat was disappearing. By reducing the vines and hardwoods we created openings to increase burrowing and foragi	Invasives Control/Removal - Vegetation		Enhancement	City of St. Petersburg			96		27.724000	-82.650000
E-210	Invasive Species Control	2014		Estuarine			Chemical treatment of Brazilian pepper and other non-native, invasive species across two quadrants of the base (1,011 acres). Invasive trees and grasses were treated through a mixture of foliar application and girdling to kill the plants in place. Contrac	Invasives Control/Removal - Vegetation		Enhancement	MacDill Air Force Base			850		27.843000	-82.535000
E-211	Mac Dill Shoreline Restoration	2014		Estuarine			Saltmarsh (Spartina alterniflora) is utilized for shoreline stabilization and habitat enhancement at the project location.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			3		27.825000	-82.472000

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E-212	NE 4th Avenue Wetlands Restoration	2014		Estuarine			The project is located on approximately 2.1 acres within the City of Mulberry in Polk County. The project site is bisected by the Ellis Branch, a tributary to the North Prong of the Alafia River, which drains to Tampa Bay. Approximately, 620 linear feet o	Invasives Control/Removal - Vegetation		Enhancement	City of Mulberry				320	27.896000	-81.969000
E-213	Serena Park	2014	Serena Park is located in Temple Terrace and is a one acre park containing native plants and trees with a walking path.	Freshwater	2000		Created new Florida-native gardens with Malaleuca mulch and planted more than 180 trees, shrubs and plants including African Iris, Coontie Palm, Muhly Grass, Indian Hawthorne, Firebushes, Walter's Viburnum, Crape Myrtle and Cassia Trees.	Planting		Enhancement	Keep Tampa Bay Beautiful	City of Temple Terrace		1		28.043000	-82.397000
E-214	Terra Ceia Upland Restoration Phase 7	2014		Upland			Removal of non-native vegetation, followed by replanting of native uplands to restore and enhance pine flatwoods and selective removal of agricultural berms.	Invasives Control/Removal - Vegetation		Enhancement	SWFWMD			67		27.589000	-82.571000
E-215	Allen's Creek Management Area Exotic Vegetation Control	2015	Hammock, mangrove swamp, and marsh in Allen's Creek Management Area.	Estuarine	29379		Nuisance exotic vegetation control in hammock, mangrove swamp and marsh areas in Allen's Creek. The site is under maintenance control. Two treatments are done per year.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			4		27.930000	-82.741000
E-216	Bahia Beach Nature Preserve	2015		Mix (freshwater and upland)			Maintenance removal of exotic, invasive vegetation to allow native plants to recruit to the natural areas. The restoration area consists of new wetlands created for the purposes of enhancing wildlife and marine habitat and improving water quality discharg	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			80		27.722000	-82.468000
E-217	Balm Boyette Scrub Preserve	2015		Upland			This project reduced hardwoods using mechanical reduction method to promote the diversity of native plants and trees. Natives such as sand pine scrub, pine flatwoods, oak hammocks, creeks, grassy meadows, and freshwater marshes.	Other		Enhancement	Hillsborough County			97		27.780000	-82.257000
E-218	Balm Scrub Addition	2015		Upland			This project removed exotic, invasive vegetation to allow native plants to recruit to the natural areas.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			430		27.723000	-82.294000

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-219	Blackwater Creek Preseve	2015	This 1993-acre preserve includes some of the finest remaining examples of pine flatwoods, palmetto prairie and riverine swamp, interspersed with oak hammock, cypress swamp, freshwater marsh and wet prairie.	Upland	37500		This project reduced hardwoods using mechanical reduction method to promote the diversity of native plants and trees. Some native plants and trees located at this site include pine flatwoods, palmetto prairie and riverine swamp, interspersed with oak ham	Other		Enhancement	Hillsborough County			650		28.132000	-82.176000
E-220	Brooker Creek Preserve Flatwoods Restoration	2015	Flatwoods in Brooker Creek Preserve located in Pinellas County.	Upland	296250		To restore the flatwoods' biodiversity and reduce the high fuel loads through mechanical thinning with use of mulching head mower equipment. This will also allow these areas to be burned under safer conditions and put on a regular burn regime to maintain	Other		Enhancement	Pinellas County			250		28.104000	-82.658000
E-221	Brooker Creek Preserve Prescribed Burn – Unit: Northeast	2015	Forested uplands in Brooker Creek Preserve located in Pinellas County.	Upland	1015		Prescribed burn used to enhance native habitats by recycling nutrients and increasing plant growth.	Prescribed Burn		Enhancement	Pinellas County			21		28.144000	-82.652000
E-222	Brooker Creek Preserve Prescribed Burn – Unit: Red Trail	2015	Flatwoods in Brooker Creek Preserve located in Pinellas County.	Upland	4090		Prescribed burn used to enhance native habitats by recycling nutrients and increasing plant growth.	Prescribed Burn		Enhancement	Pinellas County			66		28.097000	-82.656000
E-223	Brooker Creek Preserve Prescribed Burn – Unit: Twisted Pine Trail	2015	Flatwoods in Brooker Creek Preserve located in Pinellas County.	Upland	4090		Prescribed burn used to enhance native habitats by recycling nutrients and increasing plant growth.	Prescribed Burn		Enhancement	Pinellas County			59		28.093000	-82.654000
E-224	Brooker Creek Preserve Prescribed Burn – Unit: Whispering Lakes West	2015	Flatwoods within Brooker Creek Preserve located in Pinellas County.	Upland	3275		Prescribed burn used to enhance native habitats by recycling nutrients and increasing plant growth.	Prescribed Burn		Enhancement	Pinellas County			9		28.141000	-82.662000
E-225	Duette Preserve Exotic Treatment	2015		Upland			Treatment of exotic plants with herbicides in Pine Plantations, Pine Flatwoods, and Scrub areas. Example of plants treated include Cogon Grass, Brazilian Pepper, Climbing Fern, Tropical Soda Apple, and Natal Grass.	Invasives Control/Removal - Vegetation		Enhancement	Manatee County			7000		27.534000	-82.104000
E-226	Duette Preserve Longleaf Pine Planting 2015	2015		Upland			The purpose of this project is to reestablish longleaf pines at Duette Preserve to bring back Saw palmetto and wiregrass which dominated native flatwoods community with some patches of hardwood hammock, scrub, and scrubby flatwoods.	Planting		Enhancement	Manatee County			165		27.532000	-82.101000

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E-227	Duette Preserve Prescribed Burning	2015		Upland			Use of prescribed fire to aid in the maintenance of the natural areas within Duette Preserve to maintain the plant biodiversity which will also provide good habitat for resident wildlife.	Prescribed Burn		Enhancement	Manatee County			5775		27.534000	-82.104000
E-228	East Lake Management Area Exotic Vegetation Control	2015	Forested wetland in East Lake Management Area.	Freshwater	4000		Nuisance exotic vegetation control removal using chemical and mechanical methods which will provide good habitat for resident wildlife.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			4		28.096000	-82.700000
E-229	Give A Day for the Bay Boyd Hill Nature Preserve	2015		Upland			The 245 acre park is part of the Great Florida Birding Trail and is home to a Bird of prey aviary. Volunteers removed invasive plants such as Caesar weed, invasive pothos, and air potatoes to allow more natural habitat for wildlife.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			2		27.732000	-82.658000
E-230	Give A Day for the Bay Fort De Soto Park	2015		Upland			Volunteers planted 15,000 plants along the shoreline at Fort De Soto Park. Plants included sea oats, beach sunflower and railroad vine.	Planting		Enhancement	Tampa Bay Estuary Program			3		27.618000	-82.723000
E-231	Give A Day for the Bay Moccasin Lake Nature Center	2015	Moccasin Lake is a 51-acre nature preserve with trails and boardwalks under a canopy of mature oaks and across ponds and creeks, with an array of wildlife including gopher turtles, raccoons, and many birds. It is home to several injured birds of prey.	Upland	400		Volunteers removed invasive plants within the park to improve water quality and provide habitat for other wildlife. Invasive plants include air potato, rosary pea and Caesar weed.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program			5		27.977000	-82.725000
E-232	Golden Aster Scrub Preserve	2015		Upland			Reduction of hardwoods using mechanical reduction method to promote the diversity of native plants and trees which will also provide good habitat for resident wildlife.	Other		Enhancement	Hillsborough County			30		27.819000	-82.358000
E-233	Gopher Tortoise Habitat Management	2015		Upland			Habitats were undergoing succession. Hardwoods and vines were altering the composition of the habitats. As a result, quality gopher tortoise habitat was disappearing. By reducing the vines, non-native invasive plants and hardwoods we created openings to i	Prescribed Burn		Enhancement	City of St. Petersburg			97		27.724000	-82.650000
E-234	Hidden Harbor Exotics Treatment	2015		Upland			Treatment of exotic/invasive plants within Hidden Harbor utilizing chemical and physical treatments. Targeted Species Include: Cogon Grass, Lygodium, Brazilian Pepper, Guinea Grass, Natal Grass, Tropical Soda Apple.	Invasives Control/Removal - Vegetation		Enhancement	Manatee County			66		27.525000	-82.425000

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E-235	Lower Green Swamp Preserve	2015	The Lower Green Swamp Preserve provides linkages between various natural areas and maintains a wildlife corridor to the Green Swamp in central Florida. The property is currently being managed as a cattle ranch and pine plantation. This preserve is home to	Upland	19380		Reduction of hardwoods using mechanical reduction method to promote the diversity of native plants and trees which will also provide good habitat for resident wildlife.	Other		Enhancement	SWFWMD			340		28.093000	-82.176000
E-236	Pond Restoration & Water Quality Monitoring	2015	A small freshwater pond surrounded by an oak forest at the Learning Gate School in Tampa, FL.	Freshwater	5000		Removal of invasive Salvinia minima using mechanical means then planting native aquatic plants around the margin of the pond.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			1		28.103000	-82.449000
E-237	Rock Ponds Ecosystem Restoration	2015		Estuarine			Saltmarsh (Spartina alterniflora) was utilized for shoreline stabilization and habitat enhancement at the project location for erosion control, to improve water quality and provide habitat for other wildlife..	Shoreline Stabilization/Enhancement		Enhancement	SWFWMD			10		27.649000	-82.538000
E-238	Rock Ponds Ecosystem Restoration in Tampa Bay: Tampa Bay Environmental Fund project	2015		Estuarine			The Rock Ponds Ecosystem Restoration Project is the largest single coastal ecosystem restoration project performed in Tampa Bay to date. The entire project enhanced/restored/created 1,043 acres of various estuarine, freshwater, and upland habitat. The Tam	Other		Enhancement	SWFWMD			20		27.647000	-82.542000
E-239	Rye Preserve Exotics Treatment	2015		Estuarine			Treatment of exotic/invasive plants at Rye Preserve utilizing chemical and physical treatments to allow for natural plant biodiversity which will also provide good habitat for resident wildlife. Targeted Species Include: Cogon Grass, Lygodium, Brazilian P	Invasives Control/Removal - Vegetation		Enhancement	Manatee County			100		27.514000	-82.363000
E-240	Rye Preserve Gopher Habitat Improvements	2015		Upland			Sand pine and oak tree reduction in areas of known gopher tortoise populations. This grant money provided by the Florida Fish and Wildlife Commission which was used to improve gopher tortoise habitat by the cutting down of excessively large oaks and sand	Other		Enhancement	Manatee County			35		27.514000	-82.363000

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E-241	Triple Creek Preserve - PH II	2015		Upland			Maintenance removal of exotic, invasive vegetation to allow native plants to recruit to the natural areas which will also provide good habitat for resident wildlife.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			138		27.820000	-82.256000
E-242	Wolf Branch Nature Preserve	2015		Estuarine			This 1400-acre nature preserve features some of the finest examples of coastal habitat restoration in the Tampa Bay area, as well as natural mangrove shoreline, upland cabbage palm hammocks, offshore sea grass beds, and tidally-influenced Wolf Branch Cree	Invasives Control/Removal - Fauna		Enhancement	Hillsborough County			526		27.747000	-82.437000
E-243	Allen's Creek Management Area Exotic Vegetation Control	2016	Hammock, mangrove swamp, and marsh in Allen's Creek Management Area.	Estuarine			Nuisance exotic vegetation control in hammock, mangrove swamp and marsh areas in Allen's Creek. The site is under maintenance control. Two treatments are done per year.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			10		27.930000	-82.741000
E-244	Bahia Beach Nature Preserve	2016		Mix (freshwater and upland)			This property was previously cleared of the citrus trees which in turn allowed some native and non-native plants and shrubs to grow.This project site will be properly graded to transition from oligohaline marsh to forested wetlands and mixed forested wetland habitat after removal of invasives.	Vegetation Buffer		Enhancement	Hillsborough County			148		27.722000	-82.468000
E-245	Invasive Species Control (MacDill AFB)	2016	Pine forest areas are largely historic planted pine which has not been managed for timber. Areas of oak hammock and mangrove lined ditches are scattered throughout the pine areas and mangrove esturary predominates along the southern boundary of the site. Additionally, there are large tracts of land within the site that have been historically disturbed (former landfill areas) which are highly invaded with Brazilian pepper. Brazilian pepper, melaleuca, and lead tree are commonly found along the forest edges and scattered throughout the understory. Open fields have scattered areas of cogan grass.	Mix (estuarine, freshwater, and upland)			Chemical treatment for maintenance control of Brazilian pepper, lead tree, melaleuca, Australian pine and melaleuca throughout 2,300 acres on the southern side of the base. Invasive grasses were treated through foliar application, and the tree species were primarily treated through basal bark application to kill the plants in place. Following the initial herbicide applications, contractors were responsible to retreat invasive plant species within the project area until the plants were completely dead. No further removal or treatment was required after the invasive species were killed, and plants were left to breakdown over time. In addition, mechanical clearing of Brazilian pepper was accomplished on a 30 acre site which included an area of gopher tortoise habitat in the south central portion of the base. MacDill also accomplished a formal survey of invasive species coverage throughout the 2,300 wooded acres being managed for control of invasive	Invasives Control/Removal - Vegetation		Enhancement	MacDill Air Force Base			2000		27.837252	-82.506941
E-246	Kayaks for Education and Cleanups	2016	Project takes place on Lake Maggiore in St. Petersburg. Lake Maggiore supports multiple habitats such as estuarine shoreline, marsh and swamps.	Freshwater			Use of kayaks to remove exotic Brazillian pepper, water hyacinth, lake lettuce, and litter.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Estuary Program				5280	27.737485	-82.652684

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E-247	Lake Seminole Regional Stormwater Retrofit: Sub-Basin 2 Alum Facility Phase I	2016	Stream and associated bank leading to Lake Seminole.	Freshwater			Phase 1 of this project consisted of removing invasive vegetation, cleaning debris out of the stream bed, stabilizing the banks and installing some alum injection equipment to a stream. This stream receives stormwater from the surrounding area and directly conveys it to Lake Seminole. Project benefits include water quality improvements to increase fish habitat.	Stream Bank Stabilization		Enhancement	Pinellas County			0.2		27.854385	-82.782034
E-248	Newman Branch Dredge Disposal Area DA1	2016		Upland			Clearing invasive vegetation, Brazilian pepper			Enhancement	TECO			34		27.781404	-82.406525
E-249	Robles Park Water Quality & Natural Systems Enhancement	2016	Park lake and marsh along Hillsborough River shoreline	Estuarine			Installation of 5 baffle boxes and 0.38-acre littoral shelf planting at Robles Park. Removal of non-native vegetation along 600 LF of shoreline at Glenwood outfall, shoreline stabilization of 600 LF and marsh planting approximately 0.1-acre with upland restoration of approximately 0.2-acre.	Shoreline Stabilization/Enhancement		Enhancement	SWFWMD-SWIM			4.5		27.973350	-82.454901
E-250	Rock Ponds Ecosystem Restoration Project	2016	Coastal upland, freshwater wetlands and estuarine habitat from previously agriculture land.	Mix (estuarine, freshwater, and upland)			Project included native plantings, invasive plant removal and berm/dike removal. Project benefits include hydrology and water quality improvements, increase bird and other wildlife habitat, climate change adaptation and increase educational opportunities.	Planting		Enhancement	Tampa Bay Watch			381		27.647974	-82.539242
E-251	Trash Free Waters Day	2016	Shorelines communities trash free water day event around Hillsborough Bay and Hillsborough River.	estuarine			Volunteers removed over 50 tons of litter at over 80 sites throughout Hillsborough County. The Hillsborough River Trash Free Waters Initiative encourages community residents throughout Hillsborough, Polk and Pasco counties to be vigilant in protecting the waterways towards a more beautiful Tampa Bay. The Hillsborough River Trash Free Waters Initiative is a call to action to create more sustainable communities, counteract behaviors and preventing activities that pose water quality issues and habitat concerns in Florida.	Debris Removal		Enhancement	Keep Tampa Bay Beautiful				31680	27.702880	-82.582889

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-252	World Oceans Day	2016	Clean up events to remove trash and debris took place in Hillsborough County along the Hillsborough River and Hillsborough Bay.	estuarine			Keep Tampa Bay Beautiful – along with volunteers and support from Hillsborough County, the City of Tampa, the City of Temple Terrace, Port Tampa Bay, CSX, JP Morgan Chase, Tampa Bay Estuary Program, Keep Polk County Beautiful, Republic Services, Crystal Springs Preserve, Zephyrhills® Brand 100% Natural Spring Water, Pepin Distributing, Invictus Paddling Club, Adventure Outfitters and Urban Kai – conducted 11 simultaneous cleanup events in celebration of World Oceans Day. Volunteers with boats, canoes, kayaks and paddleboards helped remove litter and debris from the Hillsborough River watershed. They were equipped with trash grabbing tools and recycled mesh bags to battle against unsightly litter and debris that is damaging to water quality and wildlife.	Debris Removal		Enhancement	Keep Tampa Bay Beautiful				52800	27.702880	-82.582889
E-253	Allen’s Creek Management Area Exotic Vegetation Control	2017	Hammock, mangrove swamp, and marsh in Allen’s Creek Management Area.	Estuarine			Nuisance exotic vegetation control in hammock, mangrove swamp and marsh areas in Allen's Creek. The site is under maintenance control. Two treatments are done per year.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			10		27.930000	-82.741000
E-254	Bahia Beach Nature Preserve	2017		Mix (freshwater and upland)			This property was previously cleared of the citrus trees which in turn allowed some native and non-native plants and shrubs to grow.This project site will be properly graded to transition from oligohaline marsh to forested wetlands and mixed forested wetland habitat after removal of invasives.	Vegetation Buffer		Enhancement	Hillsborough County			148		27.722000	-82.468000
E-255	Balm Boyette Scrub Preserve	2017	The Balm-Boyette Scrub Nature Preserve is a 5,723-acre preserve located in Hillsborough County, Florida.	Upland			Restoration consisted of mechanical reduction of hardwood trees to improve habitats for native plants, other wildlife.	Other		Enhancement	Hillsborough County			13		27.787695	-82.228888
E-256	Balm Scrub Preserve	2017	Agricultural land located in the Balm Boyette Scrub Preserve.	Upland			Removal of invasive vegetation. Invasive plants were removed/controlled to provide habitat for native plants and wildlife.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			632		27.787695	-82.228888
E-257	Bear Creek Clean-Up	2017	Bear Creek flows through a neighborhood in St. Petersburg before draining into Boca Ciega Bay.	Freshwater			Volunteers participated in bi-annual debris removal events at the creek each year. More than three tons of debris is removed annually from the creek. 60 yard large trash bags of debris were removed from the creek.	Debris Removal		Enhancement	Keep Pinellas Beautiful				5280	27.772397	-82.713778

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E-258	Brooker Creek Headwaters Preserve	2017	Containing the largest area of contiguous natural habitat remaining in northwest Hillsborough County.	Upland			Mechanical reduction using roller chopping. Removal of trees, shrubs and plants to improve habitats using roller chopping.	Other		Enhancement	Pinellas County			42		28.136531	-82.555598
E-259	Brooker Creek Preserve Flatwoods Restoration	2017	flatwoods in Brooker Creek Preserve	Upland			To restore the flatwoods' biodiversity and reduce the high fuel loads through mechanical thinning with use of mulching head mower equipment. This will also allow these areas to be burned under safer conditions and put on a regular burn regime to maintain the plant biodiversity which will also provide good habitat for resident wildlife	Prescribed Burn		Enhancement	Pinellas County			275		28.118910	-82.663660
E-260	Brooker Creek Preserve Timber Thinning	2017	flatwoods in southeastern area of Brooker Creek Preserve	Upland			To help restore the flatwoods, increase wildfire safety, and allow for safer controlled burning pine trees will be thinned in the southeastern area of Brooker Creek Preserve. Approximately 25 to 30 trees per acre are to remain. In addition, all timber, both pine and hardwood, will be clearcut in a strip approximately 25-30 feet in width behind all homes along the north and west boundaries to provide a firebreak for wildfire protection and prescribed burns.	Other		Enhancement	Pinellas County			150		28.118910	-82.663660
E-261	City of Safety Harbor Waterfront Park	2017	Area consisted of Brazilian Peppers, Australian Pines, concrete debris, man made debris, and trash, within wetland area.	estuarine			Restoration of wetland area with wetland 18,000 habitat plants. Planting of trees and plants in upland areas by volunteers and City staff. Construction of a 2,000 LF boardwalk system made with IPE wood decking and pressure treated timber.	Invasives Control/Removal - Vegetation		Enhancement	City of Safety Harbor			2		27.992398	-82.685438
E-262	East Lake Mgmt Area Exotic Veg. Control	2017	forested wetland in East Lake Mgmt Area	Freshwater			Nuisance exotic vegetation control to remove invasive plants, site under maintenance control	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			4		27.987638	-82.388498
E-263	English Creek Preserve	2017	English Creek is located on 380 acres in eastern Hillsborough County, just east of Plant City, FL and consists of open grasslands, mesic flatwoods, upland mixed forest, and bottomland forest.	Mix (freshwater and upland)			Removal of invasive vegetation. Invasive plants were removed/controlled to provide habitat for native plants and wildlife.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			60		27.928216	-82.065477

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E-264	Fantasy Island Native Vegetation Planting	2017	Open beach/partial mangrove shoreline, intertidal and upland area on Fantasy Island in Hillsborough Bay	estuarine			Seven native species (6,040 individual plants/~6,700 sq. ft.) were planted on Fantasy Island in Hillsborough Bay to assist in sediment erosion control and shoreline stabilization, in addition to providing invaluable habitat, food source, improved water quality, and protection for wildlife. Planting priority areas included the rapidly eroding southern shoreline, along with upland locations.	Planting		Enhancement	Tampa Bay Watch			0.08		27.867814	-82.425113
E-265	Fish Hawk Preserve	2017	Habitats include Pine flatwoods, sandhill, scrub, and creek corridors	Upland			Mechanical reduction of hardwoods; trees, shrubs and plants to encourage native species growth.	Other		Enhancement	Hillsborough County			116		27.864922	-82.229573
E-266	Fred & Idah Schultz Preserve	2017	Formerly used to deposit dredge material, the Schultz Preserve was restored to mangrove forest, coastal and freshwater marsh, coastal dunes and uplands. It provides important habitat for fisheries, shorebirds, mangrove species and upland wildlife, including bobcats and migrating neotropical songbirds.	Mix (estuarine, freshwater, and upland)			Removal of invasive vegetation. Invasive plants were removed/controlled to provide habitat for native plants and wildlife.	Invasives Control/Removal - Vegetation		Enhancement	Tampa Bay Watch			78		27.811705	-82.395704
E-267	Golden Aster Scrub Preserve	2017	A 1,236 acres preserve containing sand pine and oak scrub areas. Species located within the park include the Scrub Jay and Golden Aster.	Upland			Reduction of trees, plants and shrubs to allow improve habitats for native plant and animal species.	Other		Enhancement	Hillsborough County			189		27.811476	-82.359201

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E-268	Lower Green Swamp Preserve - Invasives	2017	Includes about 13,000 acres of former cattle ranchland and farmlands that are now being restored to a more a natural state. Species in the area include white-tailed deer, Sherman's fox squirrels, bald eagles and an occasional bobcat.	Upland			Removal of invasive vegetation. Invasive plants were removed/controlled to provide habitat for native plants and wildlife.	Invasives Control/Removal - Vegetation		Enhancement	SWFWMD			68		28.103314	-82.079853
E-269	Wolf Branch Nature Preserve	2017	A 1,400-acre preserve in Hillsborough County, Florida. It offers fishing and hiking opportunities in areas of natural mangrove shoreline, upland cabbage palm hammocks, offshore sea grass beds in Tampa Bay, and tidally-influenced Wolf Branch Creek.	estuarine			Removal of invasive vegetation. Invasive plants were removed/controlled to provide habitat for native plants and wildlife.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			78		27.745312	-82.439844
E-270	Alafia River Corridor Preserve	2018	Alafia River Corridor Preserve is a 4,700 acre area of protected lands in Hillsborough County, Florida.	Upland			Alafia River Corridor Preserve removal of invasive vegetation. The Alafia River Corridor Preserve is a 4,700 acre area of protected lands in Hillsborough County, Florida. Invasive plants were removed/controlled on 444 acres to provide increased habitat for native plants and wildlife. This project effort support the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	Audubon of Florida			444		27.822642	-82.135945
E-271	Allen's Creek Management Area Exotic Vegetation Control	2018	Hammock, mangrove swamp, and marsh in Allen's Creek Management Area.	Estuarine			Nuisance exotic vegetation control in hammock, mangrove swamp and marsh areas in Allen's Creek. The site is under maintenance control. Two treatments are done per year.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			10		27.930000	-82.741000
E-272	Bahia Beach Nature Preserve	2018		Mix (freshwater and upland)			This property was previously cleared of the citrus trees which in turn allowed some native and non-native plants and shrubs to grow.This project site will be properly graded to transition from oligohaline marsh to forested wetlands and mixed forested wetland habitat after removal of invasives.	Vegetation Buffer		Enhancement	Hillsborough County			148		27.722000	-82.468000

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E-273	Balm Scrub Preserve	2018	The preserve is also home to more than 800 acres of intact scrub habitat. This rare and declining habitat supports many protected plant and animal species, many of which cannot survive without it. These species include the Florida golden aster, Florida scrub-jays, indigo snakes, and gopher tortoises.	Upland			Balm Scrub Preserve removal of invasive vegetation on 51 acres in Hillsborough County. The preserve is also home to more than 800 acres of intact scrub habitat. This rare and declining habitat supports many protected plant and animal species, many of which cannot survive without it. These species include the Florida golden aster, Florida scrub-jays, indigo snakes, and gopher tortoises. Invasive plants were removed/controlled to provide habitat for native plants and wildlife. This project effort support the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			51		27.787695	-82.228888
E-274	Bay Vista Waterfront Park	2018	Intertidal wetland habitat near the mouth of Tampa Bay	Estuarine			Bay Vista Waterfront Park intertidal wetland habitat enhancement project near the mouth of Tampa Bay; City of St. Petersburg. This project consist of planting .05 acres of Saltmarsh (Spartina alterniflora) and Paspalum vaginatum is utilized for shoreline stabilization and habitat enhancement at the project location. This project effort support the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Shoreline Stabilization/Enhancement		Enhancement	City of St. Petersburg			0.05		27.703696	-82.640430
E-275	Blackwater Creek Preseve	2018	A 1,993 acre preserve in Plant City predominately pine flatwoods, palmetto prairie and riverine swamp with scattered areas of oak hammock, cypress swamp, freshwater marsh and wet prairie.	Mix (freshwater and upland)			Blackwater Creek Preserve removal of invasive vegetation located in Hillsborough County. A 1,993 acre preserve in Plant City predominately pine flatwoods, palmetto prairie and riverine swamp with scattered areas of oak hammock, cypress swamp, freshwater marsh and wet prairie. Invasive plants were removed/controlled from 54 acres to provide habitat for native plants and wildlife. This project effort support the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			54		28.135270	-82.158741

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-276	Bower Tract Non-native plant removal and control	2018	The project area includes coastal uplands, mangroves, intact and ditched, mangrove and upland islands, salt barrens and fresh water wetlands. The site is bisected by Channel A which includes the manmade channel berms. These habitats are primarily in a healthy condition with scattered non-native vegetation occurring throughout the site.	Mix (estuarine, freshwater, and upland)			The 167 acre Bower Tract Non-native plant removal and control project in Hillsborough County is intended to remove and control non-native and nuisance plants using a variety of methods. The project area includes coastal uplands, mangroves, intact and ditched, mangrove and upland islands, salt barrens and fresh water wetlands. There were 10 large ear pod trees on the eastern berm of Channel A that were cut down and all biomass removed from the site. Stumps were treated with herbicide to prevent re-sprouting. A skid steer with a forestry mulcher was used to clear non-native vegetation on the western Channel A berm and on the firelanes in the uplands. Areas were then treated with herbicide.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			187		28.013677	-82.616116
E-277	Cypress Creek Nature Preserve	2018	The 2500-acre Cypress Creek Nature Preserve is part of a vast wildlife corridor which extends into Pasco and Polk Counties. Cypress Creek drains into the Hillsborough River and thus provides important water quality benefits to the region. Natural habitats within the preserve include hardwood forests and swamps, pine flatwoods, wet prairies, cypress stands and freshwater marshes.	Upland			Cypress Creek Nature Preserve effort to restore 11 acres of flatwoods' biodiversity and reduce the high fuel loads through mechanical thinning with use of mulching head mower equipment. Use of roller chopping to mechanically remove vegetation. The 2500-acre Cypress Creek Nature Preserve is part of a vast wildlife corridor which extends into Pasco and Polk Counties. Cypress Creek drains into the Hillsborough River and thus provides important water quality benefits to the region. Natural habitats within the preserve include hardwood forests and swamps, pine flatwoods, wet prairies, cypress stands and freshwater marshes.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			11		28.135150	-82.401810

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-278	Invasive Plant Removal at Gandy Boat Ramp	2018	A public boat ramp area consisting of estuarine shoreline and invasive plants.	Estuarine			Invasive Plant Removal at Gandy Boat Ramp. A public boat ramp area consisting of estuarine shoreline and invasive plants. Removal of approximately 1 acre of invasive plant Invasive Plant Removal at Gandy Boat Ramp. A public boat ramp area consisting of estuarine shoreline and invasive plants. Removal of approximately 1 acre of invasive plant species from the shorelines (Brazilian Pepper species from the shorelines (Brazilian Pepper and Lead Trees) in Hillsborough County and the City of Tampa. Project benefits to improve water quality and provide protection and increase habitat for fish/shellfish. This project effort support the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			1		27.892207	-82.533595
E-279	Little Manatee River Preserve	2018	This nature preserve contains wetlands, uplands and supports habitats for many species of wildlife. This area has been designated a Florida Scenic Birding Trail.	Mix (freshwater and upland)			Little Manatee River Preserve enhancement effort to control/remove vegetation on 330 acres located in Hillsborough County. This nature preserve contains wetlands, uplands and supports habitats for many species of wildlife. This area has been designated a	Invasives Control/Removal - Vegetation		Enhancement	SWFWMD			330		27.675841	-82.301738
E-280	McKay Bay Greenway	2018	The complete McKay Bay Park and Greenway encompass about 200 acres.	Upland			The complete McKay Bay Park and Greenway located in Hillsborough County encompass about 200 acres. However, this project only encompasses 26 acres of forested/woodland enhancements; removal of invasive vegetation. Invasive plants were removed/controlled to provide habitat for native plants and wildlife. This effort supports the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	City of Tampa			26		27.953991	-82.415989

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-281	McKay Invasive Plant and Litter Removal at McKay Bay Nature Park	2018	Mangrove shoreline and mud flats	estuarine			Invasive plant and litter removal of 38 acres of mangrove shoreline and mud flats at McKay Bay Nature Park located in Hillsborough County. Eradicate invasive plant species, remove litter and debris from McKay Bay Nature Park and Preserve. Plant mangroves along shoreline to prevent erosion. Approximately 1,091 volunteers worked to remove 47 tires, 50,320 pounds of trash and debris (including 27,680 pounds of invasive plants) and planted 50 mangroves. This project effort support the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	City of Tampa			38		27.952292	-82.421891
E-282	Pam Callahan Nature Preserve	2018	Local park in Riverview, Florida containing several important habitats within roughly 150 acres.	Upland			Pam Callahan Nature Preserve removal of invasive vegetation located on 22 acres in Hillsborough County. This is a local park in Riverview, Florida containing several important habitats within roughly 150 acres. Invasive plants were removed/controlled to provide habitat for native plants and wildlife. This project effort support the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			22		27.981481	-82.566864
E-283	Philippe Park Exotic Treatment	2018	Unmowed natural areas in Philippe Park	Upland			The Philippe Park exotic treatment of 16 acres of unmowed natural areas in the park located in Pinellas County. Removal of invasive vegetation. Invasive plants were removed/controlled to provide habitat for native plants and wildlife. Project benefits include water quality improvements as well as protection/improvement for increased habitat for other wildlife. The site is under maintenance control. This effort supports the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			16		28.005103	-82.677566
E-284	Redus Preserve	2018	The Redus Preserve parcel is roughly an additional 40 acres in the Little Manatee River watershed.	Upland			Redus Preserve removal of invasive vegetation on 22 acres located in Hillsborough County. The Redus Preserve parcel is roughly an additional 40 acres in the Little Manatee River watershed. Invasive plants were removed/controlled to provide habitat for native plants and wildlife. Project benefits include water quality improvements and protect/provide for increases habitat for other wildlife. This effort supports the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			22		27.693140	-82.451880

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-285	Rock Ponds Ecosystem Restoration	2018	Intertidal wetland habitat in Southern Hillsborough County	Estuarine			Rock Ponds Ecosystem Restoration tidal wetland habitat enhancement of .34 acres in Southern Hillsborough County. Paspalum vaginatum is utilized for shoreline stabilization and habitat enhancement at the project location. The benefits of this project include erosion control and improve water quality. This effort supports the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Shoreline Stabilization/Enhancement		Enhancement	Tampa Bay Watch			0.34		27.665151	-82.509426
E-286	Town and Country Preserve	2018	This preserve is home to pine flatwoods, freshwater marshes, and hardwood swamps.	Upland			This Town and Country preserve is home to pine flatwoods, freshwater marshes, and hardwood swamps. Mechanical enhancement/reduction of 12 acres of hardwoods; trees, shrubs and plants to encourage native species growth. Project benefit to protect/improve water quality and to provide habitat for other wildlife. This effort supports the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Other		Enhancement	Hillsborough County			12	4000	28.025522	-82.602173
E-287	Tropicana Nature Preserve	2018	Forested uplands, flatwoods with invasive plants.	Upland			Tropicana Nature Preserve vegetation control/removal effort on 75 acres in Hillsborough County. Maintenance removal of exotic, invasive vegetation in forested uplands and flatwoods to allow native plants to recruit to the natural areas. This effort supports the Tampa Bay Estuary Program (TBEP) Comprehensive Conservation Management Plan (CCMP) Action; Bay Habitats (BH)-1.	Invasives Control/Removal - Vegetation		Enhancement	Hillsborough County			75		27.652923	-82.249368
E-288	Weedon Island Preserve Exotic Vegetation Maintenance	2018	vegetated uplands and mosquito ditches	Mix (estuarine and upland)			Exotic vegetation maintenance control/removal of vegetation; consisting of herbicide spraying of exotic vegetation throughout 300 acres of Weedon Island Preserve. All Florida Exotic Pest Plant Council Category I and II exotic vegetation was targeted. Project benefits include water quality improvements and provide for protection and increased of wildlife. Pinellas County (Parks) is the lead implementer.	Invasives Control/Removal - Vegetation		Enhancement	Pinellas County			228		27.850936	-82.607232
E-289	Alafia River Corridor Preserve	2019		Upland	20000		Contracted Removal of any Category 1 and Category 2 Exotic Species on fragmented riverine system due to previous mining activities along with pine flatwoods	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Hillsborough County			444		27.825000	-82.133900
E-290	Alafia River State Park Invasive Plant Removal	2019		Upland	500		29 volunteers removed 500 lbs. of invasive plants from Alafia River State	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Keep Tampa Bay Beautiful			10		27.772030	-82.533280

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
E-291	Bell Creek Nature Preserve	2019		Mix (freshwater and upland)	39999		Planting of native plant species to create habitat for local wildlife species in pine flatwoods along with pockets of xeric oak hammocks, sand pine scrub, and hydric hammocks	Planting	Protect/improve/provide habitat for other wildlife	Enhancement	Hillsborough County			10		27.841200	-82.297400
E-292	Coastal Preserves Invasive Plant Maintenance (Emerson, Robinson, Perico, Ungarelli , Neal	2019		Mix (estuarine and upland)	139056		County staff and volunteers employ a variety of techniques to control a broad spectrum of invasive plant species	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County			150		27.532000	-82.628000
E-293	Courtney Campbell Mangrove Planting	2019		Estuarine	2500		Volunteers planted 70 red and white mangroves along the Courtney Campbell Causeway North Trail to restore the shoreline and prevent erosion. Keep Tampa Bay Beautiful worked with the City of Tampa Parks Department to select the best sites to make to most impact.	Planting	Erosion control	Enhancement	Keep Tampa Bay Beautiful	City of Tampa Parks and Rec, Tree Inc, William Moriaty		5		27.972170	-82.608080
E-294	Curiosity Creek Preserve Invasive Plant Maintenance	2019		Freshwater	300		County staff employ a variety of techniques to control a broad spectrum of invasive plant species	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County			18		27.646000	-82.456000
E-295	Duette Preserve Invasive Plant Maintenance	2019		Upland	270900		Contracted and staff initiated control of Cogon grass, Old World Climbing Fern and Brazliian pepper	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County	FWC		1100		27.532000	-82.101000
E-296	Duette Preserve Long Leaf Pine Canopy Restoration	2019		Upland	17500		Continue canopy restoration effort in longleaf pine savannahs via planting of 5,000 containereized 1 gallon Long leaf pines(Pinus palustris)	Planting	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County			150		27.532000	-82.101000
E-297	E.G. Simmons Regional Park Wetland Plant Restoration	2019		Estuarine	5000		Transplanted 850 plugs of Paspalum vaginatum and 2,005 plugs of Spartina alterniflora along shoreline - Wetland grass nurseries are established at local schools where students and teachers raise grasses to be transplanted at a restoration site. Students get education and hand-on restoration experience that may lead them to become environmental stewards in the future.	Planting	Erosion control	Enhancement	Tampa Bay Watch	Hillsborough County and School District, Community Foundation of Tampa Bay, TBERF, North American Partnership for Community Action		0.19		27.747000	-82.472000
E-298	Ed Center Loop South	2019		Mix (freshwater and upland)	2500		Prescribed burn in sandhill and marsh in Brooker Creek Preserve	Prescribed Burn	Protect/improve/provide habitat for other wildlife	Enhancement	Pinellas County	Florida Forest Service		55		28.111128	-82.661379

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E-299	Fort De Soto Park Wetland Plant Restoration	2019		Estuarine	10000		Transplanted 4,000 plugs of Spartina alterniflora, 100 Rhizophora mangle and 100 Conocarpus erectus along shoreline - Wetland grass nurseries are established at local schools where students and teachers raise grasses to be transplanted at a restoration site. Students get education and hand-on restoration experience that may lead them to become environmental stewards in the future.	Planting	Erosion control	Enhancement	Tampa Bay Watch	Pinellas County, Community Foundation of Tampa Bay, TBERF, North American Partnership for Environmental Community Action		0.16		27.633000	-82.719000
E-300	Fred and Idah Shultz Nature Preserve	2019		Estuarine	3900		Planting of native plant species to create habitat for local wildlife species on spoil dredged from Tampa Bay then restored to coastal habitat	Planting	Protect/improve/provide habitat for other wildlife	Enhancement	Hillsborough County			5		27.812100	-82.393700
E-301	Ft. DeSoto Recirculation Study-Upland Community Planting	2019		Mix (estuarine and upland)	2000		Community planting project where 100 buttonwood, 4000 spartina, and 100 Red Mangroves were planted at intertidal and upland areas	Planting	Erosion control	Enhancement	Pinellas County	TBEP, TBW	RESTORE ACT grant	0.9		27.630000	-82.709000
E-302	Gandy Boat Ramp Invasive Plant Removal	2019		Estuarine	500		70 volunteers removed 4,000 lbs. of invasive plant species from Gandy Boat Ramp	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Keep Tampa Bay Beautiful	TECO, Hillsborough County, City of Tampa		3		27.892810	-82.533280
E-303	Give a Day for the Bay: Clam Bayou	2019		Estuarine	500		80 volunteers showed up to plant native plants and remove trash from Clam Bayou park - a great spot in South St. Petersburg to enjoy all nature has to offer.	Planting	Protect/improve/provide habitat for other wildlife	Enhancement	Tampa Bay Estuary Program	Keep Pinellas Beautiful		2		27.739000	-82.694000
E-304	Headwaters Preserve Invasive Plant Maintenance	2019		Upland	33700		Contracted and staff initiated control of Cogon grass, Old World Climbing Fern and Brazliian pepper	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County	FWC		190		27.532000	-82.101000
E-305	Hidden Harbor Groundcover Restoration	2019		Upland	72900		establishment of desirable native groundcover	Planting	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County	SWFWMD		44.25		27.524900	-82.420003
E-306	Little Manatee River Corridor Preserve Disking	2019		Mix (freshwater and upland)	23040		Disking or soil turning is an effective method to break up perennial grasses and uncover seed beds. Disked riverine ecosystem with pine flatwoods, forested wetlands and former agricultural and cattle fields	Other	Protect/improve/provide habitat for other wildlife	Enhancement	Hillsborough County			160		27.672100	-82.288200
E-307	Little Manatee River Corridor Preserve Invasive Removal	2019		Mix (freshwater and upland)	33225		Contracted Removal of any Category 1 and Category 2 Exotic Species of riverine system with pine flatwoods, forested wetlands, and former agricultural and cattle fields	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Hillsborough County			195		27.672100	-82.288200

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E-308	MacDill AFB Wetland Plant Restoration	2019		Estuarine	5000		Transplanted 2,380 plugs of Paspalum vaginatum and 400 plugs of Spartina alterniflora along shoreline- Wetland grass nurseries are established at local schools where students and teachers raise grasses to be transplanted at a restoration site. Students get education and hand-on restoration experience that may lead them to become environmental stewards in the future.	Planting	Erosion control	Enhancement	Tampa Bay Watch	Hillsborough County and School District, Community Foundation of Tampa Bay, TBERF, North American Partnership for Community Action		0.12		27.853000	-82.503000
E-309	MacDill Chemical Invasive Control	2019		Upland	17040		Herbicide treatment of invasive plant species on mix of pine flatwoods, open grassy areas, palmetto	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	MacDill Air Force Base			142		27.845000	-82.533000
E-310	MacDill Chemical Invasive Control	2019		Mix (estuarine and freshwater)	11160		Herbicide treatment of invasive plant species in forested wetlands	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	MacDill Air Force Base			93		27.833000	-82.500000
E-311	MacDill Prescribed Burning - Units 4-8/4-9 and EOD (3 burns)	2019		Upland	30000		Prescribed burn on mix of pine flatwoods, open grassy areas, palmetto	Prescribed Burn	Protect/improve/provide habitat for other wildlife	Enhancement	MacDill Air Force Base	USFWS		57		27.837000	-82.510000
E-312	Picnic Island Invasive Plant Removal	2019		Estuarine	500		22 volunteers removed 3,000 lbs. of invasives from Picnic Island Park	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Keep Tampa Bay Beautiful	Boehringer-Ingelheim		5		27.849580	-82.553640
E-313	Picnic Island Mangrove Planting	2019		Estuarine	1000		Volunteers planted 400 red and white mangroves along the shorline of Picnic Island Park to restore the shoreline and prevent erosion. Keep Tampa Bay Beautiful worked with the City of Tampa Parks Department to select the best sites to make to most impact.	Planting	Erosion control	Enhancement	Keep Tampa Bay Beautiful	City of Tampa Parks and Rec, Tree Inc, William Moriaty		5		27.847753	-82.553961

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E-314	Rock Ponds Ecosystem restoration Project Wetland Plant Restoration	2019		Estuarine	10000		Transplanted 4,250 plugs of Paspalum vaginatum along shoreline - Wetland grass nurseries are established at local schools where students and teachers raise grasses to be transplanted at a restoration site. Students get education and hand-on restoration experience that may lead them to become environmental stewards in the future.	Planting	Erosion control	Enhancement	Tampa Bay Watch	SWFWMD, Community Foundation of Tampa Bay, TBERF, North American Partnership for Environmental Community Action		0.57		27.659000	-82.535000
E-315	Rye Preserve Invasive Plant Maintenance	2019		Freshwater	3381		Contracted and staff initiated control of a broad spectrum of invasive plant species	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County	FWC		27		27.513000	-82.364000
E-316	Rye Preserve Scrub Restoration	2019		Upland	21000		Mechanical vegetation redcution using Brown's tree cutter and chainsaw crews to restor aspect and facilitate prescribed fire for the benefit of gopher tortoises	Other	Protect/improve/provide habitat for other wildlife	Enhancement	Manatee County	Florida Forest Service, FWC		45		27.516075	-82.362646
E-317	Tampa Invasive Plant Removal	2019		Upland	500		3 Volunteers removed 3 lbs. of invasive plant species from N Blvd - Lakewood Ave to Fletcher Ave	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Keep Tampa Bay Beautiful	Caribbean Cultural Exchange			10560	28.077443	-82.467589
E-318	Town and Country Preserve	2019		Mix (freshwater and upland)	8945		Mechanical Hardwood Reduction performed to increase habitat diversity of native trees and plants in pine flatwoods, freshwater marshes, and hardwood swamps.	Other	Protect/improve/provide habitat for other wildlife	Enhancement	Hillsborough County			12		28.024100	-82.600700
E-319	Tropicana - Little Manatee River Corridor Preserve	2019		Mix (freshwater and upland)	16544.6		Contracted Removal of any Category 1 and Category 2 Exotic Species in Former Cattle Ranch used as a dumping ground for hurricane debris with small areas of pine flatwoods and hydric hammocks	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Hillsborough County			85		27.652600	-82.248300
E-320	Ulele Springs Flow Augmentation	2019	Natural spring run	Freshwater	80,000		Increase spring flows	Stream flow modification	restore natural hydrology	Enhancement	Ecosphere Restoration Institute	USFWS, FWC, City of Tampa	USFWS	1		27.959000	-82.462000
E-321	Weedon Island Preserve Exotic Vegetation Maintenance	2019		Mix (estuarine and upland)	1000		Herbicide spraying of exotic vegetation thorughout 300 acres of Weedon Island Preserve. All FLEPPC Category I & II species targeted on vegetated uplands and mosquito ditches	Invasives Control/Removal-Vegetation	Protect/improve/provide habitat for other wildlife	Enhancement	Pinellas County			300		27.848000	-82.608000
R-1	Peanut Lake Rotary Ditching	1987		Estuarine			Restore tidal flushing	Rotary ditching		Restoration	FDER			100		27.623001	-82.561741
R-2	Cabbagehead Bayou	1989		Estuarine			cut berm breach to restore tidal flow to Cabbagehead Bayou	cut berm breach to restore tidal flow to Cabbagehead Bayou		Restoration	SWFWMD-SWIM			50		27.998175	-82.617238
R-3	Hendry Delta Fill	1989		Estuarine			estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			3		27.625461	-82.565525
R-4	Boca Ceiga (Milenum Park)	1990		Estuarine			Excavation, planting of Spartina alterniflora	Excavation, planting of Spartina alterniflora		Restoration	FDNR			2.5		27.832504	-82.812558
R-5	Delaney Pop-Off Canal	1990		Estuarine			Intertidal creek restoration, removed spoil banks	Streambank grading, planting		Restoration	FDEP			10		27.885124	-82.402507

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R-6	E.G. Simmons Park: Phase 1	1990		Estuarine			restoration of open water and estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			14		27.744798	-82.472225
R-7	Joe's Creek Restoration: Phase 1	1990		Estuarine			Rotary ditching, exotic removal, clearing and planting of Spartina alterniflora	Excavation, Invasive Removal – Vegetation, Planting of Spartina alterniflora		Restoration	FDER			4.61		27.838335	-82.752885
R-8	Polanis Park	1990		Estuarine			planting of Spartina alterniflora	Excavation, grading, planting of Spartina alterniflora, removal of invasives		Restoration	FDNR			3.3		27.892209	-82.540301
R-9	Foch Lake	1991		Estuarine			filling to shallow depth, dredged tidal channels, exotic removal	filling to shallow depth		Restoration	FDER			3.9		27.826530	-82.620776
R-10	Joe's Creek Restoration: Phase 2	1991		Estuarine			exotic removal, clearing and planting of Spartina alterniflora	Regrading, Invasive Removal – Vegetation, Planting of Spartina alterniflora		Restoration	FDER			6.06		27.838335	-82.752885
R-11	Mangrove Bay: Phase 1	1991		Estuarine			low salinity open water estuarine and wetlands and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			13.5		27.842593	-82.629808
R-12	McKay Bay Northeast	1991		Estuarine	116775		low salinity esturaine wetlands and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM	City of Tampa		4		27.952120	-82.411395
R-13	Boca Ciega: Phase 1	1992		Mix (estuarine and freshwater)			low salinity open water and estuarine and freshwater wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			3.5		27.832504	-82.812558
R-14	Joe's Creek Restoration: Phase 3	1992		Estuarine			exotic removal, clearing and planting of Spartina alterniflora	Invasive Removal – Vegetation, Planting of Spartina alterniflora		Restoration	FDER			1.83		27.838335	-82.752885
R-15	Lake Tarpon Outfall Canal: Phase 1	1992		Estuarine	2000		estuarine/low salinity wetlands	Substrate modification, planting of Spartina		Restoration	SWFWMD-SWIM	Volunteers		1		28.053149	-82.708918
R-16	Little Bayou Habitat Restoration Project: Phase 1	1992		Estuarine			Restoration of tidal creek	Excavation, planting		Restoration	SWFWMD-SWIM			3		27.719013	-82.637688
R-17	Lowry Park: Spring	1992		Estuarine	18000		Freshwater and low salinity wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM	FDEP, City of Tampa		0.5		28.014751	-82.464601
R-18	Mangrove Bay Pit Filling	1992		Estuarine			filling to shallow depth from 27 feet to 10 feet			Restoration	FDEP			20		27.842593	-82.629808
R-19	Mangrove Bay: Phase 2	1992		Estuarine			estuarine wetlands, artificial reefs	Substrate modification, planting		Restoration	SWFWMD-SWIM			0.5		27.839790	-82.625822
R-20	Boca Ciega: Phase 2	1993		Mix (estuarine and freshwater)			estuarine and freshwater wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			1		27.832504	-82.812558
R-21	Freeman Park	1993		Estuarine			Create tidal lagoon, enhanced hardened shoreline, Plantings of Spartina alterniflora, exotic removal	Excavation, planting of Spartina alterniflora, Exotic removal		Restoration	BAEAT			7		27.892209	-82.540301
R-22	Peanut Lake	1993		Estuarine			estuarine, open water, and wetlands	Substrate modification, planting		Restoration	FDEP			10		27.622965	-82.556267
R-23	Picnic Island	1993		Estuarine			Estuarine open water and wetlands and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			8		27.852878	-82.552700
R-24	Al Lopez Park	1994		Freshwater			planting of freshwater wetlands	planting of freshwater wetlands		Restoration	SWFWMD-SWIM			2		27.990934	-82.503094
R-25	Harbor Palms Park	1994		Estuarine	118541		low salinity estuarine wetlands and open water and stormwater polishing	Substrate modification, planting		Restoration	SWFWMD-SWIM	City of Oldsmar		4.4		28.039279	-82.693374
R-26	Howard Frankland East	1994		Estuarine	60000		estuarine wetlands and fringing uplands			Restoration	SWFWMD-SWIM	FDOT		3		27.942142	-82.545673
R-27	Jungle Prada Park	1994		Estuarine			estuarine wetlands and open water habitat	Substrate modification, planting		Restoration	SWFWMD-SWIM			1		27.787403	-82.753628
R-28	MacDill Air Force Base: Phase 1A	1994		Mix (estuarine and upland)			low salinity, estuarine wetlands, open water and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			3		27.829760	-82.476617
R-29	Terra Ceia Causeway	1994		Estuarine			estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			2.2		27.568731	-82.571038

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R-30	Ballast Point	1995		Estuarine			restoration of estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			0.5		27.888978	-82.480643
R-31	Cargill South Parcel	1995		Estuarine			Coastal Habitat Restoration, Brazilian Pepper Removal, Re-established south channel of Alafia River	Canal Dredging, Planting of Spartina alterniflora		Restoration	FDEP			50		27.842230	-82.390065
R-32	Clam Bayou (Osgood Point): Phase 1	1995		Estuarine			estuarine, open water, and wetlands	Substrate modification, planting of Spartina		Restoration	SWFWMD-SWIM			10		27.738062	-82.691463
R-33	Joe's Creek: Phase 1A	1995		Estuarine			estuarine and low salinity wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			0.5		27.831920	-82.754396
R-34	Jungle Lake Restoration	1995		Freshwater			Re-countouring of area, Exotic removal, planting of native species			Restoration	City of St. Petersburg			35		27.797005	-82.745554
R-35	Lake Tarpon Outfall Canal: Phase 2	1995		Estuarine			estuarine/low salinity wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM	Volunteers		1		28.053149	-82.708918
R-36	Long/Cross Bayou	1995		Estuarine			estuarine wetlands - low salinity	estuarine wetlands - low salinity, Spartina alterniflora		Restoration	SWFWMD-SWIM			2		27.830498	-82.754610
R-37	Allen's Creek at St. Paul's Drive	1996		Estuarine	40000		estuarine wetlands - low salinity	Substrate modification, planting		Restoration	SWFWMD-SWIM	Pinellas County		1		27.931575	-82.753931
R-38	Cockroach Bay: Phase 1B2	1996		Estuarine			tidal creek system with marshes	Substrate modification, planting		Restoration	SWFWMD-SWIM			18.5		27.684603	-82.499355
R-39	Cockroach Bay: Phase 1A1	1997		Mix (estuarine and upland)			create estuarine open water channels, lagoon, marshes, and some uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			37.2		27.692460	-82.510730
R-40	Cockroach Bay: Phase 1B	1997		Mix (estuarine and freshwater)			freshwater and low salinity wetlands that also provide stormwater treatment	Substrate modification, planting		Restoration	SWFWMD-SWIM			24.5		27.686144	-82.499258
R-41	Del Oro Park	1997		Estuarine	30000		low salinity esturine wetlands	Excavation, planting		Restoration	SWFWMD-SWIM	City of Clearwater		1		27.970438	-82.705315
R-42	Epps Park Shoreline Restoration	1997		Freshwater			Hillsborough River shoreline protection and restoration, planting, rip rap placement, associated with living shoreline project	Freshwater wetlands		Restoration	City of Tampa	SWFWMD		1		28.005038	-82.467695
R-43	MacDill Air Force Base: Phase 1B	1997		Mix (estuarine and upland)			low salinity, estuarine wetlands, open water and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			31.3		27.829760	-82.473317
R-44	Bartlett Park	1998		Estuarine			low salinity tidal creek and wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			4		27.749293	-82.639292
R-45	Cypress Point Park Restoration	1998		Estuarine			Created tidal lagoons, replanting shoreline			Restoration	City of Tampa	SWFWMD		3		27.950873	-82.541804
R-46	Emerson Point: Phase 1	1998		Estuarine			low salinity estuarine wetlands and estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			25		27.533913	-82.632219
R-47	Mangrove Bay: Phase 3	1998		Estuarine			estuarine low salinity open water and wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			21		27.835347	-82.622798
R-48	Mobbly Bayou: Phase 1	1998		Estuarine	200000		low salinity estuarine open water and wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM	City of Oldsmar		14		28.026143	-82.662079
R-49	Weedon Island	1998		Estuarine			planting of Spartina alterniflora			Restoration	SWFWMD-SWIM			0.1		27.846975	-82.609493
R-50	Boca Ciega: Phase 3	1999		Mix (estuarine and freshwater)			estuarine and freshwater wetlands	Excavation, planting		Restoration	SWFWMD-SWIM			2.5		27.832504	-82.812558
R-51	Braden River: Phase 2 (SR70)	1999		Estuarine			estuarine wetlands - low salinity	Excavation, planting		Restoration	SWFWMD-SWIM			10		27.450251	-82.491132
R-52	Cockroach Bay: Phase 1 Uplands	1999		Upland			coastal uplands - mixed pine and harwood forest	Planting		Restoration	SWFWMD-SWIM			45		27.689372	-82.503392
R-53	Cockroach Bay: Phase 1A2	1999		Mix (estuarine and upland)			create estuarine open water channels, lagoon, marshes, and some uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			55.8		27.694443	-82.507368
R-54	Coopers Point	1999		Estuarine	200000		estuarine open water and wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM	City of Clearwater		10		27.968614	-82.693590

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R-55	Emerson Point: Phase 2	1999		Estuarine			low salinity estuarine wetlands and estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			5		27.533940	-82.625770
R-56	Lake Thonotosassa Project	1999		Freshwater			Excavation, Planting of native species	Excavation, Planting of native species		Restoration	SWFWMD	EPCHC, FDEP		80		28.054001	-82.268807
R-57	MacDill Air Force Base: Phase 2	1999		Mix (estuarine and upland)			low salinity, estuarine wetlands, open water and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			32.6		27.822205	-82.479637
R-58	South Skyway	1999		Estuarine			estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			3		27.584024	-82.599459
R-59	Braden River: Phase 1 (SR64)	2000		Estuarine			estuarine wetlands - low salinity	Excavation, planting		Restoration	SWFWMD-SWIM			10		27.498090	-82.521931
R-60	Clam Bayou (Osgood Point): Phase 2	2000		Estuarine			estuarine open water and wetlands and some low salinity	Substrate modification, planting of Spartina		Restoration	SWFWMD-SWIM			10		27.745067	-82.687888
R-61	Palmetto Estuary	2000		Mix (estuarine and upland)			estuarine wetlands, low salinity wetlands and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM	Ecosphere Restoration Institute		26		27.511605	-82.564149
R-62	Davis Tract Salt Marsh Restoration	2001		Estuarine			regrading of slopes and marsh planting			Restoration	Tampa Bay Watch			7		27.834600	-82.395700
R-63	Fort Brooke Park Shoreline Restoration	2001		Estuarine			dock and warf removal, shoreline restoration revegetated with wetland and coastal habitat plants			Restoration	City of Tampa	SWFWMD		1		27.947222	-82.458333
R-64	Red Maple Swamp (Allen's Creek)	2001		Freshwater			Excavation and re-establishment of marsh	Excavation, Planting of native species		Restoration	City of Clearwater	SWIM, PCDEM		8.2		27.950230	-82.751223
R-65	Wolf Branch Creek 1	2001		Mix (estuarine, freshwater, and upland)			estuarine wetlands, open water, tidal creek, freshwater wetlands and uplands	estuarine wetlands, open water, tidal creek, freshwater wetlands and uplands		Restoration	SWFWMD-SWIM			181		27.741949	-82.440722
R-66	Wolf Branch Creek 2	2001		Estuarine			re-establish tidal flow to estuarine wetlands -enhancement only	re-establish tidal flow to estuarine wetlands - enhancement only		Restoration	SWFWMD-SWIM			134		27.746511	-82.446975
R-67	Davis Tract	2002		Mix (estuarine and upland)			estuarine open water and wetlands and uplands	Regrading, planting		Restoration	SWFWMD-SWIM			60		27.829129	-82.387955
R-68	Cockroach Bay Freshwater Wetlands	2003		Freshwater			Creation of freshwater wetland, in part FDOT mitigation	Substrate modification, planting		Restoration	Hillsborough County Expressway Authority			25		27.689836	-82.507512
R-69	Joe's Creek School Site	2003		Estuarine			exotic removal (Brazilian pepper), hydrological restoration	Invasive Removal – Vegetation, Planting, Hydrological manipulation		Restoration	SWFWMD-SWIM			20		27.831632	-82.747785
R-70	Mangrove Bay Habitat Rehabilitation	2003		Estuarine			exotic removal (Brazilian pepper), restoration of intertidal wetlands along shoreline of Riviera Bay	Invasive Removal – Vegetation		Restoration	City of St. Petersburg			13		27.833333	-82.616667
R-71	Tappan Site	2003		Mix (estuarine, freshwater, and upland)			Restoration of coastal uplands, freshwater wetlands and estuarine marsh areas	Substrate modification, planting		Restoration	SWFWMD-SWIM			17		27.869478	-82.533754
R-72	Apollo Beach	2004		Mix (estuarine and upland)			restoration of estuarine open water/wetlands and uplands	restoration of estuarine open water/wetlands and uplands		Restoration	SWFWMD-SWIM			37		27.790055	-82.416695
R-73	Balm Road Marsh	2004		Mix (freshwater and upland)			restoration of freshwater wetlands and uplands	Excavation, Exotic removal, planting		Restoration	SWFWMD-SWIM			49		27.743245	-82.292317
R-74	Cockroach Bay: Freshwater Wetlands	2004		Freshwater			create freshwater wetlands - part of a 30 acre FDOT mitigation project	Substrate modification, planting		Restoration	SWFWMD-SWIM			22		27.685963	-82.506673
R-75	Fred & Idah Schultz Preserve (Port Redwing)	2004		Mix (estuarine, freshwater, and upland)			restoration of estuarine open water/wetlands, freshwater wetlands, and coastal uplands	restoration of estuarine open water/wetlands, freshwater wetlands, and coastal uplands		Restoration	SWFWMD-SWIM			120		27.811964	-82.391639
R-76	Ft. Desoto Circulation Project	2004		Estuarine			restored tidal currents to estuarine islands/lagoons for water quality enhancement	restored tidal currents to estuarine islands/lagoons for water quality enhancement		Restoration	Pinellas County			200		27.625467	-82.715436

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R-77	Gateway Tract	2004		Estuarine			estuarine wetlands	Substrate modification, planting		Restoration	SWFWMD-SWIM			110		27.888986	-82.653974
R-78	Wolf Branch Creek Uplands	2004		Upland			restoration of coastal uplands	restoration of coastal uplands		Restoration	SWFWMD-SWIM			281		27.746904	-82.436726
R-79	Brooker Creek Channel F	2005		Freshwater	1001440		freshwater wetlands and enhancement of watershed	Excavation, planting		Restoration	SWFWMD-SWIM	Pinellas County		0.2		28.078317	-82.676179
R-80	Brooker Creek Channel L	2005		Freshwater	919590		freshwater wetlands and enhancement of watershed	Excavation, planting		Restoration	SWFWMD-SWIM	Pinellas County		4		28.119026	-82.653319
R-81	Clam Bayou Salt Marsh Restoration	2005		Estuarine			regrading of slopes and marsh planting			Restoration	Tampa Bay Watch			6		27.741400	-82.691400
R-82	Cockroach Bay: Braided Tidal Creek	2005		Estuarine			created braided tidal creek that eventually will connect to a freshwater source	Substrate modification, planting		Restoration	SWFWMD-SWIM			11.5		27.691954	-82.506783
R-83	Cockroach Bay: Uplands Final Phase	2005		Upland			coastal pine flatwoods	Substrate modification, planting		Restoration	SWFWMD-SWIM			69		27.685414	-82.509910
R-84	Lancaster Tract (Allen's Creek)	2005		Estuarine	600000		Intertidal wetland establishment (4 ac); shoreline enhancement (2 ac), exotic species removal (2 ac);	Substrate modification, planting		Restoration	SWFWMD-SWIM	PCDEM		14		27.931328	-82.738201
R-85	Little Bayou Habitat Restoration Project: Phase 2	2005		Estuarine			Phase II: seawall removed and upland field removed. Creation of saltwater wetland, low salinity open water estuarine creek, lagoons, and wetlands	Phase II: seawall removed and upland field removed. Creation of saltwater wetland, low salinity open water estuarine creek, lagoons, and wetlands		Restoration	City of St. Petersburg			3		27.720628	-82.632545
R-86	Marsh Creek	2005		Estuarine			estuarine low salinity wetlands/tidal creek	Substrate modification, planting		Restoration	SWFWMD-SWIM			9		27.719030	-82.432454
R-87	Weedon Island Exotic Removal and Saltern Restoration	2005		Estuarine			11 acres exotic removal, hydraulic restoration	11 acres exotic removal, hydraulic restoration		Restoration	Pinellas County			11		27.846975	-82.609475
R-88	Archie Creek Restoration	2006		Freshwater			Relocate portions of channelized and natural Archie Creek, accept basin flows and volumes, eliminate exotic species, replace old fish ponds and borrows with freshwater marsh and forested wetland creation areas	Major flowway modeling, excavation, grading, and wetland creation. Extensive wetland and unpland plantings. Continued exotic plant species management.		Restoration	Mosaic			49.7		27.881421	-82.398333
R-89	Cockroach Bay - Middle Uplands and Wetlands	2006		Mix (estuarine and upland)			estuarine wetlands and uplands	Substrate modification, planting		Restoration	SWFWMD-SWIM			128		27.686111	-82.506944
R-90	Dug Creek	2006	creation of tidal passes to improve circulation and non-native plant control on islands	Estuarine			excavated three tidal passes along a spoil berm to improve tidal circulation through mangrove forest and tidal channel and non-native plant control on four islands	Invasives Control/Removal - Vegetation		Restoration	SWFWMD-SWIM			30		27.822822	-82.385540
R-91	Felts Preserve-Audubon Restoration Project	2006		Freshwater			Rehabilitation/Creation	Rehabilitation/Creation		Restoration	FDEP			30		27.555100	-82.539600
R-92	Kapok Restoration Project	2006		Freshwater			Excavation and re-establishment of marsh	Excavation, Invasive removal, Plant native species		Restoration	City of Clearwater			26		27.973699	-82.715043
R-93	Newmans Branch Restoration	2006	shoreline restoration along Newmans Branch Creek	estuarine			The Newmans Branch Restoration is a project which includes restoration of disturbed habitat to restore native plant communities. Native plant species will be planted to enhance this area.	Planting		Restoration	Ecosphere Restoration Institute			12		27.784432	-82.405811
R-94	Ribbon of Green (USF Property)	2006		Estuarine	71826		Shoreline restoration/revegetation on urban seawalled/riprapped shore	planting		Restoration	SWFWMD-SWIM	City of Tampa		0.62		27.942350	-82.458090

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R-95	Reed Property	2007	Intertidal wetland system along the Hillsborough River.	Estuarine	650000	31-Oct-06	This project aims to restore an area of intertidal wetland habitat along the Hillsborough River to promote habitat for fish, shellfish and other wildlife.	Rehabilitation/Creation		Restoration	SWFWMD	City of Tampa		4.75		27.985504	-82.470760
R-96	Terra Ceia Ecosystem Restoration	2008		Estuarine			Restoration and enhancement including debris removal and removal of invasive vegetation and re-planting with native plant species.	Planting		Restoration	SWFWMD-SWIM			59.6		27.579624	-82.608809
R-97	Marsh Creek Phase 2	2009		Estuarine			Phase 2 of Marsh Creek project includes removal of non-native plants and debris along creek shoreline.	Invasive Removal - Vegetation		Restoration	SWFWMD-SWIM			40.1		27.719000	-82.432000
R-98	Terra Ceia 'Airplane Forest' Upland Restoration	2009		Estuarine			The 'Airplane Forest' restoration project consisted of removal of non-native plants followed by planting of native pine and palmetto.	Rehabilitation/Creation		Restoration	SWFWMD-SWIM			47.9		27.693769	-82.506104
R-99	Terra Ceia Wetlands I	2009		Mix (estuarine, freshwater, and upland)			The Terra Ceia project consisted of restoration and enhancement of various coastal habitats.	Rehabilitation/Creation		Restoration	SWFWMD-SWIM			134		27.602800	-82.560900
R-100	Wolf Branch Freshwater Wetlands	2009		Freshwater			Freshwater wetland creation and planting	Freshwater wetland creation and planting		Restoration	Ecosphere Restoration Institute			5		27.739589	-82.445536
R-101	Cockroach Bay Aquatic Preserve Salt Barren Restoration	2010		Estuarine			Habitat types in this project include high marsh, mangroves, ditched uplands and exotic vegetation. Hydroblasting, exotic vegetation removal and regrading berms were used to achieve project goals.	Invasives Control/Removal - Vegetation		Restoration	Ecosphere Restoration Institute			26		27.684000	-82.513000
R-102	Ekker Restoration Project	2010		Mix (freshwater and upland)			Historical pine flatwoods and freshwater wetlands have been converted to aquaculture (tropical fish farm); re-worked site to a freshwater wetland with fringing uplands. Project also contains establishment of 5 acres of coastal uplands.	Invasives Control/Removal - Vegetation		Restoration	SWFWMD-SWIM			19		27.841631	-82.367844
R-103	Hooker's Point Outfall	2010		Estuarine			Wetland creation approximately 1 ac and 6 ac of stormwater retrofit polishing			Restoration	Ecosphere Restoration Institute			1		27.908132	-82.436788
R-104	Lost River Preserve/Cockroach Bay Wetland Creation Project	2010		Mix (estuarine, freshwater, and upland)			Invasive plant removal, estuarine and freshwater wetland creation, upland and wetland planting, storm water retrofit and attenuation. Project also includes establishment of 6.5 acres of estuarine marsh, 9 acres of coastal uplands and 21 acres of mangrove	Invasives Control/Removal - Vegetation		Restoration	Ecosphere Restoration Institute			43		27.707000	-82.487000
R-105	Site 9 Mangrove Restoration	2010		Estuarine			The project dug up the mosquito ditch mounds, removing all of the vegetation including invasive species along a 1,200 foot length of historic mosquito ditch. A zone approximately 50 feet wide on both sides of the ditch was dug up to remove the mounds and	Ditch Removal, Filling, or Plugging		Restoration	MacDill Air Force Base			2		27.842000	-82.507000
R-106	Wolf Branch Creek Nature Preserve Ephemeral Pond Creation	2010		Upland			Re-sculptured existing coastal uplands previously filled and degraded with overburden from adjacent, on-site restoration. Project also includes enhancement of 1.5 acres of coastal uplands.	Other		Restoration	Ecosphere Restoration Institute			3.5		27.739000	-82.444000
R-107	Newman Branch Phase II	2011		Estuarine			Wetland and mangrove restoration			Restoration	Ecosphere Restoration Institute			12		27.780272	-82.403097

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R-108	Three Mile North Reef	2011		Estuarine			Portions of the Sunshine Skyway Fishing Pier will be demolished and submerged to create 70,000 tons of artificial reef.	Reef Construction - Artificial Materials		Restoration	Manatee County Natural Resources			23		27.537000	-82.745000
R-109	Alligator Lake Habitat Restoration	2012	Alligator Lake is located in north Pinellas County and drains directly into Old Tampa Bay. The property contains ruderal uplands and stormwater ditch wetlands.	Mix (freshwater and upland)	1750000	31-Mar-12	This project consisted of removal of exotic vegetation and hydrological restoration and creation to improve water quality flowing into Old Tampa Bay.	Invasives Control/Removal - Vegetation		Restoration	Pinellas County Parks and Conservation Resources	SWFWMD		18.64		27.981896	-82.698139
R-110	Clam Bayou Phase 3	2012		Upland			This final phase of restoration at Clam Bayou consisted of restoration and stormwater treatment and restoration of various coastal upland habitats.	Invasives Control/Removal - Vegetation		Restoration	SWFWMD			28.36		27.743000	-82.685000
R-111	Duette Preserve Hydrological Restoration	2012		Freshwater			Man-made ditches associated with historic agricultural use were filled and plugged, contributing over 300 acres of isolated, seasonal wetlands.	Ditch Removal, Filling, or Plugging		Restoration	Manatee County			300		27.523000	-82.156000
R-112	Duette Preserve Hydrological Restoration	2012		Freshwater			Man-made ditches associated with historic agricultural use were filled and plugged, contributing over 300 acres of isolated, seasonal wetlands.	Ditch Removal, Filling, or Plugging		Restoration	Manatee County			300		27.523000	-82.156000
R-113	Palmetto Estuary Phase 2	2012		Estuarine			Wetland creation			Restoration	Ecosphere Restoration Institute			1		27.516553	-82.564347
R-114	Alligator Lake Habitat Restoration	2013	Ruderal upland and stormwater ditch wetlands	Mix (freshwater and upland)	1750000		Exotic invasive plant removal and hydrological restoration/creation within the Alligator Lake drainage basin, which is directly adjacent to Old Tampa Bay.The Alligator Lake Management Area is a 53 acre preserve owned and managed by Pinellas County located	Vegetation Buffer		Restoration	SWFWMD			19		27.981000	-82.702000
R-115	MacDill Air Force Base Phase 3	2013		Estuarine			This project has enhanced/restored 111.45 ac of various estuarine, freshwater, and coastal upland habitats. Portions of base and golf course stormwater runoff were re-routed through wetlands that will provide some cleansing of potential pollutants prior t	Invasives Control/Removal - Vegetation		Restoration	SWFWMD			111		27.835000	-82.476000
R-116	Ulele Springs Restoration Project	2013	Ulele Spring is currently concrete-lined and is piped to the Hillsborough River.	Mix (estuarine and freshwater)	655000		This natural spring will be expanded to create native freshwater wetlands and the pipe will be removed as well a section of the seawall to allow a spring run to be restored to the river for fisheries habitat enhancement; in addition, ~500 linear feet of “	Bulkhead Removal		Restoration	Ecosphere Restoration Institute			1		27.959000	-82.462000
R-117	Mac Dill Air Force Base Phase III	2014		Mix (freshwater and upland)			Removal of invasive plants and trees to promote establishment of freshwater and upland habitats.	Invasives Control/Removal - Vegetation		Restoration	SWFWMD-SWIM			109		27.828922	-82.484104
R-118	Newman Branch II B, C, D	2014		Estuarine			Saltern restoration, 1 acre of creation and enhancement			Restoration	Ecosphere Restoration Institute			20		27.782317	-82.409430

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R-119	Ulele Springs Restoration Project	2014	Ulele Spring is currently concrete-lined and is piped to the Hillsborough River in Hillsborough County.	Mix (estuarine and freshwater)	670000		This natural spring basin was expanded to created native freshwater wetlands and the pipe was removed as well as a section of the seawall to allow a spring run to be restored to the river for fisheries habitat enhancement; in addition, ~500 linear feet of	Bulkhead Removal		Restoration	Ecosphere Restoration Institute	ERI, NOAA, USFWS, FWC, EPC, TBERF, & City of Tampa		1		27.959000	-82.462000
R-120	Alligator Lake Habitat Restoration	2015	Alligator Lake is a 55 acre property located in Safety Harbor, Pinellas County, Florida. This area supports flatwoods, hammocks, and freshwater marshes.	Mix (freshwater and upland)	1750000		This project is removal of exotic, invasive vegetation and hydrological restoration and/or creation in flatwoods, hammocks and freshwater marshes in Alligator Lake in Safety Harbor.	Invasives Control/Removal - Vegetation		Restoration	Pinellas County	SWFWMD		19		27.981000	-82.702000
R-121	Bear Creek Channel Improvements	2015		Mix (estuarine and freshwater)			Construction of in-line sediment sump on the Bear Creek Channel. Erosion control on slopes of channel and removal of sedimentation within the Bear Creek lagoon. Bear Creek is a major outfall into Boca Ciega Bay within Pinellas County. This project will im	Shoreline Stabilization/Enhancement		Restoration	Pinellas County			7		27.759000	-82.729000
R-122	Bullfrog Creek Scrub Preserve	2015		Freshwater			Design and construction of two low-flow water crossings across tributaries to Bullfrog Creek was completed using geoweb and stone to allow maintenance vehicles access to the site while minimizing impacts to water quality and streambeds. The project benefi	Stream Flow Modification (including stream pool construction)		Restoration	Hillsborough County			302		27.837000	-82.382000
R-123	Feather Sound Coastal Restoration	2015		Mix (freshwater and upland)			Non-native invasive vegetation was removed and native coastal upland plants replace the non-native species that were removed in these coastal uplands and high marsh areas to improve water quality and provide habitat for other wildlife.	Planting		Restoration	Pinellas County			5		27.902000	-82.658000
R-124	FWC Plant Grow Out Pond	2015		Estuarine			Estuarine wetland creation for plant harvesting pruposes			Restoration	TECO			0.8		27.779872	-82.404106
R-125	MacDill Mangrove Restoration	2015		Estuarine			Hydroblasted 274 spoil mounds to restore sheetflow on 52 acres, 8.5 acres of creation of estuarine wetlands by leveling spoil mounds, 1.5 ac uplands and salterns			Restoration	Ecosphere Restoration Institute			65		27.832384	-82.509514
R-126	Mangrove Restoration, Sites 8 & 15 (Phase I)	2015		Estuarine			The primary project goal is removal of the upland mounds throughout the site to restore historic hydrology. The mounds are being removed using the hydroblasting technique. Exotic vegetation on the mounds is removed and the mound material is spread in 360-	Fill Removal		Restoration	MacDill Air Force Base			1		27.843000	-82.535000

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
R-127	Rocky Creek Preserve Habitat Restoration	2015	Rocky Creek bisects the project area and includes several mangrove and upland spoil islands which are part of the project.	Estuarine	93394		The project is located on the approximately 348 acre Rocky Creek Coastal Preserve in the northeastern reaches of Old Tampa. The project is intended to control/kill-in-place non-native nuisance plant species which are scattered about the Preserve to regain	Invasives Control/Removal - Vegetation		Restoration	SWFWMD			70		27.989000	-82.593000
R-128	Feather Sound Coastal Restoration	2016	Coastal upland and high marsh with non-native, invasive vegetation.	Mix (freshwater and upland)			Non-native vegetation was removed and volunteers from Tampa Bay Watch planted the native plants that included seagrape, buttonwood, Florida privet, sandcordgrass, slash pine, and seashore paspalum. The project benefits included hydrology restoration and habitat for wildlife.	Invasives Control/Removal - Vegetation		Restoration	Pinellas County			10		27.900372	-82.659317
R-129	Feather Sound Phase 2	2016	Estuarine wetland and coastal upland restoration along Feather Sound Drive extending into existing hydrologically modified mangrove forest.	estuarine			Mechanical removal of invasives and hydroblasting 10.8 acres of saltern restoration, 1.37 acres of estuarine highmarsh and coastal upland restoration. Project benefits include hydrology restoration, water quality improvements, increased habitat for birds, fish and shellfish.	Invasives Control/Removal - Vegetation		Restoration	Tampa Bay Estuary Program			11		27.902387	-82.659654
R-130	Ft De Soto Ecological Enhancement Recirculation Phase II	2016	The largest park within the Pinellas County Park System, Fort De Soto park consists of 1,136 acres made up of five interconnected islands (keys). These keys are home to beach plants, mangroves, wetlands, palm hammocks, hardwoods and scores of native plants. Each of these species plays a vital role in the preservation and protection of the natural environment.	estuarine			A causeway constructed to allow access to a maintenance area at Ft DeSoto Park was breached allowing increased flow and improved water quality between two back bays. Project benefits include increase water flow, improved water quality, increase habitat for birds, fish and shellfish.	Berm/Dike Removal		Restoration	Pinellas County			450		27.629401	-82.708469
R-131	MacDill AFB – Mangrove Restoration Expansion Project	2016	Mangrove forest bisected by ditches with resultant spoil mounds.	estuarine			Mangrove habitat was mosquito ditched ('70) which altered the former sheet flow conditions within the mangrove community; the resultant spoil mounds were hydro-blasted out and areas were planted with native vegetation. Project benefits include increase of water flow to improve water quality thus an increase fish habitat.	Fill Removal		Restoration	Ecosphere Restoration Institute			0.1		27.833101	-82.512524

ID Number	Name	Year	Description	Category	Total Project Cost	Start Date	Project Description	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
R-132	Newman Branch II Exp. E- Saltern & Sheet Flow Restoration	2016	Former saltern community with spoil mounds covered with exotic vegetation.	estuarine			Former saltern habitat was mosquito ditched ('69) which altered the micro-topography and eliminated the saltern community; additional resultant spoil mounds were hydro-blasted out and the stagnate portions of the blocked ditches were blocked to improve sheet flow across the saltern/ salt barrens to increase bird habitat.	Ditch Removal, Filling, or Plugging		Restoration	Ecosphere Restoration Institute			16.3		27.782883	-82.408271
R-133	Newman Branch III - Creek & Coastal Restoration	2016	Oligohaline creek section & surrounding coastal community	estuarine			Former natural creek bed was filled in by development ('73) which disrupted the creek's flow and the surrounding coastal habitat inclusive of small freshwater ponds. The entire site was also covered with non-native vegetation. Project benefits include increase water flow, water quality and increase fish habitat.	Fill Removal		Restoration	Ecosphere Restoration Institute			5		27.779789	-82.399268
R-134	Lower Green Swamp Preserve	2017	Preserve includes about 13,000 acres of former cattle ranchland and farmlands that are now being restored to a more a natural state.Species in the area include white-tailed deer, Sherman's fox squirrels, bald eagles and an occasional bobcat.	Freshwater			Ditch removal, ditch filling and plugging. This project will aid with proper water flow and levels.	Ditch Removal, Filling, or Plugging		Restoration	SWFWMD			1		28.103314	-82.079853
R-135	Mangrove Restoration Phase III & IV, Sites 4 and 16	2017	Extensive mangrove estuary that has been degraded through construction of mosquito ditches, and creation of upland mounds.	estuarine			Phase III and IV are extensions of previous mangrove restoration work involving the same techniques. The goal is removal of upland mounts throughout the site to restore historic hydrology. Mounds are removed using hydroblasting. Invasive vegetation is removed and the mound material is spread out evenly using the jet to adjust elevation to below mean high water. Newly graded mound areas are planted with appropriate vegetation. Ditch blocks are being installed in the mosquito	Fill Removal		Restoration	Tampa Bay Estuary Program			17		27.833789	-82.519458
R-136	Palmetto Estuary Phase 2A	2017	Coastal uplands and estuarine wetlands	Mix (estuarine and upland)			Side cast fill material from the creation of the Carr Drain was used to create a small coastal upland area with berm breaches that connected a formally disconnected black mangrove forest. Exotic removal and native plantings were also incorporated	Other		Restoration	SWFWMD-SWIM			0.32		27.516992	-82.564297
R-137	MacDill Mangrove Restaration Phase V	2018	Wetland creation, marsh, mangrove, and saltern restoration	Estuarine			Wetland creation, marsh, mangrove, and saltern restoration			Restoration	Ecosphere Restoration Institute			28.4		27.836739	-82.520089

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R-138	MacDill Air Force Base Saltern Restoration	2019	Hydroblasting spoil mounds	Estuarine	33,000		Saltern restored	fill removal	restore natural hydrology	Restoration	Ecosphere Restoration Institute	MacDill Air Force Base	Department of Defense	1.8		27.830580	-82.519270
R-139	Waterfront Park Spring Feature	2019		Estuarine	200490		Spring restoration associated with living shoreline project: removal of 150 LF existing sea wall and concrete; installation of 240 tons of rip rap stone, 36 tons of oyster shell and 3,300 SF of geosynthetic mesh for the oyeter bags; installation of 450 herbaceous estuarine plantings. Spring Feature work consisted of : Removal of an existing concrete head wall and 15 LF of existing storm pipe, installation of 1 pre-cast flared end section, and installation of 1,200 SF of impervious geotextile fabric, installation of approx. 60 tons of frip rap stone around an existing spring discharging into Tampa Bay, and installation of estuarine plants.	Vegetation Buffer	Improve or protect water quality	Restoration	City of Safety Harbor	TBERF		0.2		27.989270	-82.685810

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-1	LS	Palm River	1979		Estuarine	0		planting of Spartina alterniflora, Paspalum	planting of Spartina alterniflora, Paspalum	Enhancement	FDNR				50	27.9424	-82.408302
LS-2	LS	Lowry Park: Shoreline	1992		Estuarine	18000		Freshwater and low salinity wetlands	Substrate modification, planting	Enhancement	SWFWMD-SWIM	FDEP, City of Tampa			400	28.01443	-82.464525
LS-3	LS	Hamilton Creek	1993		Freshwater	0		Stream restoration and planting	Stream restoration and planting	Enhancement	SWFWMD-SWIM				250	28.01371	-82.465363
LS-4	LS	Picnic Island	1993		Estuarine	0		Living shoreline associated with larger wetland restoration effort	Substrate modification, planting	Restoration	SWFWMD-SWIM				300	27.85732	-82.551815
LS-5	LS	Epps Park Shoreline Restoration	1997		Freshwater	0		Hillsborough River shoreline protection and restoration, planting, rip rap placement	Freshwater wetlands	Restoration	City of Tampa	SWFWMD			250	28.00542	-82.467783
LS-6	LS	Rivercrest Park	1999		Estuarine	0		Living shoreline/breakwater with native vegetation to protect shoreline		Restoration	City of Tampa				800	27.99616	-82.46534
LS-7	LS	Green Key 1	2002		Estuarine	0		Oyster bar creation, Control erosion,	Oyster bar creation	Restoration	Audubon of Florida Audubon of Florida Audubon of Florida				300	27.81842	-82.399723
LS-8	LS	Whiskey Stump Key 1	2002		Estuarine	0		oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	Audubon of Florida				300	27.81488	-82.401997
LS-9	LS	Al Palonis Park Oyster Restoration	2003		Estuarine	0		Oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	Tampa Bay Watch	NOAA			750	27.89274	-82.540818
LS-10	LS	Demen's Landing	2003		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				490	27.76983	-82.63218
LS-11	LS	Vinoy Basin Northeast	2003		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				1500	27.77741	-82.627694
LS-12	LS	Bayshore Boulevard: Phase 1	2003		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creatin of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				100	27.87426	-82.486947

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-13	LS	Green Key 2	2003		Estuarine	0		oyster shell reefs built along shoreline oyster shell reefs built along shoreline oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	Audubon of Florida				200	27.81935	-82.398818
LS-14	LS	Davis Island Beach Boat Ramp	2004		Estuarine	0		Planting of Spartina alterniflora		Enhancement	City of Tampa Parks and Recreation Department	TBW			100	27.91007	-82.4472
LS-15	LS	Ballast Point Habitat Restoration	2004		Estuarine	0		Oyster bars: reef placed along 200' of shoreline for oyster growth	Substrate modification, planting	Restoration	Tampa Bay Watch				200	27.88902	-82.48064
LS-16	LS	Coffee Pot Bayou	2004		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				150	27.79968	-82.633472
LS-17	LS	Cunningham Key Oyster Dome Project	2004		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				100	27.65456	-82.718141
LS-18	LS	Fantasy Island	2004		Estuarine	0		Oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	TPA				144	27.86826	-82.426051
LS-19	LS	MacDill Air Force Base Oyster Dome: Phase 1	2004		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				700	27.82048	-82.477569
LS-20	LS	Rowlett Park	2005		Freshwater	0		Removed Brazilian pepper, planted native trees and shrubs		Enhancement	City of Tampa				250	28.02334	-82.431292
LS-21	LS	Davis Tract (Kitchen Nature Preserve) Oyster Restoration	2005		Estuarine	0		Oyster cultch placement	Substrate modification, planting	Restoration	Tampa Bay Watch				500	27.83207	-82.387776
LS-22	LS	Little Bird Key National Wildlife Refuge	2005		Estuarine	0		Oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	USFWS				200	27.68535	-82.71722
LS-23	LS	Mosaic Process Water Discharge - Hillsborough Bay Oyster Pilot Project	2005		Estuarine	0		Shoreline improvement		Restoration	NOAA				500	27.86787	-82.425188
LS-24	LS	War Vets Oyster Bar Restoration	2005		Estuarine	0		Construction of oyster reef west of War Veteran's Mem. Park	Construction of oyster reef west of War Veteran's Mem. Park	Restoration	Pinellas County				600	27.80168	-82.775275

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LS-25	LS	MacDill Air Force Base Oyster Reef: Phase 2	2005		Estuarine	0		oyster shell reefs built along shoreline	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				700	27.82061	-82.47515
LS-26	LS	Bayshore Boulevard: Phase 2	2005		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				100	27.89489	-82.485804
LS-27	LS	Whiskey Stump Key 2	2005		Estuarine	0		Rebuild and enlarge oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	Audubon of Florida				300	27.81347	-82.40214
LS-28	LS	22nd Street Park	2006		Freshwater	0		Removed exotics and replanted		Enhancement	City of Tampa				450	28.02073	-82.436681
LS-29	LS	Blackwater Hammock Park	2006		Freshwater	0		Planting with native vegetation		Enhancement	Hillsborough County				100	28.02061	-82.420783
LS-30	LS	Sulphur Springs Park	2006		Freshwater	0		Planting with native vegetation		Enhancement	City of Tampa				400	28.02044	-82.45225
LS-31	LS	Temple Crest Center Park	2006		Freshwater	0		Planting with native vegetation		Enhancement	City of Tampa				250	28.02474	-82.419484
LS-32	LS	Ft. DeSoto 1	2006		Estuarine	0		Oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	Tampa Bay Watch				480	27.63195	-82.721759
LS-33	LS	Ribbon of Green (USF Property)	2006		Estuarine	71826		Shoreline restoration/revegetation on urban seawalled/riprapped shore	planting	Restoration	SWFWMD-SWIM	City of Tampa			80	27.94243	-82.458307
LS-34	LS	Tarpon Key National Wildlife Refuge	2006		Estuarine	0		Oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	USFWS				755	27.66695	-82.694667
LS-35	LS	MacDill Air Force Base Oyster Reef: Phase 3	2006		Estuarine	0		oyster shell reefs built along shoreline	Creation of oyster habitat (oyster shell reef)	Restoration	Tampa Bay Watch				400	27.8285	-82.470525
LS-36	LS	E.G. Simmons Park	2007		Estuarine	0		Project consists of planting of salt marsh plants at an intertidal shoreline area within E.G. Simmons Park in Hillsborough County to aid in erosion control and provide habitat for wildlife.	Erosion Control	Enhancement	Tampa Bay Watch				1700	27.74192	-82.479275
LS-37	LS	MacDill Oyster Bar Creation Project	2007		Estuarine	0		Project consists of creation of an oyster shell bar using natural oyster materials along the shoreline at MacDill Air Force Base in Hillsborough County.	Reef Construction – Natural Materials	Restoration	Tampa Bay Watch				246	27.8214	-82.478211

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LS-38	LS	Reed Property	2007	Intertidal wetland system along the Hillsborough River.	Estuarine	650000	31-Oct-06	Living shoreline associated with larger wetland restoration effort	Rehabilitation/Creation	Restoration	SWFWMD	City of Tampa			550	27.98589	-82.470813
LS-39	LS	Andrew's Island Oyster Bar Creation	2007		Estuarine	0		Project consists of creation of an oyster shell bar using natural oyster shell material along the shoreline of Andrew's Island to promote erosion control and provide habitat for fish and wildlife.	Reef Construction – Natural Materials	Restoration	Tampa Bay Watch				500	27.79323	-82.778594
LS-40	LS	Bayshore Boulevard Seawall Oyster Dome Project Phase III	2007		Estuarine	0		Project consists of placement of oyster domes along the shoreline of Bayshore Boulevard in Hillsborough County to encourage oyster enhancement and provide habitat for wildlife.	Reef Construction – Artificial Materials	Restoration	Tampa Bay Watch				300	27.89527	-82.487288
LS-41	LS	Fort De Soto Oyster Bar Creation Project	2007		Estuarine	0		Project consists of creating of an oyster shell bar using natural oyster materials along the shoreline of an estuary at Fort De Soto Park in Pinellas County to promote fish and wildlife habitat.	Reef Construction – Natural Materials	Restoration	Tampa Bay Watch				830	27.63362	-82.719313
LS-42	LS	MacDill Air Force Base Oyster Dome: Phase 2	2007		Estuarine	0		Reef Balls®, a.k.a. "oyster domes" placed along seawalls and shorelines	Creation of oyster habitat (oyster dome)	Restoration	Tampa Bay Watch				700	27.82028	-82.475102
LS-43	LS	Cypress Point Park Beach Restoration	2008	Beach shoreline at Cypress Point Park located in Hillsborough County	Estuarine	250000	31-Dec-07	Beach stabilization achieved through re-contouring and softening slope of shoreline as erosion control	Erosion Control	Restoration	City of Tampa	Hillsborough County			2640	27.94944	-82.546042

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LS-44	LS	Weedon Island Oyster Bar Creation	2008		Estuarine	0		Project consists of creation of an oyster shell bar using natural oyster shell material contained in bags along the shoreline at Weedon Island Preserve to promote erosion control and provide habitat for fish and wildlife.	Reef Construction – Natural Materials	Restoration	Tampa Bay Watch				630	27.85539	-82.620816
LS-45	LS	Cunningham Key Oyster Dome Project - Phase II	2008		Estuarine	0		This project consists of placement of oyster domes along the shoreline of Cummingham Key in Pinellas County to encourage oyster enhancement and provide habitat for wildlife.	Reef Construction – Artificial Materials	Restoration	Tampa Bay Watch				100	27.65454	-82.718189
LS-46	LS	Madeira Beach Middle School Oyster Dome Project	2008		Estuarine	0		Project consists of placement of oyster domes along the shoreline at Madeira Beach Middle School in Pinellas County to encourage oyster enhancement and provide habitat for wildlife.	Reef Construction – Artificial Materials	Restoration	Tampa Bay Watch and Madeira Beach Middle School				240	27.80859	-82.790156
LS-47	LS	Ft. Brooke/Cotanchobee Park	2009	Riparian habitat along the shoreline of the Hillsborough River	Estuarine	300000	30-Apr-09	Erosion Control	Erosion Control	Restoration	City of Tampa Parks and Recreation Department	SWFWMD			300	27.94132	-82.451438

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LS-48	LS	Rivergarden Shoreline Restoration Project	2010	Riparian shoreline located on the Hillsborough River in Hillsborough County.	Estuarine	1000000	31-Jul-10	The shoreline was regraded to a more gentle slope for stabilization and erosion abatement. Rip rap was installed at the toe of slope in some areas to dissipate boat wake action. Native plantings were installed throughout.	Shoreline Stabilization/Enhancement	Restoration	City of Tampa	Surface Water Improvement and Management of Southwest Florida Water Management District			900	27.96799	-82.477035
LS-49	LS	Stewart Middle School Shoreline Restoration	2010	Riparian shoreline adjacent to the school which is located on the Hillsborough River in Hillsborough County.	Estuarine	250000	31-Mar-10	The shoreline of the project was regarded to a more gentle 4:1/3:1 slope for stabilization. Rip rap was installed at the toe of slope to dissipate boat wake action. Geoweb walls were constructed at two locations for bank stabilization where regrading was	Shoreline Stabilization/Enhancement	Restoration	Ecosphere Restoration Institute	SWFWMD - SWIM, ERI & HCSD			1700	27.96109	-82.470436
LS-50	LS	Whiskey Stump Key Oyster Bar Creation Project	2010		Estuarine	0		Fossilized oyster shell from local shell mines provides a hard surface for oyster larvae to settle upon and grow, eventually forming a natural reef. Mesh bags filled with fossilized shells will be used to create the oyster bar habitats.	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				730	27.81438	-82.402435
LS-51	LS	Green Key Oyster Bar Creation Project	2010		Estuarine	0		Fossilized oyster shell from local shell mines provides a hard surface for oyster larvae to settle upon and grow, eventually forming a natural reef. Mesh bags filled with fossilized shells will be used to create the oyster bar habitats.	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				790	27.81836	-82.399647

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LS-52	LS	Oyster Reef Shoreline Stabilization Phase IV	2010		Estuarine	0		The project installed concrete oyster domes (reef balls) within the tidal flat zone approximately 50 feet seaward of the high tide line. Domes were placed base to base to create a solid substrate roughly 10 feet wide on which oysters could establish. The	Shoreline Stabilization/Enhancement	Restoration	MacDill Air Force Base				1890	27.82111	-82.474503
LS-53	LS	Whale Island Oyster Bar Creation Project	2011		Estuarine	0		This project is a community-based oyster reef creation project, to install recycled oyster shell along the northern shoreline of Whale Island	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				860	27.66258	-82.693906
LS-54	LS	Green Key Oyster Bar Creation Project	2011		Estuarine	0		This project is a community-based oyster reef creation project, to install fossilized oyster shell along the western shoreline of Green Key.	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				790	27.81899	-82.39946
LS-55	LS	Canterbury School Bay Restoration	2011		Estuarine	0		Students shoveled 24 tons of shell into mesh bags. The bags were transported by boat and students stacked the shell-filled mesh bags to create a reef structure.	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				225	27.8552	-82.619086
LS-56	LS	Tarpon Key Oyster Bar Creation Project	2011		Estuarine	0		This project is a community-based oyster reef creation project, to install recycled oyster shell along the western shoreline of Tarpon Key.	Reef Construction – Artificial Materials	Restoration	Tampa Bay Watch				250	27.66365	-82.69234

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LS-57	LS	Alafia Bank Bird Sanctuary Artificial Reef	2012	In the 1920's dredging to create a shipping channel in Tampa Bay created two man-made islands: Bird Island and Sunken Island. Over time the two islands have become known as Alafia Bank Bird Sanctuary.	Estuarine	0		Creation of an artificial reef made from 212 concrete reef balls. Each reef ball is four feet wide and three and a half feet tall, weighing 1,300 pounds. The reef balls will to prevent erosion along the shore and provide habitat for oysters.	Reef Construction - Artificial Materials	Restoration	Audubon of Florida				425	27.84893	-82.409338
LS-58	LS	Alafia Bank Bird Sanctuary Artificial Reef	2012		Estuarine	0		Creation of an artificial reef made from 212 concrete reef balls. Each reef ball is four feet wide and three and a half feet tall, weighing 1,300 pounds. The reef balls will to prevent erosion along the shore and provide habitat for oysters.	Reef Construction - Artificial Materials	Restoration	Audubon of Florida				425	27.84732	-82.418803
LS-59	LS	Weedon Island Oyster Bar Creation Project	2012		Estuarine	0		This project is a community-based oyster reef creation project, to continue the installation of oyster shell bars along the northern shoreline of Riviera Bay. This is Phase 3 of this project.	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				945	27.85556	-82.617725

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-60	LS	Schultz Nature Preserve Oyster Bar Creation Project	2012		Estuarine	0		The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms, prevent erosion, improve water quality and improve fish and wildlife hab	Reef Construction – Artificial Materials	Restoration	Tampa Bay Watch				2090	27.81272	-82.402837
LS-61	LS	Shoreline Enhancement for MacDill Air Force Base, Phase IV	2012		Estuarine	0		The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				1290	27.82272	-82.472149
LS-62	LS	Elnor Island Oyster Bar Creation Project	2013		Estuarine	0		The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms, prevent erosion, improve water quality and improve fish and wildlife h	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				650	27.78696	-82.775895

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-63	LS	Green Key Oyster Bar Creation Project	2013		Estuarine	0		This project is a community-based oyster reef creation project, to install fossilized oyster shell along the western shoreline of Green Key. To create the 790 linear feet of shoreline, approximately 96 tons of shell was used. Restoring this shoreline wil	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				790	27.81764	-82.3991
LS-64	LS	Tarpon Key Oyster Bar Creation Project	2013		Estuarine	0		This project is a community-based oyster reef creation project, to install recycled oyster shell along the western shoreline of Tarpon Key. Establishment of oyster bars along the shorelines of both islands will buffer the area from wave action, providing	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				755	27.6854	-82.717269
LS-65	LS	Schultz Nature Preserve Oyster Bar Creation Project	2013		Estuarine	0		Oyster bars places along the shoreline of the beach.To create the 1,850 linear feet of shoreline approximately 187.1 tons of shell was used.	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				1850	27.81383	-82.400746
LS-66	LS	MacDill Shoreline Stabilization and Enhancement Project	2013		Estuarine	0		The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				774	27.82352	-82.471337

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-67	LS	MacDill Shoreline Stabilization and Enhancement Project Phase 5	2014		Estuarine	0		Artificial reefs (oyster domes) were placed along the shoreline of the beach in an effort to enhance the shoreline and provide erosion control.	Shoreline Stabilization/Enhancement	Restoration	MacDill Air Force Base				213	27.82442	-82.471767
LS-68	LS	Longshore Bars	2015		Estuarine	0		Breakwater created at MacDill Air Force Base	Breakwater	Restoration	Tampa Bay Estuary Program	Port Tampa Bay			800	27.81833	-82.489142
LS-69	LS	MacDill AFB Living Shoreline Creation Project	2015		Estuarine	0		Oyster reefs were constructed using natural materials such as oyster shell which provides a surface for the attachment of oyster larvae or spat to attach and grow. Oyster reefs provide habitats for small organisms, prevent erosion, improve water quality	Shoreline Stabilization/Enhancement	Restoration	MacDill Air Force Base				1287	27.83089	-82.470737
LS-70	LS	McKay Bay Oyster Creation Project	2015		Estuarine	0		Oyster reefs were constructed using natural materials such as oyster shell which provides a surface for the attachment of oyster larvae or spat to attach and grow. Oyster reefs provide habitats for small organisms, prevent erosion, improve	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				1300	27.94283	-82.419051
LS-71	LS	Robles Park Water Quality & Natural Systems Enhancement	2016	Park lake and marsh along Hillsborough River shoreline	Estuarine	0		Living shoreline associated with larger wetland restoration effort	Shoreline Stabilization/Enhancement	Restoration	SWFWMD-SWIM				50	27.96163	-82.469307

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-72	LS	Abercrombie Park Oyster Reef Creation Project	2016	Project takes place along a mangrove shoreline at the western end of the park. Park drain to Boca Ciega Bay. The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay.	Estuarine	0		Artificial reefs placed along shoreline on western end of the park. The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms, pr	Reef Construction - Natural Materials	Restoration	City of St. Petersburg				125	27.80672	-82.757912
LS-73	LS	Maximo Park Oyster Reef Creation Project	2016	Maximo Park is a 70 acre, waterfront park that drains to Boca Ciega Bay. This park contains 7 boat ramps and an estuarine beach area. This project was along the southern end of the park to help stabilize the shoreline and prevent erosion.	estuarine	0		Maximo Park is a 70 acre park in south St. Petersburg located directly on Frenchman's Creek. This park features a wilderness area, boat ramps, beach area and an Indian Midden site. Oyster reefs were created using fossilized shell placed in mesh bags.	Reef Construction - Natural Materials	Restoration	City of St. Petersburg				300	27.70861	-82.681564

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-74	LS	Bay Vista Park Oyster Reef Creation Project	2016	Bay Vista is a 4 acre, city-owned recreational park on the shore on Tampa Bay. The park has 2 boat ramps. Community Oyster Reef Enhancement Program is to increase the oyster population.	Estuarine	0		Artificial reefs were placed along estuarine shoreline on southern end of park. The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time,	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				450	27.70346	-82.640366
LS-75	LS	MacDill Air Force Base Oyster Reef: Phase 5	2016	A degraded coastal system undergoing sever erosion due to wind and waves. Habitat is primarily an open sand beach fronted by tidal flats and backed by a heavily eroded dune system (upland edge).	Estuarine	0		The reef building materials were placed in the shallow tidal zone approximately 40-50 feet seaward of the high tide line. The oyster reef helps reduce wave energy and trap sediment,	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				700	27.81989	-82.474556
LS-76	LS	2D Oyster Reef Community Construction Project	2017	Artificial reefs (oyster beds placed along the eastern shoreline)	Estuarine	0		The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				800	27.8729	-82.426568

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-77	LS	Fantasy Island Community Creation and Shoreline	2017	Artificial Reefs (oyster domes and oyster shell bar placed along shoreline)	Estuarine	0		The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				1200	27.87719	-82.424735
LS-78	LS	McKay Bay South Oyster Reef Creation and Enhancement	2017	Artificial reefs (oyster bars and beds placed along the south western shoreline)	Estuarine	0		The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch				1300	27.9269	-82.422115
LS-79	LS	Apollo Beach Coastal Restoration	2018	Supratidal bank with sandy substrate and a sparse population of upper-wetland plants. Eight breakwaters located directly offshore with developing oyster reefs.	Estuarine	0		Apollo Beach coastal restoration/enhancement of 4000 linear feet of tidal wetland planting with sandy substrate and a sparse population of upper-wetland plants located in Hillsborough County. Students from East Bay High School and Lennard High School, a	Planting	Restoration	Hillsborough County				4000	27.79247	-82.419094
LS-80	LS	Fantasy Island Community Creation and Shoreline	2018	Artificial Reefs (oyster domes and oyster shell bar placed along shoreline).	estuarine	0		Fantasy Island Community creation and shoreline of artificial reefs; oyster domes and oyster shell bar placed along .21 acres of shoreline. The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in	Reef Construction - Natural Materials	Restoration	Tampa Bay Watch				126	27.86775	-82.425157

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-81	LS	Safety Harbor Coastal Restoration	2018	Estuarine intertidal marsh protected from the Bay by mangroves and wetland plants. Small seagrass beds and thick mats of Spartina alterniflora (from previous TBW wetland plant restoration efforts) occupy the landward side of the mangrove-settled shorelin	Estuarine	0		Safety Harbor coastal estuarine shoreline restoration of 1.82 acres located in the City of Safety Harbor. Students from Lakewood High School, Dowdell Middle School, Canterbury School of Florida and Channelside Academy of Math and Science as well as some	Planting	Restoration	City of Safety Harbor				80	27.9892	-82.685843
LS-82	LS	MacDill AFB Living Shoreline Creation Project	2019		Estuarine	75000		Artificial reefs (oyster bags placed along the shoreline of the beach)- The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms,	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch	MacDill Air Force Base, TBERF, EPCHC, Bloomin Brands			669	27.84324	-82.469428
LS-83	LS	Bermuda Bay	2019	Oyster bag arrays for beach protection	Estuarine	22000	19-May	Oyster arrays aligned along the shoreline, beach sand added to beach area	Shoreline Stabilization/Enhancement	Restoration	Bermuda Bay Condo Association		Private		450	27.73438	-82.691736

ID Number	LS/SEP	Name	Year	Description	Category	Total Project Cost	Start Date	Technique	Benefits	Activity	Lead Partner	Other Partners	Funding Source	Acres	Linear Ft	Lat	Long
LS-84	LS	McKay Bay South Oyster Reef Creation	2019		Estuarine	225000		Artificial reefs (oyster bags placed along the southwestern shoreline)- The goal of Tampa Bay Watch's Community Oyster Reef Enhancement Program is to increase the oyster population in Tampa Bay and at the same time, provide habitats for small organisms	Shoreline Stabilization/Enhancement	Restoration	Tampa Bay Watch	TBERF, EPC Pollution Recovery Fund, Royal Bank of Canada, USFWS, Bloomin Brands, Mosaic			1664	27.9305	-82.425643
LS-85	LS	Ignacio Haya Park	2020	Breakwater along shoreline to restore eroded shoreline	Estuarine	130000	20-Apr	2,000 linear feet of shoreline work	Shoreline Stabilization/Enhancement	Restoration	City of Tampa	ERI	EPC/TBERF		1800	27.99503	-82.46527
SEP-1	SEP	Gandy Park	1992		Estuarine	0		Block planters with mangroves at shoreline		Restoration	Tampa Bay Estuary Program				100	27.89038	-82.539453
SEP-2	SEP	Bayshore Beautiful HOA Seawall Oyster Dome Project	2011		Estuarine	0		Installation of 793 marine friendly, hollow, concrete oyster domes to create fisheries habitat and provide stormwater biological filters.	Reef Construction - Artificial Materials	Restoration	Tampa Bay Watch				1156	27.89866	-82.488323
SEP-3	SEP	Ulele Springs Restoration Project	2014	Ulele Spring is currently concrete-lined and is piped to the Hillsborough River in Hillsborough County.	Mix (estuarine and freshwater)	670000		SEP associated with spring restoration project	Bulkhead Removal	Restoration	Ecosphere Restoration Institute	ERI, NOAA, USFWS, FWC, EPC, TBERF, & City of Tampa			350	27.95967	-82.463661
SEP-4	SEP	Julian B. Lane Riverfront Park	2018	Living shoreline along Hillsborough River existing seawall	Estuarine	0		Julian B. Lane Riverfront Park living shoreline along Hillsborough River existing seawall. Native stone rip-rap was placed along 232 linear feet/.03 acres of existing seawall to elevation +1.0 to create planting area at upper elevations, and planted wit	Shoreline Stabilization/Enhancement	Restoration	City of Tampa				490	27.95423	-82.465449